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Energy Justice in Maryland's Residential and Renewable Energy Sectors

A report of the Renewable Maryland Project

Lake City Village low-income housing, Seattle, Washington. *Photo courtesy of SolarWorld – www.solarworld.com*

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October 2015

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http://ieer.org/projects/renewable-maryland.

Materials related specifically to this report are at
http://ieer.org/resource/energy-issues/energy-justice-marylands-residential.

Preface and Acknowledgements

This report is part of a series of works being produced by the Renewable Maryland Project. The project aims to create a roadmap for an energy sector with the following attributes:

- **Essentially emissions-free**: more than 90 percent reduction in CO_2 emissions relative to 2006 by the year 2050;
- **Reasonable cost:** the fraction of income spent on energy by consumers does not exceed current levels (we use 2011 as our baseline year);
- **Just and equitable**: all Marylanders, including those with low incomes, can meet their energy needs without the high burdens that energy bills impose on them today;
- **Robust and resilient**: resistant to failure for essential services and quick to recover from breakdowns;
- **Democratized**: a transparent electricity sector that provides more choices to people of all income levels, including greater opportunities to participate in various aspects of the electricity system, including electricity generation and demand response.

The first phase of the project, in late 2012 and early 2013 began with consulting various stakeholders and the formation of an Advisory Board, a process in which Stuart Clarke, Executive Director of the Town Creek Foundation, played a central role. The consultations have continued since that time, including Advisory Board meetings that reviewed a draft report on the buildings sector emission reductions and electricity sector modeling, a draft and a final version of the report focused on heating and cooling of buildings in Maryland, and a draft of the present report, which is now being finalized. Advisory Board members serve in their personal (and not institutional) capacities; they may or may not agree with or endorse any of the findings, analyses, and recommendations of the work of this project, including the present report.

The role of the Advisory Board is as follows:

1. Ensuring that IEER's work is informed by near-term opportunities and careful understanding of what advocacy groups are doing. Reciprocally, there should be enough understanding on the part of advocacy groups to see what a path to climate protection and an emissions-free energy sector would look like.
2. Ensuring that the project remains grounded in - and cognizant of - Maryland's legislative, regulatory, and business landscape, a project where vision and pragmatism are linked to ensure that policies will be flexible enough to enable correction.
3. Advising on a communications approach and strategy, which is critical to achieving broad acceptance, adoption, and implementation of an emissions-free energy sector.
4. Helping the project not only to illuminate paths to the long-term vision but also to help identify obstacles that may need to be overcome along the way as well as diversions and dead-ends that would distract or detract from the goal.

The Advisory Board members are:

1. Rebecca Bertram, Program Director, Environment and Global Dialog, Heinrich Böll Foundation, Washington, D.C., office;

2. James McGarry, Chief Policy Analyst, Chesapeake Climate Action Center (alternate Tommy Landers, also of the Chesapeake Climate Action Network);
3. Lynn Heller, Baltimore Commission on Sustainability and Vice-President, Abell Foundation;
4. Larissa Johnson, Coordinator, Climate Change Outreach and Communication, Maryland Department of the Environment;
5. Pranay Kohli, Amidus;
6. Kathy Magruder, Executive Director, Maryland Clean Energy Center;
7. Ed Maibach, Director, Center for Climate Change Communication, George Mason University;
8. Alison Shea, Siemens;
9. Joe Uehlein, Labor Network for Sustainability.

Abby Hopper, who was Energy Advisor to the Governor of Maryland and Director, Maryland Energy Administration (MEA), was also a member of the Advisory Board until the end of 2014. Her appointment as Director of the United States Interior Department's Bureau of Ocean Energy Management has meant that she is unable to continue in that capacity. The Project benefited enormously from her advice and participation.

Overall, it is our assessment that almost every major sector will need to reduce CO_2 emissions by the target of 90 percent or more by 2050. This is because energy use is responsible for the vast majority of greenhouse gas emissions and because 90 percent reductions in some important sectors, such as aircraft fuel, may be difficult.

This report analyzes energy use in and emissions from low-income households in Maryland as well as corresponding costs. It provides some national context, and an approximate assessment for the efficiency of energy use in low-income households compared to average Maryland households. Most of the analysis is focused on low-income households that get bill payment assistance for heating or for electricity costs or both; the main aim of such programs is to reduce the burden of energy bills faced by low-income households and to enable heating and electricity supply to be maintained without interruption. Finally, we examine policies for ensuring greater energy affordability and analyze how weatherization and universal solar energy access might benefit low-income households as well as ratepayers and taxpayers who provide the funds for energy assistance.

The high energy burdens faced by low-income households are one part of a larger, complex combination of problems. Ultimately, the fundamental solution to high energy burdens is higher income, which means jobs that pay well, good education, a secure place to live, good health care, all of which become scarce with less income. This report deals with energy alone – and we recognize that brings with it significant limitations since we are dealing with the energy expenses side of the equation rather than the income, education, and other broader issues side. Nonetheless, energy is a critical issue in its own right because lack of it threatens health, economic security, and sometimes even life itself; for these reasons programs exist to assist low-income households to pay energy bills to ensure supply continuity and some measure of energy security, apart from other forms of assistance such as rent and food subsidies.

We are grateful to Paula Carmody, Director of Maryland's Office of People's Counsel (OPC), Seema Iyer of the University of Baltimore, and Bill Ariano and his staff at the Maryland Department of Housing and Community Development for providing many of the materials that we have used in the development of

this report and for sharing their insights. Cynthia Riely (Senior Consumer Liaison, OPC) provided useful comments as well.

Besides benefiting from the review of the Advisory Board, we also received feedback from the staff of the Fuel Fund of Maryland and specifically Mary Ellen Vanni (now retired) and Bill Freeman (now with Grid Alternatives). They convened a meeting of Energy Advocates, a Maryland group that helps low-income households obtain energy assistance, to review and discuss the report. This meeting was very helpful in providing in-depth practical perspectives on energy assistance, on policies to reduce energy burdens, and on the Affordable Energy Program, a proposal to restructure energy assistance to low-income households. We are thankful to Tiffany Hartung, Senior Coordinator of the Maryland Climate Coalition for making the connection with the Fuel Fund. Roger Colton generously lent us his expertise regarding the intricacies of the use of federal funds in certain assistance programs called Percentage of Income Payment Plans.

We are also thankful to Rebecca Ruggles, Director of the Maryland Environmental Health Network, Cheryl Casciani, Chair of Baltimore's Commission on Sustainability, David Costello, former Acting Secretary, Maryland Department of the Environment, Crissy Godfrey, Director Energy Analysis & Planning Division of the Public Service Commission, Alice Kennedy, Sustainability Coordinator, Baltimore Office of Sustainability, and Kristin Baja, Climate and Resilience Planner, Baltimore Office of Sustainability, who, among others, have given us advice at various times along the way.[1]

As always, only the authors of this report are responsible for its contents, analysis, findings, and recommendations, and any errors that remain.

A most special vote of thanks is due to the Town Creek Foundation, which has funded the Renewable Maryland Project in its entirety since its inception. It has been a special privilege that Stuart Clarke has shared his keen insights with us from the start, and has been central to the stakeholder outreach that has been part of our work since the project's inception. We also want to thank Megan Milliken on the Foundation's staff – she has flawlessly organized several stakeholder meetings in the last two years and has participated in them.

Lois Chalmers, IEER's Librarian, provided bibliographic assistance, fact checked and proofread the report, and carefully compiled the reference list. She is always due many thanks for her painstaking efforts in these critical areas.

Arjun Makhijani, Christina Mills, and Annie Makhijani
October 2, 2015

[1] Advice has been proffered in their personal capacity; organizations are noted for identification only.

Table of Contents

List of Tables

List of Figures

Report Overview

A. The Problem: Energy, Housing, and Health Insecurity

Low-income households face impossible choices between paying for energy, health, food, and housing. A 2011 national survey stated that sometime in the past five years more than one-third of them had to forgo medical/dental care and purchasing medicines because of high energy bills; almost one in five became ill because their homes were too cold. Six percent of energy assistance recipients were evicted from rental units and four percent faced foreclosure, exacerbating homelessness.

A Maryland household with average income pays 3-4 percent of their income on electricity and heating; for low-income households, that energy burden can be 10, 15, or even 20 percent and more. Why? First, low-income homes have much lower income but their energy consumption is not much lower than average. Their homes are less efficient than the average home, especially when it comes to space heating – on average they use about 50 percent more energy for heating per square foot than the average household. They tend to have older appliances and less effective insulation. Older and sicker people may also need to keep their homes warmer in the winter in order not to fall ill. Additionally, more low-income residents are renters who depend on landlords to improve their properties; yet many landlords may lack the incentive or the capital to do so. Landlords often refuse to give access to auditors even when offered free improvements, trapping low-income families with high energy bills.

B. The Social and Economic Impact

The costs to society of energy-housing-health conflicts are also huge. For instance, a 2010 U.S. Department of Housing and Urban Development study found that costs of housing a homeless family in Washington, D.C., ranged from $1,251 to $3,698 per month. Homelessness also aggravates health problems and causes new ones. A careful medical assessment of over 6,000 homeless people in Boston concluded that the added health care costs, like hospitalization and emergency room visits, compared to average low- and medium-income people totaled more than $1,400 per month. Once homeless, all problems become more difficult and complex; individuals and families can remain homeless for weeks, months, and even years.

The problem of high energy burdens has so far been addressed by assistance with paying electricity and heating bills, though some funds are also devoted to improving efficiency. About one-third of eligible Maryland households get aid, which materially reduces their energy burdens. Even so, burdens often remain unaffordable at 7, 8, 10 percent or more of income. Further, assistance funds are limited; household income at the low end of the income spectrum has stagnated or declined; needs have increased.

C. The Solution Part I: Affordable Bills

A fundamental approach is to ensure that the energy bills of low-income families are affordable – generally defined as 6 percent of gross household income. The rest of the energy bills would be covered by public funds from various sources. Such an Affordable Energy Program was researched by the Public

Service Commission staff in 2012. It has been put on the shelf mainly due to concerns about cost. But our research indicates that when the social benefits, including reduced costs of health care and homelessness, are taken into account, the overall cost of the Affordable Energy Program to the public will likely be lower than the present assistance costs. The principle of including such benefits when evaluating efficiency programs, including for low-income households, was ordered by the PSC in July 2015. Limiting energy bills of low-income households to six percent through the Affordable Energy Program can be the bedrock on which programs to reduce the need for assistance can be built.

D. The Solution Part II: Solar Energy, Efficiency, and Weatherization

The cost of solar installations has fallen dramatically, creating an enormous economic opportunity to bring solar to low-income households, even renters. This is a huge opportunity because providing solar energy at a discount to low-income households would reduce the costs of energy assistance.

Efficiency and weatherization will also reduce energy bills and the costs of assistance. Just one measure, a heat pump water heater, would save $220 per year compared to a regular electric water heater. For comparison, the average electric bill assistance was $325 per year in 2013.

The combination of investments in solar energy, efficiency, and weatherization will reduce the amount of assistance needed; in many cases, the bills will be below six percent of income, eliminating the need for assistance. The long-term social cost of a comprehensive program will likely be lower than the present assistance program, even if the number of recipients increases substantially in the future.

E. Complementary Policies

- Maryland should enforce its “minimum livability” and other codes and require landlords to allow property access for weatherization and efficiency improvements.
- Maryland should expand its efficiency and weatherization investments to bring down bills and the long-term cost of assistance.
- All new public and publicly subsidized low-income housing should be net-zero with solar panels onsite and/or offsite. Generally, residents of such housing will not need energy assistance because their bills will be very low.
- State energy assistance programs should allow units to switch from using fossil fuels, especially propane and fuel oil, to efficient electric HVAC systems. This will save money and reduce emissions.

F. Jobs and the Environment

A solar energy and efficiency program directed at low-income households will create 1,000 to 2,000 steady jobs that will endure for at least 10 to 15 years. Reduced air pollution, CO_2 emissions, health care costs, and homelessness will be other major benefits.

I. Executive Summary

A. The context of energy justice

For low-income households, paying for electricity and heating one component of a complex set of economic problems that includes food, medicine, rent or mortgage payments, and transportation to work. Very often a single event, such as a layoff or an unexpected illness of a family member who requires care, can unleash a crisis that involves missed payments on one or more fronts. The results range from increased distress to family disaster like loss of a home or a job. Energy bills are often a principal component of the economic distress of low-income households since they run to 10, 15, 20 percent or more of gross household income. At very low levels of income – 50 percent or less of the federal poverty level – the fraction of income needed to keep the lights on and the home warm enough to ward off illness can greatly exceed 20 percent. An affordable energy burden is usually defined as being at most 6 percent of gross income; the affordable total of energy and housing costs are considered as being up to 30 percent of income.

A large part of the problem is inadequate compensation for working low-income people. This is not an ideological or political statement. It is simply a fact relating income to cost of living: when rent and energy costs are so high that people stand to lose their homes or wind up in the emergency room or both, despite working one or more jobs, incomes are not adequate to allow people to live with dignity and security. People are housing, health, and energy insecure.

Energy assistance programs reduce the burden of energy bills for those who get such assistance – generally a minority of those who are eligible for it. But for the most part, assistance does not make bills affordable in the sense of keeping them below six percent of income. Nor do assistance programs address how access to renewable energy and energy efficiency programs can be made equitable for low-income households, especially those who are renters.

An energy justice approach to assistance would move assistance in a direction of assured affordability and fairness so that low-income households can equitably avail themselves of opportunities to reduce energy bills, and hence the need for assistance. Given that assistance to low-income households is often accompanied by indignities and social opprobrium, an approach to assistance that leads to a structural reduction of bills, and also a structural reduction of the tendency to accumulate arrears, would not only lead to greater energy security, but also allow low-income families to meet their needs with greater dignity and on a basis more akin to non-low-income households. A direction of energy justice is but one component of social and economic justice. Nonetheless, it holds the promise of making a significant contribution to the larger issue of the well-being of low-income families, especially if jobs in the energy sector are created so as to benefit low-income neighborhoods.

In this report we:

- Analyze energy use in average and low-income households, including estimation of energy burdens in Maryland.
- Examine some of the causes of high energy burdens faced by low-income households.
- Analyze how the combination of an Affordable Energy Program that limits burdens to six percent of income and investment in solar energy and efficiency can create a direction of greatly increased energy security, reduce the need for assistance, and provide significant social benefits that appear likely to make the overall cost of the program lower in time.

B. Findings

1. Energy burdens of low income households are high

High household energy bills as a fraction of income, known as "energy burdens" are part of the complex of economic problems faced by low-income households. While average-income households in Maryland have energy burdens of three or four percent, low-income households' burdens are high -- typically in the 10 to 15 percent range. For families at the lower end of the income spectrum, energy burdens are 20 percent or more. Figure ES-1 shows energy burdens for the average Maryland household, the average household receiving energy assistance, and a household with income at 75 percent of poverty level.[2] The figure indicates that households with income significantly less than 75 percent of poverty level can have energy burdens greater than 20 percent. This is in line with national data as well.

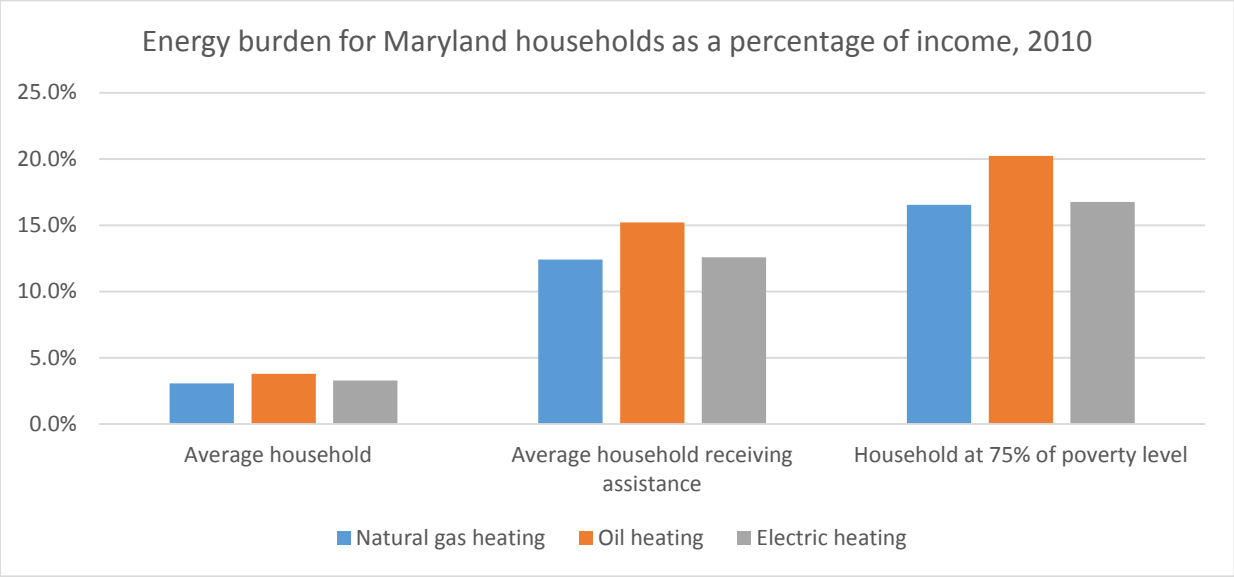

Figure ES-1: Energy burdens for average-income households and households at income levels where most energy assistance is targeted.

[2] The term "average Maryland household" is used to denote a household with income and number of people equal to the respective averages for Maryland. Similarly, the term "the average household receiving assistance" denotes a household with the average income and number of people of all Maryland low-income households receiving energy assistance.

Energy burdens can spiral to well over 20 percent at even lower levels of income than the 75 percent of poverty level shown in Figure ES-1. There were on the order of a million households with children living in "extreme poverty" at the start of 2011 – a condition defined as an income of $2 per day per person or less (in 2011 dollars), or about $2,000 per year or less,[3] about 12 percent of the federal poverty level.

At high energy burden levels, conflicts between allocating money for food, medicine, rent (or mortgage payment), and energy are frequent and often intense. They can and do have serious consequences for low-income families, including foreclosures and evictions, forgone health care, and medicines. When people become homeless for long periods of time, their life expectancy is greatly reduced.

One critical reason for high energy burdens is that energy use in low-income households is almost as high as the average household energy use, though income is more than four times lower (Figure ES-2).

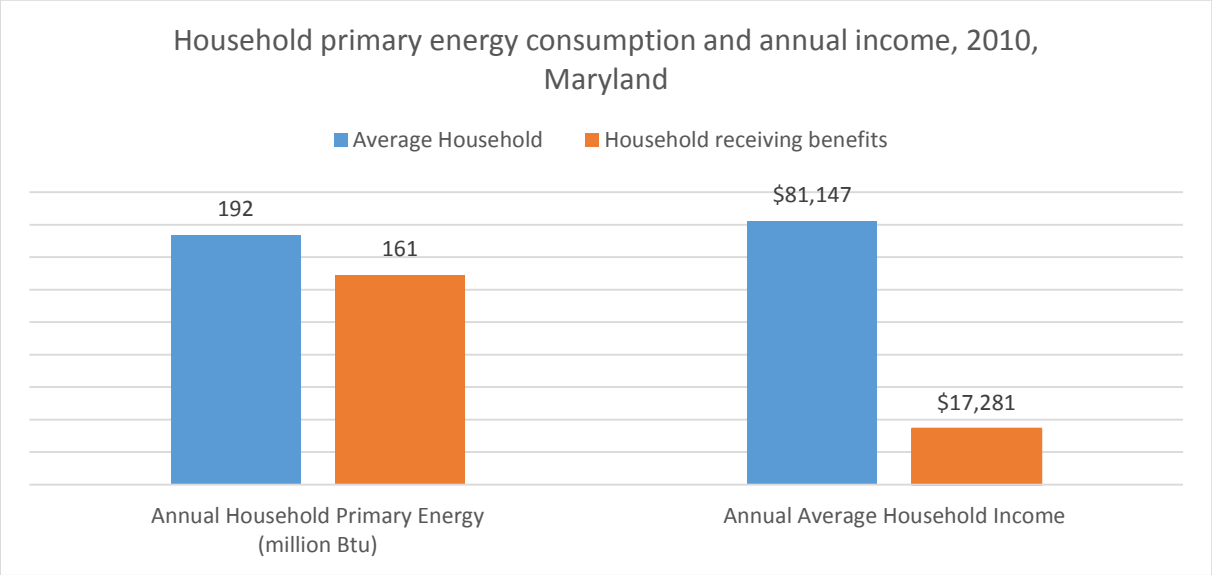

Figure ES-2: Average primary energy consumption and annual incomes in Maryland for average-income households and low-income households. Source: IEER.

2. Energy efficiency of low-income houses is relatively low

There are many reasons why energy consumption stays high even though income declines. One principal reason appears to be that low-income homes are less efficient than the average – that is they require more energy to provide the same energy services – heating, lighting, and running appliances than the average house. This is especially true when it comes to heating. Low-income household heating energy use per square foot is about 50 percent more than the average; in this context it is important to remember that the average residential household is also not very efficient. Figure ES-3 shows the efficiency per square foot for all energy uses and for heating alone, for both an average household and a household receiving heating assistance.

