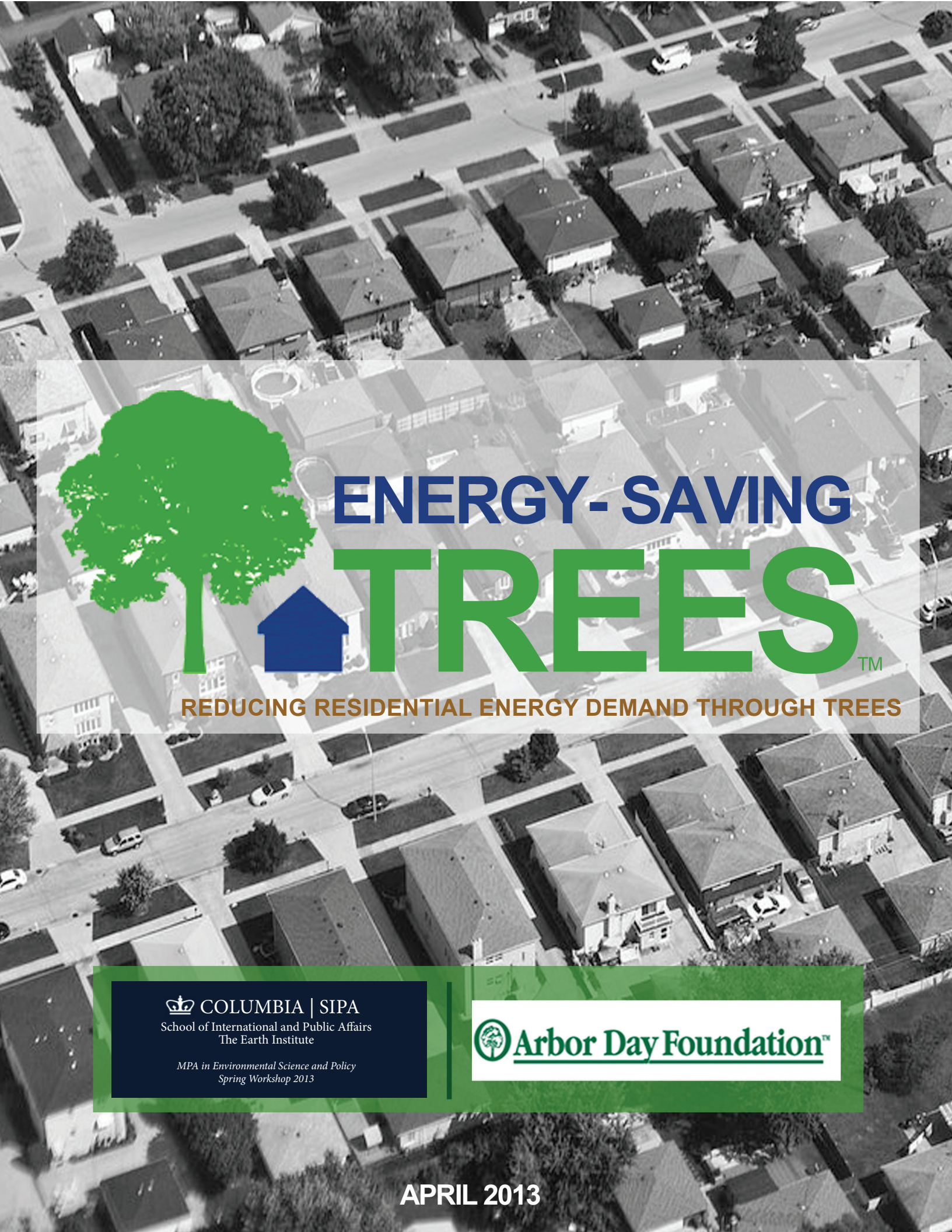

ENERGY-SAVING TREES™

REDUCING RESIDENTIAL ENERGY DEMAND THROUGH TREES

COLUMBIA | SIPA
School of International and Public Affairs
The Earth Institute

MPA in Environmental Science and Policy
Spring Workshop 2013

Arbor Day Foundation™

APRIL 2013

THE ARBOR DAY FOUNDATION

Founded in 1972, the centennial of the first Arbor Day observance in the 19th century, the Foundation has grown to become the largest nonprofit membership organization dedicated to planting trees, with over one million members, supporters, and valued partners.

"WE INSPIRE PEOPLE TO PLANT, NURTURE, AND CELEBRATE TREES."

WORKSHOP IN APPLIED EARTH SYSTEMS
SPRING 2013

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PREFACE

The MPA in Environmental Science and Policy program at Columbia University's School of International and Public Affairs concludes with a consulting project that requires students to address a policy or management problem it faces. The Workshop in Applied Earth Systems Policy Analysis is a practical, real-world application of skills acquired from the summer and fall workshop semesters, which teach the students to explain the science behind a policy focusing on an environmental problem and then asks them to create innovative solutions to address that problem.

The following report is the final product of the spring semester Workshop in Applied Earth Systems Policy Analysis. It contains a program and policy analysis of Arbor Day Foundation's pilot program, Energy-Saving Trees — a tree-based energy conservation program.

ACKNOWLEDGEMENTS

We would first like to extend our sincere gratitude to our faculty advisor, Professor Sara Tjossem, for providing our team with invaluable guidance, support and encouragement throughout the project. Additionally, we would like to thank our client, Arbor Day Foundation, especially Amanda Barker, Jared Carlson and Dan Lambe, for providing us with essential knowledge and connecting us to their vast network of individuals and organizations that we interviewed during the project. We would also like to thank every one of our interview subjects across the nation who provided their invaluable time and knowledge that helped inform and enrich our research. A special thanks to Christopher Baggett of Arizona Public Service, Christopher Flores of Congresswoman Matsui's office, Misha Sarkovich of Sacramento Municipal Utility District, Ray Tretheway of Sacramento Tree Foundation, Sam Watson of North Carolina Utility Commission, Crissy Godfrey and Mike Pasucci of Maryland Public Service Commission, and Ramsey Brown of Hawaii Energy.

ACRONYMS

APS	Arizona Public Service
ARRA	American Recovery & Reinvestment Act
BGE	Baltimore Gas & Electric
CO_2	Carbon Dioxide
DCSEU	District of Columbia Sustainable Energy Utility
DESEU	Delaware Sustainable Energy Utility
DOE	US Department of Energy
DSM	Demand-side Management
ECMB	Energy Conservation Management Board
EIA	Energy Information Administration
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
kWh	Kilowatt hour
MWh	Megawatt hour
NGO	Non-government Organization
PACE	Property Assessed Clean Energy
PEPCO	Potomac Electric Power Company
PSC	Public Service Commission
PUC	Public Utility Commission
RGGI	Regional Greenhouse Gas Initiative
SMUD	Sacramento Municipal Utility District
SRP	Salt River Project Power and Water
TREES	The Residential Energy & Economic Savings Act

ENERGY-SAVING TREES:

Reducing Residential Energy Demand through Trees

APRIL 2013

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EXECUTIVE SUMMARY

In 2011, Arbor Day Foundation launched the Energy-Saving Trees pilot program, an energy conservation project that provides trees to utility companies for distribution to their residential customers.

The trees are free of cost to residential participants, who are responsible for strategically planting the trees around their home — deciduous trees on the south and west sides of the home and coniferous trees on the north — to provide shade and windbreaks. As a result, the trees help reduce heating and cooling costs, as well as residential energy consumption.

Arbor Day Foundation asked Columbia University to help them identify how Energy-Saving Trees can be implemented on both a state-by-state level by working with state Public Utility Commissions (PUCs), and nationally through federal policy. Our analysis provides a policy roadmap to Arbor Day Foundation. In scaling up Energy-Saving Trees from a pilot-program, Arbor Day Foundation faces several implementation challenges. The primary challenge is to make the program as cost-effective as possible. In evaluating the program's cost effectiveness, most utility companies are restricted to only consider the kilowatt hours (kWh) of energy saved, preventing utility companies from incorporating all of the additional benefits in their calculations. Another key challenge leading to the program not having a positive return on investment is the current high mortality rates of distributed trees. Nearly one-third of trees die during the

shipping process and many trees are never planted after distribution. Even if the tree does reach its destination and is properly planted, there is no guarantee it will receive the proper care it needs to flourish and realize the full energy saving benefits. This report will discuss several recommendations to address these issues:

- **Work with state's investor-owned utilities and PUCs to secure state funding**
- **Target states with energy reduction goals and decoupling**
- **Partner with local tree planting organizations**
- **Collect performance metrics on future pilot programs**

After conducting rigorous academic research, the team selected target states most likely to adopt the Energy-Saving Tree program and developed recommendations on how to bring the program to fruition in these states. Lastly, the team interviewed representatives from PUCs across the nation to determine how to incorporate the Energy-Saving Tree program into a state's energy efficiency portfolio. This report provides a step-by-step walkthrough of the process within Maryland, one of the top recommended target states.

Ultimately, the program must be cost-effective to succeed. Several methods to make this a reality are discussed within the report. Although the highest probability for successful program implementation resides at the state level, preliminary movement to promote energy efficiency programs through federal legislation is also discussed. Additionally, the expansion of carbon cap-and-trade programs in the United States provides another opportunity to market the benefits of planting shade trees through their ability to sequester carbon and provide carbon offsets and credits. Both of these possibilities offer new avenues of funding and an optimistic future for the Energy-Saving Tree program.

BACKGROUND INFORMATION

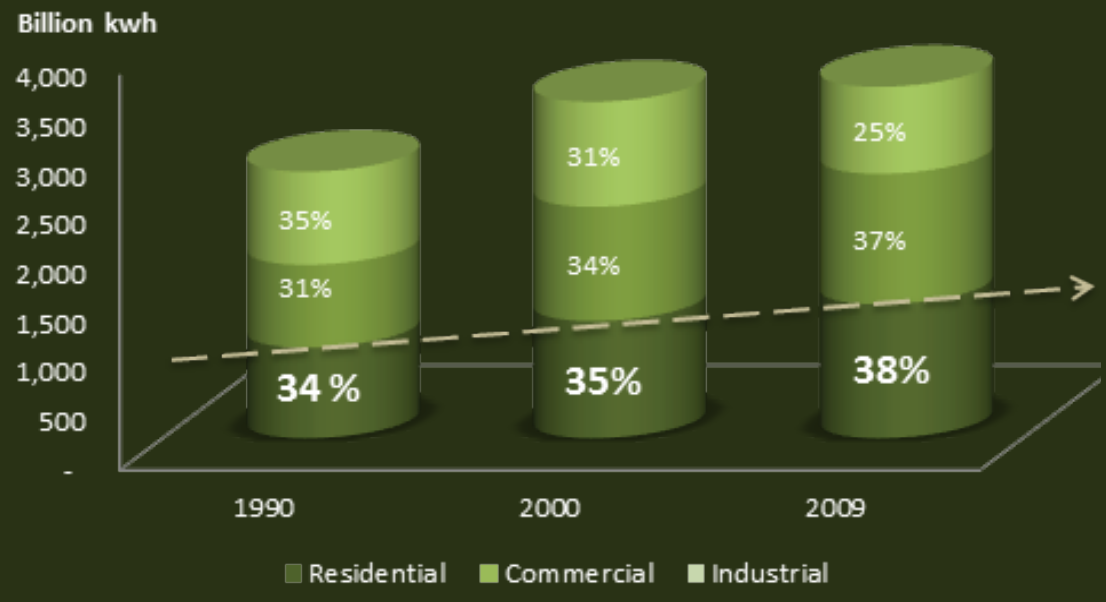
BACKGROUND INFORMATION

Introduction

Arbor Day Foundation's Energy-Saving Trees program is designed to distribute trees to a utility company's residential customers as an innovative demand-side management program to improve residential energy conservation and efficiency. Energy conservation means consuming less energy due to the reduction or elimination of a service, while energy efficiency refers to the consumption of less energy performing the same service. Though achieving energy conservation through trees is not a new concept, it is often overlooked in this context. When properly planted next to a building, trees increase energy conservation by providing shade during summer months and a windbreak during winter months. As a result, less energy is consumed for cooling and heating.[1] Trees also reduce energy consumed for heating and cooling through evapotranspiration, a process that cools the surrounding air by releasing moisture and consuming heat.