[3] Shaefer and Edin 2012, pp. 2-3

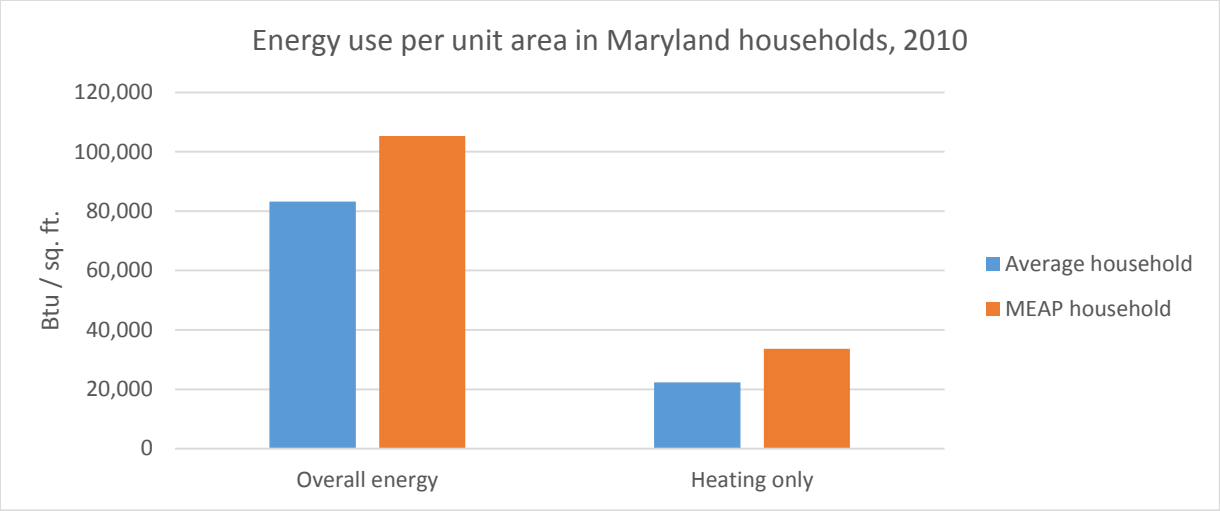

Figure ES-3: Total and heating only primary energy use per unit area, average for all Maryland households and the average for low-income households receiving heating energy assistance from the Maryland Energy Assistance Program (MEAP).

The lack of incentive for landlords to invest in energy efficiency who do not pay the energy bills is a well-known problem – it is called the "spilt incentive." Since a higher proportion of low-income families are renters, the split incentive problem affects them disproportionately.

3. High energy bills can and do have severe, even devastating consequences for low-income families

Low-income households face impossible choices between paying for energy, health, food, and housing. A 2011 national survey of households receiving assistance found that in the previous five years more than one-third had to forgo medical/dental care and purchasing medicines because of high energy bills; almost one in five had someone become ill because their homes were too cold. Six percent were evicted from rental units and four percent faced foreclosure, exacerbating homelessness.

The costs to society of energy-housing-health conflicts are also huge. For instance, a 2010 U.S. Department of Housing and Urban Development study found that costs of housing a homeless family in Washington, D.C., ranged from $1,251 to $3,698 per month. Homelessness also aggravates health problems and causes new ones. A careful medical assessment of over 6,000 homeless people in Boston concluded that the added health care costs, like hospitalization and emergency room visits, compared to average low- and medium-income people are more than $1,400 per month. The life expectancy of homeless people is drastically lower than average. Once homeless, all problems become more difficult and complex; individuals and families can remain homeless for weeks, months, and even years.

There are also costs to a variety of other parties. Utilities face higher unpaid bills; landlords do not collect as much rent as they might otherwise. Almost one-third of energy assistance recipients did not pay their full rent or mortgage payment sometime over a five-year period – adversely affecting landlords and banks.

4. Current energy assistance programs materially help aid recipients

A federal assistance program for heating bills and a state/utility program for electricity bills both help reduce energy burdens significantly. However, even after assistance energy burdens for low-income households exceed the affordable six percent amount.

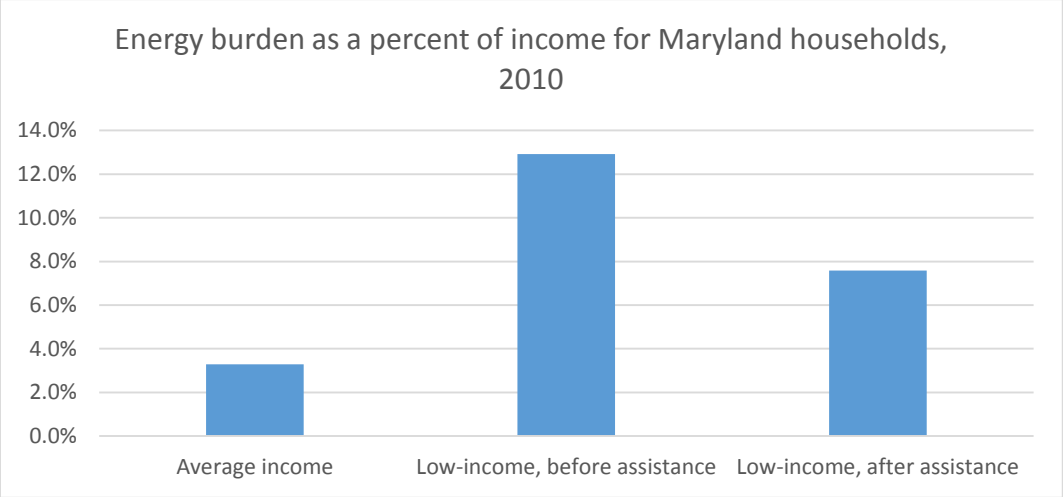

Figure ES-4: Average, pre-assistance and post-assistance energy burdens in Maryland. Source: IEER.

The areas where more than 10 percent of households apply for energy assistance are Garrett and Allegany counties in Western Maryland, the City of Baltimore, and Caroline, Cecil, Dorchester, Kent, Somerset, Wicomico, and Worcester counties on Maryland's Eastern Shore.

Heating assistance funds come entirely from the federal government; they are administered by the state under the rubric of the Maryland Energy Assistance Program (MEAP). Electricity bill assistance (the Electric Universal Service Program (EUSP) funds are a mixture of electricity ratepayer and other funds, including funds allocated from the Regional Greenhouse Gas Initiative (RGGI), in which Maryland participates. While the number varies from year to year, about 120,000 Maryland households receive energy bill assistance (heating or electricity or both).

5. Current assistance programs are insufficient and also do not address the problem of energy insecurity structurally

Only about one-third of Maryland's low-income households who are eligible for assistance get it. Yet, incomes are stagnating or declining and needs have been growing. Energy burdens after assistance are significantly lowered, but remain high – more than 7 percent for the average low-income assistance recipient. But in many cases energy burdens can be 10, 15, or even 20 percent of income, even after assistance.

More fundamentally, energy bill assistance does not address the problem structurally – it does not reduce the need for assistance. Efficiency and weatherization programs are aimed at doing that, but they are limited, and face many obstacles, especially for renters.

Further, one of Maryland's rules for efficiency actually prohibit some investments that could significantly reduce energy burdens and hence the need for assistance. Specifically, the funds of the state's efficiency program, EmPOWER, cannot be used in investments that involve fuel switching; for instance, assisting a low-income household in shifting from expensive oil and propane heating to invest in efficiency electric HVAC systems is not allowed. However, such fuel switching is available to households who do not need assistance for paying their energy bills. There are even state and utility programs that provide incentives for efficient electric technologies, such as highly efficient heat pumps, even when they involve fuel switching. This is both unfair to assistance recipients and wasteful for taxpayers and ratepayers, because it perpetuates the need for assistance, instead of reducing it.

6. The hurdles in making low-income homes more efficient are immense, even when the funds are forthcoming, especially in privately-owned rental housing.

Many landlords are resistant to efficiency improvements even when they are offered free by government-sponsored or -mandated efficiency programs. A weatherization pilot program in Baltimore found that "the **landlord is a unique and major barrier** [to weatherization] **for renters**." Of the barriers, permission to enter was the biggest: "Nearly half (46%) of all tenants who applied could not get permission for audit despite qualifying for weatherization otherwise."[4]

The issue of weatherization in low-income rentals raises the question: if tenants can be evicted for failure to pay rent, with the costs of homelessness to be borne at least in part by the public, why cannot landlords who spurn help be compelled to bring their properties into conformity with the law or else forfeit them to public ownership?

The problem of a lack of permission from the landlord to enter the property for an audit appears to be particularly serious where it concerns unsubsidized privately-owned low-income rental housing. A pilot project in Baltimore found that in most cases such privately-owned rental units tend to not be up to code. This commonplace lack of compliance exists despite the fact that Maryland has a "livability code" that requires rental properties (and others) to be maintained according to an international code of maintenance. Lack of code compliance may be a critical reason for refusal of permission to enter and hence a significant barrier to implementing energy efficiency measures. But whatever the set of reasons, the result is inefficient low-income rental housing and high energy bills. Such housing may also be unhealthy on other grounds.

Low-income efficiency assistance programs are still in their early stages in Maryland. These include weatherization and replacing heating systems and appliances with more efficient models. However, verification of the impacts indicated that early estimates of savings were rather optimistic. They also indicated problems with baseline data – that is, electricity use prior to weatherization. Nonetheless, an

[4] Pontious 2012, pdf p. 10 (bold in original)

energy-bill based review indicated significant benefits, even if in most cases the direct economic benefits were less than the costs.

7. Low-income households lack access to solar energy, despite its rapidly declining cost

Low-income households are almost completely excluded from the economic benefits of solar energy. Low rates of homeownership, lack of a broad community solar program from which renters can benefit, and other factors contribute to this result. **The lack of a broadly applicable virtual net metering law is an also an obstacle.** Recent community solar legislation in Maryland has allowed for a three-year community solar pilot program to be developed by the Public Service Commission (PSC). A stakeholder group will produce a final report documenting the pilot program, including any success of reaching low-income communities.[5] However there is no requirement in the program development to consider the particular concerns of low-income communities. It is also on a pace that is slow; it will be a long time before a significant fraction of low-income households can benefit from community solar energy.

8. Universal solar access would lower the cost of assistance

Solar energy costs have declined to a point that larger-scale distributed installations are lower in cost than regular residential electricity costs. This is a recent development in Maryland. **If utilities were required to acquire solar energy for low-income households on a commercial basis, it would lower the electricity bills of low-income households that get assistance, and therefore also lower the cost of assistance.** This conclusion assumes that the largest subsidy to solar energy – the federal investment tax credit of 30 percent – will expire at the end of 2016 as scheduled at the time of this writing (August 2015). Other solar subsidies, such as solar renewable energy credits and rebates on the first cost of solar installations, are also not required. Solar energy acquisition for low-income households can be done outside of the context of renewable portfolio standards and other climate considerations. There would be a climate protection benefit as well as other pollution reduction benefits of added solar energy acquisition.

9. More than 1,000 long-term jobs would be created by implementing a universal solar access and intensive efficiency improvement program for recipients of energy assistance.

Marylanders currently send more than $10 billion out of state each year to purchase natural gas, petroleum, and to import electricity. Building solar facilities in the state that are dedicated to supplying low-income households would keep some of that money in-state and also create jobs; efficiency programs would also have the same effect. Our initial estimate shows that 1,000 to 2,000 jobs would be created by a comprehensive program to provide universal solar access and efficiency improvements to current recipients of energy assistance. They would endure for 10 to 15 years. Of course, this is only a

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[5] "The Public Service Commission, in consultation with the Maryland Energy Administration, shall convene a stakeholder workgroup to study the value and costs of the pilot program established under § 7-306.1 of the Public Utilities Article, as enacted by Section 1 of this Act and make recommendations to the Commission on the advisability of establishing a permanent program... In conducting the study, the workgroup shall identify and examine: … (12) how community solar project developers can increase participation by low- and moderate-income retail electric customers in community solar projects;" See Maryland House Bill 1087 (2015), Section 2(a) and (b).

small slice of the new jobs in the broader transition to an efficient and renewable energy system overall in Maryland.[6]

10. CO_2 emissions would be significantly reduced by implementing a program of universal solar access and efficiency for low-income households.

Residential energy-related greenhouse gas emissions are about 22 percent of Maryland's total. Emissions from energy use in low-income households eligible for assistance (361,000 in 2011) are about 3 percent of Maryland's energy-related CO_2 emissions; households receiving energy assistance account for almost 40 percent of that 3 percent. Making the homes of those now receiving assistance more efficient and converting the electricity supply to solar would make an important dent in Maryland's residential sector emissions. The emissions-reduction benefit could be increased if the program were to be extended to low-income households not now receiving assistance.

C. Recommendations

1. The Affordable Energy Program, which would put a cap on energy burdens, should be the foundation of energy assistance

The most basic approach to addressing the core problem of assistance is to put a limit on household energy expenses in relation to income. Just such a program, called the Affordable Energy Program (or Plan), has been proposed in Maryland.

In 2012 the Maryland Public Service Commission (PSC) initiated a review of the adequacy of the Electric Universal Service Program. The PSC Staff, with the collaboration of the Office of People's Counsel, prepared a proposal under which **energy burdens, including natural gas (where applicable) and electricity, should, in general, not exceed 6 percent of gross income.**[7] The program has not yet been adopted, but the matter could be reopened for possible further consideration.

While there would be some provision for crisis assistance, the AEP would put low-income households on a par with non-low-income households in that they would be responsible for the affordable portion of their energy bills. For many households with income at the higher end of eligibility for assistance, this would mean payment of the entire energy bill. For the rest, responsibility would be for payment up to 6 percent of gross income; assistance would cover the entire amount above that.

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[6] We will address the transition to an emissions-free energy future as part of the Renewable Maryland Project's final report on the topic. This report will also include an estimate of the total number of steady, well-paying jobs that would be created in the process.

[7] Maryland AEP 2012, pp. 1-6. The 6 percent figure was arrived at by a general rule that housing plus utility expenses should not exceed 30 percent of gross income and energy expenses not be more than 20 percent of that. In households with both electricity and natural gas bills, there would be a maximum sublimit of 3 percent for each. See also Maryland AEP 2013. For oil and propane heated homes, we assume that heating assistance would continue as at present; in such cases, electricity assistance would limit electric bills to 3 percent of gross income.

In this report we assume here that the necessary regulatory and legislative changes to merge the available streams of funds would be taken so that the gas and electricity burdens combined are limited to six percent. Legislative and regulatory changes would be required to accomplish that. On that basis, and using the energy analysis of Maryland low-income household energy use, we estimate that the direct cost of energy assistance would have been about $29 million more in 2013 compared to the actual cost under the current program of about $121 million, assuming the same number of recipients. The number of recipients may go up under an AEP. The cost increase is not likely to be proportional to the increased number of participants, since present assistance is oriented to those most in need at the lower end of the low-income spectrum.

2. Low-income assistance recipients should be granted a choice of getting their electricity from solar thereby reducing the cost of assistance, promoting equity, creating local jobs, and reducing emissions.

Megawatt-scale distributed solar energy is now more economical in Maryland than grid residential supply even without the 30 percent federal investment tax credit. Procuring solar energy supply dedicated to energy assistance recipients would reduce the cost of assistance and reduce emissions of CO_2 and other pollutants. State subsidies and mandates, such as rebates or solar renewable energy credits are not required for this. Distributed solar energy installations in, or close to, the communities served by energy assistance programs would also create local jobs and provide opportunities for job training.

A program of solar energy procurement along the lines of community choice aggregation should be implemented; low-income households applying for assistance would automatically be signed up for solar supply unless they choose to opt out of it. On this basis, utilities could procure a supply competitively, using the instrument of purchased power agreements. We recommend that distribution utilities (or their local subsidiaries) be allowed to participate in the competitive bidding, but not allowed to include the facilities in the rate base, should they win the contracts.

3. The non-energy benefits of the Affordable Energy Program should be taken into account – they are huge, and are likely to offset the increased direct cost of assistance.

There would be large non-energy benefits from an implementation of the AEP; when they are taken into account, the net costs may be lower than at present, for the same number of recipients. In July 2015 the Maryland PSC ruled that if the costs to participants in energy efficiency programs are taken into account, then the benefits that accrue to them and to society at large also need to be factored into program decision-making.[8] The same thinking needs to be applied to the AEP, which would produce a host of non-energy benefits, including more money for food and medicine (and therefore better health), reduced evictions due to non-payment of energy bills, reduced bill payment arrearages, as well as greater incentives for the State of Maryland to promote conservation and efficiency (since that would reduce the costs of the program). We estimate that **the reduction in shelter and health care costs due**

[8] Maryland PSC 2015, pp. 13-16

to reduced homelessness alone is likely to be amount the same as the increase in the direct cost of the AEP for current recipients of aid. Other non-energy benefits, such as increased rent and utility bill collections, and better performance at school and work due to reduced stress on household budgets would likely make the net social cost lower than the present program. **A major policy issue is how to gather the quantifiable benefits and costs into a single stream and allocate them fairly to various parties.**

4. A comprehensive Affordable Energy Program, including universal solar access and efficiency investments should be implemented; the net cost of such a program for current recipients is likely to be lower than at present; there is more uncertainty about net costs if the number of recipients of assistance increases significantly under an AEP.

Solar energy acquisition would not only reduce the costs of assistance by lowering the cost of electricity for low-income households. It would create a number of non-energy benefits including reduced air pollution, reduced CO_2 emissions, increased jobs, and, if implemented on a neighborhood basis, possibilities for job training and community economic development. We used the middle estimate (of three) for air pollution reduction and CO_2 emission reduction benefits from in a 2014 study commissioned by the Maryland Public Service Commission. When these are added to the non-energy benefits of reduced costs of shelter and health care due to reduced homelessness, the net benefits of the AEP become very large over time as the solar energy acquisition increases, as can be seen in Table ES-1.

Table ES-1 Comparison costs and benefits of an Affordable Energy Program, with and without solar energy, to the present assistance program

	AEP no solar (2017)	AEP with solar (2017)	AEP with solar (2031)
Total 2013 assistance costs	$121,000,000	$121,000,000	$121,000,000
Total AEP costs	$150,000,000	$149,000,000	$119,000,000
Added AEP costs over present program	$29,000,000	$28,000,000	($2,000,000)
Non-energy benefits	$32,000,000	$35,000,000	$71,000,000
Net costs (negative = cost savings)	($3,000,000)	($7,000,000)	($73,000,000)

Source: IEER calculations.
Note 1: Estimates based on the number of assistance recipients in 2013
Note 2: All costs, including heating and electricity bill assistance, arrearage assistance, and administrative costs.
Note 3: Administrative costs of the AEP assumed to be double those of the present program

If the AEP is implemented using funds only from residential electricity ratepayers, but implemented with acquisition of solar energy, the added costs per month would be modest initially and decline to a small level. These costs would be more than offset by the social benefits, as can be seen in Figure ES-5.

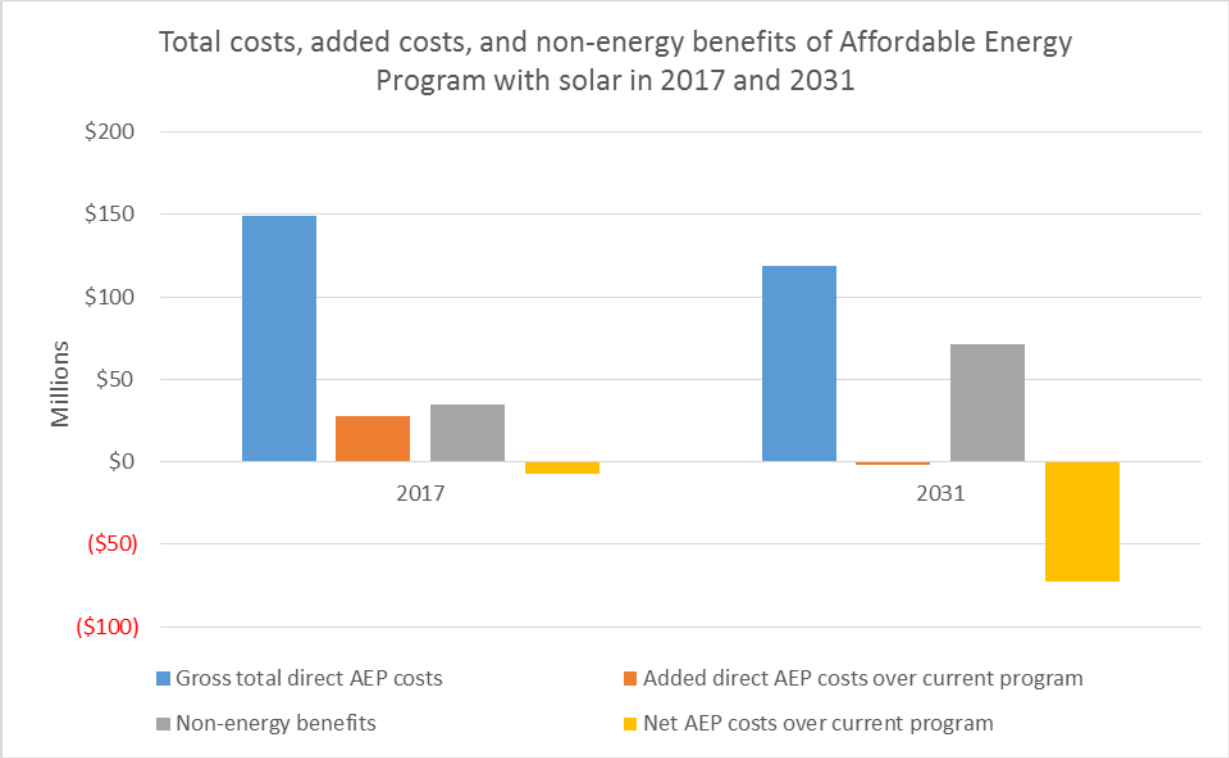

Figure ES-5: Gross and net total costs in 2017 and 2031 for an Affordable Energy Program, with universal solar access, for all current energy assistance recipients.
Source: IEER calculations.
Note 1: Number of residential ratepayers assumed to grow at the rate of Maryland population growth.
Note 2: Acquisition of solar energy assumed to take place in 15 equal increments, starting in 2017 and ending in 2031.

It is difficult to estimate the costs and benefits in the case of a much larger number of applicants. The cost per recipient is likely to be lower, but the benefit in terms of reduced health and shelter costs are also likely to be lower. The gross and net social costs of an AEP with double the number of recipients if both costs and benefits per recipient remain the same as for current recipients are shown in Table ES-2. This is a highly simplified conceptual calculation.

Table ES-2: Direct and net social costs of an AEP, with universal solar access, with double the number of recipients of 2013

	2017	2031
Direct AEP incremental cost over 2013 baseline	$177,000,000	$117,000,000
Non-energy benefits	$70,000,000	$142,000,000
Net added cost for double the recipients	$107,000,000	($25,000,000)

Source: IEER calculations.
Note 1: Number of residential ratepayers assumed to grow at the rate of Maryland population growth.

5. Implement a pilot program to determine the parameters, including costs and non-energy benefits across the range of eligible low-income households

A pilot program of sufficient scope is necessary to estimate the scope of the costs and benefits of an Affordable Energy Program. As noted, both the costs and benefits of adding recipients who are eligible but not currently recipients of assistance are likely to be lower per-recipient than for current recipients. The range of quantifiable non-energy benefits is very large – from reduced expenditure on health care to improved collection of rent and utility bills. But the specific costs and benefits are likely to vary considerably within the broad income criteria of eligibility for assistance in Maryland, up to 175 percent of the federal poverty level. Further, the energy characteristics of assistance vary a great deal across the areas of Maryland where there is a high rate (more than 10 percent of households) of applications for energy assistance – the two westernmost counties (Allegany and Garrett), the City of Baltimore, and most counties on the Eastern Shore. The fuels used for heating, the efficiency potential, and the potential for megawatt-scale distributed solar all need to be scoped out and integrated into program design and cost estimation. Income distribution within the low-income category may also be different in different areas of Maryland, including among current non-recipients of assistance. The non-energy benefits may also vary greatly in the three regions of highest need.

In view of the uncertainties, we recommend an intensive pilot program, which would include a sufficient number of households (at least several hundred) in each of the three areas to determine the cost and benefit parameters of an Affordable Energy Program with solar and efficiency as critical components. The number of households in each area would be determined so as to yield statistically reliable results for program design, cost estimation, and policy structure. In regard to policy structure, it will be important to structure the funding of the program to reflect, at least in part, the fact that benefits will be spread widely across government departments and private parties, including landlords and utilities. The pilot program should also be designed to collect detailed energy use and housing structure data. That would benefit assistance programs broadly.

6. Efficiency and weatherization programs should be offered widely and be structured so as to reduce the need for energy assistance.

There are certain efficiency programs that provide clear benefits and short payback times. For instance, the annual reduction in the cost of water heating with a heat pump water heater would be $220 when compared with a regular electric water heater. For comparison, the annual electricity bill assistance in 2013 averaged $325.[9] Going from incandescent bulbs to LEDs is widely recognized (and implemented) as an energy efficiency measure with a short payback time. Going from oil and propane heating to highly efficient heat pumps would eliminate most heating costs. For a typical single family home, the cost would decline from about $1,400 per year to less than $500 if a cold climate heat pump is used. Of course, such heat pumps have higher first cost.

[9] This does not include assistance with arrearages.

The main point is that with up front investments in carefully selected energy efficiency measures, the need for assistance can be greatly reduced and, in many cases, eliminated. In the context of an Affordable Energy Program, the reduction in energy bills would be directly reflected in a reduction of program cost. And to the extent that bills are reduced below 6 percent of gross income, other areas of life in a low-income household, such as health care, nutrition, and ability to meet housing costs, would benefit greatly. There would be attendant non-energy benefits.

Weatherization is a more complex issue. It is essential that baseline data be correct and that post-retrofit evaluations be done based on bills, supplemented by measurements. Research in Baltimore has shown that programs to improve housing are more effective when the health issues, such as lead paint abatement, are considered along with energy issues. Indeed, when there is an intensive engagement in a particular area, investment by non-recipient households can increase, multiplying the value of assistance programs.

7. Access to low-income rental housing for efficiency improvements should be generally secured; among other things, Maryland's livability code should be enforced with special emphasis on low-income rental housing.

Efficiency improvements reduce energy bills and the need for assistance. Landlords who do not allow access to their properties for efficiency improvements impose significant burdens not only on the renters but on the public purse (ratepayers and taxpayers). Many properties are not up to the housing code. The question therefore arises as to why landlords should have access to public resources, such as the sheriff's office for evictions, when their properties are not in compliance with legal requirements. Among other things, the use of public resources should be denied to landlords who do not allow access to their properties for efficiency and weatherization programs.

Enforcing Maryland's livability code should be one important component of securing access and of improving low-income rental housing stock.

8. The rule prohibiting the use of EmPOWER efficiency funds for fuel switching should be rescinded.

Switching from fuel oil and propane to efficient electric heating would greatly reduce heating bills and hence the need for regular energy assistance. It may even eliminate the need for assistance in the context of an Affordable Energy Program. Allowing fuel switching to efficient electric systems would also reduce greenhouse gas emissions and make heating systems renewable-grid ready. In other words, CO_2 emissions would decline even further as emissions from electricity generation are reduced.

Allowing fuel switching would also increase jobs in Maryland, since expenditures to install efficient electric systems would be made instead of year-in-year-out expenses for importing fuel oil and propane from out of state.

9. All new public and publicly-subsidized low-income housing should be net-zero in energy use.

It is less expensive to build efficient housing from the start than to retrofit existing housing to make it more efficient. It is also less complex to design new housing to include solar energy supply. Heating should preferentially be of the highly-efficient electric variety. In some cases, multi-story housing for instance, there may not be enough roof area or land to build enough solar capacity to supply the entire electricity requirements. In such cases, offsite construction of supplementary solar to make the net energy requirements from external sources equal to zero, should be required.

II. Scope of the problem – energy use, bills, and burdens

Energy use in households is far less variable than income and tends to decline far more slowly than income. This is understandable – energy, including for heating and cooling, but also for refrigeration, water heating, and lighting – is, like food, a necessity. Households tend to sacrifice other things as income goes down in order to keep up with energy costs. In Maryland, low-income households, for purposes of assistance with heating or electricity bills or both, are defined as those with incomes less than 175 percent of the federally defined poverty level.[10]

A. Energy use

Table II-1 shows national data for average energy use in all households, average use in all households that are not low-income, all low-income households, and low-income households that get government and/or utility assistance to pay their energy bills. Note that upstream losses, such as thermal losses at electricity generation stations, are not included in the energy data in Table II-1 (or in subsequent tables unless otherwise mentioned).

[10] Maryland PSC 2013, p. 2, for assistance with electricity bills, and Maryland Budget Analysis FY2016, p. 31, for heating assistance. Income eligibility limits are at Maryland DHR Eligibility 2014. Maryland's EmPOWER energy assistance program provides weatherization assistance, for which the income criterion is 200 percent of the federal poverty level (EmPOWER 2015). Nationally, states are allowed to set the maximum income level at which assistance will be considered (not all applications accepted result in grants of assistance). The federal upper limit is 150 percent of poverty level or 60 percent of the state median income, whichever is greater, but the cutoff can be as low as 110 percent. See LIHEAP Campaign 2014, p. 7. There is also assistance given at most once every seven years to retire cumulative arrears in electric bills; waivers to the seven year rule are possible (Maryland EUSP Plan FY2015, pp. 11, 14-15). This program is part of the Electric Universal Service Program (EUSP) and is designed to prevent cutoffs of electricity supply. We will not deal with the arrearage part of the program in this report.

Table II-1: Average energy use per household in the United States in FY 2010 for all uses, by income level and by the main heating fuel used.

Census Region	All fuels (MMBtus)	Natural Gas (MMBtus)	Electricity (MMBtus)	Fuel Oil (MMBtus)	Kerosene (MMBtus)	LPG (MMBtus)
US - All households	97.8	113.8	63.2	143.9	55.3	112.9
US - Non low-income households	104.1	118.7	68.1	152.8	61.3	119.8
US - Low-income households	86.1	103.5	54.7	130.1	54.2	99.8
US - LIHEAP recipient households	104.6	114.7	50.7	147.4	77.9	113.7

Source: LIHEAP 2010 Notebook, Table A-2 (p. 57)

Note: The energy use includes all end uses, including heating, cooling, refrigeration, lighting, etc. The households are classified according to the main fuel used for space heating. MMBtu means million Btu. Electricity is converted to Btu at 3,412 Btu = one kilowatt-hour electrical. Energy use is the total at the point of use. Losses at power stations and in delivering fuel are not included.

We can draw several conclusions from Table II-1. First, energy use of all low-income households is lower than the average for non-low-income households by about 17 percent.[11] Second, while the differences vary according to the fuel used for heating, the energy consumption in low-income households is consistently lower. Third, households that get energy assistance through LIHEAP (Low Income Home Energy Assistance Program) and use fossil fuels for heating use about the same amount of energy on average as the average for non-low income households.[12]

A comparison of all low-income households with those receiving assistance shows that those receiving assistance use more energy than those who do not. A principal reason may be because low-income households with high energy use and bills are more likely to seek and get assistance. Other reasons may include:

- Households receiving assistance are more likely to live in colder climates.
- LIHEAP households may have more members per household than other low-income families.

Since age is one criterion for getting assistance, LIHEAP households may keep winter temperatures higher than other low-income households. Table II-2 shows the average heating energy use by income

[11] A similar difference (about 20 percent) was found for the year 2009 in the U.S. Energy Information Administration residential energy consumption survey. See EIA RECS 2009 Data, Table CE 2.1 for households with income below 150 percent of the federal poverty level compared to those above.

[12] The LIHEAP heating assistance program is known in Maryland as the Maryland Energy Assistance Program (MEAP). LIHEAP programs across the country, including in Maryland, are federally funded. The Maryland electricity bill assistance program is known as the Electricity Universal Service Program (EUSP); it is funded from state and electricity ratepayer money. There is overlap between the two programs in that heating assistance is provided to households who use electricity as their heating fuel. In Maryland, coordination is achieved, among other methods, by a single application for both heating and electricity assistance (Maryland DHR Application FY 2015).

level for the United States as a whole. Since low-income homes are smaller than average homes, the data indicate that low-income homes are more inefficient. We quantify comparative heating and overall energy efficiency for Maryland in Section III.

Table II-2: Average heating energy use per household in the United States in FY 2010, according to heating fuel and income group.

Census Region	All fuels (MMBtus)	Natural Gas (MMBtus)	Electricity (MMBtus)	Fuel Oil (MMBtus)	Kerosene (MMBtus)	LPG (MMBtus)
US - All households	40.4	52.4	9.7	92.7	21.5	55.6
US - Non low-income households	41.6	52.1	10.3	96.1	25.5	60.9
US - Low-income households	38.1	53.1	8.7	87.4	20.7	45.6
US - LIHEAP recipient households	53.8	62.5	9.4	93.6	25.5	50.2

Source: LIHEAP 2010 Notebook (2013), Table A-5 (p. 62)

1. Energy burdens, national data

Since household energy use declines much more slowly than income, if at all, the fraction of income going to energy bills, known as the "energy burden," is greater in low-income households. Table I-3 shows national data for energy cost and average individual energy burden[13] as a fraction of income for the same four income groups, by main heating fuel used.

[13] Energy burden is calculated in two ways. The "mean individual burden" is computed by first calculating the percentage of income spent on energy by each household in the group. The mean individual burden is the average of all these percentage values. The "mean group burden" is calculated by adding all the energy expenditures and all the income of households in the group and obtaining the overall energy expenditure as a percentage of total income for the group. Mean individual burden is more indicative of the typical situation of households in the group in regard to energy expenditures. Mean group burden is more useful for estimating the impact of policies to provide assistance to a group of low-income of households.

Table II-3: Energy expenditures and average individual energy burdens by income group and main heating fuel used in the United States in FY 2010

Census Region	All fuels		Natural gas		Electricity		Fuel oil	
	$ per year	% of income	$ per year	% of income	$ per year	% of income	$ per year	% of income
US - All households	$2,120	6.90%	$1,993	5.70%	$1,908	7.10%	$3,570	12.10%
US - Non-low-income households	$2,277	3.50%	$2,149	3.10%	$2,059	3.40%	$3,841	5.50%
US - Low-income households	$1,830	13.20%	$1,663	11.20%	$1,653	13.40%	$3,155	22.30%
US - LIHEAP recipient households	$1,986	15.40%	$1,762	13.40%	$1,346	15.10%	$3,596	24.90%

Source: LIHEAP 2010 Notebook (2013), Tables 2-1a, 2-1b, 2-1c, 2-1d (pp. 4-5)
Note: For brevity we have omitted LPG and kerosene heated households. The latter is not explicitly listed in some Maryland data, notably the KEMA Draft 2011 report, which we have used extensively for analysis of average-income households. The economics of LPG are similar to those of fuel oil heated homes.

The energy burden of low-income households varies by the fuel used for heating, being the highest for fuel oil. Propane heating is comparable to fuel oil. Almost 20 percent of Maryland homes use these two fuels for heating.[14] The burdens shown in Table I-3 are averages for each group. However, the "low-income" group covers a very wide array of incomes and household situation. Energy burdens in the very lowest brackets (less than the federal poverty level) are very high. For instance, in Maryland, households with income at less than 50 percent of the federal poverty level in 2014 had an estimated average energy burden of 40 percent.[15]

Eligibility criteria for heating assistance are set by the states with federal guidance. Electricity bill assistance is based on state decisions (including by Public Service or Utility Commissions); the federal government is not involved in them, except that the heating assistance portion for electrically heated homes comes from federal funds. We will use 2010 as a reference year in this analysis since we have detailed Maryland energy data for 2009, 2010, and 2011.

State eligibility criteria vary a great deal. Most states use a percentage of the federal poverty level to define heating assistance eligibility; the criteria ranged from 110 percent (Michigan, North Carolina) to 225 percent (New Jersey) in FY 2010. A number of states use a percentage of state median income to define eligibility. The maximum percentage for determining poverty levels allowed under federal guidelines was 75 percent of median income. For the states using median income criteria, the maximum income eligibility ranged from 167 percent of the federal poverty level (Louisiana) to 266 percent

[14] KEMA Draft 2011, Table 3-3 (p. 25)
[15] Fisher, Sheehan & Colton 2015, pdf p. 4

(Connecticut). New England states tend to have a higher threshold for qualification, presumably because fuel oil heating, which is the most expensive, is still common in the region.[16]

Nationally, about 30.37 million (about 26 percent) households had incomes that were low enough to qualify them for assistance in paying their heating bills under state criteria prevalent in FY 2010; the maximum federal criteria would qualify many more. Figure II-1 shows the national trends from 1981 to 2010 in the number of households eligible for heating assistance under maximum federal criteria and the number actually getting it. Generally, the need increased in the 1980s and 1990s but the fraction of households getting assistance tended to decline. Between 2005 and 2010, both the number of eligible households and assistance recipients increased. Besides income, need for heating assistance depends on the weather in any given year and fuel prices. An analysis of the combination of these factors in the period 2005-2011 showed that the impact varied considerably. In some regions, such as New England, the ratio of assistance needed to that available did not deteriorate in this period relative to a 2007-2008 reference year. But in other regions, including the South Atlantic, which includes Maryland, there was a marked deterioration in the latter part of the period.[17]

In FY 2011, the maximum federal criterion for eligibility was changed to the greater of 150 percent of the federal poverty level or 60 percent of the state median income.[18] This drastically reduced the maximum number of households that were theoretically eligible from 44 million in 2010 to 36 million in 2011.[19]

[16] LIHEAP 2010 Notebook (2013), p. i, footnote 3, for the state median income percentage, Table B-3 (p. 70) for eligibility criteria, and Table A-4 (p. 61) for heating fuel saturation data.
[17] Colton 2014, p. 15 and p. 17
[18] LIHEAP 2011 Notebook (2014), p. i, footnote 2, and Table B-3, note 2 (p. 106)
[19] LIHEAP 2010 Notebook (2013), Table B-4, and LIHEAP 2011 Notebook (2014), Table B-3. There are slight discrepancies for 2010 between the chart shown in Figure I-1 and the LIHEAP notebook data for 2010 cited in this footnote.

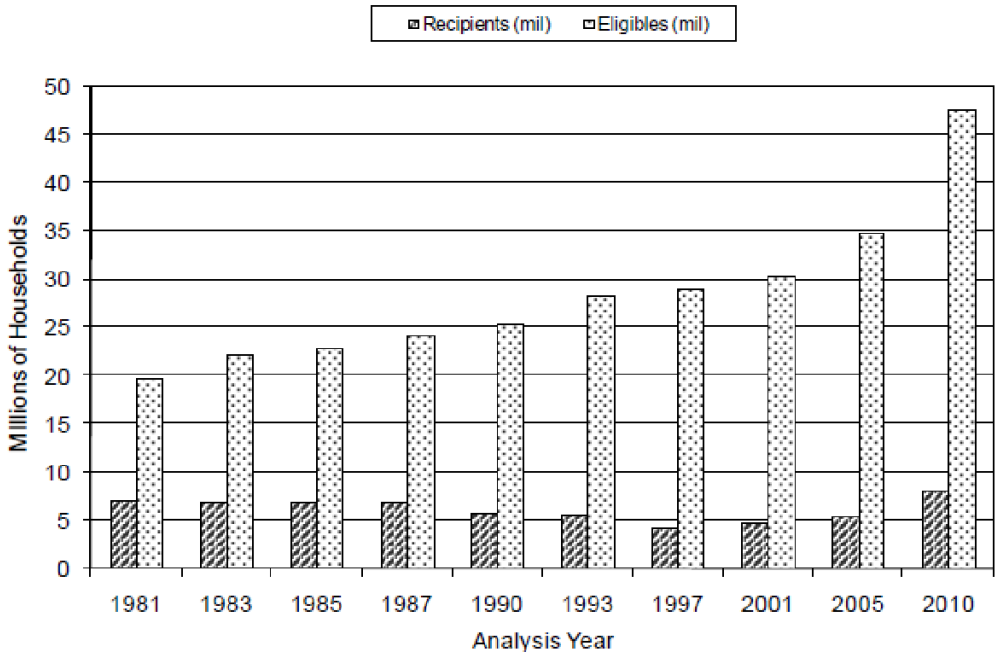

Figure II-1: Number of income-eligible households for heating and/or winter crisis assistance, and the number of households receiving assistance, FY 1981 to FY 2010. Source: LIHEAP 2010 Notebook (2013), Figure 11 (p. xi).

2. Consequences of high energy burdens

The energy burdens in

Table II-3 above represent the average values for that income group. Within those groups there are many households that have energy burdens that are higher. For those with the lowest incomes among low-income households, energy burdens, even with the less expensive fuels, can reach over 20 percent. This creates what are sometimes called "heat or eat" conflicts;[20] in reality the conflicts are often not only between energy and food, but also include other critical needs, including medical care and rent. A 2011 survey by the National Energy Assistance Directors' Association found that over five years, low-income households that received assistance in one or more of these years still faced severe distress in many areas:

> Because of the difficulty they faced in paying their utility bills, these vulnerable households were forced to make choices that carry serious health risks. As many as **37 percent** went without medical or dental care, and **34 percent** did not fill a prescription or took less than their full dose of prescribed medication. In addition, **19 percent** became sick because the home was too cold.[21]

[20] Frank et al. 2006

[21] NEADA 2011 Brief, pdf p. 3, emphasis in the original. See also NEADA 2011, where the survey is described in detail.

The survey also found clear evidence of rent or mortgage payment conflicts with energy bill payments, including evictions that resulted from such conflicts:

> Many LIHEAP recipients had difficulty paying for housing, in part because of their energy burden. Almost one-third did not make their full mortgage or rent payment. *Six percent were evicted from their homes or apartments, and four percent faced foreclosure on their mortgages.*[22]

These problems are, of course, most severe for those experiencing them. But it should be noted that the costs to the public of caring for homeless people, especially if they are ill, can run into thousands of dollars per month, while energy assistance is typically under $100 per month. (See Section VIII below for further discussion of non-energy benefits.)

Finally, about a third of LIHEAP recipients resort to using kitchen stoves or ovens to heat their homes. The use of gas stoves or ovens, especially if they are not tuned and maintained, can cause high indoor carbon monoxide levels, leading to poisoning and even death. Carbon monoxide related deaths have been documented throughout the United States, including in Maryland's largest city, Baltimore.[23] But it is unclear how many of these are related to contingencies like furnace failure, lack of appropriate heating equipment, as distinct from inability to pay electricity, natural gas, or fuel oil bills.

About one-fifth of residential fires nationally are due to causes related to home heating. In the 2002-2004 period, there were 49,100 heating-related residential fires per year on average; annual damages were 125 deaths, 575 injuries, and property losses of $232 million.[24] We do not have comparable data for fires in low-income homes. Residential fires have been declining slowly over the years.[25] There were 57 deaths due to residential fires in Maryland in 2013. There were four fatalities related to heating and lighting (candles) while the causes of about one-sixth of the fatal fires were undetermined.[26]

There are also a large number of other collateral effects on third parties, such as increased arrears in bill payment, increased rate of failure to pay rent (and hence lower rent collections), etc. Such considerations will inform our recommendations on energy and assistance policy in regard to low-income households.