Additional benefits of shade trees include enhanced neighborhood beauty, cleaner air, stormwater runoff mitigation, and carbon dioxide sequestration.[2] In order to successfully implement Energy-Saving Trees on a nationwide scale, the team researched the relationships between utility companies, PUCs, government policies, energy costs, and customer profiles of each state. This information enabled the team to provide a comprehensive and strategic recruitment plan for new utility companies, as well as recommendations on how to effectively market the program to residential customers. Given the relevance of the program to residential customers, the Energy-Saving Tree program has the ability to attract widespread public and political attention and facilitate positive behavioral changes that will increase energy efficiency and reduce carbon

FIGURE 1:
END USE ELECTRICITY BY SECTOR (WITHOUT TRANSPORTATION), 1990-2009



Source:
American Public Power Association, 2013.

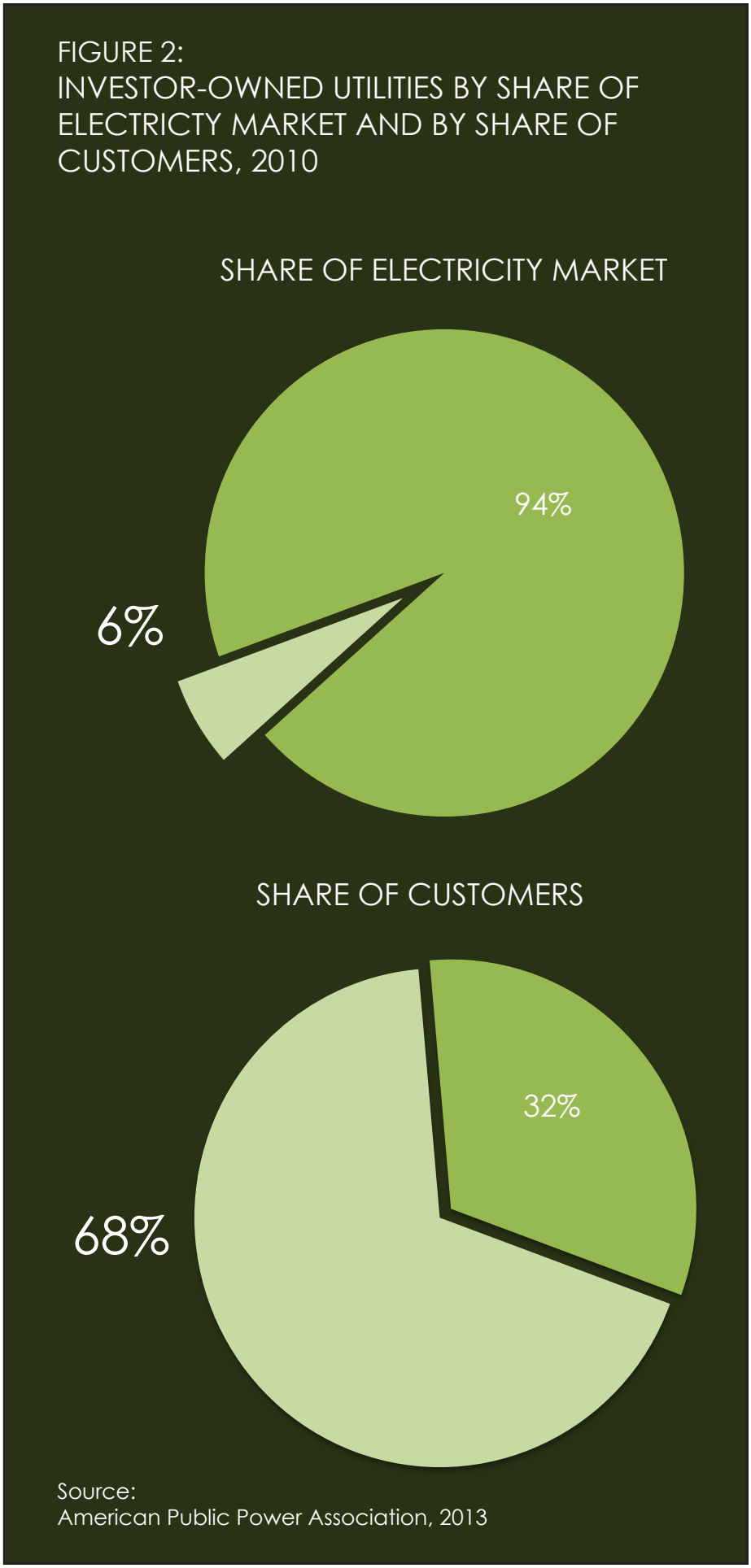
emissions.

Over the past two decades, overall energy consumption in the US has increased, with the residential sector being the largest contributor (see Figure 1). In 2009, residential electricity comprised approximately 38% of total end use electricity, up from about 24% in 1990 and nearly 35% in 2000. In dollar amounts, in 2011, the average monthly residential electricity consumption in the United States was 940 kWh, costing households $110.14 on average per month.[3] Strategically planted shade trees can be an effective method to lower these startling energy statistics.

Current Electricity Market

Each state can have multiple utility companies, either privately or publicly owned. Investor-owned utilities are private companies with ownership shares held by stockholders. Only 6% of all electricity providers are investor-owned, but these select few companies reach a wide customer-base, providing electricity to 68% of all customers in the US (see Figure 2).[4] Therefore, any energy efficiency program adopted by an investor-owned utility will be available to a large number of electricity users in the United States. The investor-owned utilities are regulated at the state level by public utility commissions (PUCs). Publicly-owned utilities include rural

FIGURE 2:
INVESTOR-OWNED UTILITIES BY SHARE OF ELECTRICTY MARKET AND BY SHARE OF CUSTOMERS, 2010



Source:
American Public Power Association, 2013

electric cooperatives, municipal utilities, and federal or state power authorities. Unlike investor-owned utilities, power authorities are not regulated by PUCs but are overseen by a variety of similar organizations such as co-op boards, municipal governments, and federal regulators.

Current Energy Efficiency Regulations and Policies

Federal

The majority of federal legislation promoting energy efficiency exists in the form of financial incentives. Existing federal regulation places minimal emphasis on the benefits from reduced CO_2 emissions and is currently nonexistent when it comes to planting trees as a tool for energy conservation and carbon sequestration. Federal energy efficiency regulations exist only for appliances and public buildings in legislation such as:

The Energy Policy and Conservation Act of 1975 requires the Department of Energy (DOE) to set appliance efficiency standards for manufacturers of appliances such as air conditioners, boilers, and heat pumps.[5]

The Energy Policy Act of 2005 funds the DOE for research, programs, development, and deployment projects that promote energy efficiency, renewable energy technologies, practices, and products for homes nationwide.[6]

The American Clean Energy Security Act of 2009, also known as the Waxman-Markey Bill, attempted to set nationwide comprehensive energy efficiency standards across all sectors.[7] This bill included renewable electricity standards and policies to increase savings from energy efficiency. Although it passed the House of Representatives, it died in the Senate due to concerns of increased energy and petroleum costs and questions regarding the role of federal government in state energy affairs.

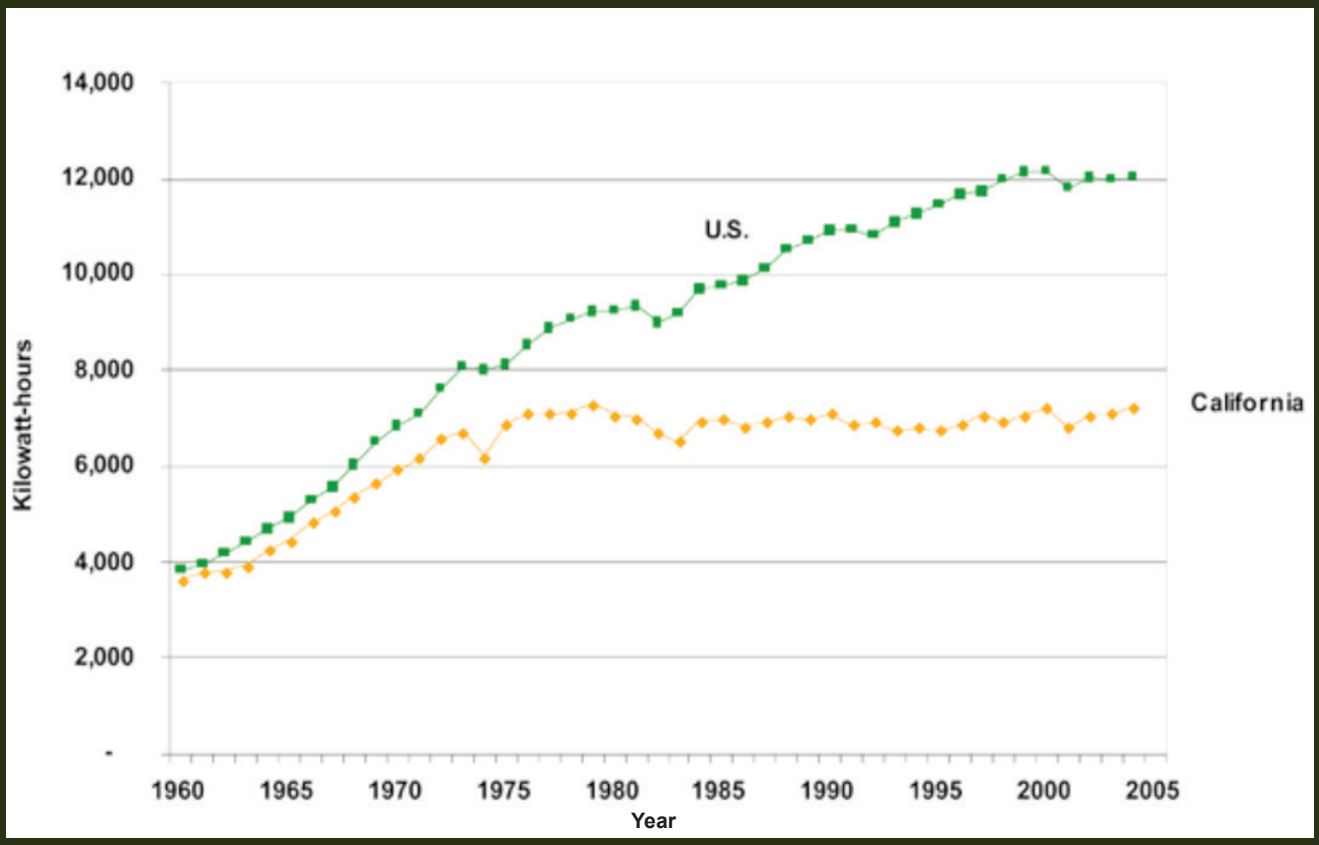
These acts demonstrate that previously successful federal energy legislation has focused solely on increasing efficiency in household appliances and manufactured goods. In regard to carbon emissions, the Envrionmental Protection Agency (EPA) has not yet exercised its jurisdiction over CO_2 emissions as granted by another federal policy, the Clean Air Act.[8]

While trees have yet to be recognized as energy efficiency tools in the federal sphere, Congresswoman Doris Matsui (CA-6) introduced the **Energy Conservation through Trees Act** in 2011. Although the bill was unsuccessful, it sought to provide federal funding for shade tree programs throughout the nation and is modeled on the successful Sacramento Municipal Utility District (SMUD) shade tree program started in 1990.[9] Congresswoman Matsui reintroduced the bill under the acronym TREES: **The Residential Energy and Economic Savings Act** on April 26th, 2013, National Arbor Day. The bill is discussed in more depth in the recommendations section of this report.

State

PUCs and other regulators enforce policies that govern utility company investments and operations. For example, states can improve energy efficiency by incentivizing utility companies to provide energy efficiency programs to ratepayers. The state does this by guaranteeing the recovery of program costs with additional funding for meeting certain targets. States can also introduce decoupling policies, a mechanism which separates utility sales from their profits, eliminating the disincentive to encouraging ratepayers to consume less of their product.[10] By providing rebates, financial incentives, and buffers to prevent loss of profit, state regulators encourage utility companies to invest in energy efficiency programs. Without these incentives, utilities that adopt energy efficiency programs face the risk of

FIGURE 3:
ELECTRICITY CONSUMPTION COMPARISON AFTER CALIFORNIA ADOPTED DECOUPLING (1960-2005)



Source:
Carter, Wang & Chang, 2006

decreased profits due to a reduction in sales from enhanced efficiency and the failure to recover program costs.[11] However, utility companies can benefit from introducing energy efficiency programs, as they reduce the need to install new capacity and upgrade and replace existing transmission and distribution equipment; improve reliability of energy distribution by reducing and managing demand; increase customer satisfaction by reducing energy costs; fulfill state or federal mandates; and achieve corporate social responsibility efforts.