3. Energy use and energy burdens in Maryland

Maryland's criterion for heating and/or electricity bill assistance is 175 percent of the federal poverty level. Using this criterion, about 351,000 households were eligible in 2010 and nearly 361,000 households were eligible in 2011. We should note, however, that under the 2010 maximum federal criterion of 175 percent of the state median income, a far larger number of Maryland households -- about 795,000 -- would have been eligible in 2010; under the 60 percent criterion, 645,000 would have

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[22] NEADA 2011 Brief, pdf p. 7, italics added.
[23] Birkby 2008, see especially slides 9, 12, and 19.
[24] National Fire Data Center 2006, p. 1 and Figure 1
[25] Data are available at the US Fire Administration website, at http://www.usfa.fema.gov/data/.
[26] Maryland Fire Marshal 2013, p. 3 and p. 5. There was a total 69 fire deaths in Maryland in 2013.

been eligible in 2011.[27] The latter figure is about 30 percent of Maryland households. The increased Maryland eligibility numbers when the state median income is used as the criterion is a reflection of the fact that Maryland has the highest median income in the United States.[28]

Figure II-2 shows that just over 30 percent of eligible households have been getting heating aid in recent years and a similar percentage get assistance with electricity bills; however, the fraction of households getting assistance has been declining slightly since 2010, in part due to fiscal constraints.[29] Figure II-3 shows the total number of Maryland households applying for heating and energy assistance and the number that receive each type of support.[30]

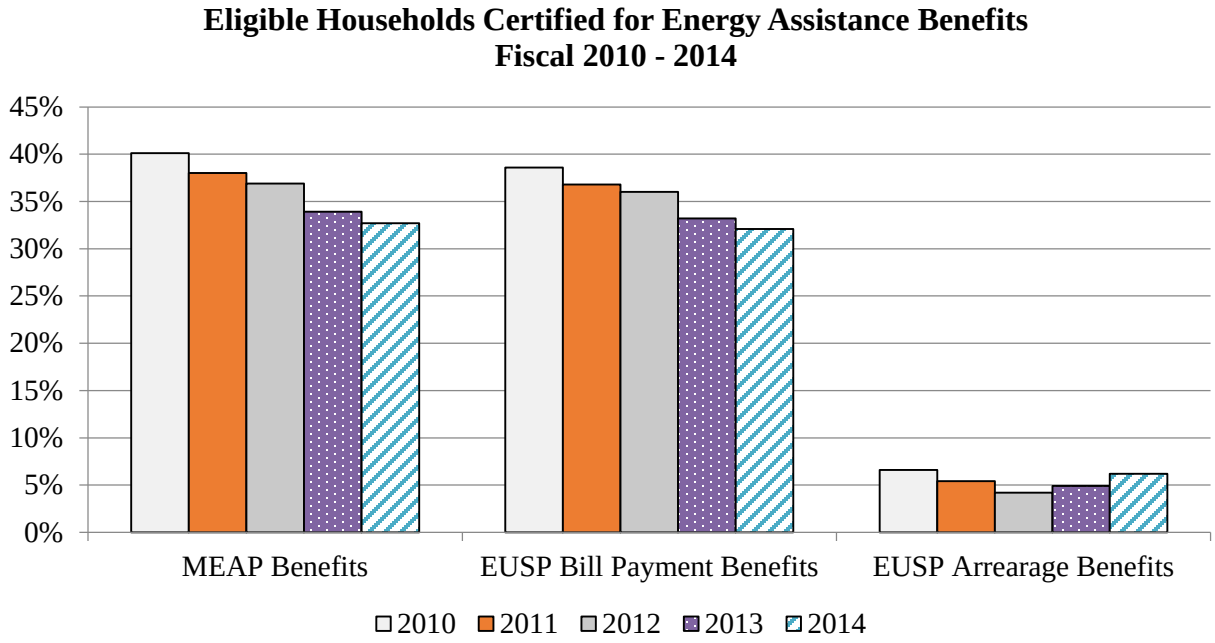

Figure II-2: Trends in heating and electricity energy assistance in Maryland. Source: Maryland Budget Analysis FY2016, Exhibit 5 (p. 11).

[27] LIHEAP 2010 Notebook (2013), Tables B-3 and B-4, and LIHEAP 2011 Notebook (2014), Tables B-2 and B-3
[28] US Census Maryland 2014; MD highest median: Maryland at a Glance Income 2014
[29] Maryland Budget Analysis FY2016, Exhibit 2 (p. 7)
[30] Arrearage assistance is also shown in Figure II-3. It is designed to help prevent shutoff of electricity supply by providing aid to clear accumulated past-due electricity bills; it is given at most once in every seven years (with waivers available) and is not analyzed in this report (Maryland EUSP Plan FY2015, pp. 11, 14-15).

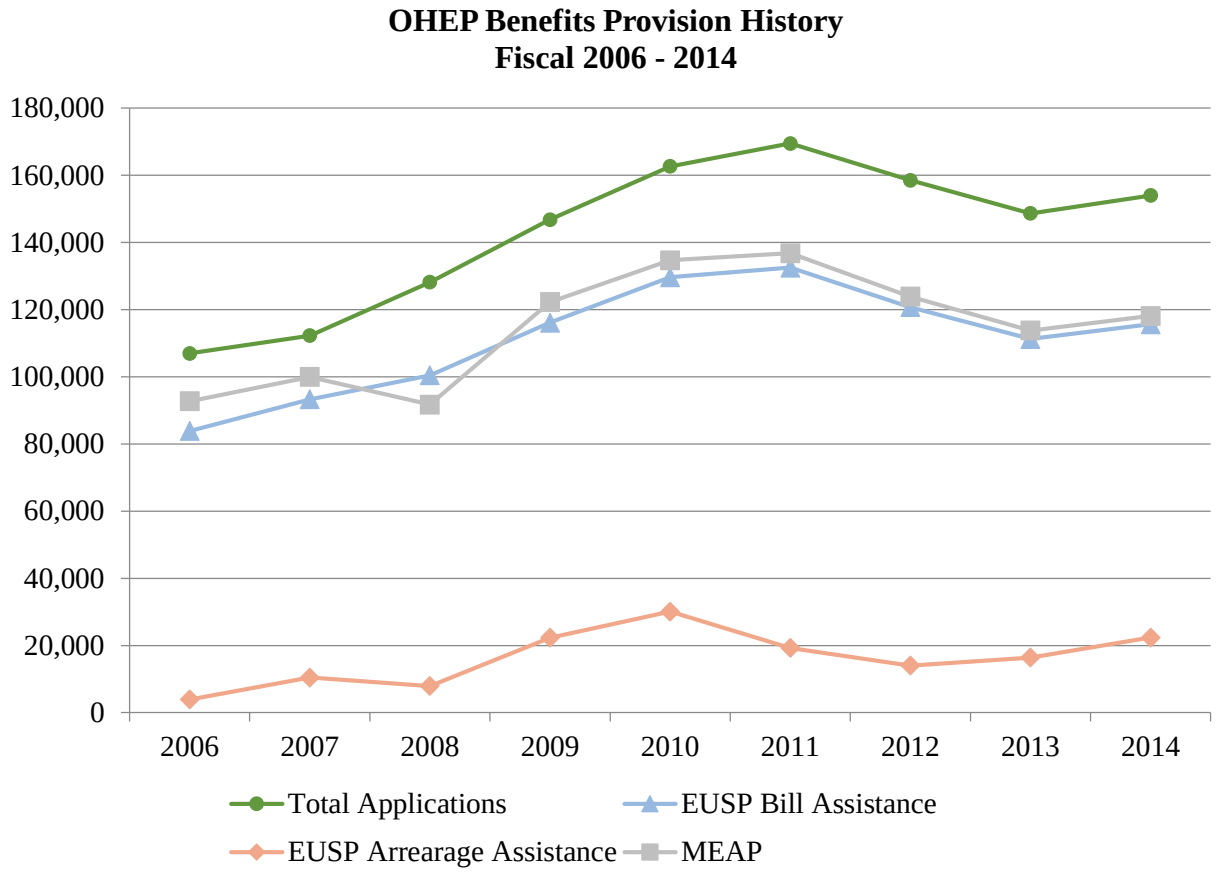

Figure II-3: Number of households applying for and receiving heating and electricity assistance in Maryland. Source: Maryland Budget Analysis FY2016, Exhibit 1 (p. 6).

There is a single, common application in Maryland for the two types of assistance and a considerable overlap between those who get both electricity assistance (EUSP) and heating assistance (MEAP). In the case of households with electric heating, the heating assistance, when provided, is added to the EUSP.

B. Detailed geographic analysis of Maryland energy assistance

Table II-4 shows recent data on county-by-county heating assistance applications (MEAP) and electricity bill payment assistance (EUSP) applications and approvals in each category through April of 2014. Table II-4 also shows the percentage of households applying for one or both types of assistance, by county. The application percentage is closely correlated with the percentage of households below the poverty level in the county. Statewide about 73 percent of the heating assistance applications and about 75 percent of the electricity applications were approved.

Table II-4: Applications for, and grants of, heating and electricity bill assistance in Maryland, FY 2014 (Note 1), by jurisdiction.

County	Number of households 2014	Percent applying	Percent below poverty level	Total Applications	MEAP		EUSP Bill Payment	
					Applied	Approved	Applied	Approved
Allegany	31,193	16.0%	17.40%	4,984	4,771	3,589	4,841	3,912
Anne Arundel	212,138	4.0%	6.30%	8,381	8,031	4,989	7,762	4,813
Baltimore City	252,072	13.1%	23.80%	33,092	32,633	24,606	30,368	23,315
Baltimore	328,861	5.9%	8.90%	19,250	18,505	10,903	17,055	10,834
Calvert	31,746	4.6%	4.90%	1,469	1,468	1,312	1,434	1,284
Caroline	11,935	16.6%	14.40%	1,987	1,978	1,764	1,934	1,725
Carroll	61,466	5.5%	5.60%	3,398	3,349	2,433	3,275	2,373
Cecil	37,295	10.9%	10.40%	4,054	4,002	3,387	3,863	3,260
Charles	53,824	5.5%	7.00%	2,965	2,961	2,741	2,902	2,690
Dorchester	13,666	20.2%	16.50%	2,756	2,663	2,532	2,694	2,562
Frederick	90,715	4.7%	6.10%	4,241	4,240	3,251	4,240	3,206
Garrett	12,170	20.6%	13.90%	2,512	2,507	2,339	2,410	2,259
Harford	92,859	6.6%	7.40%	6,152	5,801	4,655	5,523	4,639
Howard	113,383	3.3%	4.60%	3,788	3,743	2,344	3,731	2,346
Kent	8,068	15.4%	13.20%	1,245	1,241	1,122	1,190	1,077
Montgomery	379,350	2.9%	6.70%	10,942	10,770	5,720	10,500	5,528
Prince George's	320,032	4.5%	9.40%	14,444	13,351	9,060	13,822	9,406
Queen Anne's	17,991	7.5%	8.10%	1,343	1,339	1,076	1,288	1,040
St. Mary's	40,153	6.6%	7.20%	2,649	2,647	2,458	2,560	2,378
Somerset	11,451	14.8%	23.40%	1,694	1,690	1,525	1,645	1,489
Talbot	16,302	8.3%	8.60%	1,350	1,349	1,274	1,328	1,255
Washington	59,915	6.4%	12.40%	3,812	3,667	2,899	3,683	2,909
Wicomico	38,646	14.0%	17.00%	5,426	5,248	4,790	5,278	4,802
Worcester	20,915	10.6%	10.90%	2,210	2,172	1,993	2,130	1,934
Total	**2,256,147**	**6.4%**	**9.80%**	**144,144**	**140,126**	**102,762**	**135,456**	**101,036**

Sources: 2014 households from 2010 population census data at Maryland at a Glance Population 2013, adjusted by population growth rates for 2010 to 2014 from county-by-county census data at US Census Maryland Map 2015. The latter source also has the average number of people per household in each county used to calculate the number of households in 2014. For application and grant data: Maryland EUSP Plan FY2015, Attachment 2 (p. 29).
Note: Data are July 1, 2013 through April 2014

The City of Baltimore had by far the largest number of applications, followed by Baltimore County, Prince George's County, and Montgomery County, reflecting in part the fact that these jurisdictions had the largest number of households in Maryland.

A different picture emerges when we examine the proportion of households applying for (and getting) assistance. As can be seen from Table II-4 above, this percentage correlates closely with the percentage of households with incomes below the federal poverty level in that jurisdiction. Figure II-4 shows a map of Maryland with county boundaries. In terms of the fraction of the population affected, energy distress is greatest in three regions:

- The westernmost part of Maryland: Garrett and Allegany counties,
- The City of Baltimore in the central part of the state, and
- Most counties in Maryland's Eastern Shore.

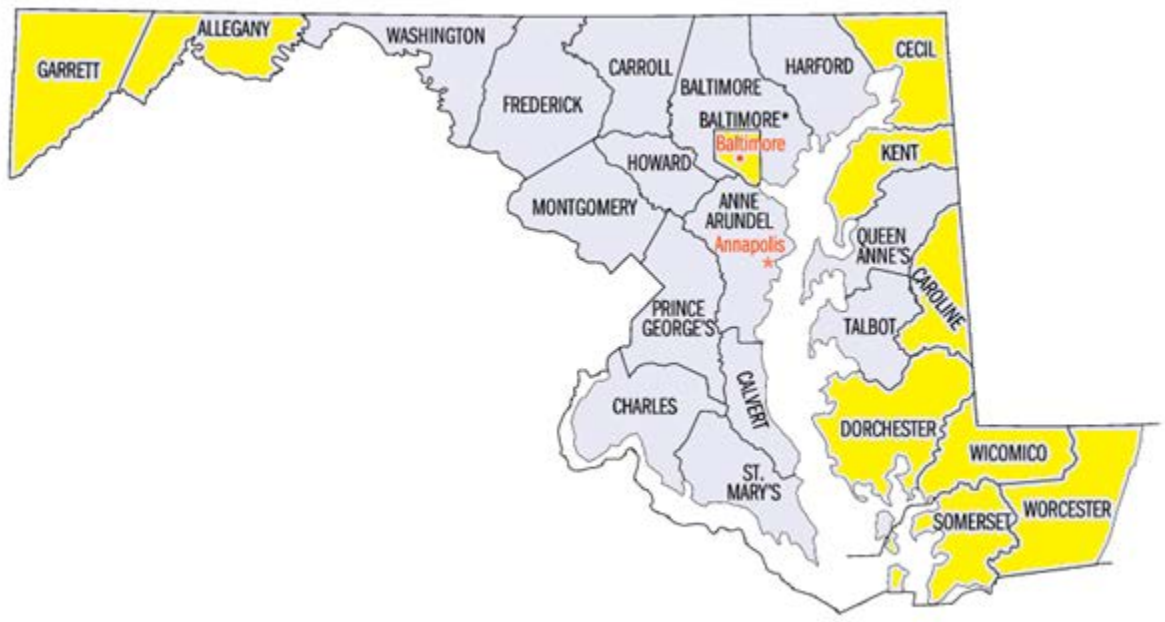

Figure II-4: Map of the State of Maryland, showing locations of its counties. Source: US Census Maryland Map 2015. Coloring added by IEER.

1. Maryland's westernmost and eastern shore counties

In the western and eastern parts of Maryland, energy distress was caused in part by the large proportion of households using fuel oil and propane fuels for space heating. These fuels are much more expensive than natural gas per unit of energy. Table I-5 shows the breakdown of space heating fuel types used in the areas served by Maryland's utilities as of 2009.

Table II-5: Space heating fuel used in the service areas of Maryland electric utilities.

Heating Fuel	Service Area PEPCO	DPL	BGE	Allegheny	SMECO	All MD
Total Units	488,546	206,400	1,109,779	243,646	135,219	2,183,590
Gas	62.9%	11.5%	45.5%	32.2%	10.0%	42.5%
Electric	32.1%	50.6%	29.7%	28.3%	52.0%	33.4%
Bottled Gas	0.8%	10.3%	1.6%	8.1%	5.0%	3.2%
Oil	3.0%	25.6%	19.1%	21.9%	27.0%	16.9%
Wood	0.0%	1.3%	1.7%	6.2%	3.0%	1.9%
Other	1.3%	0.6%	2.5%	3.2%	3.0%	2.2%

Source: KEMA Draft 2011, Table 3-4 (p. 26).

Note: Data are for residences in the year 2009. Note that Allegheny is now known as Potomac Edison.

The DPL (Delmarva Power & Light) service area includes the entire Eastern Shore of Maryland[31] and Allegheny's service area includes Maryland's westernmost counties.[32] The combined oil and bottled gas heating saturations in the Maryland portions of the service areas of these utilities is about 36 percent for DPL and 30 percent for Allegheny. Electric heating is used by another 50 percent or so of DPL's Maryland residential customers and about 28 percent of Allegheny's customers. This is largely due to lack of natural gas infrastructure, which is, in turn, partly attributable to the more rural nature of these areas. The total number of customers of Columbia Gas of Maryland, which serves the three westernmost counties of Maryland (the same ones served by Allegheny for electricity), is about 32,000,[33] which is under one-third of the total number of households in the area.

Natural gas infrastructure has been expanding on the Eastern Shore of Maryland via the Eastern Shore Natural Gas Company,[34] and distribution via local utilities, including Easton Utilities, which is the only municipal gas utility in Maryland.[35]

Fuel oil, propane, and electricity, if used as resistance heating, are expensive and, compared to the best electric heat pumps, inefficient.[36] Therefore it appears that poverty combined with expensive modes of heat combine to create a greater need for energy assistance.

2. The City of Baltimore

Baltimore Gas and Electric Company (BGE) is the distribution utility for the City of Baltimore. However, it covers a considerably larger number of households than just those within the city limits, since its service

[31] See map at Delmarva Power 2015.

[32] Allegheny was split onto several companies. The Maryland part now falls into Potomac Edison, which is a subsidiary of FirstEnergy. See service area map at FirstEnergy Maryland 2015 and Wikipedia FirstEnergy 2015.

[33] See the map at Columbia Gas 2015. The three counties have more than 100,000 households.

[34] ESNG 2015

[35] Easton Utilities 2015

[36] See Makhijani and Mills 2015, Figure IV-1 (p. 21) for a comparison of primary energy use for heating using various fuels and technologies. Propane is not shown there but the energy use and efficiency are about the same as for fuel oil, other things (such as heating system type and age), being equal.

area also covers most of Baltimore, Anne Arundel, and Howard counties, as well as parts of Calvert, Carroll, Cecil, Frederick, Harford, Montgomery, and Prince George's counties.[37]

Table II-5 above shows that natural gas is the most common heating fuel in the entire BGE service area (about 45 percent), but that electricity (about 30 percent) and oil and propane (about 20 percent combined) are also important.

However, the picture in the City of Baltimore is considerably different. Table II-6 shows that in Baltimore City natural gas is used for heating in almost two-thirds of the homes; electricity in about one-fourth. Oil and propane are used, but, in contrast to the other BGE areas with high proportions of applications for energy assistance, in only about nine percent of households.

Table II-6: Space heating fuels estimated to be used in occupied housing units in Baltimore City, Maryland, 2008-2012.

Heating fuel	Number of households	Percent of households
Utility gas	156,517	65.00%
Bottled, tank, or LP gas	2,119	0.90%
Electricity	59,480	24.70%
Fuel oil, kerosene, etc.	19,695	8.20%
Coal or coke	45	0.00%
Wood	213	0.10%
Solar energy	56	0.00%
Other fuel	1,269	0.50%
No fuel used	1,236	0.50%
Total	**240,630**	**100%**

Source: ACS 5-yr Table DP04 (2008-2012).

Natural gas is the most economical space heating fuel at present in the sense that households that use it have the lowest heating energy burdens. Oil, propane, and resistance heating are the most expensive (all other things, such as home area) being equal.[38]

III. Characterizing residential energy use in Maryland – average and MEAP recipient households

There are no statewide Maryland data that detail the use of energy in low-income households or even the subset of low-income households that get low-income energy assistance (either electricity or heating assistance or both). There are some data for low-income households that have received weatherization assistance. We will analyze these in Section VI. Energy use and costs vary a great deal in response to a variety of factors, including:

[37] See BGE Fact Sheet 2013 and BGE Map 2015.
[38] Makhijani and Mills 2015, Figures V-1 and V-2 (p. 23)

- The type of heating fuel used;
- The size, quality, and type of building;
- The type of water heating fuel use;
- Whether there is air-conditioning or not;
- The number and variety of other energy-using appliances;
- The efficiency of energy-using equipment.

We have created an approximate picture of energy use in the average Maryland home (averaged over all types of residential structures) and in households that get MEAP assistance according to the fuel used to heat them: natural gas, electricity, and fuel oil. We did not analyze propane separately, since the costs of propane and fuel oil per unit of energy is usually about the same.[39]

Several sources of data were critical in building up a detailed picture and verifying that the estimates are the correct order of magnitude. The KEMA 2011 draft report prepared for the Maryland Public Service Commission provides detailed analysis of data (largely based on billing data, but also on some survey data) on the saturation of various heating and water heating systems in the service territories of Maryland public utilities that provide electricity service. Saturations of some other appliances and end uses, notably central air conditioning and room air conditioning, are also provided. In addition, the KEMA 2011 draft report contains data on total energy use for space heating according to fuel, as well as electricity use for cooling. A number of reasonable inferences can be drawn from the data; most importantly, we can conclude that most homes heated with natural gas use the same fuel for water heating but most homes heated with fuel oil and propane use electricity for water heating. Since water heating is a major energy use, this inference is important in building up a more detailed picture of energy use than would otherwise be possible. However, the KEMA 2011 draft report does not contain any data on energy use by income level.

Second, the State of Maryland prepares reports relating to its heating and electricity assistance programs. We have used this data to derive the average amount of electricity used by recipients of electricity bill payment assistance, the average number of people per low-income household, and the heating fuels used.

National and regional data for energy use and expenses in homes classified according to the main space heating fuel are available for four different groups of households – all households, all households other than low-income households, all low-income households, and all households that get LIHEAP assistance. We have discussed these data in Section I. We draw on these data for constructing a picture of Maryland homes. Specifically, we found that the weighted average of per household energy use in the Northeast and South regions of the United States was close to the average energy use in Maryland households. We use this fact as an indication that the low-income households in Maryland would have

[39] The one major difference is that propane fuel is used mainly in manufactured/mobile structures. Most propane heating systems are therefore to be found in the more rural counties of Maryland, and specifically in the service areas of Allegheny (now Potomac Edison), in western Maryland, SMECO (Southern Maryland Electric Cooperative), and DPL on the Eastern Shore.

about the same relationship to the average Maryland household as the weighted average of Northeast and South regions. LIHEAP data are also available for one specific end use, heating, disaggregated by the type of heating fuel used. Since we do not have data for heating alone for Maryland low-income households, we used this regional data and all-household Maryland data to get an approximate picture for heating and other uses of fuel. Specifically, we used the ratio of low-income heating fuel use to all-household heating fuel use in the Northeast-South regional data we compiled from the LIHEAP report. We applied this ratio to the Maryland average heating fuel use per household derived from KEMA data.[40]

Data are available on electricity use in households that get EUSP assistance in Maryland. We use these data to check the reasonableness of our detailed calculations for electricity. Finally, data on gas use by recipients of heating assistance in the City of Baltimore are also available. These will likely differ from state averages, as discussed below; nonetheless, they provide a modest measure of verification of calculations related to energy sources other than electricity.

One more methodological note regarding calculation of energy burdens. The energy data in the LIHEAP Notebooks are in the form of average energy use per household in a given income category (or average for all households in the United States or a specific region). LIHEAP calculates energy burdens in two ways:[41]

1. The percent expenditure on energy is calculated for each individual household in a group; these percentages are then averaged over all households in the same group. This is called the "mean individual burden."
2. The expenditures of all households in a group on energy are added up as is the income of all households in the group. The ratio of the totals represents the "mean group burden."

The household-by-household energy and income data for Maryland were not available to us. The data we have analyzed allow us to calculate the approximate group energy burden for all households and for recipients of heating energy assistance (MEAP).[42] Group burden is indicative of the situation of the whole group. Individual burden, which is always greater than group burden, is indicative of the average situation of members of the group. **So it is important to keep in mind that the energy burdens calculated here understate the difficulties faced by individual low-income households in paying their energy bills.**

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[40] Since the data we use are from different years between 2009 and 2013, we adjust heating and cooling use to 2010 by the ratios of heating and cooling degree days to get an estimate for the year 2010.

[41] LIHEAP 2010 Notebook (2013), Appendix A, pp. 51-52

[42] We calculate the energy expenditure corresponding to the average energy use in the group divided by the average expenditure for that energy. This is equivalent to the group burden since each average is equivalent to the total divided by the number of households in the group. The number of households cancels out so it is equivalent to the group energy burden which is equal to sum of all energy expenditures divided by the sum of all income. (We calculate $E_{avg}/I_{avg} = (\Sigma E_i/N)/(\Sigma I_i/N) = (\Sigma E_i)/(\Sigma I_i)$ = mean group burden, where E_i – the energy expenditure of the i^{th} household; I_i = income of the i^{th} household and N = number of households.

Since energy burdens are quite different for households according to the heating fuel they use, we analyzed three types of households: natural gas heated homes; electricity heated homes; and fuel oil heated homes. These three types cover the vast majority of Maryland homes (over 90 percent).

A. Energy use in average and MEAP assistance recipient households in Maryland

Table III-1, Table III-2, and Table III-3 show energy use, energy expenses, and energy burden (energy costs as a fraction of income) profiles of an average Maryland household and those that receive heating energy assistance (MEAP).[43] Table III-1 shows our analysis for a natural gas heated homes, Table III-2 shows the analysis for an electrically heated home, while Table III-3 shows the analysis of an oil heated household. All notes provided for Table III-1 apply to both Table III-2 and Table III-3, unless otherwise stated.

Table III-1: Energy use for an average household and a low-income household receiving heating assistance (MEAP) in Maryland, 2010, both heated by natural gas.

	Average natural gas heated household				Low-income (MEAP) natural gas heated household			
	MMBtu	kWhe	Cost	Energy Burden	MMBtu	kWhe	Cost	Energy Burden
Gas space heating	57.1		$692	0.9%	63.0		$764	4.4%
Gas water heating	25.5		$309	0.4%	20.5		$249	1.4%
All other gas uses (cooking, some gas clothes dryers)	5.2		$63	0.1%	4.2		$51	0.3%
Electricity, space cooling	11.7	3,428	$514	0.6%	7.2	2,101	$315	1.8%
Electricity other (assume gas cooking)	20.8	6,087	$912	1.1%	17.5	5,127	$768	4.4%
Subtotal, Natural gas	87.8		$1,064	1.3%	87.7		$1,064	6.2%
Subtotal, Electricity	32.5	9,514	$1,425	1.8%	24.7	7,227	$1,083	6.3%
Total	**120.2**	**9,514**	**$2,490**	**3.1%**	**112.4**	**7,227**	**$2,147**	**12.4%**

Sources: KEMA Draft 2011, LIHEAP 2010 Notebook (2013), Energy Star 2008, EIA SEDS Prices 2014, IEER analysis.

Notes: 1. We assume that values derived from KEMA Draft 2011, which are for 2009, apply on a per household basis to 2010 use as well, except that heating and cooling values are adjusted for the relative heating and cooling degree days in those years. Values per household derived from the KEMA draft were obtained by dividing total use for Maryland by the number of households using that device or fuel (KEMA Draft 2011, Tables 3-3 and 3-8). Number of natural gas heated homes in Maryland in 2009 were

[43] All energy data in the tables represent energy use at the point of use. So electricity is counted as 3,412 Btu/kWh. In other words, generation, transmission, and distribution losses have been ignored as have natural gas leaks.

estimated at 42.6 percent of the total of 2,183,000 households.[44] Natural gas water heating saturation is about the same as natural gas heating (KEMA Draft 2011, Tables 3-3 and 3-5), so we assume that the average natural gas heated home uses natural gas for water heating. Gas water heating use inferred from electricity water heating use of 4,857 kWh/year but with an energy factor of 0.6 (compared to 0.9 for electric heating). Electric water heater energy use is from Energy Star 2008, Table 1 (p. 9).

2. Energy costs are based on residential natural gas and electricity prices for 2010 as provided by the EIA States energy database (EIA SEDS Prices 2014, Table ET3 for Maryland).

3. Other electricity use per household derived from the total in KEMA Draft 2011, Table 3-8, divided by the number of households. Cooling electricity use was derived in the same way assuming 100 percent cooling saturation (see KEMA Draft 2011, Table 6-7), which indicates close to 100 percent cooling saturation, when both central A/C and room air-conditioners are taken into account – some households have both.

4. "Energy burden" is the fraction of individual income spent on energy. Here the average household energy cost has been divided by the average income in Maryland to obtain this percentage. This is equivalent to the "group energy burden" as defined in LIHEAP 2010 Notebook (2013), Appendix A, p. 52.

5. Heating energy for MEAP low-income households is obtained by adjusting the heating energy use in an average household by a ratio obtained as follows. We obtained the heating energy use in average and LIHEAP homes from national and regional data in the LIHEAP 2010 Notebook (2013). We calculated the weighted average of the natural gas used for heating in the Northeast and South regions of the United States for average and LIHEAP households. The weighting was done by the number of households in each region in 2010. The ratio of LIHEAP heating energy use to average heating energy use was applied to the average Maryland heating energy use. Natural gas use for appliances other than heating was determined in the same way by applying the ratio of "Other" use in natural gas heated homes. We assume water heating use is the same in both types of households.

6. Cooling energy use for MEAP household was obtained by multiplying the cooling energy use for the average household by the ratio of the national average of expenses on cooling energy in LIHEAP households to the average (LIHEAP 2010 Notebook (2013), Table 2-6 (p. 10)).

7. We assume electricity use for all other uses is the ratio of LIHEAP to the average household in the Northeast/South weighted average as described in Note 5 except that instead of heating energy we took the ratio of all non-heating uses of energy in natural gas-heated LIHEAP households to the corresponding number for all households.

8. The "energy burden" for a MEAP household is calculated by dividing the energy expenditures the weighted average income of households receiving assistance, with that income calculated for 2.85 people per household, calculated from Maryland PSC 2013, Appendix A, Attachment C, pdf p. 37. We

[44] There is a discrepancy between the KEMA Draft 2011 report and U.S. Census data about the number of households in Maryland. The U.S. Census gives the number of households during 2009-2013 as 2,146,240 (US Census Maryland 2014). KEMA Draft 2011 has a higher total for 2009 at 2,183,590 based on utility billing data; KEMA Draft 2011 also cites a figure of 2,181,914 based on Public Service Commission data (KEMA Draft 2011, Table 3-2). The KEMA Draft 2011 numbers are about 1.7 percent higher than the Census value for the 2009-2013 period, so they would be a few percent higher for 2009. This discrepancy should not affect the per household calculations when the total energy use in Maryland for a particular application and the number of households are both based on the KEMA Draft 2011 report.

adjusted the value for 2013 by dividing by the chained consumer price index between 2010 and 2013 (which reduces the income by a factor of 1.069). Consumer price indexes can be found at US Inflation Calculator 2015.

Table III-2: Energy use for an average household and a low-income household receiving heating assistance (MEAP) in Maryland, 2010, both heated by electricity.

	Average electrically heated household				Low-income (MEAP) electrically heated household			
	MMBtu	kWhe	Cost	Energy Burden	MMBtu	kWhe	Cost	Energy Burden
Electric heating	14.7	4,303	$645	0.8%	13.2	3,882	$582	3.4%
Electric cooling	11.7	3,428	$514	0.6%	7.2	2,101	$315	1.8%
Electric water heating	11.2	3,291	$493	0.6%	9.5	2,772	$415	2.4%
Electric cooking	2.6	753	$113	0.1%	2.2	635	$95	0.6%
Other electric	20.8	6,087	$912	1.1%	17.5	5,127	$768	4.4%
Total	**60.9**	**17,862**	**$2,676**	**3.3%**	**59.5**	**14,516**	**$2,215**	**12.6%**

Sources: KEMA Draft 2011, LIHEAP 2010 Notebook (2013), Energy Star 2008, EIA SEDS Prices 2014, IEER analysis

Notes: 1. Sources and notes as in Table III-1.
2. Water heating electricity use is assumed to equal the national average. Source: Energy Star 2008.
3. We have broken out electric cooking and electric water heating as a separate items.
4. Water heating, cooking, and other electricity uses were calculated in the same manner as in Note 7 of Table III-1, except that the ratio of all other uses for electrically heated households was used.

Table III-3: Energy use for an average household and a low-income household receiving heating assistance (MEAP) in Maryland, 2010, both heated by fuel oil.

	Average oil-heated household				Low-income (MEAP) oil-heated household			
	MMBtu	kWhe	Cost	Energy Burden	MMBtu	kWhe	Cost	Energy Burden
Oil heating	47.1		$1,053	1.3%	46.2		$1,034	6.0%
Electric cooling	11.7	3,428	$514	0.6%	7.2	2,101	$315	1.8%
Electric water heating	11.2	3,291	$493	0.6%	9.5	2,772	$415	2.4%
Electric cooking	2.6	753	$113	0.1%	2.2	635	$95	0.6%
Other electric	20.8	6,087	$912	1.1%	17.5	5,127	$768	4.4%
Total	**93.4**	**13,558**	**$3,084**	**3.8%**	**82.5**	**10,902**	**$2,627**	**15.2%**

Sources: KEMA Draft 2011, LIHEAP 2010 Notebook (2013), Energy Star 2008, EIA SEDS Prices 2014, IEER analysis. See notes to Table III-1.

We have assumed electric water heating in oil heated homes: KEMA Draft 2011 saturation data indicate that most fuel oil heated homes use electricity for water heating, since the saturation for oil heating is 16.7 percent but for oil water heating it is only 4.6 percent (KEMA Draft 2011, Tables 3-3 and 3-5).

We note that in the case of homes heated with electricity or fuel oil, energy use for heating in all households is about the same as in MEAP households. MEAP homes have about 10 percent higher energy use for heating than the average for homes heated with natural gas. Electricity for uses other than heating, including cooling and appliances is significantly lower in low-income households receiving energy assistance. Overall total energy use at the point of use is 10 to 20 percent lower in Maryland low-income households compared to the average. The difference is accentuated if one takes into account energy losses in electricity generation, transmission, and distribution. Table III-4 shows a comparison of total energy use at the point of use (on-site) and in terms of primary energy, which includes electricity system losses. On a primary energy basis, low-income households' use of energy is, on average, 15 to 20 percent less than that of the average Maryland household, taking all uses of energy into account.

Table III-4: Comparison of on-site and primary energy use per household, average and MEAP recipient, 2010.

	On-site energy use			Primary energy use		
Home heating fuel type	Average, MMBtu	MEAP, MMBtu	Ratio, MEAP to Average	Average, MMBtu	MEAP, MMBtu	Ratio, MEAP to Average
Natural gas heated	120.2	112.4	93.5%	190.7	165.9	87.0%
Electrically heated	60.9	49.5	81.3%	193.3	157.1	81.3%
Fuel oil heated	93.4	83	88.4%	193.8	161.3	83.2%

Source: Based on Table III-1, Table III-2, and Table III-3 above.

While the overall energy use differences are modest, the energy burden – that is, the fraction of income spent on energy – is much greater for low-income households. For the average household the energy burden ranges from about 3 to 4 percent depending on the type of heating. For households receiving energy assistance the range is 12 to 15 percent, or about three-and-half times as great. The difference is quite consistent across heating fuels. Given the same heating fuel, low-income households have an energy burden that is about three-and-half times greater than the average Maryland household.

For households at different income levels with the same number of people as the average for MEAP recipient households, energy burdens range from about 17 percent to nearly 20 percent at a household income of 75 percent of the federal poverty level. The latter figure applies to fuel oil heated homes. The energy burdens range from about 7 percent to about 9 percent at 175 percent of the federal poverty level, with the latter figure applying to fuel oil heated homes.

Finally, we note that we have calculated mean group energy burdens – the total expenditure on energy by all members of the group divided by the total income of all members of the group. The mean individual burdens would be somewhat higher. The mean individual burden for a group is the average of the burdens calculated for each individual member of the group. For instance, the mean group burden

for all U.S. low-income households receiving assistance in 2010 was 12.4 percent; the mean individual burden was 15.4 percent.[45]

B. Estimate verification

We performed two checks on the reasonableness of the electricity use estimates presented in the Table III-1 through Table III-3 above. First we weighted the average household electricity use by the numbers of households using natural gas, electric, and fuel oil heating. We compared this total to a 2010 electricity use number derived from the KEMA Draft 2011.[46] The statewide average electricity use per household estimated in this way was just 2 percent greater than the average. This very close agreement is to be expected since much, but not all, of the data for all Maryland households came from the KEMA report.

Similarly, we estimated the average electricity consumption in MEAP households by weighting the consumption of electricity according to the numbers of MEAP households with each type of space heating: natural gas, electricity, and fuel oil. We compared this weighted average with the average for households getting electricity assistance in FY 2013, adjusting for differences in weather between the two years. The value calculated in the analysis was 94 percent of the value obtained from adjusted FY 2013 EUSP data. This is a larger discrepancy than that in the comparison with the KEMA Draft 2011 noted in the paragraph just above, indicating a greater uncertainty in our result. The lower value we derive from the LIHEAP and KEMA Draft 2011 data may also be due to the fact that the economy was still in the early stages of recovery from recession in 2010 compared to 2013.

Overall, the detailed estimates of energy use in the various types of households, differentiated according to the type of heating fuel and whether they receive heating assistance, are reasonably close to the published data.

C. Comparative efficiency – average household and MEAP households

We can compare the approximate overall efficiency of average households to LIHEAP households by estimating the energy consumption and expenditures per unit area of the house. This provides a composite measure of the efficiency of appliances, HVAC (Heating, Ventilation, and Air-Conditioning) equipment, and building envelope.

We do not have data on the indoor surface area of LIHEAP households either in Maryland or nationally. However, survey data are available for one year (2005) for households *eligible* for weatherization assistance as well as other income categories. Table III-5 shows national results, using this 2005 survey data, for average energy expenditures per person and per unit area in various income categories.

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[45] LIHEAP 2010 Notebook (2013), Tables A-3a and Table A-3b.

[46] The total residential electricity use estimated in the KEMA Draft 2011 (Table 3-2) report for 2009 is 26,009 GWh, which comes to 11,911 kWh per household on average for 2009. We adjusted the 2009 heating and cooling values to get 2010 values by applying the ratios of the heating and cooling degree days for the two years. We assumed that other electricity uses were the same in 2009 and 2010.

Table III-5: Average energy expenditures per household member and per square foot for various income categories, 2005 national survey data, by eligibility for energy assistance (2010 dollars).

	$ / household member	Members / household	$ / square foot	Area, square feet
Total U.S. Households	$780	2.6	$0.86	2,309
Federally Eligible	$617	2.7	$1.10	1,532
Federally Ineligible	$844	2.5	$0.82	2,590
Below 100% Poverty Line	$603	2.7	$1.14	1,442

Source: DOE EERE 2012 BEDB, Table 2.9.10

Energy expenditures per person are lower in households eligible for energy assistance, a much larger group than those who actually get assistance (See Figure II-1 above). But the expenditures per unit area are higher, presumably because low-income households live in smaller dwellings, including apartments.

We have not found comparable data for areas of Maryland residences by income category. We used the national data for area shown in Table III-5 above to estimate the overall energy use per square foot in all Maryland households and in households that get energy assistance. We assumed that the areas of residences that are eligible to get assistance would be about the same as the area of those that actually do, since size of the residence is not a criterion for receiving assistance. Table III-6 shows the results for total primary energy use and Table III-7 shows the results for heating primary energy use. In computing primary energy we have taken electricity generation, transmission and distribution losses into account but no processing and delivery losses for natural gas and fuel oil.

Table III-6: Total primary energy use per unit area for all Maryland households and for households receiving heating assistance.

	All households	MEAP households
Total primary energy, MMBtu	192	161
Area, square feet	2,309	1,532
Btu/sq. ft., all uses	83,236	105,316
Percent of average	100%	127%

Source: IEER calculations based on Table III-1, Table III-2, and Table III-3, and data for area from Table III-5.

Table III-7: Primary heating energy use per unit area for all Maryland households and for households receiving heating assistance.

	All households	MEAP households
Heating primary energy, MMBtu	51	52
Area, square feet	2,309	1,532
Heating Btu/sq. ft.	22,290	33,638
Percent of average	100%	151%

Source: IEER calculations based on Table III-1, Table III-2, and Table III-3, and data for area from Table III-5.

The overall energy use in MEAP households per square foot is about one-fourth greater than average. However, most of the difference is due to higher heating energy use per square foot in MEAP households. As can be seen in Table III-7, MEAP households use about 50 percent more primary energy for heating per square foot than average. For all other uses, the energy use per square foot is about 10 percent more in MEAP households than average.

This analysis indicates an enormous opportunity for improving efficiency by weatherizing low-income homes and by improving the performance of their heating and cooling systems. We examined the latter issue in the report on heating and cooling of the Renewable Maryland Project.[47]

It should also be noted that Table III-7 represents average values in heating energy use per unit area. There is likely to be a very large spread in this parameter among low-income households, depending on many factors such as the age and type of structures and equipment, improvements that may have been made over time, whether the buildings are rented or owner-occupied, income-level, and personal preferences and customs that affect energy usage. It would not be surprising to find that the least efficient low-income homes have energy consumption per unit area that is several times that of the average Maryland household.[48]

Efficiency programs are becoming an increasingly important component of low-income energy assistance. The above analysis indicates that there is a real need for more precise information about efficiency of HVAC systems and the condition of building envelopes in low-income households. The payoff will be more effective assistance and targeting of efficiency programs.[49]

D. Appliance Efficiency

We cannot infer appliance efficiency from the data that we have for low-income households. We note that the per unit area on-site energy use for non-heating uses appears to be somewhat (~10 percent) higher than average despite the fact that air-conditioning use is substantially lower than average in low-income households. Further, the saturation of certain appliances like electric clothes dryers and computers is likely lower in low-income households. We do not have Maryland-specific data but a recent Massachusetts survey provides evidence of this.[50] In combination, these data indicate significantly lower appliance efficiency in low-income households. Increasing appliance efficiency should therefore be a critical part of retrofitting low-income residences.

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[47] Makhijani and Mills 2015

[48] Of course, we also expect large differences in efficiency and performance among non-low-income households.

[49] In Maryland "weatherization" programs cover a broad array of efficiency improvements – see Section VI. We use the term "efficiency" to cover the entire array of possible reductions in energy use for the service desired, including appliances, HVAC equipment, and building structure improvements. We use the term "weatherization" to refer only to building improvements such as increased insulation, better windows, reduced leakage from the structure, and so on.

[50] Opinion Dynamics 2009, pp. 124-134. Table 53 shows that among low-income households that have dryers, more of them are electric, but overall, the saturation of electric dryers is higher among households that are not low-income.

The most important item from an energy use perspective, apart from space conditioning, is water heating. Heat pump water heaters can reduce electricity use for this purpose by about 60 percent. General Electric specifies the "energy factor" (the ratio of energy output to electrical energy input) of its GeoSpring heat pump water heater as 2.9. However, the overall efficiency will be lower than that in cold climates.[51] Assuming an energy factor of 2.5, water heating electricity use in low-income homes could be reduced by about 1,700 kWh per year, saving about $230. The savings are likely to be proportional to the number of people per household.

According to Baltimore Gas and Electric (BGE), the installed cost of a resistance electric water heater is $800 and that for a heat pump water heater is $1,700: a $900 cost difference. [52] This gives a payback time of about four years based on our savings estimate of about $220 per year, before any rebates. There is a rebate of $500 for heat pump water heaters as part of Maryland's EmPOWER program.[53] The post-rebate payback time is therefore short: two to three years typically and less for families with four or more members. BGE estimates much larger savings -- $370 per year for a household with three people. This implies a much larger hot water use per year than we have assumed in our calculations, which are based on the KEMA Draft 2011 report.

Other than light bulb replacements, replacing ordinary electric (resistance-heated) water heaters with heat pump water heaters is among the most cost effective measures that would substantially reduce energy expenditures in low-income households. In most cases it would also be one of the least intrusive measures.

Finally, we have pointed out in our study of space heating and cooling that it is necessary to replace most natural gas heating with highly efficient electrical heating in the long term if Maryland's 2050 greenhouse gas emission reduction goal is to be achieved. In this context we note that EmPOWER program rules do not allow fuel switching when carrying out weatherization in low-income homes. Exceptions may be made for safety if approved by the Department of Housing and Community Development.[54]

Since the vast majority of homes that use natural gas for space heating also use it for water heating, a switch to heat pump water heaters should be part of the process of reducing direct natural gas use in the residential and commercial sectors.