At the state level, there are several categories of energy efficiency standards. For example, eleven states have appliance energy efficiency standards that accompany federal appliance standards.[12] The availability of energy efficiency policies and programs varies greatly from state to state. Some states require all electric utilities in the state to establish energy efficiency programs. In contrast, South Carolina has no official energy reduction goal for utilities. Understanding the great variation of state policies emphasizes the complexity of implementing Energy-Saving Trees, and requires Arbor Day Foundation to develop tailored strategies for approaching and working in each state. Despite the variation, general patterns do emerge in terms of how aggressive the state is in improving energy efficiency.

As mentioned above, state policies can incentivize utilities to adopt such energy

efficiency programs by mandating specific energy reduction targets or by guaranteeing reasonable possibility of financial gain. This is often done through policy innovations such as decoupling, demand-side management, Property Assessed Clean Energy (PACE), and deregulation, which are outlined in Box 1 and further expanded on in Appendix A. These mechanisms have been very successful at reducing energy consumption. For example, Figure 3 compares US energy consumption with California energy consumption after the state adopted a decoupling policy in the early 1970's, and shows the policy's effectiveness in curbing electricity consumption.

The ten largest utility companies by number of customers are investor-owned, serve an average of three million customers, are located in high-density coastal states, and have an average retail price of 12 cents per kilowatt-hour (U.S. average is 11.55 cents/kWh, with a range of 1.08-95.7 cents/kWh).[16] Current energy efficiency state mandates mostly focus on customer demand or price reduction, which are dependent on utility pricing strategies. Most state and federal incentives for the residential sector are in the form of tax credits, which can become an unintentional competitor to the Energy-Saving Trees Program. Because homeowners have few opportunities to directly participate in energy efficiency programs free of an initial capital investment, Energy-Saving Trees it is an ideal program to expand across the U.S.

BOX 1: POLICY INNOVATIONS: GOALS AND EXAMPLES OF CURRENT UTILITY MARKET POLICY INNOVATIONS

DEMAND SIDE MANAGEMENT (DSM)

Reduces electricity use through energy efficiency or conservation programs[13]

- Popular in the form of rebate programs,tax credits and deductions
- District of Columbia offers $500 to homeowners who successfully complete eligible energy upgrades

DECOUPLING

Separates a utility's revenues from the fixed costs of providing reliable electricity by a rate adjustment mechanism

- California PUC saved ratepayers an estimated $55 billion dollars over the past thirty years[14]
- 12 states with decoupling in place (Figure 4)
- 10 states have pilot programs (Figure 4)

PROPERTY ASSESSED CLEAN ENERGY (PACE)

States or municipalities provide loans to homeowners to invest in energy efficiency (such as high efficiency appliances) improvements on their property[15]

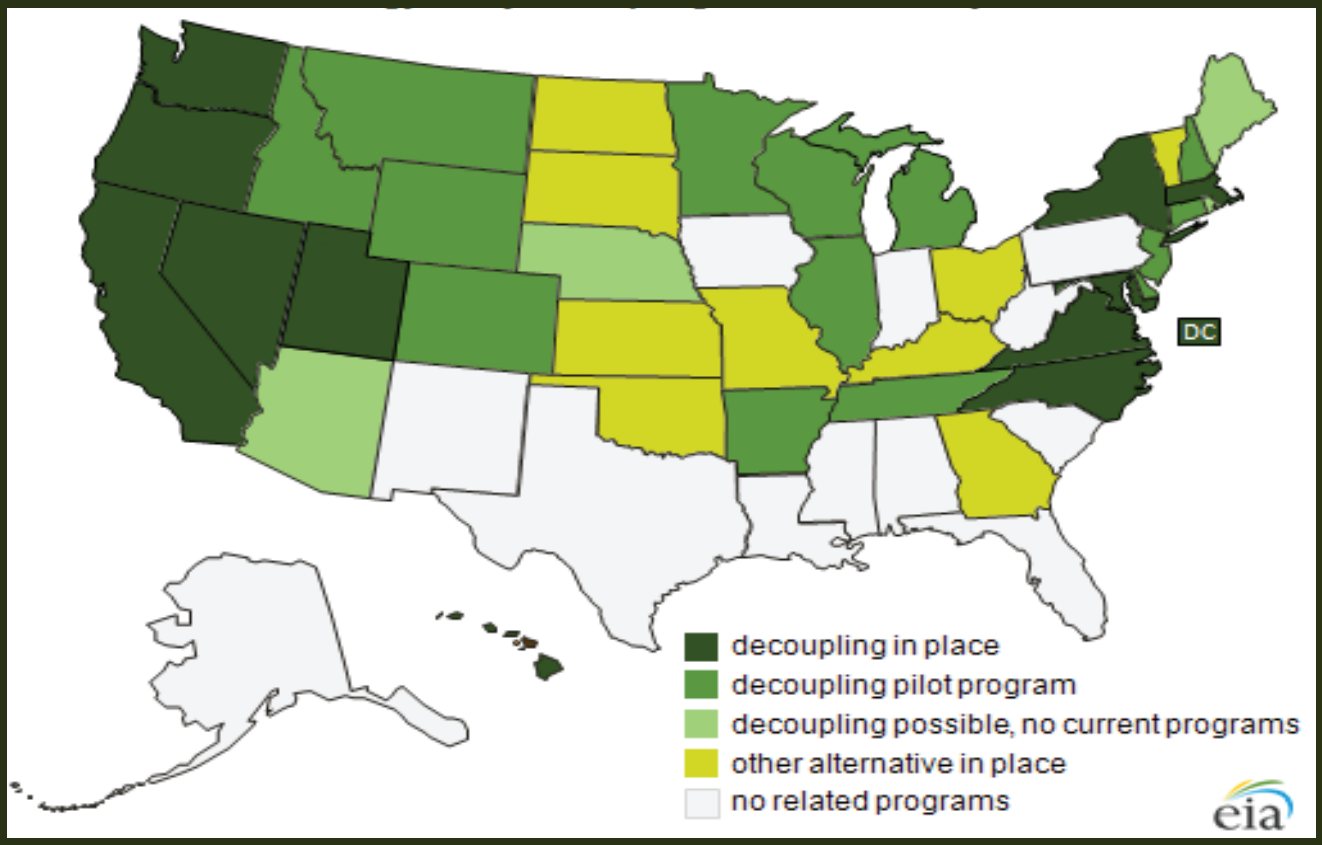
- Viable long-term alternatives to loans
- Incentivize homeowners and utilities to adopt eligible energy efficiency measures through tax credits or deductions
- First PACE pilot program was launched in California and today 28 states and DC have passed PACE-enabling legislation

DEREGULATION

Allows a customer to choose their electricity provider

- Exists in several states, including California and Texas
- Creates a public relations opportunity for utilities

FIGURE 4:
ENERGY UTILITY DECOUPLING MECHANISMS BY STATE, 2010



Source:
U.S. Energy Information Administration, 2013

US Tree-Based Energy Conservation Programs

The team chose five case studies (Arizona Public Service, CPS Energy, Salt River Project Power and Water, Alliant Energy and Sacramento Municipality Utility District) to analyze historical and current tree-based energy conservation programs offered by utility companies in the US. By examining their program design, and drawing lessons learned from their implementation, this research helped provide the qualitative foundation for our subsequent research. The team considered program scale, location, outreach, logistics, funding levels, and management. Box 2 provides a brief summary of each of the case studies, and further explanation is in Appendix B.

In addition to learning more about the increased prevalence of such programs throughout the US, the findings indicate that external factors for long-term program success include: direct community participation, training and assistance to customers, and long-term stewardship, including inspection, maintenance, and customer satisfaction feedback.

BOX 2:
CASE STUDIES SUMMARY: SHADE TREE PROGRAMS OFFERED BY UTILITIES IN VARIOUS STATES AND MUNICIPALITIES

ARIZONA PUBLIC SERVICE (APS)
Serves part of the Phoenix metropolitan area

APS offers free required tree workshops. Customers must live in Maricopa County and be current APS single home residential customers. Depending on age of home, each household can receive two to three trees.[17] Trees in this program can reduce cooling needs by up to 10% and reach up to $50 per year in energy savings.

CPS ENERGY
Community-owned, not-for-profit utility serving the Greater San Antonio, TX area

In CPS's Green Shade Tree Rebates program, a rebate application is required. Customers can then purchase and plant up to five eligible trees with a $50 rebate per tree. Program representatives are allowed to visually inspect the site in the future to track tree survival. CPS Energy projects approximately 381 kWh, or $37 per year, in energy savings.[18]

SALT RIVER PROJECT POWER AND WATER (SRP)
SRP provides water and electricity to more than 2 million customers in Central Arizona

A required workshop includes instruction for tree selection, planting, and care. Customers can receive two to three desert-adapted shade trees. Mature trees will provide an estimated 20 degrees in summer cooling, remove up to 2.6 tons of CO_2 each year, and save residents up to $50 a year on energy bills.[19]

ALLIANT ENERGY
A Midwest utility that serves customers in Iowa, Wisconsin, and Minnesota

Operation ReLeaf offers residential utility customers in Iowa trees at highly discounted prices. Funded by Alliant Energy, ReLeaf is administered by the Iowa Department of Natural Resources Bureau of Forestry, the conservation boards of host counties,[20] and uses *iTree* software. The trees are projected to help reduce cooling costs by up to 25%.

SACRAMENTO MUNICIPAL UTILITY DISTRICT (SMUD)
Sixth-largest electricity utility provider in the U.S serving 1.4 million Sacramento region residents

SMUD works with the Sacramento Tree Foundation (STF) to implement its Shade Tree program. SMUD estimates up to a 40% energy savings on summer electricity bills. SMUD sends a representative to conduct a site visit to determine correct site selection. Up to 10 trees can be ordered and delivered to each home.[21]

POLICY RECOMMENDATIONS

POLICY RECOMMENDATIONS

This section provides detailed policy recommendations at both the federal and state levels. While it is noteworthy that there are federal efforts to expand tree-based energy conservation programs, the probability of success at the federal level remains low. This is mostly a result of the strong partisanship in the current federal legislature. Therefore, targeting state legislatures, utility commissions, and utility companies is a more viable solution than targeting federal regulation. In order to get PUC approval and subsequently state energy efficiency funding, state utility commissions and utility companies must be convinced that an Energy-Saving Trees program is cost-effective.

Key recommendations for the federal level include:

1. Sign on as a formal supporter to **The Residential Energy and Economic Savings (TREES) Act**

2. Encourage other members of Congress to sign on as supporters of this legislation

Key recommendations for the state level include:

1. Focus on states with energy reduction goals

2. Work simultaneously with the state's investor-owned utilities and PUCs

3. Improve cost effectiveness by:
    a. Partnering with local tree planting organizations
    b. Targeting states with higher electricity rates or with more extreme weather patterns
    c. Prioritizing states with both energy reduction goals and programs to reduce carbon emissions to realize multiple benefits from Energy-Saving Trees
    d. Collecting metrics on pilot programs

Federal Policy Recommendation

A common theme within federal energy conservation is that regulations are rarely proposed, and what is proposed typically does not pass due to congressional partisanship. Due to the complexity of the current political climate, Arbor Day Foundation should support existing initiatives that promote shade tree programs. Congresswoman Matsui's newly proposed **The Residential Energy and Economic Savings (TREES) Act** would use federal grants to match funding for utilities and non-profit organizations with shade tree programs.[22] Previous versions of this bill have proven to be more successful when paired with other legislation. This was seen when her bill **Energy Conservation through Trees Act of 2011** was included in the **American Clean Energy and Security Act of 2009**, also known as the Waxman-Markey bill, which was an omnibus bill focused on establishing a national carbon cap-and-trade that passed the House of Representatives but died in the Senate.[23] Congresswoman Matsui introduced the TREES Act on National Arbor Day of this year, April 26th, 2013.[24] If this bill were to pass, the federal government would encourage retail power providers to participate in shade tree planting programs by covering up to 50% of the cost. Arbor Day Foundation can improve the likelihood of the bill's success by signing on as a supporter of the Act and by encouraging other members of Congress to sign on as supporters of this legislation.