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[51] GE 2015. The net savings will be somewhat lower than the energy factor for water heaters alone suggests. The heat pump water heater extracts energy from ambient air inside the house. This increases space heating energy consumption but reduces air-conditioning energy use.

[52] BGE 2015

[53] See PEPCO 2015 and BGE 2015

[54] Indeed, fossil fuel furnaces many not be repaired or replaced with EmPOWER LIEEP funds except in the BGE territory (Maryland DHCD Weatherization 2014, p. 89 and p. 44 (for safety-related exceptions)).

Light bulb change outs are already a major part of efficiency initiatives. Heat pump water heater rebates of the EmPOWER program can help achieve efficiency goals and, in the case of low-income households, energy security and justice goals as well.

E. Sensitivity to natural gas and fuel oil prices

The above calculations provide a static picture for one year for average and MEAP households that use natural gas, electricity, or fuel oil as the heating energy sources. Specifically, they are static as to income per household and also fuel and electricity prices.

The overall national trend in household income at the lower ends of the income spectrum has, with some ups and downs, been in decline. The income of the lowest quintile of households has declined by an average of about 1.2 percent from 1999 to 2013; it has not shown any increase even during the recovery from the Great Recession. The comparable figure for the next quintile is a decline of about 0.8 percent per year.[55] Indeed, at $11,651, the household income of the lowest quintile in 2013 nationally was lower than the corresponding value in 1973: $11,899.

Based on these trends, one may anticipate a worsening of the energy burden among low-income households in the coming years unless the forces and policies that have given rise to these socio-economic trends are changed sufficiently to reverse the economic deterioration of low-income households.

In practical terms, the decline of income in low-income households is much larger than these figures suggest. This is because household income now typically reflects a larger number of working people per household than in 1973. Specifically, the labor force participation of women in the 25- to 54-year age bracket increased from about 60 percent in 1977 to about 75 percent in 2012.[56] This means that, on average, expenses associated with work, such as travel and childcare are greater. Therefore the share of income available for non-work-related household expenses, such as housing and energy, has declined significantly more than indicated by overall household income data.

Finally, the number of households who get energy assistance as a fraction of those who are eligible has tended to decline nationally though the trend since 2005 is not as clear. The number of households who get assistance nationally has been in the five to ten million range since 1981, except for a period in the mid-to-late 1990s, when it was lower (see Figure II-1 above).

Any increase in fuel prices will exacerbate the problems associated with income deterioration. At present, the lowest energy burden is among natural gas households. However, in its *Annual Energy Outlook 2014* reference case, the U.S. Energy Information Administration estimates that residential natural gas prices will increase by about 1.5 percent per year, while electricity prices will increase by 0.4 percent per year.[57] This means an increase in the residential natural gas price to about $16 per million

[55] Data from US Census Household Income 2014, Table H-3.
[56] Estimate by IEER from Sullivan 2013, p. 8.
[57] EIA AEO 2014, Table A3

Btu (in 2012 dollars) by 2030. Assuming that in Maryland, MEAP household income does not deteriorate further, the overall energy burden in natural gas heated homes will rise to over 13 percent from about 11.2 percent in 2010.[58] This means that a given amount of energy assistance will be less effective at reducing the various kinds of distress associated with high energy burdens. The vulnerability to severe weather will also increase. As research by Roger Colton has shown, the relative effectiveness of a given amount of assistance depends both on the weather and fuel prices.[59]

A comment on the decline in crude oil prices since mid-2014 -- and, hence, also fuel oil prices -- is in order. Oil prices have fluctuated immensely in the past decade and also over the longer period since the first oil shock of 1973. Our calculations do not reflect the peak of fuel oil prices. We used a fuel oil cost of $22.36 per million Btu, which corresponds to a retail fuel oil price of about $3.10 a gallon. That is close to the price of about $3.13 per gallon in mid-March 2015. The fuel oil price at the peak of crude oil prices last year was about $4.14 per gallon or about $30 per million Btu. Thus, there is no need to adjust the energy burden calculations for fuel oil heated homes above; they approximately correspond to the crude oil prices in early 2015. [60]

F. Carbon dioxide emissions

Nationally, about 22 percent of all energy-sector CO_2 emissions in 2010 were attributable to the residential sector.[61] Almost half of that (10 percent) is attributable to space heating and cooling.[62] In Maryland, the fraction for heating and cooling is slightly higher at about 11 percent for the year 2011; overall residential energy use accounts for about 23 percent of Maryland emissions.[63] Water heating is the most important single source of emissions in the residential sector after space heating and cooling.

As we have seen, about 30 percent of households, nationally and in Maryland, met the maximum federal eligibility criteria for heating energy assistance in 2011 (see Section II). The energy data in the LIHEAP notebooks show that these households' use of energy is about the same or moderately lower (about 10 percent lower) than the average household in the United States. Therefore as a first approximation, we may deduce that about 6 to 7 percent of energy sector CO_2 emissions are attributable to low-income households if the "low-income" upper limit is defined by the federal maximum. Low-income households that are eligible for energy assistance under Maryland criteria

[58] National burdens are higher than in Maryland. See Table II-3 above.
[59] Colton 2014
[60] EIA Fuel Oil 2015
[61] EPA GHG Inventory 2014, Table ES-3 (p. ES-11)
[62] Derived by IEER from the Buildings Energy Data Base (DOE EERE 2012 BEDB, Table 2.4.3, and the EPA emissions data (EPA GHG Inventory 2014, Table ES-3). The Buildings Energy Data figure for residential sector emissions is slightly higher than the value in the EPA GHG Inventory (1231.4 million metric tons compared to 1,175.2 million metric tons. We applied the percentage of emissions attributable to space heating and cooling in BEDB Table 2.4.3 to the EPA emissions value to derive the 10 percent estimate.).
[63] The Maryland fraction of 11 percent was derived by IEER from KEMA Draft 2011, adjusted by heating and cooling degree-day differences between 2009 and 2011.

account for about 3 percent of Maryland's energy-related CO_2 emissions; almost 40 percent of that is attributable to households that get energy assistance.

From a long-term (year 2050) perspective, Maryland's goal is to reduce greenhouse gas emissions by 90 percent by 2050, with the year 2006 as the base. Low-income households, broadly defined, are a large enough fraction of the residential sector. Therefore it would be very difficult to achieve a goal of 90 percent reduction in CO_2 emissions by 2050 without significant reductions in emissions attributable to low-income households. **It is essential to address energy-sector related CO_2 emissions from low-income households both for energy justice and climate considerations.** This is because we may expect that there will be a small fraction of remaining emissions in most sectors due to the costs of squeezing out the last few percent. Further, sectors like aircraft fuel, may not be able to achieve 90 percent reductions, requiring other sectors to get as close to 100 percent as possible. In this report, we recommend starting with households that get energy assistance, with an evaluation of the means and methods for addressing low-income households that do not get energy assistance in the coming years.

IV. Energy burdens before and after assistance

We have already noted that energy burdens can exceed 20 percent in the lowest income households with fuel oil heating. Heating and electricity bill assistance can reduce these burdens, but they remain much higher than the 3 to 4 percent that is typical of households with average income. Table IV-1 shows that, nationally, 91 percent of households receiving heating assistance had energy burdens of more than 5 percent, and 22 percent had energy burdens of more than 20 percent. Heating energy assistance reduced the number of households with burdens of more than 20 percent from 22 to 13 percent, still a high number; more than 40 percent of households still had energy burdens greater than 10 percent.

As for Maryland, Table IV-2 shows heating bill assistance provided in Fiscal Year 2013 while Table IV-3 shows electricity bill assistance trends from fiscal year 2011 to fiscal year 2014 (which ended on June 30, 2014).

Table IV-1: Proportion of households with high energy burdens before and after receiving heating energy assistance, national survey data for 2011.

	Total Residential Energy Burden	
	Pre-LIHEAP	Post-LIHEAP
Number of Respondents	1,275	1,275
[Energy Burden]	[Percent of Respondents]	
0-5%	9%	26%
6-10%	32%	32%
11-15%	23%	20%
16-20%	13%	9%
21-25%	9%	5%
>25%	13%	8%

Source: Recreated by IEER from NEADA 2011, Table IV-3A (p. 18).

Table IV-2: Households receiving heating bill assistance and amounts of assistance by heating fuel and income level (MEAP for FY 2013).

Type of heat	0 to 75% poverty level	75 to 110% poverty level	110 to 150% poverty level	150 to 175% poverty level	Total households	Expenditures	Benefit per household
Coal	43	31	38	10	122	$78,009	$639
Electricity	18,807	13,945	11,709	4,584	49,045	$12,477,355	$254
Gas	19,314	11,940	10,550	4,346	46,150	$19,422,324	$421
Kerosene	651	784	686	217	2,338	$2,773,506	$1,186
Oil	3,315	3,355	3,575	1,316	11,561	$17,727,036	$1,533
Propane	1238	1197	1282	477	4,194	$5,530,781	$1,319
Wood	135	103	104	35	377	$234,327	$622
Total	43,503	31,355	27,944	10,985	113,787	$58,243,338	$512

Source: Adapted from Maryland PSC 2013, page 6 and Appendix A, Attachment J

Table IV-3: Electricity bill assistance in Maryland, total and per recipient, trends fiscal years 2011 to 2014.

	FY 2014	FY 2013	FY 2012	FY 2011
Applicants Served	115,664	111,393	120,739	132,323
Average Grant	$ 481	$324	$334	$446
Benefit Expenditures	$ 55,6 million	$36.1 million	$40.3 million	$59.0 million

Sources: Maryland EUSP Annual Report FY2014, Attachment E and Attachment L

As noted previously, Maryland has a combined application for electricity bill and heating assistance. Figure II-3 above shows that the vast majority of applicants get both electricity and heating assistance.[64] However, no non-overlapping number for the total number of unique households that get assistance of one or both types is available. Further complicating the problem of understanding this data is that assistance is also available to clear longstanding electricity bill arrears at most once every seven years (with waivers to the frequency available). For FY 2010, the Maryland budget analysis indicates that about 140,000 households received some form of assistance with energy bills amounting to about $160 million (see Figure II-3 above). Of this assistance the amount provided for electricity bill arrears was just over $30 million,[65] making the heating and electricity bill assistance about $130 million. About 30,000 households received assistance with arrears, but many of them also received other kinds of assistance. Assuming 130,000 unique households received electricity bill or heating energy assistance gives an average assistance amount of about $923. The weighted average energy burden for low-income households (across heating fuel types) in 2010 was about $2,232, or about 12.9 percent of household

[64] Applicants who have electric heating can get assistance for both electricity bill payments and for heating assistance that is designed to assist with winter heating bills.
[65] Maryland EUSP Plan FY2015, Table 2 (p. 8)

income. With assistance of $923, the energy burden comes down significantly, to about 7.6 percent of income – but still about double that of the average household.

Two conclusions are very clear:

- Heating and electricity bill assistance makes a great deal of difference, especially since it is directed preferentially at those with the lowest incomes.
- Heating and energy assistance still leaves lowest income households with energy burdens that are two to three times that of the average Maryland household. In some cases, the energy burden may remain even higher than that. The PSC Staff proposal for limiting energy bills generally to 6 percent of income is reasonable; it would generally cure the problem of high post-assistance burdens (see Section V below).

We should note here that the largest number of households getting assistance are below the level of income defined by the federal poverty level.[66] For instance, in FY 2013, about 38 percent of the households getting heating assistance in Maryland had incomes at or below 75 percent of the federal poverty level and another 21 percent had incomes between 75 percent and 100 percent of the federal poverty level.[67] Assuming an average household size and a total heating and electricity assistance of $923, a household with income at 75 percent of the federal poverty level would still have a post-assistance energy burden of more than 10 percent of income. Table IV-4 summarizes pre- and post-assistance burdens at various income levels, assuming an average low-income family size (2.85 people) and an average level of assistance. Of course, in practice assistance is not distributed uniformly (as assumed in Table IV-4) but is oriented to preferentially assisting the lowest-income households.

Table IV-4: Pre- and post-assistance energy burdens, Maryland 2010

Income level	Pre-assistance burden, %	Post-assistance burden, %
75% of poverty level	17.2%	10.1%
Weighted average income of recipients	12.9%	7.6%
175% of poverty level	7.4%	4.3%

Source: Calculated by IEER

Notes: 1. Average household size = 2.85 people in all cases.

2. Pre-assistance burden is a weighted average of the various types of heating used in homes that get heating assistance.

3. Assumes that each household gets the average amount of assistance.

[66] Preference is also given to low-income households with elderly people, small children, or disabled people or combinations of these vulnerabilities (Maryland EUSP Annual Report FY2014, Attachment I (pdf p. 36)).

[67] Maryland EUSP Annual Report FY2014, Attachment I (pdf p. 36). Normally EUSP reports give income ranges as <75 percent, 75 to 110 percent, 110 percent to 150 percent and 150 percent to 175 percent. Attachment I gives a finer grained split. There would be additional numbers between 100 percent and 110 percent of course, so the proportion of households below 110 percent of poverty level income would be greater than the 59 percent indicated here. This does not affect the calculations of burdens shown in Table IV-4.

V. The proposed Affordable Energy Program

In January 2012, The Maryland Public Service Commission initiated a "Public Conference" to review the state's energy assistance programs regarding the energy that was under its purview – that is, electricity and natural gas. The Staff of the Commission, working in coordination with the Office of People's Counsel, which represents the state's residential energy consumers before the Commission, filed a report for the Commission's review on November 1, 2012. The report recommended a modification of electricity and natural gas energy assistance: a new "Affordable Energy Program" or AEP.[68] The central feature of the program would be that the post-assistance energy burden (electricity plus natural gas) of eligible low-income households would be limited to a maximum of 6 percent of gross household income. This is in contrast to the present program, where a bill payment assistance is determined based on a complex combination of factors, including income, but which leaves many low-income households with energy burdens that are still high.

The central idea was that instead of focusing on bill payment assistance, the program's focus would be on limiting the energy burden of participating low-income households to 6 percent of their gross income. For all-electric homes, the electric bill would be limited to 6 percent. For homes with natural gas heating, the natural gas bill would be limited to 3 percent of income and the electricity bill to 3 percent. For homes with a non-regulated heating fuel, like propane or fuel oil, electricity bills would be limited to 3 percent. The rationale for the choice of 6 percent was as follows:

> It is generally accepted that a household's "shelter burden" (rent/mortgage plus taxes and utilities) should not exceed thirty percent (30%) of income. In addition, a household's home utility bill should not exceed twenty percent (20%) of the household's shelter costs. Combining these two sets of costs yields an affordable home energy burden of six percent (6%).[69]

No specific provision was made in the recommended program for varying the post-assistance energy burden according to size of household. It was recognized that households with more people may spend a larger fraction of their income on expenses other than energy, such as food, rent, transportation, and medicines. The Commission Staff recommended that "[t]he AEP implementation process should investigate whether an income adjustment mechanism related to household size is necessary to calculate an appropriate POI-based payment ' for each customer."[70] In other words, for large household

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[68] This section is based on Maryland AEP 2012 unless otherwise mentioned; specific page numbers are cited only when there is reference to a number or for quotations. The records in the docket of this Public Conference are located on the Web at http://167.102.231.189/search-results/?keyword=PC27&x.x=0&x.y=0&search=all&search=rulemaking.

[69] Maryland AEP 2012, p. 5. The 30 percent housing affordability criterion was based on a 2008 analysis that reviewed the history of housing costs and assistance going back to 1937 and set it all in the contemporary context of a 2006 housing cost survey. See Schwartz and Wilson 2008.

[70] Maryland AEP 2012, p. 6. POI: percentage of income.

sizes the gross income might be adjusted downward for the purposes of calculating the 6 percent energy burden in order to reduce the maximum payment for such households.

Other elements of the proposal include:

- Eliminating assistance for paying bills that are in arrears, after an initial period of assistance to clear some of the past arrears that would exist at the start of the program;
- Increasing energy efficiency by coordinating weatherization with Maryland's EmPOWER program, which provides incentives for increasing electricity and natural gas efficiency (see below for further discussion).
- Targeting eligible households that have very high electricity and/or natural gas use – three times or more than the average Maryland home. The reasons for such high use are not clear but could result from "poor housing stock, faulty heating or cooling equipment, consumption behavior, or some combination of factors."[71] Efforts to reduce consumption in homes with very high energy use would be undertaken in a variety of ways ranging from education to implementation of efficiency measures.
- Providing for crisis assistance in extraordinary circumstances, such as unanticipated medical expenses, a reduction in work hours, or loss of a job.

In abolishing payment of arrears that might be accumulated after the start of the AEP, the proposal would put more responsibility on the household to ensure that payments corresponding to the 6 percent maximum are made (equal monthly payments based on estimated annual energy bills). Further, if the bills are less than 6 percent of gross income (as they would be in some cases at the higher end of the eligibility income limit, there would be no assistance, because the energy burden would be deemed to be affordable. The "core principle" here, as articulated by the Commission Staff and the Office of People's Counsel, is that "the AEP puts eligible [low-income] customers on payment footing equal to non-low-income customers" because once the affordable amount is determined, they would be expected to pay that amount in full.[72] Crisis assistance would not be for payment of arrears but for true crises such as those occasioned by illness or loss of a job.

The PSC Staff's proposal recognizes that electricity and gas ratepayers would be unlikely to subsidize heating bill payments for non-regulated fuels – namely fuel oil and propane. These are also the most expensive fuels. Households that use them for heating typically have relatively high energy burdens. This is the main reason that such households get 45 percent of the heating assistance even though they constitute just 16 percent of those receiving assistance (See Table IV-2 where the assistance and household numbers are shown). In such cases, a 3 percent energy burden limit would still apply for the electricity portion of the energy bills of a low-income household. As for heating assistance, the PSC Staff noted the following:

> There is no expectation in this proposal that an AEP that is likely to be funded by utility ratepayers would support benefits for non-utility energy sources. If AEP is implemented,

[71] Maryland AEP 2012, p. 23
[72] Maryland AEP 2013, slide 6

> OHEP [Office of Home Energy Programs] might take into consideration the 3% POI [percentage of income] electric benefit for MEAP grants to customers with non-utility heat sources.[73]

As a complement to the PSC Staff's suggestion, it would be equitable to target more funds for the conversion of fuel oil and propane heated low-income residences to efficient electric heating so that these households do not remain with high overall energy burdens. Such conversions would also reduce the need for energy assistance since heating bills would be greatly reduced. Finally, converting fuel oil and propane heated homes to electricity (where technically feasible) would also bring them fully under the umbrella of the AEP for both electricity and heating assistance since such homes would have an identical status to homes that are now electrically heated.[74]

Limiting energy burdens not only benefits low-income households but also utilities; experience in other states shows that a larger fraction of low-income households pays 90 percent or more of their energy bills when burdens are reduced. Utility revenues increase and arrearages decrease, making utility collection expenditures more effective and efficient. A restructuring of assistance according to the PSC Staff's recommendation would also likely produce many other benefits. For instance, the AEP would remove low-income households' energy burden from the volatility of energy prices and from inflation in energy prices. Their share of energy bills would be limited to 6 percent of household income, which is generally unaffected by energy price volatility.[75] By generally limiting the energy burden to 6 percent of income, there is predictability in energy payments, making the management of other financial problems less complex.

The AEP addresses a host of issues, including the major one that post-assistance energy burdens remain high for a large number of low-income households. With a maximum energy burden of 6 percent, income would be freed up for rent or mortgage payments, food, medical bills, transportation to work, etc. This would improve the quality of life for low-income households and also reduce assistance needed in other areas such as that for food, homeless shelters, or emergency room visits.

The present system of assistance does provide real relief to well over a hundred thousand Maryland households per year. However, it still leaves many low-income households with high energy burdens even after assistance. It also does not adequately account for the variety of social, economic, and health costs of those high energy burdens. By limiting energy burdens to 6 percent of gross income, the Affordable Energy Program would focus assistance in a way that is likely to significantly reduce the various costs of high energy burdens. At the same time, the AEP is compatible with greater dignity for low-income households, in that they would be responsible for an *affordable* share of their energy bills; this is compatible with energy and economic justice, which should be the central organizing principle for energy assistance. Programs such as efficiency measures, including weatherization, and universal solar

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[73] Maryland AEP 2012, p. 6

[74] This presumes that EmPOWER and other funds for efficiency will be adjusted to allow for conversions from fuel oil and propane to efficient electric systems. This would benefit ratepayers and electric utilities since it would increase electricity use (and use of the transmission and distribution system), other things being equal.

[75] Of course, larger trends in energy prices have effects on the economy and on jobs.

access would be complements to the AEP; they would serve to reduce its costs over the long-term. That would benefit both ratepayers and low-income households. See Sections VI and VII below.

In its comments at the start of Public Conference 27, the Office of Home Energy Programs (OHEP), which administers both the EUSP and the MEAP, noted that "making bills affordable to low income families should remain the primary program goal."[76] After the Commission Staff submitted the program for review, the Maryland Department of Human Resources (DHR), which overseas OHEP, expressed concerns about the cost of the program and, according to the PSC, suggested other ways that could "increase the efficiency and impact of energy assistance programs."[77]

DHR also noted two other objective in addition to the main goal of keeping bills affordable at the start of the process of evaluating energy assistance programs:

- "The application process should be easy to understand, incorporate the concept of 'no wrong door' and generally minimize the burden on the customer applying for benefits.
- "In order to maximize resources going to the customer, Maryland's home energy assistance programs should be coordinated and streamlined to avoid unnecessary administrative costs."[78]

After the AEP was published, DHR, in reviewing the program, noted that "the AEP model would likely have a positive impact on the affordability of utilities for eligible households…" among other advantages.[79]

DHR's main concern appears to have been the cost of the program and its impact on ratepayers; it estimated that ratepayers "could" see their bills increase by "as much as $7 to $10 per month." [80] DHR set forth four "themes" that emerged from the AEP proposal and the experience gained from the use of the "Customer Investment Fund that resulted from the Constellation-Exelon merger"[81] in 2012.