State Policy Recommendation

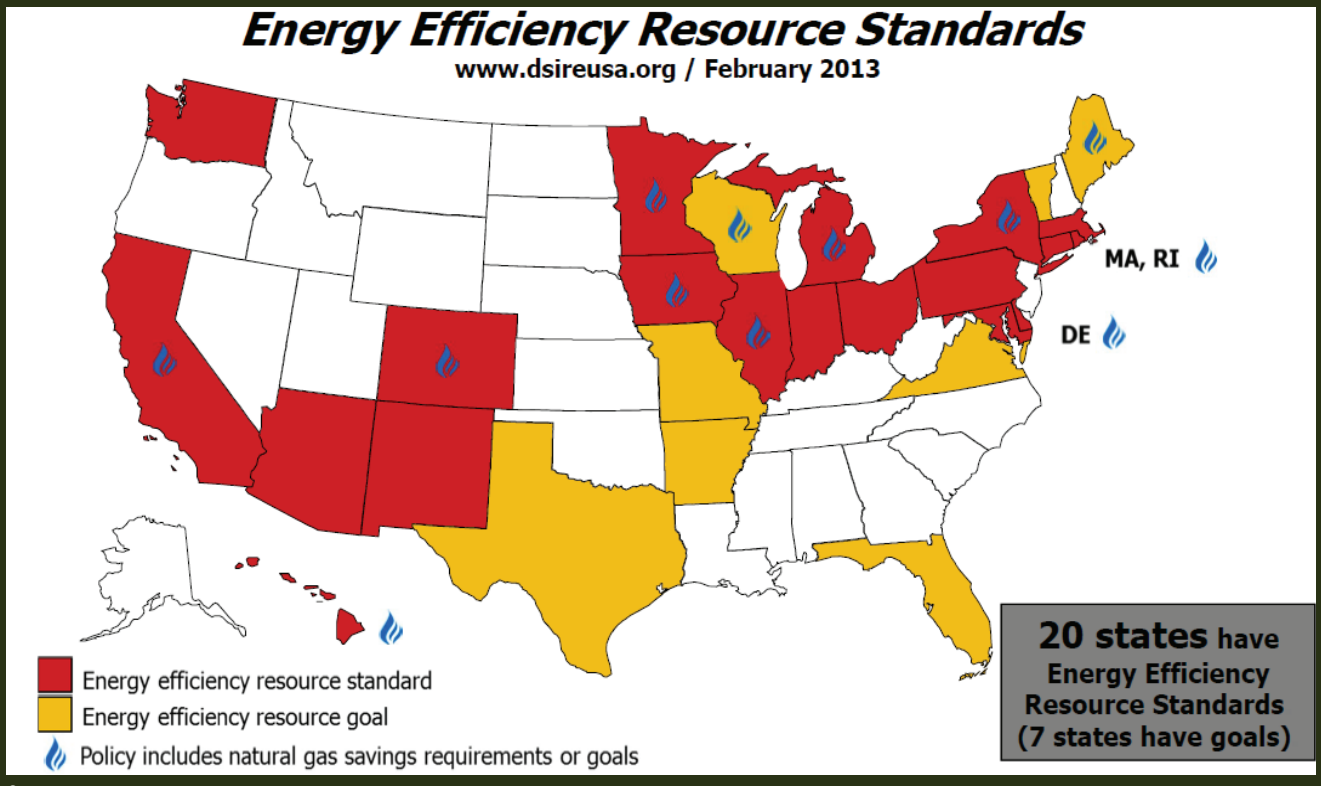
Currently, there is no federal policy mandate requiring states to reduce energy consumption or promoting energy efficiency; however, many states have imposed their own energy reduction mandates. By targeting states that have energy efficiency resource standards and goals (see Figure 5), and those with designated energy efficiency funding, an Energy-Saving Trees program will have reliable and consistent sources of funding to ensure long-term sustainability. To improve the success rate of implementing Energy-Saving Trees programs, Arbor Day Foundation should focus on states with decoupling regulation, high electricity rates (kWh), more extreme weather patterns, a large proportion of low-income households, and high homeownership rates. These criteria either provide the necessary institutional framework or help increase the likelihood of proving cost-effectiveness, and in turn, program adoption. Based on these recommendations, all 50 states and DC were ranked using the following methodology.

Methodology for State Rankings

In order to determine the viability of the Energy-Savings Trees program in each state, the team undertook a comprehensive and systematic approach based on measurable characteristics. Specifically, the team calculated a weighted average for each state, representing a feasibility score to compare across states based on the following six criteria:

1. Existence of energy demand reduction goals. Energy reduction goals were identified as the most important state characteristic

FIGURE 5:
ENERGY EFFICIENCY RESOURCE STANDARDS AND GOALS, 2013



Source:
DSIRE, 2013

for the successful adoption of an Energy-Saving Trees program by the PUC. Without these goals, energy efficiency programs are not likely to be approved or funded. *Weight of 50%.*

2. Utility companies with decoupling policies. Decoupled states are more likely to adopt a program that reduces energy consumption because the bottom line of utilities would not be affected. *Weight of 15%.*

3. High electricity prices. High electricity prices (in price per kWh) yield a greater demand for energy saving programs. *Weight of 15%.*

4. Utility companies with higher levels of low-income population. States with utility companies catering to low-income populations will be more likely to adopt an Energy-Saving Trees program as a way to offer energy efficiency programs to a wider market base. *Weight of 10%.*

5. Utility companies in areas with high home ownership. Homeowners are more likely to adopt Energy-Saving Trees as they are more invested than renters to plant trees around their homes. *Weight of 5%.*

6. Extreme temperatures. States that experience extreme high or low temperatures are likely to have greater savings from Energy-Saving Trees; this program will be more cost-effective in these states. *Weight of 5%.*

STATE RANKING EQUATION

Rank = 50% (Policy)
+ 15% (Decoupling)
+ 15% (price per kwh)
+ 10% (Low Income Population)
+ 5% (Homeownership Rate)
+ 5% (Extreme Temperature)

After weighting each of the five criteria based on their relative importance to implementing Energy-Saving Trees, we developed an equation and calculated a ranking for each state. Following this formula, the top ten states where Energy-Saving Trees would have the highest likelihood of long-term implementation and viability are:

New York
California
Ohio
Maine
Hawaii
Delaware
Connecticut
Maryland
Rhode Island
DC

Appendix C provides a complete list of the results for all 50 states and Washington DC.

Three of these locations overlap with the Arbor Day Foundation's ten priority states (DC, Maryland and Delaware) and many of these states are also members of a carbon cap-and-trade partnership (New York, Maine, Delaware, Connecticut, Maryland, and Rhode Island).

Arbor Day Foundation should work with both the investor-owned utilities and the PUCs in each of the ten recommended target states, as well as the original ten priority states. In many states with energy efficiency programs, investor-owned utilities often determine the specific energy efficiency programs they will implement and the PUC approves the programs based on their cost-effectiveness—the main concern for both the utilities and the PUC. To improve the accuracy of such cost effective measurements, it is imperative that Arbor Day Foundation collects metrics from pilot programs and uses those numbers for marketing and cost estimates for potential

program adopters. An example of a metrics collection form is in Appendix D.

The energy savings from trees is a long-term investment, especially when compared to other energy efficiency measures, such as switching off a light bulb or switching to Energy Star appliances. Therefore, Arbor Day Foundation should take actions towards making the program more desirable to both the utilities and PUCs. Drawing off the six criteria given above, some example actions could include:

- Partnering with local tree planting organizations to act as the "boots on the ground"; these organizations can reduce mortality rates through increased stewardship, decreased shipping costs, and by collecting metrics from pilot programs.
- Focusing on counties with extreme climate conditions to reap higher energy cost savings.
- Prioritizing states that have policies mandating energy efficiency and programs to reduce carbon emissions to realize greater benefits from planting trees.

Findings

By incorporating qualitative research into the state ranking methodology, Table 1 provides the rationale behind program viability for each of the top ten ranked states. Additionally, understanding that the Arbor Day Foundation already has valuable pilot programs and relationships established in some states outside of the rankings, Table 1 also includes detailed descriptions of program viability for these states (Appendix E provides a more in-depth recommendation tailored specifically to Arbor Day Foundation's ten priority states where partnerships are already underway).

Cap-and-Trade States

Another potential avenue for consistent funding for Energy-Saving Trees is through participation with cap-and-trade programs. In addition to reducing energy costs for homeowners, shade trees can sequester some of the large amounts of carbon emitted by private residences. Marrying kWh savings with carbon sequestration offsets will greatly improve cost effectiveness of the Energy-Saving Trees program. One example of this is the Regional Greenhouse Gas Initiative (RGGI) taking place between many of the Northeast and Mid-Atlantic States. Since 2009, RGGI has invested over $617 million into improving energy futures of participating states, which includes supporting energy efficiency programs. Each state's carbon emissions are capped at a specific level, gradually decreasing over time. To reduce the economic challenges for larger emitters, RGGI established trading program for them to purchase offsets in order to counterbalance their emissions and comply with the regulation.

Reforestation and afforestation are examples of carbon offsets within a cap-and-trade program. These projects can sequester large amounts of CO_2 through the conversion of land from a non-forested to a forested condition. Energy-Saving Trees could potentially qualify as a reforestation or afforestation offset, but to date there has been zero afforestation offset allowances awarded by RGGI participating states.[25] This is likely due to the carbon offset pricing of forestry projects, as offsets have remained around $2 and forestry projects need offsets to be closer to $5 to make the project economically viable.[26,27] Thus, although leveraging the funds created by cap-and-trade markets does not seem like a viable option at the moment, this source of funding remains a large potential resource for Energy-Saving Trees and Arbor Day Foundation.

Appendix F gives details on each RGGI state and the offset funding to date. Specifically focusing on those states which overlap in the systematized ranking, pre-existing relationships, and cap-and-trade programs, such as Maryland and Delaware, should maximize the likelihood of successfully implementing an Energy-Saving Trees program in more states.

TABLE 1:
SUMMARY OF VIABLE STATES FOR ENERGY-SAVING TREES

	Ranking	Arbor Day Foundation Priority States	Statewide Energy Reduction Goals	Decoupling Policy
NEW YORK	1		✓	✓
CALIFORNIA	2		✓	✓
OHIO	3		✓	✓
MAINE	4		✓	
HAWAII	5		✓	✓
DELAWARE	6	✓	✓	✓
CONNECTICUT	7		✓	✓
MARYLAND	8	✓	✓	✓
RHODE ISLAND	8		✓	
MISSOURI	10		✓	✓
WASHINGTON DC	10	✓	✓	✓
NEW JERSEY	12	✓	✓	✓
COLORADO	18	✓	✓	✓
ARIZONA	20	✓	✓	
NORTH CAROLINA	28	✓		✓
TEXAS	29	✓	✓	
NEBRASKA	50	✓		
IDAHO	51	✓		

High Electricity Prices	High Proportion of Low-income Population	High Home-ownership	Extreme Temperatures	CO_2 Cap-and-Trade
✓	✓			✓
✓	✓			✓
✓	✓	✓		
✓	✓	✓	✓	✓
✓				
✓		✓		✓
✓		✓		✓
✓				✓
✓	✓			✓
	✓	✓		
✓				
✓				
			✓	
✓	✓	✓		
	✓		✓	
		✓		
		✓		

IMPLEMENTATION

IMPLEMENTATION

Though the process may vary from state to state, the general course of action for getting Energy-Saving Trees to become an approved energy efficiency program by the PUC is as follows:

- Once a utility company decides they want to adopt Energy-Saving Trees they must first apply to the state PUC in which they are seeking program approval. The key component of the application process requires the utility company to prove cost-effectiveness. Most often, the PUC requires the utility company to use the Total Resource Cost Test.
- After the utility company is able to prove cost-effectiveness, the PUC should approve Energy-Saving Trees, enabling the access to energy efficiency funds, which are usually collected as a surcharge to customer bills.

While this seems like a straightforward process, seeking approval can take a considerable amount of time and resources from a utility company. Moreover, many PUCs require energy efficiency programs to be re-evaluated annually. Given the multiple stakeholders involved in the approval process, Arbor Day Foundation must have a clear strategy for energy efficiency propositions, considering the process, timeline, and any stakeholder involvement. To begin outreach in any state, Arbor Day Foundation should first initiate a relationship with a utility company or PUC. Additionally, it is recommended that Arbor Day Foundation emphasize both quantitative and qualitative benefits of the Energy-Saving Trees program, even if not all of the benefits can be used in the cost-effectiveness calculation. Appendix G provides a sample one-page informational sheet as an example of useful information for potential utility companies to know when considering implementing Energy-Saving Trees.