- The need for a more holistic approach,
- Addressing the affordability of payments,
- Promoting customer accountability,
- Targeting of energy conservation resources.[82]

The DHR report on the AEP set forth a number of possible ways in which the existing programs could be enhanced. For instance, bill payment assistance would be combined with "required" participation in energy conservation programs such as the quick checkups offered by utilities.[83] However, DHR did not

[76] Maryland OHEP 2012, p. 2.
[77] Maryland AEP 2014, p. 5
[78] Maryland OHEP 2012, p. 2
[79] Maryland DHR AEP comments 2012, p. 5
[80] Maryland DHR AEP comments 2012, p. 5; see also p. 4
[81] Maryland DHR AEP comments 2012, p. 5
[82] These four bullets are a paraphrase from Maryland DHR AEP comments 2012, p. 7.
[83] Maryland DHR AEP comments 2012, pp. 5-6.

address a major obstacle for many low-income households who rent: the refusal of many landlords to allow access to their properties.

DHR made an important suggestion that could improve the AEP and make it more holistic:

> DHR [the Maryland Department of Human Resources] will also work with its local human service partners to connect each client in the enhanced program to a case manager. Case managers would ensure that clients take concrete steps towards improving their self sufficiency such as developing a household budget, screening for additional benefits, and employment development referrals.[84]

The many economic difficulties faced by low-income households are connected via the central fact of limited income, while the specific difficulties faced by low-income families vary widely. In this context, the case-manager approach holds out two promises:

- The various forms of assistance could be coordinated while at the same time improving the economic prospects of a household.
- The benefits from coordinating assistance could be realized over time by reduced costs because of better health, lower emergency room visits, better attendance in school and at work, and reducing homelessness.

We noted in the preface that energy is but one part of a larger, complex problem of economic equity and justice; the case-manager approach could help connect energy justice with broader socio-economic goals. It also conforms to the findings of the Baltimore pilot project, discussed below, that a holistic approach can yield far greater benefits and even result in collateral benefits such as investments by households that have not received direct assistance.

However, there is no reason why the case-manager approach could not be made part of the AEP. Further, the measures suggested by DHR, individually or in combination, would not address affordability as thoroughly and integrally as the AEP, though if integrated with the AEP would provide a stronger program. In our view, limiting energy burdens to six percent, as proposed in the AEP, would best accomplish the goal of making energy bills affordable for low-income families. And as the analysis of efficiency, solar energy, and non-energy benefits shows, the AEP can provide the foundation for reducing the need for assistance.

After reviewing the Commission Staff proposal, the Commission itself did not take "final action" on the program. In its 2014 report to the Maryland legislature, the PSC noted some of the reasons for deferring action:

> The AEP is a conceptual document designed to address bill payment from a new perspective….This [the AEP] would be a major change from existing Maryland energy

[84] Maryland DHR AEP comments 2012, p. 6

assistance programs. Such an approach to bill assistance and the additional elements of the AEP would require new legislation, new and revised regulations.[85]

Thus, issues relating to cost, procedures, and possible alternative approaches to enhancing the program appear to have contributed to the deferral of action on the AEP.

The statewide costs of implementing the AEP was estimated by the PSC at $250 million using data for the year 2011 based on that year's participation level. This is not an incremental amount over present cost, but the total estimated AEP cost. [86] The total cost of the EUSP program in that year was $58 million. According to the PSC Staff paper, the addition to a residential bill for the AEP may be between about $4 and $8 per month, depending on how those the costs were distributed between residential and non-residential customers.[87]

However, the estimates of the increase in monthly bills assumes that the entire additional cost will come from electricity ratepayers. Part of the AEP would be for assistance with heating bills of households that use natural gas for heating; this currently comes from MEAP, which is funded by the federal government. If the energy assistance program overall, and not only electricity, is revised to reflect the principles of the AEP, the MEAP funds now devoted to assisting low-income households heating with natural gas would, in principle, be available for the AEP. Further, the administrative costs for the AEP were assumed to be considerably larger than for the current programs. However, this was the result of the way the cost was estimated – that the AEP would replace only the EUSP and not both the EUSP and the gas and electric heating portions of MEAP.[88]

From a jurisdictional perspective, it is understandable that the PSC Staff did not fold in the funds available from MEAP into its initial estimate of the costs of the Affordable Energy Program. MEAP gets its funding from the federal government's low-income heating assistance program (LIHEAP). The PSC does not have jurisdiction over the use of these funds; they are administered by the Office of Home Energy Programs (OHEP), which is part of Maryland's Department of Human Resources.

However, this does not mean that the funds would not be available to a ***properly structured*** Affordable Energy Program. The specific structure is important. The federal government has allowed the use of LIHEAP funds in such programs, which go under the general rubric of "Percentage of Income Payment Plan" (PIPP). Guidance for the integration of LIHEAP funds with PIPPs were issued by the federal LIHEAP office in 2010. It stated that "the process of subtracting the LIHEAP benefit from the client's energy bill and to then calculate the PIPP discount and/or the client's payment amount appears to be using LIHEAP as a resource and creates an inequity or adverse treatment for LIHEAP clients participating in the

[85] Maryland AEP 2014, p. 5
[86] Maryland AEP 2012, pp. 27-28
[87] Maryland AEP 2012, pp. 29-30
[88] In commenting on the administrative cost estimate, the PSC Staff noted that "It is reasonable to assume administrative cost could be much less in that the AEP could be implemented largely with the existing energy assistance infrastructure and personnel." (Maryland AEP 2012, p. 28)

PIPP."[89] This specific approach was disallowed. But a number of other states have programs in which LIHEAP finds are integrated with PIPPs.

For example Ohio has a Percentage of Income Payment Plan that fully integrates LIHEAP funds with ratepayer funds. As part of Ohio's PIPP, the Ohio Department of Development reports on the organization and integration of the various streams of energy assistance funds for low-income households. As is the case in Maryland, electric ratepayers contribute to an electric universal service program, the federal government to a heating program. Ohio has a common application for its PIPP and federal LIHEAP heating assistance.[90]

There are several other states where LIHEAP funds are integrated into PIPP-type programs. Colton 2011 cites several examples, including Colorado, Illinois, and Nevada.[91] Like Ohio, Maryland has a joint application and integrated administration of the assistance programs, since both the MEAP heating assistance and EUSP electricity assistance are administered by the Office of Home Energy Programs. It is possible that regulatory, legislative, and/or executive branch action may be required to enable Maryland to integrate MEAP with the Affordable Energy Program in a manner that conforms to the LIHEAP office's strictures.

Our review indicates that the federal government explicitly allows for the use of LIHEAP funds in PIPPs, like the proposed Affordable Energy Program. However, it is essential that the necessary steps to fully integrate MEAP and the AEP be taken in Maryland and that the integration be reported to the federal government in Maryland's application for federal LIHEAP funds to ensure acceptability of the use of the LIHEAP funds in the new context.[92]

The use of LIHEAP funds in Maryland's AEP would substantially reduce costs below those estimated in the 2012 PSC staff memorandum. There will, however, be some added direct costs above the present program if the AEP is implemented. Leaving aside for the moment the issue of where the additional direct funds needed for the AEP would come from, and how the reduced expenditures by other offices and departments due to indirect program benefits would be factored into the AEP, we estimate that *with the same number of recipients as in 2013*, the costs of the AEP would be about $30 million more than the cost of present assistance. This estimate includes a doubling of the administrative cost, as assumed by the PSC staff.[93] If the entire amount is covered by residential electricity ratepayers, it would amount to just over $1 per month. As we shall see, this cost can be substantially reduced by procuring solar energy for the program (see Section VII).

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[89] LIHEAP 2010
[90] Ohio Department of Development 2012. See especially pdf page 35 onward.
[91] Colton 2011, Attachments 2, 3, and 4.
[92] Specifically, the process laid out on page 10 of the PSC staff proposal would have to be reviewed and, if necessary, modified, to conform to federal requirements. Maryland AEP 2012, p. 10
[93] Maryland AEP 2012, p. 28

How many additional applicants there may be and how much assistance they may need are open questions. Present assistance preferentially goes to the lowest income brackets among low-income households.

At the same time, if more people get assistance, many of the costs now borne by society due to high energy burdens, including the costs for health care, shelter for homeless families, energy bill arrears, etc., would substantially decline. We will address this issue once we have considered such non-energy benefits, as well as efficiency, and solar energy; all three can be combined to lower net costs of the Affordable Energy Program. Indeed, they indicate that, when fully implemented, the *net* costs may well be less than the costs of present assistance.

We now turn to the issue of assessing energy efficiency (Section VI), solar energy (Section VII), and non-energy benefits (Section VIII) as they relate to energy assistance, including the proposed Affordable Energy Program.

VI. Low-income energy efficiency programs and their effects

Reducing heating bills by weatherizing homes and installing more efficient appliances and HVAC systems would reduce energy burdens and be beneficial from a number of viewpoints. However, increasing efficiency would be most effective from a public and private standpoint if coupled with the Affordable Energy Program. Increasing efficiency brings down energy bills; under the AEP the benefit of the reduced bill would directly reduce the cost of the program until the energy bills went down to 6 percent of gross income for that household.

We illustrate the benefits to ratepayers of an efficiency program using electricity data for an average all-electric low-income household getting assistance – income and electricity rates are for the year 2013:[94]

- Annual Income: $17,283
- Electricity use: 14,215 kWh
- Annual electricity bill before assistance: $1,948
- Affordable amount for paying electricity bill at 6 percent: $1,037
- Assistance amount under AEP: $911
- Average EUSP assistance in FY 2013: $325 (excluding heating assistance) plus $317 for heating for a total of $642

In this example, the post-assistance energy burden under the present EUSP and MEAP programs would be 7.6 percent compared to 6 percent with the Affordable Energy Program. The AEP would therefore give recipient households an additional $269 to spend on other needs. In contrast, a household with income at 175 percent of the federal poverty level (the maximum for current assistance eligibility) and

[94] Electricity use: IEER calculation; assistance data for the present EUSP and MEAP program from Maryland PSC 2013, p. 5.

the same electricity usage would get no assistance under AEP because the electricity bill would be less than 6 percent of household income.

Judicious efficiency investments would bring down the costs of the Affordable Energy Program. For instance, a heat pump water heater costs $900 more than a regular electric water heater; it is about 2.5 times as efficient. The annual savings would be about $220, equal to two-thirds of the EUSP assistance in 2013. However, we have added an annual $50 for maintenance compared to a regular resistance water heater, which reduces the savings to $170 per year. The payback time before any rebates is just over 5 years.[95] Figure VI-1 shows the investments and payback in a scenario that converts all electric water heaters in homes getting energy assistance to heat pump water heaters over a period of 10 years, the typical lifetime of a water heater. In this scenario, the AEP would go into the black in the third year, since the annual capital investment is constant but the savings are cumulative for an increasing number of water heaters. We can similarly calculate the costs and benefits of replacing other appliances like refrigerators.

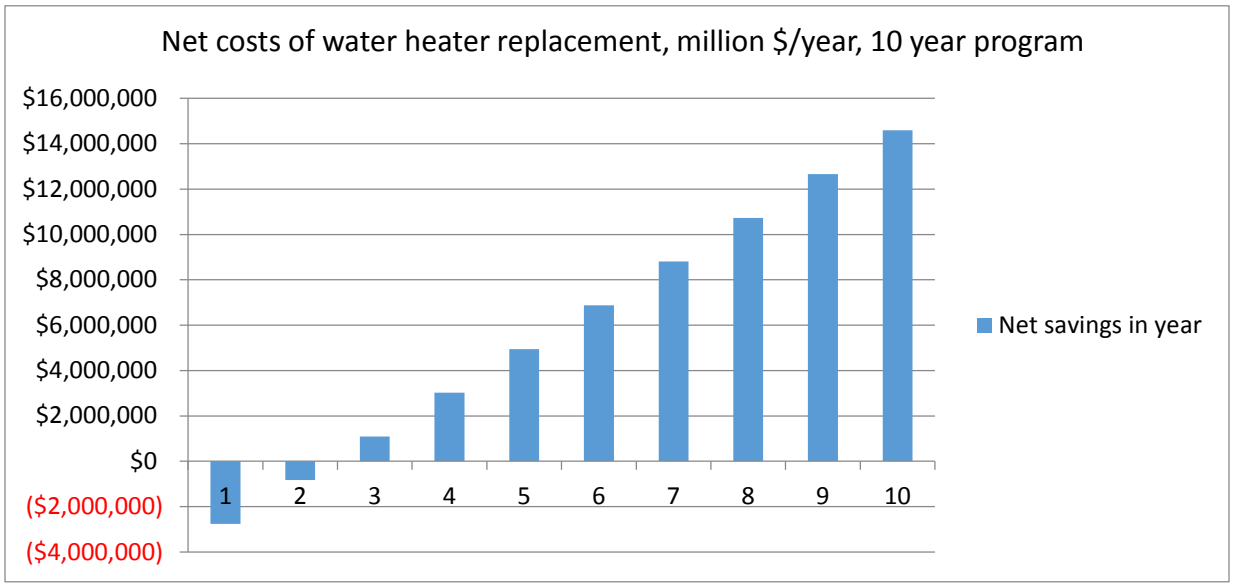

Figure VI-1: Net present value of replacing electric resistance water heaters with electric heat pump water heaters in low-income households currently receiving assistance. Source: IEER.

Both Maryland and the federal government recognize that inefficiency of existing housing stock, both in terms of the quality of the building envelope (with subpar insulation, high air infiltration, etc.), is a major cause of high energy burdens, along with relatively low appliance efficiency (including HVAC equipment)

[95] The rated coefficient of performance of the water heater is 2.9. We have used a value to 2.5 as an annual average to account (approximately) for the fact that in the winter, when hot water use is heaviest, the heat pump draws heat from the house thereby increasing heating requirements. Air conditioning requirements in the summer are reduced for the same reason. We have not taken the $500 rebate into account in the payback time since we assume that the entire cost increment of the heat pump water heater would be borne by ratepayers in the case of low-income EmPOWER programs.

and, in many cases, high cost fuels (mainly fuel oil and propane). There are therefore state programs, in some cases supplemented by federal programs, to fund increases in energy-use efficiency in low-income households. There are also other sources of funds such as the Department of Energy and the Regional Greenhouse Gas Initiative (RGGI).[96] In the past, there have also been specific funds from Congress, for instance the American Recovery and Reinvestment Act (ARRA).

Maryland's main energy efficiency program, primarily for electricity but also for natural gas, is the EmPOWER program and is administered by the Maryland Department of Housing and Community Development. It is subject to approval by the Maryland's Public Service Commission because the funding for the program comes from a charge levied on utility ratepayers. The EmPOWER program has a low-income weatherization component, described as follows:

> The EmPOWER Low Income Energy Efficiency Program (LIEEP), administered by the Maryland Department of Housing and Community Development (DHCD) helps low income households with installation of energy conservation materials in their homes at no charge. These improvements will both reduce a household's energy use and lower the monthly utility bills, and will also make occupants more comfortable and may improve the air quality and overall health of the family.[97]

The eligibility criterion for the program is set at 200 percent of the federal poverty level, compared to 175 percent for heating and electricity bill assistance. The EmPOWER program, known as the Low Income Energy Efficiency Program (LIEEP), may pay the entire cost of the retrofitting in the following areas:

- Insulation in the attic, floors and walls;
- Hot water system improvements;
- Lighting retrofits;
- Furnace cleaning, tuning and safety repairs;
- Refrigerator retrofit, if applicable;
- Health and safety items.[98]

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[96] Ariano 2014, slide 2

[97] EmPOWER website (EmPOWER 2015). All further statements about the EmPOWER low-income weatherization program are based on or quoted from this website, unless otherwise mentioned. We note here that the EmPOWER program is much broader than low-income weatherization. It is based on a 2008 law that mandates energy efficiency and electricity demand reduction targets. Maryland's Public Service Commission sets rates that allow utilities to recover the costs of these programs that cover the residential, commercial, and industrial sectors. The text of the legislation (Maryland Statute Public Utilities §7–211 (2015)) sets an overall target of reducing per capita peak energy demand and per capita electricity consumption by 15 percent by the year 2015 relative to a 2007 baseline. In BGE territory, funds designated for energy assistance in 2011 as a condition of the merger of Exelon with Constellation may be used to convert fuel oil heating systems to other fuels. The usual conversion is from fuel oil to natural gas.

[98] EmPOWER 2015. The list is a direct quote.

While the heating system item only mentions "furnace cleaning, tuning and safety repairs," in practice replacement of heating systems and window air-conditioning units is also done. We note here that currently LIEEP funds may not be used for replacing a fossil fuel heating system with an electric one, no matter how efficient.[99] This is a major obstacle to achieving the AEP goals and the state's greenhouse gas reduction goals. It also reduces long-term cost relief for ratepayers since efficient electric HVAC systems have the lowest annual operating costs. For instance, the average cost of heating an oil-heated detached home in Maryland is about $1,400 per year, while heating the same home with a cold climate heat pump cost would be less than $500 per year – an annual savings of more than $900.[100] The upfront cost of a cold climate heat pump is considerably higher that a new oil-fired furnace plus an air-conditioner; yet replacing oil-fired systems with cold climate heat pumps would be very economical even when that higher initial heat pump cost is taken into account. *Indeed, under the AEP such a replacement would likely eliminate the need for assistance for many low-income homes altogether*. Further, efficient electrification of heating systems makes them compatible with a decarbonized grid, and hence with Maryland's goals for reducing greenhouse gas emissions.

A prohibition against using LIEEP funds for switching away from fuel oil and propane is akin to a food assistance policy that would force low-income household to purchase only carbohydrates. It is poor policy and creates a variety of costs than can and should be avoided.

It serves no public interest to leverage public funds for weatherization and HVAC system replacement and then oblige low-income people to stay stuck with expensive fuel oil and propane. It perpetuates the need for assistance. It is also contrary to energy dignity: low-income households are not offered a rational and economical choice of heating systems, which all other individuals are free to make, for the sole reason that they need assistance. ***We strongly recommend that the prohibition against the use of LIEEP funds for fuel switching be repealed.*** This will create more jobs in the HVAC industry though it will negatively affect fuel oil and propane dealers. That concern should be addressed with the community and worker protection fund that we recommend be created to assist with a transition to a low-emissions energy system.[101]

In all, more than $154 million was spent between 2007 and 2014 on various efficiency programs (including replacement of furnaces, refrigerators, and air conditioning units) in Maryland. Nearly 20,000 single family homes and nearly 7,000 multifamily homes received assistance, for a total of nearly 27,000 households in the period.[102] Estimates of energy use (both electricity and, where applicable, natural

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[99] Maryland DHCD Weatherization 2014, p. 89. Fuel switching is temporarily allowed in BGE territory because it was part of the agreement when Exelon took over Constellation Energy.

[100] Makhijani and Mills 2015, Section V.A, which shows combined heating and cooling costs. The disaggregated costs for heating, cited here for one of the case studies, are available upon request for the three types of houses studied in the report.

[101] At the present time shifting from fuel oil and propane (when technically feasible) to cold climate heat pumps is economical. Shifting away from natural gas to efficient electric systems should also be allowed. This is necessary in the long-term to achieve the goal of 90 percent CO_2 emissions reductions by 2050 (relative to 2006). See Makhijani and Mills 2015.

[102] Ariano 2014, slide 3

gas) were made before the efficiency program was implemented. Post-implementation evaluations were also done.

The energy savings appear to be substantial. Initial engineering estimates of the savings on energy bills for the single family homes that had improvements were estimated at $8.3 million per year. The retrofits were mainly to electrically heated homes.[103]

Yet there remains considerable uncertainty in energy and money savings estimates resulting from efficiency investments in low-income households. An evaluation based on actual billing data for 2012-2013 continued to indicate that the savings were substantial but that they were lower than the initial estimates. The evaluation was commissioned by the utilities that participate in the EmPOWER program and the Maryland Public Service Commission.[104] Table VI-1 shows a comparison of the initial estimates (by GDS Associates) of energy savings and the bill-verified savings (by Itron, Inc.).

Table VI-1: Initial estimates of the Maryland low-income efficiency program impact and bill verified savings for the year 2013.

	GDS Evaluated Savings			Itron Verified Savings		
Utility	MWh	Utility kW	Therms	MWh	Utility kW	Therms
BGE	7,622	2,104	394,457	5,368	1,390	258,428
PEPCO	1,395	654	73,719	983	341	50,442
DPL	1,493	683	4,093	1,051	364	2,829
SMECO	755	284	1,878	531	146	1,055
PE	1,377	161	8,737	970	238	5,773
Total	**12,641**	**3,886**	**482,884**	**8,903**	**2,479**	**318,528**

Source: Adapted from Itron 2014, Table 1-3 (p. 1-4)

The total benefit-cost ratio as initially evaluated averaged 1.31 overall, and varied from 0.52 to 1.8 for various utilities. But the bill verified evaluation showed the average statewide benefit-cost ratio to be less than 0.86, with a range of 0.4 to 1.11 across Maryland's utilities.[105] The relatively low benefit-cost ratio was seen by the evaluators as part of the learning process in a program that is still quite young:

> Overall, the realization rates and cost-effectiveness results found by GDS and Itron are consistent with findings from previous program evaluation studies for program administrators who have just recently assumed the responsibility of developing and managing a suite of energy efficiency programs designed to assist limited income households. Gross realization rates tend to be less than one in the initial stages of any efficiency program launch as kinks in the program tracking systems and energy savings algorithms are worked out. We recommend that the current program administrator focus on improving the design and delivery of the programs going forward and not be distracted by the fact that program savings may have been overestimated in this first

[103] For this paragraph see Ariano 2014, slides 2, 3, 6 and 11.
[104] Itron 2014
[105] Itron 2014, Table 1-5 and Table 1-6

program year due to the growing pains associated with developing new tracking systems and new relationships with evaluation firms.[106]

A noteworthy finding supporting the above conclusion was that the benefit-cost ratio improved from 0.45 in 2011 to 0.86 in 2013.[107]

One of the more surprising findings of the Itron evaluation was that the amounts of initial electricity and gas consumption entered into the database were very frequently wrong, more so for gas than electricity. For electricity, about one-fourth of the data entries were more than 20 percent in error when the database values were compared to actual utility bills. This is very problematic because savings estimates are often in the 10 or 20 percent range. If the initial baseline data are frequently more than 20 percent wrong then considerable uncertainty is needlessly introduced into the analysis of the impacts. A large number of the errors was clustered around 10,000 kWh per year of usage. This may have been due to the program specification that directed resources preferentially to high usage households.[108]

The problem of incorrect baseline data was far more severe in the case of natural gas. Over two-thirds of the baseline data entries were wrong by more than 20 percent.