In implementation, partnership with local nurseries is important to reduce shipping costs and increase survivorship. Successfully addressing the issue of high mortality will improve the cost effectiveness of the program, and thus improve the likelihood of program approval by the PUC. Further, case studies where partnerships with local tree planting organizations are emphasized have shown positive effects on tree survivorship.

Since program approval primarily rests on proving cost-effectiveness, robust data are vital not only to the longevity of the program, but in actually being able to quantify the program costs and benefits. As such, credible metrics will help promote program adoption by utilities and PUCs. These metrics can then be used in tree benefit calculators and software. One such example is *iTree*. The *i-Tree* tool is an innovative software that serves as a foundation of metrics for the Energy-Saving Trees program. It is essential to build on this foundation with new data as the program is implemented throughout the US, and making the tool more easily accessible to potential clients. Additionally, making these metrics more readily available

I-TREE TOOL

i-Tree is a tool for assessing and managing community forests that have been adopted by Energy-Saving Trees. This peer-reviewed software produced by the USDA analyzes and calculates benefits provided by trees. *i-Tree*, located at itreetools.org, is public domain and readily accessible.

to the public, such as providing moare detailed information regarding *i-Tree* on the Arbor Day Foundation website, would help entice more utility companies to implement and seek state energy efficiency approval.

Lastly, in conjunction to partnering with non-profits to improve tree stewardship among residential adopters, Arbor Day Foundation should also utilize local non-profit networks to follow up with calls or site visits to homeowners with the distributed trees. Further, Arbor Day Foundation's metrics should be collected during planting, frequently in the first several years after planting, and then on at least a five-year interval to aid in proving the vitality of the program.

Maryland as an Example

Maryland has energy demand reduction goals of 15% of 2007 per capita energy use and peak demand by 2015. Further, decoupling is in place in the state. A customer surcharge on all Maryland resident's electrical bills provides funding for a variety of energy efficiency programs and initiatives. EmPOWER Maryland, a program with a goal of statewide energy reduction, is funded by this surcharge.

Arbor Day Foundation currently has an established relationship with the two largest utility companies in Maryland, Baltimore Gas & Electric and PEPCO. In evaluation of statewide energy efficiency program approval, both utility companies and the Maryland Public Service Commission (PSC), Maryland's version of a PUC, evaluate and approve proposed programs.

To prove cost effectiveness, Maryland PSC utilizes the Total Resource Cost Test, based on the *California Standard Practice Manual*.[28] In addition, each utility also conducts cost effectiveness for their three-year plan, including a Total Resource Cost Test, Participant Test, Program Administrator Test, and Societal Test for their entire portfolio. Low-income programs can be an exception to this test and are not included in the utility's overall portfolio. [29] For example, in 2009 Southern Maryland Electric Cooperative's "Low Income Program" secured American Recovery and Reinvestment Act (ARRA) funding without passing the benefit-cost tests. The program provided free energy audits, weatherization, and retrofits to low income households.

Low-income customers may qualify as a participant if within 175% of the federal poverty level, and must be registered with Maryland's Electrical Universal Service Program. The Maryland Office of Home Energy reviews these qualifications before weatherization is performed. Upon approval, the Maryland Department of Housing and Community development implements the program for the five largest Maryland utilities, all part of the EmPOWER program.[30A] Currently low-income programs consist of only 1.3% of energy savings of all targeted megawatt hours, indicating an opportunity for increased energy efficiency in this sector.[30B]

CHALLENGES

CHALLENGES

Arbor Day Foundation faces several challenges in expanding the Energy-Saving Trees program nation-wide, classified into three main areas:

1. **Proving cost effectiveness**
2. **Tree delivery methods and stewardship**
3. **Other energy saving programs**

Each of these are discussed in more depth below, with greater detail for the three priority states of Maryland, Delaware and Washington DC.

Cost Effectiveness

The greatest challenge for utility companies seeking energy efficiency program approval from a PUC is proving the cost effectiveness of Energy-Saving Trees. Those savings can be quite variable and sometimes small. For instance, Table 2 shows energy savings in Maryland, Delaware and Washington DC derived from the **National Tree Benefit Calculator.** The table indicates high variance in energy savings depending on zonal temperature and altitude.[31] After ten years, the energy savings in Maryland and Delaware is approximately 136 kWh, whereas in Washington DC it is less than 60 kWh (to place these figures in context, the average American household uses 27,841 kWh per year).[32]

Given the high variability in energy savings from trees, proving cost-effectiveness would likely be less challenging if utility companies are allowed to look beyond direct energy savings. Other quantifiable benefits trees provide, which could be incorporated into cost-effectiveness are listed in the sidebox.

Unfortunately, at the time of writing, most utilities are not allowed by their state PUC to incorporate benefits outside of direct energy reduction when seeking energy efficiency program approval.

BENEFITS OF TREES

Environmental
- Reduce building energy demand (heat and cooling)
- Reduce stormwater runoff [34]
- Store carbon [35]
- Reduce air pollutants such as sulfur dioxide and nitrous oxide
- Provide landscape diversity

Public Health
- Filter airborne pollutants [36]
- Improve physical and mental health [37]
- Reduce noise [38]

Economic and Social
- Increase residential property values [39]
- Improve neighborhood connectivity [40]

Tree Distribution

Tree-based energy conservation programs face important challenges that include the inability to meet residential demand, a low proportion of planted trees that actually save energy, underperforming tree survival rate, and ambiguous tree planting locations. By addressing the following elements as part of the logistics process, Arbor Day Foundation may improve the cost-effectiveness of implementing the Energy-Saving Trees program.

Application process

Most tree giveaway programs ask potential participants to fill out requests or permit forms that are reviewed by forestry staff who then conduct site inspections. The

TABLE 2:
EXAMPLE OF BENEFITS IN MARYLAND, DELAWARE, & WASHINGTON, DC

Annapolis, MD ZIP: 21401 Climate zone: South Tree: American Elm	Benefits at 1 year 1.5" dia.	Benefits at 5 years 7.5" dia.	Benefits at 10 years 15" dia.
Energy Savings	2 kWh	50 kWh	136 kWh
Carbon Sequestration	9 pounds	218 pounds	486 pounds
Storm Water	45 gallons	938 gallons	3,351 gallons
Claymont, DE ZIP: 19703 Climate zone: South Tree: American Elm	Benefits at 1 year 1.5" dia.	Benefits at 5 years 7.5" dia.	Benefits at 10 years 15" dia.
Energy Savings	2 kWh	50 kWh	136 kWh
Carbon Sequestration	9 pounds	218 pounds	486 pounds
Storm Water	45 gallons	938 gallons	3,351 gallons
Washington, DC ZIP: 20003 Climate zone: South Tree: Red Maple	Benefits at 1 year 1.5" dia.	Benefits at 5 years 7.5" dia.	Benefits at 10 years 15" dia.
Energy Savings	0 kWh	16 kWh	58 kWh
Carbon Sequestration	26 pounds	78 pounds	239 pounds
Storm Water	21 gallons	305 gallons	1,565 gallons

Source: National Tree Benefit Calculator[33]

application can help collect useful metrics such as characterization of participants, their homes and their knowledge of trees. Having a thorough application and review process will reduce the number of participants but increase success rate. Additionally, some programs request participants to attend a workshop on planting and caring for the trees before final approval is granted. The main differences across programs are in the length of the request forms and whether attending a workshop is optional or mandatory. In Denver, Colorado, a not-for-profit organization, Park People, found that requiring attendance at a tree care workshop greatly reduced the number of persons interested in taking part in the program.[41] Therefore, instead of mandating attendance at a workshop, Park People now offers arborist expertise or pamphlets to participants to obtain the information needed to properly plant and care for their trees.

Cost of trees

Programs across the country vary in terms of how much participants pay for the trees. Some programs give trees away for free to encourage high participation, while others charge the participants but offer substantial rebates or coupons. Programs that charge participants tend to have higher tree survival rates. Having participants pay a portion of the tree cost cuts costs of the program and spurs higher engagement since they have a financial stake in the tree. In addition, some programs encourage donations or buying a tree for someone else, which can increase affordability for people in poorer neighborhoods and spread the overall costs amongst all participants.

Delivery methods

Trees are generally distributed to participants via a site pick up for group giveaways or through home delivery. Group giveaways maximize distribution efficiency and reduce delivery costs. However, while having participants pick up the trees themselves can decrease project costs, it could affect tree survival if they are not properly transported to the homes. A program based in Fort Worth, Texas, requires participants to organize into groups, and will only deliver trees if there are a minimum number of participants.[42] Requiring these kinds of group projects can create and reinforce relationships among participants, instill a level of community pressure to maintain a healthy tree, and enhance educational outreach.

Program coordination

In the Fort Worth, Texas program, one person from the neighborhood agrees to be the neighborhood coordinator and serves as the link between the forestry experts and the participating group.[43] A designated group leader goes through training, is responsible for ensuring that the trees are planted, and provides the program with a monthly report. This makes managing tree maintenance easier and less costly for utilities. Since the Energy-Saving Trees program is a multi-year project, it is critical that participants remain excited about caring for their trees in the long-term, and take ownership of the program. Enthusiastic residents motivate others to participate and are key to the program's long-term success and the survival of planted trees. Finally, new participants must be sought out each year, as existing participants are unlikely to plant trees again. An efficient way to market the program in the future is to mail application forms to new homeowners (a list of addresses can be obtained from the county assessor's office) and to target homeowner's associations and new subdivisions that may want to purchase trees for landscaping.

CONCLUSION

CONCLUSION

Tree-based energy conservation programs should create more partnerships among utilities and tree planting and education organizations to share best practices, mandate tree training for applicants, standardize *i-Tree* software use for site selection, and evaluate program implementation through field inspections and customer satisfaction surveys. For long-term program success, effective marketing materials and educational workshops are essential to teach residents about the benefits beyond energy savings such carbon sequestration and stormwater reduction.

Tree planting programs are increasing in popularity across the country due in part to the added aesthetic value, the increased community involvement, and the good public relations for utility companies and organizations. Because the overall benefits are often realized over decades, a long term program like Energy-Saving Trees may be more desirable when implemented as a state energy efficiency program. When all benefits are included, it is clear that the benefits to society outweigh the costs. Five main recommendations must be addressed to ensure continued growth and success of the Energy-Saving Trees program:

1. SUPPORT THE RESIDENTIAL ENERGY AND ECONOMIC SAVINGS (TREES) ACT

Arbor Day Foundation should sign on as a supporter to the TREES Act that was introduced by Congresswoman Matsui (CA-6) in April 2013. If passed, the bill would help provide funding for tree-planting programs aimed at energy reduction.

2. FOCUS ON THE IDENTIFIED PRIORITY STATES FOR EXPANSION

This report identified the states in which an Energy-Saving Trees program would be the most effective based on factors such as the electricity rates, the percentage of homeowners, the already existing state energy reduction goals, and more extreme weather patterns. The ten recommended states are: New York, California, Ohio, Maine, Hawaii, Delaware, Connecticut, Maryland, Rhode Island and DC. This ranking, along with the ten states prioritized by the Arbor Day Foundation, and the states with an existing cap-and-trade programs, provides a strategic expansion plan for Energy-Saving Trees.

3. CONTINUE TO DEVELOP RELATIONSHIPS AND PARTNERSHIPS WITH THE STAKEHOLDERS

There is a complex relationship among all the different stakeholders in each state, so implementation is different in every state. However, there is a common approach that this report advises: continue to develop relationships with investor-owned utilities and Public Utility Commissions, both of which are critical in implementing energy efficiency programs in each state. Furthermore, it is recommended that Arbor Day Foundation expand their connections with other local tree planting organizations and nurseries to provide deeper educational outreach and improve stewardship. This should result in better-informed and involved customers, which will ultimately influence the overall success of the program.

4. COLLECT METRICS TO EVALUATE OBJECTIVES

While the Energy-Saving Trees program is branded to reduce energy costs for customers, it is also important to emphasize the other

benefits of trees, particularly when it comes to evaluating whether the program is cost-effective. While many of the supplemental benefits of trees can be quantified, they are currently not included in cost-benefit analysis conducted by the utilities because the Public Utility Commissions are focused on energy consumption. Encouraging the development and enhancement of software like *iTree* to get more and better data, and monitoring the ongoing pilot programs will help improve the Energy-Saving Trees program overtime and provide the Arbor Day Foundation valuable marketing information to expand the program.

5. LEARN FROM OTHER EXISTING TREE PLANTING PROGRAMS

This report analyzed four key aspects of the programs including the application process, the cost of the trees, the delivery methods, and the program coordination existing tree-planting programs around the country to synthesize data on how they are managed and their success, especially regarding tree mortality rates and the program's cost-effectiveness.

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While this report identifies key methods to help scale-up Energy-Saving Trees and several associated challenges, Energy-Saving Trees is a program that is widely praised by both utility companies and its participants. Moreover, the Energy-Saving Trees program is instrumental in helping reduce the residential energy demand within the United States, as well as providing environmental, health, and social benefits. Although not all of these benefits can be incorporated into calculating cost-effectiveness for the program's approval at the state level, the full ecosystem and societal benefits achieved through Energy-Saving Trees certainly outweigh the costs. Furthermore, as the state of Arizona has demonstrated, when implemented efficiently, tree-based conservation can prove cost-effective for PUC approval. Hopefully, as Energy-Saving Trees continues to increase its presence throughout the US, Arbor Day Foundation will be able to reduce the program's implementation and operating cost, as it will have more utility companies to spread those costs across. In turn, this should help utility companies prove the program's cost-effectiveness on the PUC's terms.

APPENDICES

APPENDIX A. POLICY INNOVATIONS

DECOUPLING

Policies can separate a utility's revenues from the fixed costs of providing reliable electricity by a rate adjustment mechanism called decoupling.[44] Regulators first determine the utility's revenue requirement (typically based on the size of their customer base), which is then used to calculate what the utility charges to consumers independent of the amount of electricity they sell. Decoupling removes the incentive for utilities to avoid energy efficiency programs. Decoupling is often used to complement energy efficiency mandates or state energy goals.

Utility decoupling in the US was spearheaded in 1982 by the California Public Utilities Commission (CPUC), which adopted a decoupling policy for the state's natural gas and electric power sector, saving ratepayers an estimated $55 billion dollars over the past thirty years.[45] California's per capita energy use has since plateaued, while the rest of the country's per capita energy use has increased by nearly 50% (see Figure 3). As of 2011, there are twelve states (including Washington, DC) that have decoupling policies in place and over ten states with pilot programs,[46] which indicate a recent expansion in interest (see Figure 4). Decoupling can reduce a utility's financial risk and capital costs, but it can also shift financial risk to customers and unintentionally discourage utilities to control costs.[47,48]

DEMAND-SIDE MANAGEMENT

Demand-side management (DSM) reduces electricity use through energy efficiency or conservation programs at the end user side.[49] For the scope of this project, the end user is the residential homeowner. Rebate programs are popular DSM strategies for utilities to encourage homeowners to participate in energy efficient practices; however, most utilities exclude tree planting and are limited to upgrading appliances, installing high-efficiency appliances in new homes, or utilizing high-efficiency insulation and windows. State-issued rebate programs also exist. For example, Delaware offers independent incentives to install on-site renewable energy systems such as photovoltaics (PV), and the District of Columbia offers $500 to homeowners who successfully complete eligible energy upgrades on their properties.[50] Similar to rebates, tax credits and deductions can incentivize a large number of people but eligibility is limited by specific energy efficiency standards that vary by state.

PACE FINANCING AND TAX-CREDITS/ DEDUCTIONS

Property Assessed Clean Energy (PACE) financing involves states or municipalities providing homeowners loans to invest in energy efficiency improvements on their property.[51] In 2007, the first PACE pilot program was launched in California and today 28 states and Washington, DC have passed PACE-enabling legislation. States can also incentivize homeowners and utilities to adopt eligible energy efficiency measures by offering tax credits or deductions. Eligible energy efficiency measures often include the installation of energy efficient appliances and building retrofits for homeowners and utilizing renewable energy sources and energy efficiency programs for utilities. Although PACE programs are a viable long-term alternative to loans, they have been criticized by the Federal Housing Finance Authority (FHFA) for posing difficult risk management challenges for lenders, servicers, and mortgage securities investors.[52]

APPENDIX B. SUMMARY OF CASE STUDIES

ARIZONA PUBLIC SERVICE (APS)

(Serves part of the Phoenix metropolitan area)

APS funds a Shade Tree program in Maricopa County and is approved by the Arizona Corporation Commission, Arizona's public utility commission. APS offers free tree workshops and free trees to help customers reduce cooling needs by up to 10 percent and reach up to $50 per year in energy savings. Customers must be a current APS single home residential customer living in the county. Each household can receive up to three trees, depending on the age of the house (only two trees for houses built after 1980), and must complete program training.[53]

CPS ENERGY

(Community-owned, not-for-profit utility serving the Greater San Antonio, Texas Area)

CPS is the largest municipally-owned energy company in the U.S., providing electricity to 728,000 customers. Since October 1st, 2010, CPS has an ongoing Green Shade Tree Rebates program that currently runs from October 1st, 2012 to April 30th, 2013. Customers can purchase and plant up to five eligible trees and receive a $50 rebate per tree up to a maximum of $250 in total rebates per residential address. Customers submit a rebate application agreeing upon a specific planting site and allow program representatives to visually inspect the site in the future to track tree survivability. CPS Energy projects approximately 381 kWh, or $37 per year, in energy savings.[54]

SALT RIVER PROJECT POWER AND WATER (SRP)

(One of the largest U.S. public power utilities serving Central Arizona)

SRP provides water and electricity to more than 2 million customers in Central Arizona. It has a shade tree program that allows customers in the Phoenix metro area to receive up to three desert-adapted shade trees for Salt River Valley homes built before 1980 and up to two for all other homes. Residents are required to attend an intensive detailed workshop on how to best select, plant, and care for the trees. The 4-6 foot saplings will eventually provide an estimated 20 degrees in summer cooling, remove up to 2.6 tons of CO^2 each year per acre of trees, and save residents up to $50 a year on energy bills.[55]

ALLIANT ENERGY

(A Midwest utility that serves customers in Iowa, Wisconsin, and Minnesota)

Operation ReLeaf offers residential utility customers in Iowa the opportunity to purchase landscape trees at deep discount prices. This operation is funded by Alliant Energy and administered by the Iowa Department of Natural Resources Bureau of Forestry and the conservation boards of host counties.[56] The program began in fall 2001 and has hosted 119 Operation ReLeaf events, with more than 45,000 new trees planted. Currently, 2,800 three to eight foot trees are offered at $25 each during spring and fall planting season. Operation ReLeaf uses the *iTree* software to determine the best planting location for optimal energy savings. The trees are projected to help reduce cooling costs by up to 25%.

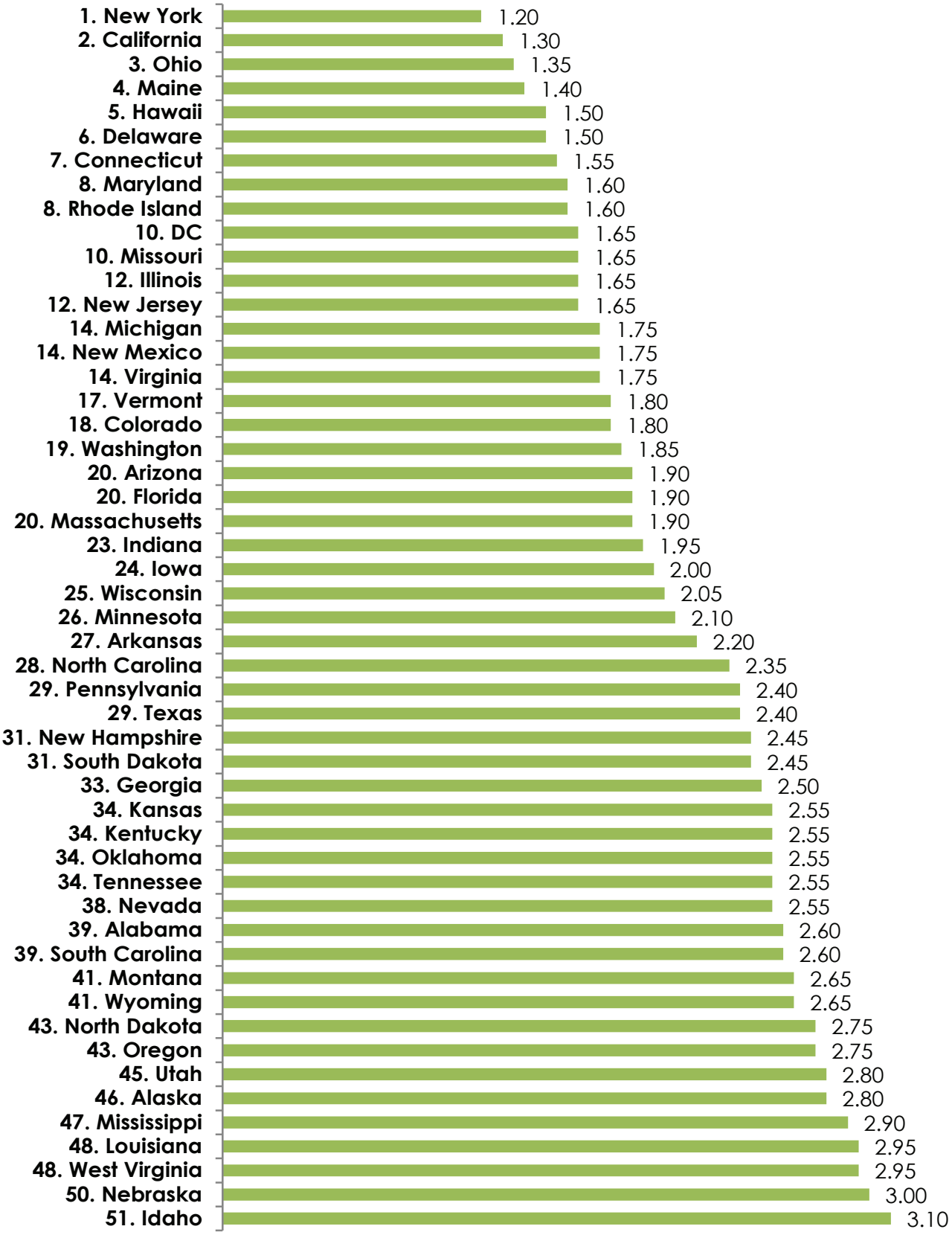
SACRAMENTO MUNICIPAL UTILITY DISTRICT (SMUD)

(Sixth-largest publicly owned electricity utility provider in the U.S.)

SMUD serves 1.4 million Sacramento region residents and has one of the most well-known and successful shade tree programs. SMUD's Shade Tree program estimates up to 40% energy savings on summer electricity bills. SMUD works with the Sacramento Tree Foundation (STF) to implement the Shade Tree program. STF sends a Community Forester to conduct a site visit to determine site selection. Up to 10 trees can be ordered and delivered to each home.[57]

APPENDIX C. STATE RANKING TABLE

Appendix C shows the complete results from the ranking system described in the methodology section. Each state recieved a ranking of 1 through 4 for each of the six criteria and were then weighted and averaged. Scores closer to 1 indicate a greater viability for ImplementingEnergy-Saving Trees.



APPENDIX D. METRICS FOR DATA COLLECTION

Appendix D shows an example of a table field workers can use to collect various types of metrics and measure tree health and benefits.

Date:

Location:

Name:

ID #	Species Name	Age			Condition				DBH				Height			Location Relative to House				Year Planted	kWh Savings	CO_2 Sequestered
		Young	Immature	Mature	Good	Fair	Poor	Dead	0"-8"	9"-16"	17"-24"	>24"	<25'	25'-45'	>45'	North	East	South	West	Use Benefit Calculator		

APPENDIX E.
TEN PRIORITY STATE POLICY RECOMMENDATIONS

Below are policy recommendations for each of the ten priority states identified by Arbor Day Foundation and already have pilot programs underway. States are ranked based on the greatest possibility of implementing ongoing Energy-Saving Trees programs at the state level based on funding for energy efficiency programs, decoupling, RGGI, and if they are considered by our ranking to be recommended target states.

1. MARYLAND

Maryland is an ideal candidate for a permanent Energy-Saving Trees policy. The current energy efficiency program is called "EmPOWER Maryland" and calls for a 15% reduction in per capita energy consumption by 2015 compared to 2007 levels. EmPOWER Maryland does not include a shade tree program, although the Maryland Public Service Commission does recommend it to customers to improve energy efficiency as a useful tip rather than an actual efficiency measure. Arbor Day Foundation has launched pilot programs in Prince George's and Montgomery County in Maryland and worked with Delmarva and Pepco that serve many customers within the state. It has also solicited commitment from Baltimore Gas & Electric (BGE) to participate in Energy-Saving Trees in fall 2013. Maryland is a member of RGGI and actively participates in carbon offset trading to invest in energy saving programs. If afforestation or reforestation offsets can be performed in a way that also produces kWh savings, then an Energy-Saving Trees program would be extremely cost effective.[58]

Additionally, Maryland has multiple well-established tree programs including Marylanders Plant Trees, Baltimore Tree Trust and Big Tree Program that could partner with Arbor Day Foundation to improve tree survival rate. Due to its previous and future Energy-Saving Trees program involvement, participation in RGGI, and placement on the top ten recommended target states Arbor Day Foundation should prioritize Maryland as a state to seek an ongoing Energy-Saving Trees program with the state PUC and major utilities.

2. COLORADO

Colorado passed a statute in 2007 that requires the two investor-owned utilities in the state to implement energy efficiency programs to reduce 5% electrical use and 5% peak demand from the 2006 level by 2018. The state is likely to achieve this statutory minimum requirement sometime this year and the PUC plans to increase these goals to carry out until 2018. According to the state statue, the PUC must go through a two- stage process to approve the energy efficiency programs outlined by the utilities to ensure that they are cost effective and that all customer categories (non-residential, residential, and low income) can participate. First, the utility files their strategic issue plan to the PUC docket that is open for the public to comment, and once this is approved by the Commission, the utilities can then develop and finalize the plan for implementing the energy efficiency programs. The utilities include NGOs, PUC staff members, other stakeholders, the State Energy Office, and large industrial customers for a series of conversations, and negotiations. Once the group has settled on a plan, it is presented to the Commission and, if the three categories, rather than the individual programs, are cost effective then it is approved. This is different from how other states evaluate the cost effectiveness of these programs because Colorado assesses the entire category instead of the individual program.[59]

Colorado has three main tree planting programs: Denver Digs Trees, Trees Across

Arvada, and The Street Tree Planting Program that are privately and publically funded programs dedicated to planting shade trees. With established local tree planting organizations and an energy efficiency program that analyzes cost effectiveness on a portfolio basis, the team recommends prioritizing Colorado for an Energy-Saving Trees program.

3. WASHINGTON DC

Washington DC is an ideal district for Arbor Day Foundation to target. Not only is Pepco, a current Energy-Saving Trees partner, the largest utility provider in the area, DC also has the District of Columbia Sustainable Energy Utility (DCSEU). DCSEU recently established to help "… District residents, businesses, and institutions save energy and money through energy efficiency and renewable energy programs."[60] Furthermore, DC has renewable energy portfolio standards and energy reduction goals in place to reinforce energy efficiency programs. One challenge for targeting DC is that many of its residents live in apartment buildings, which is not ideal for shade-tree programs. On the other hand, DC does have some low-income neighborhoods served by Pepco, where Energy-Saving Trees could possibly diversify its market base. Arbor Day Foundation could work with local tree non-profits, including *Casey Trees Tree Planting* and *American Forests*, to help with on-the-ground implementation.[61]

4. DELAWARE

Delaware has a history of promoting energy efficiency programs through the Sustainable Energy Utility (SEU) and the Energy Efficiency Resource Standard Act that became a statute in 2009. To date, energy efficiency programs have been funded through RGGI and the Federal Recovery Act and not through a surcharge to customers. The Department of Natural Resources and Environmental Control is trying to address some of the flaws in the statute and is drafting new legislation that will be introduced this year to allow Delmarva Power to seek rate recovery from the Public Service Commission for energy efficiency programs. Prior to drafting the bill, Delaware looked to best practices of energy efficiency programs throughout the United States and is proposing to allow Delmarva Power to charge customers a surcharge to perform energy efficiency programs that are cost effective.[62]

While Delaware is going through a transition period for energy efficiency funding, it is still ranked relatively high on our list because they participate in RGGI and is a part of the top ten recommended target states by our ranking. Additionally, Delaware has a local tree-planting program called *The Delaware Center for Horticulture-Community Trees* that could be a partner to help distribute trees at the local level and foster stewardship.

5. ARIZONA

Arizona is the model state for Arbor Day Foundation. Because it already has energy efficiency mandates, Arizona Public Service (APS), Arizona's leading producer of electric power, was able to apply for its shade tree program to become an approved energy efficiency program. By doing so, APS is able to use its allocated energy efficiency funds to pay for the shade tree program. APS's energy efficiency fund is maintained by charging all customers an "adjuster" fee in their monthly bill. This gives APS a reliable and consistent source of funding for its shade tree program. Currently, APS's tree program is offered only in Maricopa County for two reasons. First, Maricopa County has a very hot climate, and thus residents have a high cooling load, making Maricopa County an ideal location for a shade tree program because all energy efficiency programs need to be cost effective. If APS were to offer a shade tree program in a more mountainous area, the cooler climate

and smaller cooling load would not make the shade tree program cost effective, and therefore APS would not be able to fund the shade tree program using energy efficiency funds. Second, since Arizona has a unique desert climate, APS must use specialized trees that require little water. This means APS must find new local growers for future expansion. Understanding these two reasons will help Arbor Day Foundation address barriers to expanding Energy-Saving Trees expansion. One possibility for the expansion of this program in Arizona is for Arbor Day Foundation to partner with *Trees for Tucson*, a not-for-profit that offers trees at low cost to homeowners who plant the trees strategically for energy saving benefits.

In order to address the issue of cost effectiveness, Arbor Day Foundation can help lower the costs APS faces in program implementation and marketing. Currently, APS offers one hour in-person mandatory workshops to all shade tree participants. While the in-person workshops ensure that all participants have the skills to plant and care for their trees, they are costly. As an alternative, Arbor Day Foundation can work with APS to offer online workshops to reduce program operational costs, making it more cost effective in other counties. Another challenge for APS is to market their shade tree program at low to no cost. APS has to solicit sufficient participation to keep the program cost effective, but garnering interest can be difficult and marketing chips away at the overall operating cost of the program. Arbor Day Foundation could help APS reduce operating costs by providing marketing strategies and materials, making the shade tree program more cost effective in other counties.[63]

6. TEXAS

Texas is one of the few states that allow consumers to choose their electricity provider. The large number of competitive firms in combination with the high rates of customer satisfaction associated with energy saving trees may indicate that Texas is a good candidate for this program. Additionally, the state's warmer weather provides greater energy savings and its goal to reduce electricity demand over time both support an Energy-Saving Trees program. However, Texas does not have any statewide energy efficiency rebates in place, so state and federal legislature are not good targets within the state. We recommend partnership with *Neighborhood Tree Planting Program, COSA Tree Planting Challenge Program, and Neighborwoods*, the three major tree planting organizations in Texas, located in Fort Worth, San Antonio, and Austin, respectively.

While Texas does not have statewide energy efficiency rebates in place, we still recommend targeting Texas for Energy-Saving Trees programs as they have warmer weather, a need for customer satisfaction, and local tree planting organizations to help provide stewardship and increase tree survivorship.

7. IDAHO

The Idaho PUC mandates that utilities regulated under the PUC implement energy efficiency programs that are paid for by the consumers with a tariff rider on each bill. Each year the PUC does a prudency review on the utilities to ensure that they are cost effectively carrying out energy efficiency programs for their customers. The utilities complete a Demand Management Report each year that highlights all of the energy efficiency programs, including residential, commercial and industrial, and describes the cost effectiveness of each program. It is up to the discretion of the utilities to decide which energy efficiency programs to execute and it is the responsibility of the PUC to ensure that the programs are cost effective for the consumers.[64]

Since Idaho has an energy efficiency program and encourages their customers to plant

trees, we recommend Arbor Day Foundation work with the state's PUC and major utilities, such as Idaho Power, to demonstrate the cost effectiveness of Energy-Saving Trees as an energy efficiency program.

8. NORTH CAROLINA

The PUC of North Carolina has a great deal of control over energy efficiency programs in the state because three privately owned companies account for the vast majority of provided electricity. One private company, Duke Energy, provides electricity for 70% of customers in North Carolina, and has a history of pursuing energy efficiency standards. We recommend targeting Duke Energy for an Energy-Saving Trees program in North Carolina, in partnership with local tree planting programs such as *Trees NC Inc.* in the cities of Asheboro, Liberty, Seagrove, *and Trees Across Raleigh* in the city of Raleigh. The utility commission in North Carolina will need proof of strict cost effectiveness solely from an energy reduction standpoint.[65]

Because shade trees provide many societal benefits in addition to energy conservation, it may be more effective to pursue a state legislative mandate or other type of incentive. This seems viable due to North Carolina's history of approving green building codes, a utility decoupling strategy, and a Renewable Energy Portfolio Standards; although the state's temperate climate and wavering political affiliation may detract from that possibility.[66]

9. NEW JERSEY

New Jersey is working under Governor Chris Christie's Energy Master Plan, which calls for a 17% reduction in energy use to 80 million MWh by 2020 through the use of energy efficient building codes and appliance standards. These programs are part of the New Jersey Clean Energy Program, a statewide energy efficiency and renewable energy program that is administered and managed by the New Jersey Board of Public Utilities. According to the board, New Jersey is on track of meeting their goal of a 17% reduction in energy usage since 2008. The program is funded by a societal benefits charge (SBC) on the bills of all electric and gas customers of regulated utilities. The charge is estimated to add about 0.3 cents per kWh to the electric rate. The funding levels and budgets are established through a public process with energy efficiency and renewable energy committees that meet monthly. Interested stakeholders can suggest new efficiency programs that will then be evaluated for cost effectiveness and benefits.[67]

Currently, New Jersey does not have any energy efficiency program involving trees, but it could be part of an individual pay-for-performance application if the program provided a model demonstrating its energy savings and cost effectiveness. New Jersey withdrew from RGGI in 2011, but they are working towards a realistic energy efficiency goal and are open to new programs proven to be cost effective. Additionally, there is a local tree planting organization, *New Jersey Shade Tree Federation*, which could be a partner in improving the cost effectiveness of the program through stewardship and reduced tree mortality.

10. NEBRASKA

To date, Nebraska has no state legislation on energy efficiency, energy reduction goals or Renewable Portfolio Standards. Despite having no state mandates, eight utility companies offer energy efficiency rebate programs.[68] Additionally, Arbor Day Foundation launched an Energy-Saving Trees pilot program with Nebraska City Utilities in fall of 2011. During the same period, Pepco and Entergy also launched Energy-Saving Trees pilot programs at a much greater scale. Nebraska City Utility gave away 52 trees, whereas Pepco and Entergy each gave away 3,000 trees.

Nebraska City Utility offered the Energy-Saving Trees program again in the spring of 2012, scaling up to 98 trees. Access to reliable and consistent funding is one of the greatest challenges Nebraska City Utility faces in continuing and increasing the scale of the program. The lack of funding is likely a result of the absence of a state legislation on energy efficiency; therefore, at this time we recommend prioritizing other states with energy efficiency legislation and funding.

APPENDIX F. RGGI STATE PROGRAM FUNDING

Each RGGI state has acquired funds from the sale of carbon offsets. Below is a description of how each state has used their allocated money.

CONNECTICUT

About 70% of Connecticut's proceeds from the sale of RGGI CO_2 allowances are allocated for energy efficiency programs overseen by the Energy Conservation Management Board (ECMB) and administered by local utilities and cooperatives. In 2011, the program funded the installation of a 200kW solar electric power generator at the Ansonia High School. The remaining proceeds go to renewable energy programs administered by the Connecticut Clean Energy Fund (CCEF). By 2010, Connecticut had invested $29.6 million in energy efficiency programs, providing energy efficiency services to more than 1 million households, and $4.7 million to solar PV energy system installations on municipal buildings, adding an additional 1,200kW of power to the grid. The primary objectives of the CCEF manages the proceeds from the sale of RGGI CO_2 allowances to reduce ratepayer bills, promote economic development and energy security, and reduce negative environmental impacts; therefore, working with Connecticut to establish an Energy-Saving Trees program could be viable.[69]

DELAWARE

Approximately 65% of Delaware's proceeds from the sale of RGGI CO_2 allowances are managed by the Sustainable Energy Utility, a local entity tasked with providing energy efficiency and renewable energy programs for households and businesses. About 15% of the proceeds are allotted to low-income consumers through programs administered by the Department of Health and Social Services, including the Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP). The remaining proceeds are split evenly between greenhouse gas reduction projects and administering RGGI and climate change programs; therefore, Energy-Saving Trees programs could fall under these categories. In 2010, RGGI proceeds were invested into rebate programs of up to $200 for the purchase of Energy Star-approved appliances. More than 15,900 rebates were given to customers, reducing consumer energy costs by more than $366,000 per year and avoiding 1,196 tons of CO_2 pollution per year.[70]

MAINE

The proceeds from the sale of RGGI CO_2 allowances established the Efficiency Maine Trust to promote energy efficiency projects within the state. To date, the trust has spent $7.1 million to provide grants between $100,000 and $1 million for large-scale energy efficiency projects, such as the installation of combined heat and power systems. $5.8 million of the trust was invested in the Efficiency Maine Business Program, which provides incentives for businesses to replace out of date equipment and upgrade to energy-efficient alternatives. $2.9 million of the trust supports the Efficiency Maine Residential Lighting Program and Appliance Rebate Program to reduce energy demand and provide energy cost savings for consumers. In 2012, the program distributed over 200,000 energy saving compact fluorescent lightbulbs to low-income residents, saving families $2.3 million on electricity every year for the next ten year. Lastly, $650,000 of the trust was allocated to weatherization programs catering to low-income families. To date, no shade tree programs were included in the

programs.[71]

MARYLAND

Maryland's RGGI proceeds go to a Strategic Energy Investment Fund (SIEF), which is administered by the Maryland Energy Administration. SIEF mainly funds energy efficiency, conservation, demand response, renewables, and education programs. Through 2010, $19.9 million was invested in energy efficiency and renewable energy projects and $4.9 million was spent on solar, wind, and geothermal systems. A large portion of SIEF funds went to non-energy-efficiency programs as well, such as low-income bill payments ($45.4 million) and general Public Service Commission (PSC) relief ($23.5 million). To date, no shade tree programs were included in the programs.[72]

MASSACHUSETTS

Approximately 80% of Massachusetts' RGGI proceeds are required to go to utility administered energy efficiency programs in its Energy Efficiency Investment Plans. It is administered by the Department of Environmental Protection, which handles cap-and-trade implementation, and Department of Energy Resources (DOER), which handles RGGI auctions and use of proceeds. In 2009, $50 million was distributed to Program Administrators (PA) or electric utility providers. The allocations are based on each PA's electricity sales relative to total state sales. In 2009, National Grid received the most at $19.6 million. To date, no shade tree programs are administered so far through RGGI, but it could potentially qualify as an offset through the forestry category.[73]

NEW HAMPSHIRE

In New Hampshire, RGGI proceeds go to the Greenhouse Gas Emissions Reduction Fund (GHGERF). Ten percent of allocations are required to go to low income energy efficiency programs, and the remaining are allocated to electric and fossil fuel energy efficiency programs. Most allocations have been grants to private companies that focus mainly on energy efficiency audits and retrofits. A large shade tree program could possibly qualify as reforestation if it met all offset allowances criteria as outlined in the RGGI Model Rule. Since Climate Action Reserve protocol is the basis for RGGI Protocol, initial future developments are likely to happen at the program level.[74]

NEW YORK

The New York State Energy Research Development Authority (NYSERDA), the Department of Environmental Conservation, and the New York Public Service Commission are investing auction proceeds to improve energy efficiency; research, develop and deploy clean and renewable technologies; develop a green workforce; build capacity; and increase consumer awareness of cost effective options for conserving energy. In 2009, proceed investments were determined according to an Operating Plan and approved by NYSERDA. The majority of funds are invested to achieve cost effective near-term reductions, but at least 25% address longer investment horizons. Funds are also invested to help state, regional, municipal, and other government institutions to commit to and achieve significant reductions in green house gas emissions. A number of initiatives are specifically designed to reduce disproportionate energy cost burdens and harmful environmental impacts on low-income families. Through 2010, New York has committed $150 million of RGGI proceeds to twelve consumer benefit programs that reduce greenhouse gas emissions while promoting energy efficiency and renewable energy. While New York has not participated in Energy-Saving Trees programs in the past, their funding allocations suggest that it could be a viable program to reduce greenhouse gas emissions while promoting energy efficiency.[75]

RHODE ISLAND

Rhode Island abides by rules proposed by the Office of Energy Resources, Department of Environmental Management, and the Energy Efficiency and Resources Management Council, to distribute RGGI auction proceeds to consumer-benefit programs. The Plan for the Allocation and Distribution of Regional Greenhouse Gas Initiative Auction Proceeds directs 60% towards expanding existing and successful energy efficiency projects and programs supported by the Least Cost Energy Efficiency Utility Account. The remaining 40 % goes towards supporting new partnerships, research and financing options to drive energy efficiency program development and broaden energy savings for its residents. These programs have resulted in household energy savings of up to 25% and the generation of $3.73 in electricity cost savings for every $1 invested statewide. Energy-Saving Trees programs could be a part of the funding that supports new partnerships to increase energy efficiency and promote savings for the citizens of Rhode Island.[76]

VERMONT

Proceeds from Vermont's sale of RGGI allowances are directed to programs that support building heating and energy efficiency, and facilitate appropriate fuel switch. Half of these programs are tailored to benefit low-income residential consumers. A noteworthy program is *The Vermont Community Energy Mobilization Project*, a volunteer-based program that was created to install simple, cost effective energy-saving measures in homes across the state. Through 2010, volunteers visited roughly 1,100 homes in fourteen different towns in Rutland County. During the first two years of the program, the installed measures saved an estimated 590,000 kWh of electricity and 1,750 MMBTU of heating energy. Due to the recent funding allocations, Energy-Saving Trees programs may not be able to use RGGI funding in Vermont.[77]

APPENDIX G. SAMPLE FACT SHEET FOR UTILITIES

ENERGY-SAVING TREES

Utility Fact Sheet

Energy-Saving Trees is a scientifically proven program helps utility companies reach energy reduction goals through decreasing residential energy consumption. By strategically planting shade and wind-breaking trees, residents can conserve energy and reduce their daily and seasonal peak load. In addition to reducing carbon emissions through energy conservation, the trees also sequester carbon within a utility's service area.

Utility companies across the country are taking advantage of this innovative program by becoming partners with the Arbor Day Foundation. Current utility partnerships include:

Arizona Public Service
Delmarva Power
Baltimore Gas and Electric
Omaha Public Power District
Pepco
Sacramento Municipal Utility District

This innovative partnership allows electric utilities to avoid paying the full costs of fuel, variable operations, and maintenance through energy conservation from planted trees throughout the service area. The City of Sacramento saves 13,500,000 kWh of electricity every year from strategic tree planting. In addition to energy savings, these trees provide tangible benefits for the entire community, such as improved air quality, reduced stormwater runoff, lower urban heat island effect, and decreased carbon footprint. Energy-Savings Trees is an effective strategy to satisfy regulatory energy requirements and build a positive relationship with customers and the community.

I'm a representative of a utility company. How do I get started?

Contact an Arbor Day Foundation representative at 1-855-234-3801 or info@arborday.org. With our expertise, Arbor Day Foundation will help you set up a program with your budget, create partnerships with tree organizations, facilitate tree distribution, and organize workshops for planting and maintaining trees. In addition, Arbor Day Foundation will provide metrics to track the amount of energy saved over time.

Is there public funding available for the Energy-Saving Trees program?

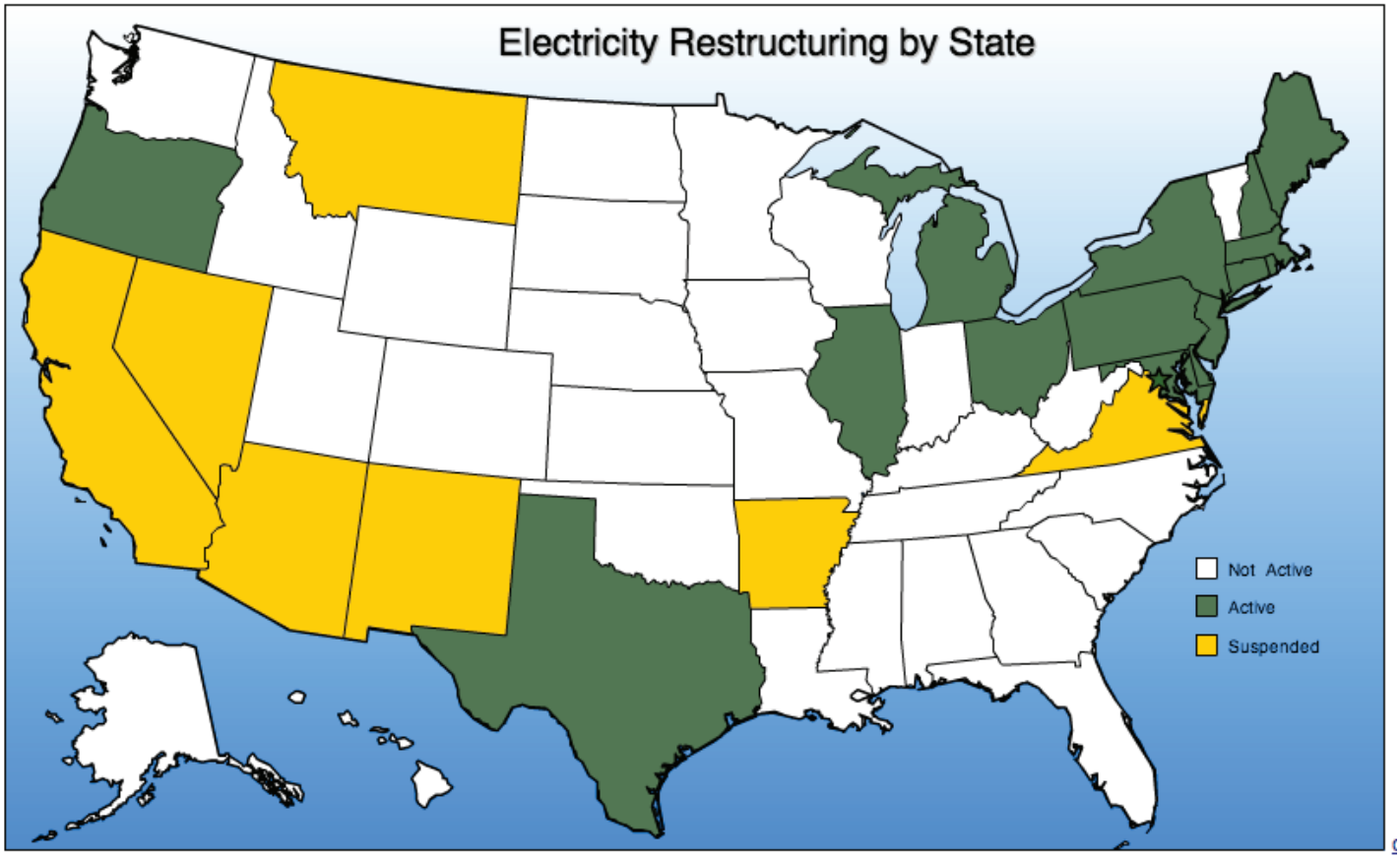
It depends on your state! Funding for energy efficiency and conservation programs, whether established through state legislation or through approval by your state's Public Utility Commission, can be obtained to finance Energy-Savings Trees. To find more information about state specific legislation on energy efficiency financing, please go to http://www.dsireusa.org/.

Energy-Saving Trees is operated in conjunction with:

Arbor Day Foundation DAVEY

APPENDIX H. ELECTRICITY RESTRUCTURING BY STATE

Appendix H shows a map of Electricity Restructuring by State. Electricity Restructuring is also known as dergulation. States are Active, Not Active, and Suspended. Twenty-four states and DC have either enacted or enabled legislation or issued a regulatory order to implement retail access. Six states have delayed restructuring, and 7 states have suspended retail open access. Twenty-six states are not currently pursuing restructuring/deregulation.



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