Certainly, it is essential to have a carefully vetted set of baseline data and verified savings estimates in order to estimate the impact of improvements to building envelopes and new HVAC equipment on energy bills and hence on the net costs of energy assistance programs. Nonetheless, it is clear that certain efficiency improvements, notably replacing incandescent bulbs with LED lights and installing heat pump water heaters could play an important role in reducing long-term assistance costs.

The calculation of the benefits of improved weatherization of buildings and upgraded heating and cooling equipment is more complex. First, we do not have adequate data on the savings that would accrue for different types of weatherization investments in Maryland. Second, the costs of replacing HVAC equipment with efficient electric systems will depend on the type of housing structure, whether the home has ducts or not, and other technical factors. Third, the condition of the structure is also an important factor in the costs. Some of these points are illustrated by a pilot project in Baltimore.

A. Baltimore weatherization pilot project

The American Recovery and Reinvestment Act enabled the City of Baltimore to carry out a pilot project aimed at assessing the efficacy of efficiency programs with and without accompanying education for low-income households. The program included both renter and owner-occupied low-income households; a variety of renter-landlord arrangements were included. Finally, there was a control group that received neither educational visits nor efficiency investments.[109]

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[106] Itron 2014, p. 1-7
[107] Itron 2014, Table 1-6 (p. 1-7)
[108] Itron 2014, pp. 1-15 to 1-17
[109] The rest of the description of the Baltimore pilot project in this section is based on Pontious 2012 unless otherwise specified. Pontius 2012 uses the term “weatherization”; however, various kinds of efficiency

A number of steps had to be taken before investments could actually be made to a household:

- The home had to pass an audit and be up to code.
- Permission to enter had to be obtained from the owner in case of owner-occupied homes and from both the renter and landlord in case of renter-occupied homes.
- Being able to contact the parties was a preliminary necessity that could not be accomplished in many cases.
- The applications had to be complete.

The initial project design was to have 70 percent renters and 30 percent owners in the group that got the efficiency upgrade and also in the control group. Both groups had sub-groups that did or did not receive educational visits.

The main measure of the success of any pilot program should be lessons learned so that insights are as rich as possible and may be applied to make larger-scale efforts more efficient and economical (in the sense of results per dollar invested). By that criterion, the pilot program was a big success. Some of the principal lessons relevant to the policy discussion in this report were as follows:

- Possibly the biggest lesson was that "the **landlord is a unique and major barrier** [to weatherization] **for renters**." Of the barriers, permission to enter was the biggest: "Nearly half (46%) of all tenants who applied could not get permission for audit despite qualifying for weatherization otherwise."[110]
- Many homes, both rented and owner-occupied, were not up to code, with bad roofs, mold, and wet basements being the most common problems.
- The pass-rate for audits in rented homes was very high (88 percent) in subsidized housing, which is subject to annual inspections, and where subsidies enable landlords to keep up their properties. In contrast, only 43 percent of unsubsidized low-income rental housing passed the audit. Ownership of such properties by small landlords who do not receive enough rent to keep up the properties may be a factor in the high audit failure rate. The knowledge that their properties are or may be in violation of building and safety codes may be related to their reluctance to grant auditors and weatherization program personnel permission to enter their property. Thus the two barriers – lack of permission to enter and code violations – may well be related.

Verification of the energy savings (both electricity and natural gas) was based on actual bills before and after the efficiency investments. However, the very large differences in weather between the pre- and post-weatherization years complicated comparisons. Adjusting for winter and summer weather by using the heating and cooling degree days in the two years did not eliminate the problems. The most obvious of these was that households that received neither an educational visit nor weatherization showed

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investments were made. Many of the difficulties were around weatherization investments, which involve changes to the structure.

[110] Pontious 2012, pdf p. 10 (bold in original)

significant savings even after weather adjustment, indicating that degree-day adjustment of energy consumption, while important, is not enough in at least some circumstances.[111]

It is reasonable to use the control households as the baseline, as the study suggests, because it would eliminate the problem of adjusting for year-to-year weather changes. The data for the control group in any year are compared to the data for the groups receiving various forms of assistance. Weather-related adjustments would still be needed to be to evaluate the effectiveness of the efficiency measure(s) implemented in any particular home. In general, there were still significant energy savings in the homes receiving efficiency investments compared to those that did not, both for gas and electricity except in one case. Ironically, that was the case for electricity use in households that received both weatherization and education visits. Review of this problem indicated that the cause may have been the resetting of programmable thermostats from the factory settings aiming at energy conservation to what appeared to be a preferred summer temperature setting of just 65 ^{o}F. This conclusion was admittedly speculative, however.

B. Perspective on efficiency assistance

Our analysis (Section II.C) indicates that low-income homes appear to be considerably less efficient so far as heating is concerned than average Maryland homes. Poverty and inefficiency combine to create persistent needs for assistance. This was noted in the evaluation of the Baltimore City pilot project discussed just above. Households with high usage got the most assistance; further, of the sample in the pilot project, 44 percent of the households got energy assistance in three or more years in the 2008-2012 period. Cumulative assistance ranged from under $1,000 to over $5,000 over this period. Together these findings illustrate the reasonableness of making significant investments in increasing efficiency of low-income households by various means. As the pilot project report noted, “conservation could be an effective investment for both Energy Assistance recipients and the program itself if it can reduce repeated and high energy assistance awards.”[112]

The need to address the problem structurally through efficiency improvements is further underscored by the declining fractions of electricity bills that shrinking assistance budgets can cover. This is seen in Table VI-2, reproduced from the Baltimore City pilot project report.

[111] Pontious 2012, pdf p. 17
[112] Pontious 2012, pdf pages 22 to 25. The quote is on pdf p. 25.

Table VI-2: Fraction of electricity bills covered by assistance in Baltimore City

Benefit Level (% of Poverty Level)	FY 2012	FY 2011	FY 2010
0-75%	35%	45%	65%
>75%-110%	30%	35%	50%
>110%-150%	25%	27%	40%
>150%-175%	17%	17%	30%
Subsidized Housing	14%	15%	20%

Source: Pontious 2012, pdf p. 23

But the Baltimore efforts, notably the Green and Healthy Homes Initiative (GHHI), show that it is more than an energy issue. The GHHI made investments on a wide front aimed at multiple issues faced by families, beyond just efficiency. The GHHI has eight criteria for green and healthy homes: they should be dry, clean (in relation to dust and contaminants), safe (including in relation to storage of materials, physical configuration, smoke detectors, etc.), well-ventilated, pest-free, contaminant-free (lead, radon, etc.), well-maintained, and energy efficient.

The Baltimore GHHI achieved quite remarkable results with this holistic approach. Two of the most important not only for the low-income families but also for evaluating the Affordable Energy Program are:[113]

> ***"Lower rates of foreclosures":*** This not only impacts the affected households positively but also neighborhood property values. It would also reduce expenditures on housing assistance, aid to the homeless, and public expenditures associated with adverse health outcomes related to homelessness.
> ***"Reduction of vacant and abandoned housing"***: Vacant and abandoned housing negatively affects neighborhood security and property values.

The GHHI work in Baltimore City indicates the need for broadening the scope of low-income housing improvements as well as assessment of non-energy benefits. We will return to this issue in Section VII on evaluating non-energy benefits of energy assistance programs.

C. Scope of Maryland's existing low-income efficiency program

Maryland's utilities charge ratepayers for funds for the EmPOWER efficiency program as part of their electricity bills. A part of these funds have been used for low-income efficiency programs, which have been fully administered by the Maryland Department of Housing and Community Development since July 2012.[114] Other funding streams, including federal funds, are also used. The program in its present form is therefore relatively new. However efficiency assistance itself goes farther back.

[113] GHHI 2013, pp. 16-17.
[114] Maryland PSC EmPOWER 2014, p. 17

There were about 27,000 Maryland homes that received efficiency assistance in the eight-year period FY 2007 to FY 2014 (inclusive), which averages out to about 3,400 homes per year.[115] This is a very substantial effort. However, it is still short of the need. At the average pace of the past eight years, it would take more than 100 years to reach a majority of the 361,000 households in Maryland currently eligible for energy assistance at 175 percent of the federal poverty level.[116] The pace of the program would have to be significantly increased to reach even just the qualified households now getting assistance within a reasonable time. To complete efficiency improvements of the households within 10 to 15 years, the program may have to be ramped up by two- to three-fold from the 2007-2014 average (depending on the number of households that qualify structurally and otherwise). Such a ramping up may require two or three years to sort out the various issues associated with estimating energy savings, various costs and benefits, and putting in place policies to address landlord issues.

For an average efficiency investment of $5,000 per household, and 10,000 residences per year, the total annual investment needed would be about $50 million. That is the pace needed to provide low-income households who got assistance in 2013 in Maryland with weatherization by the year 2030. It is difficult at the present time to estimate the direct payback period and the reduction in energy assistance since the efficiency programs are still too recent. The Itron evaluation for the year FY 2013 indicates a simple payback time of about 12 years.[117] However, when non-energy benefits are taken into account, the payback period may be reduced by a factor of two or more. (See Section VII below.) Finally, we note that if the efficiency program is implemented together with the Affordable Energy Program, virtually all of the reduction in energy bills would flow back to ratepayers in the form of lower charges for energy assistance (see Section VIII below).

D. Fossil fuel heating systems conversion

The most expensive fossil fuel heating systems use fuel oil and propane – a result of the much higher costs per unit energy of these fuels compared to natural gas. In the case of low-income households receiving heating assistance (MEAP households for short), we have noted the much higher energy burden faced by low-income households heating with fuel oil. Propane's impact would be similar due to similarly higher cost of fuel compared to natural gas. The impact of higher energy burdens creates a need for greater assistance, which in turn is reflected in the disproportionate allocation of assistance to such households. While these MEAP households are just 14 percent of the total, the amount of assistance is about 40 percent of the total.[118]

The Renewable Maryland Project has previously examined in some detail the issue of energy use and CO_2 emissions related to heating and cooling in the residential sector. This evaluation found that

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[115] Ariano 2014, slide 3

[116] For the number households eligible under Maryland rules, see LIHEAP 2011 Notebook (2014), Table B-2.

[117] The total cost of the program was $18.9 million. Itron estimated the annual natural gas savings at 318,528 therms and electricity savings at 8,903 megawatt-hours. See Itron 2014, Table 1-3 and Table 1-6. At $1.20 per therm and $140 per megawatt-hour, the total annual savings work out to about $1.6 million, giving a simple payback time of 11.6 years, rounded to 12 years in the text above.

[118] Maryland PSC 2013, Appendix A, Attachment J (pdf p. 46)

resistance heating and fuel oil and propane heating systems are the most expensive and can be economically replaced by highly efficient electric systems.[119] As we have discussed, it is crucial to focus the resources of the LIEEP program to allow conversion of MEAP households with fuel oil and propane heating to efficient electric systems. The prohibition against the use of LIEEP funds for fuel switching needs to be repealed as part of the process of initiating the program.

Relative fuel prices would favor a conversion from fuel oil or propane to natural gas since it is the lowest cost system overall. However, from the point of view of running cost, a cold climate heat pump would cost less to run than a natural gas furnace, reducing the need for assistance after the HVAC system is installed. Conversions from fuel oil to natural gas would complicate the essential long-term need (from a climate perspective) to greatly reduce natural gas use for space heating in the buildings sector (except for combined heat and power and standby electric generation capacity). An approach that prioritizes greater efficiency, lower cost, and climate protection involves

- Investment in cold climate heat pumps by conversion from inefficient electric heating systems, fuel oil, or propane heating systems;
- Reducing the need for assistance by making a one-time investment up front compared to simply converting a household to natural gas heating from oil or propane;

VII. The role of solar energy and energy assistance

There has been an assumption that solar installations are mainly in upper-income households, while all ratepayers (and taxpayers) pay for the associated rebates and other incentives. For instance, a *Wall Street Journal* expert blog presented the following as fact: "Subsidies take money from working-class families and give it to people who can afford high, up-front capital costs."[120] However, research by the Center for American Progress published the month before this blog entry showed that solar installations are broadly spread among middle- and upper-income zip-codes, used as a proxy for middle-and-upper-income households.

While upper-income households (defined as having more than $90,000 in annual income in the report[121]) are disproportionately represented, the vast majority of installations are in households in the $40,000 to $90,000 income range. Figure VII-1 also shows that the fraction of solar installations in middle-income households has been increasing steadily in the three states studied (Arizona, California, and New Jersey). What is true is that **low-income households, defined as below $40,000 in annual income, are underrepresented** in all three states that were studied (see Figure VII-1) and that the situation has not improved over time. $40,000 is approximately 175 percent of the federal poverty level

[119] Makhijani and Mills 2015
[120] Myers 2013
[121] Hernandez 2013. This is a rather modest lower bound for "upper income" households, especially given that California, where housing costs are high, was one of the three states studied.

for a family of four. For the average size low-income family getting energy assistance in Maryland (2.85 people), 175 percent of the poverty level in 2013 was an annual income of about $32,000 (rounded).

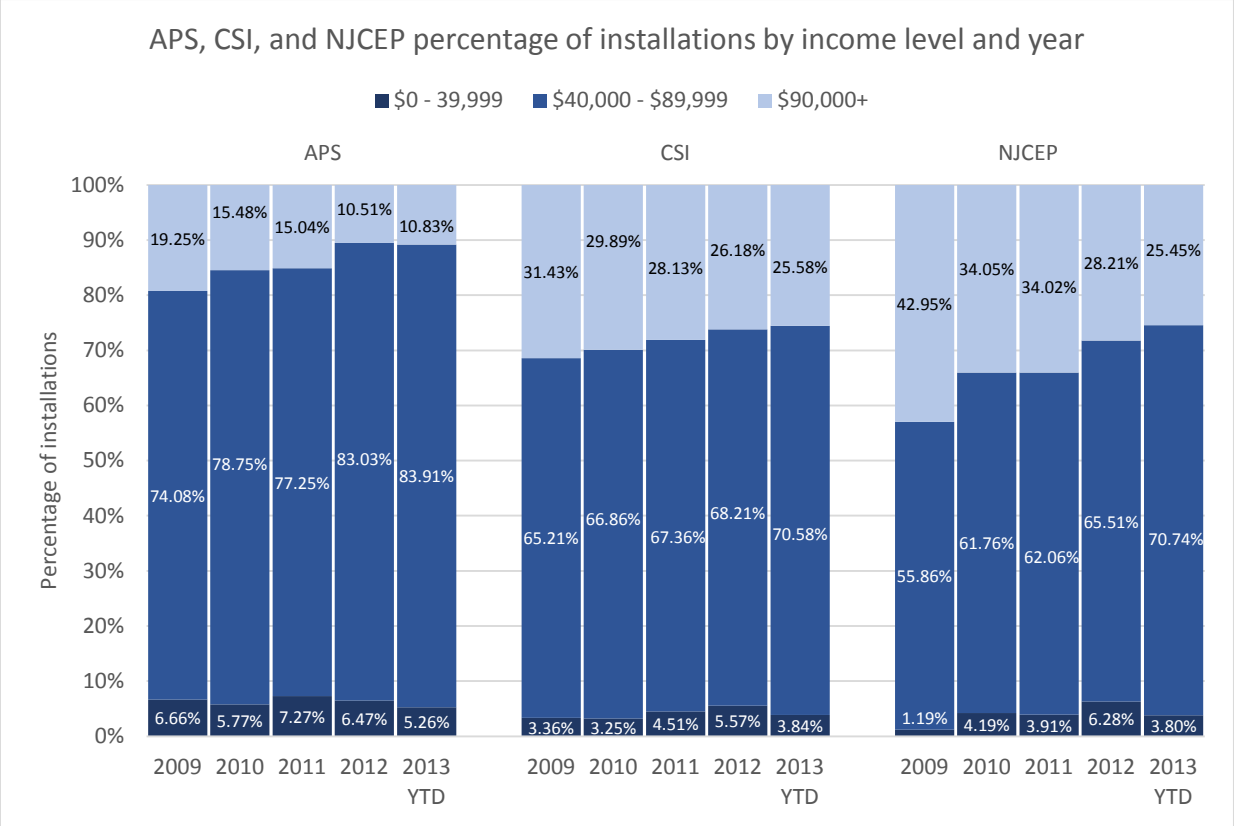

Figure VII-1: Income distribution of households installing solar in the 2009-2013 period (APS = Arizona Public Service; CSI = California Solar Initiative; NJCEP = New Jersey's Clean Energy Program). Source: Recreated from Hernandez 2013, Figure 3 (p. 4). This report, *Solar Power to the People: The Rise of Rooftop Solar Among the Middle Class*, by Mari Hernandez, was published by the Center for American Progress.

The low solar installation rate among low-income households is not surprising. The spread of leasing with zero down payment as a way to acquire solar and also reduce electricity bills has made it possible in theory to overcome the high first cost of solar. But in general one must own the roof for the solar installation, though community solar initiatives, still in their infancy generally, are making broader participation, including by renters, possible. Information is also key. Besides, owning the roof is not enough. The roof must have the strength to take the additional load of the solar panels. As it is, the Baltimore weatherization pilot project found that bad roofs were by far the most common problem causing homes to fail the audit required to proceed with the weatherization program (see Section VI above).

Low-income housing problems are very complex, the more so with rented homes, as discussed in Section A above. Economic justice considerations require therefore that the issue of equity in solar be addressed with some thoroughness and urgency.

The answer is not to curtail distributed solar installations among middle- and upper-income households, but to extend the opportunity to every low-income household; it is understood that, as in any other income category, not all of them may take advantage of the availability, independent of feasibility. **The goal should be to provide the opportunity to all low-income households to avail themselves of solar energy, even when they cannot put it on their rooftops, do not own the homes they live in, or do not have the capital to invest in them.** We might call this program "Universal Solar Access" by analogy with the program that exists now, the Electric Universal Service Program, which was created to ensure that low-income households do not have their electricity switched off for lack of funds to pay the bills.

There are many programs that are currently addressing the admittedly complex issues associated with broadening and eventually universalizing low-income households' access to solar energy.[122]

Community solar installations with virtual net metering (that is, where the meter credited with the solar generation is not at the site of the solar installation) represent one avenue, possibly the most important, since it opens up a way for low-income households to actually own parts of solar electricity installations. In this approach, a solar installation much larger than the typical rooftop installation is built and fractions of it are offered for sale to businesses, non-profit groups, or households. The output of the panels is credited to the bill of the owner of those panels. This approach, known as "virtual net metering" is likely to encourage both conservation and efficiency efforts in the same way that ownership of a home encourages and makes possible investments that appear pointless or out of reach for renters. The electricity would belong to the low-income households, presuming that financing assistance can be worked out. Thus, efficiency and conservation would likely be a huge collateral benefit of community solar programs with virtual net metering, if there are appropriate educational investments in promoting them.

This is the type of community solar program which was passed in 2015 as a three-year pilot program in Maryland. In previous years, it has faced opposition from Exelon, a co-owner of the Calvert Cliffs nuclear plant, which provides about 40 percent of electricity generation in the state of Maryland. Exelon also owns the largest distribution utility in Maryland, Baltimore Gas and Electric (BGE), which has about half of the electricity customers in the state. Merchant generation utilities and even some regulated utilities view distributed solar generation as a threat, though this is not always the case. For instance, Pepco supported community solar legislation in the District of Columbia. [123]

Despite the success in getting a community solar pilot program started, the prospect for a permanent program remains cloudy. Further, the financing issues will be difficult to solve for many, perhaps the majority of low-income households. The solar energy assistance discussed above could be applied to provide ownership of a part of the community solar system to participating low-income households. Since the community net metering program is only a three-year pilot, we also explore other avenues of

[122] A good summary with links is in Passera 2013.
[123] Makhijani 2015, pp. 8-9

providing broad access to renewable energy to low-income households. We do so in the context of the prospect that the largest subsidy for solar electricity, the federal business energy investment tax credit, is due to decline from 30 percent to 10 percent at the start of 2017 for non-residential installations. We assume just a 10 percent investment tax credit in our calculations, since that has no sunset date.[124]

We propose a program to provide all of the electricity requirements of low-income households who now get electricity bill payment assistance, with solar, which should be distributed so far as possible. If all of them subscribe to the solar program, it would amount to about 2 percent of Maryland's total electricity usage.

There are various ways in which low-income households could get solar energy assistance. A project in Denver involved low-income renters. Residents were provided with solar electricity and their electricity bills were taken over by the landlord in exchange for an effective rent increase of $25 per month. The renters did not own the solar installations; in fact, actual ownership arrangements were rather complex because of the nature of solar incentives, including federal tax credits.[125]

A somewhat limited community net metering, called aggregate net metering, has been initiated in Maryland. Under this program, agricultural entities, local governments, and non-profit institutions could aggregate electricity consumption from various meters located at different places and have them net-metered from a single solar installation.[126] Thus, some buildings that are not suitable for on-site solar or do not have enough rooftop or land area to accommodate a sufficient amount of solar panels can nonetheless benefit from solar energy. This is, in effect, virtual net metering, but its application is very limited at the present time.

Maryland's aggregate net metering program could be expanded to cover low-income housing that is owned by landlords and subsidized or owned by governmental agencies or non-profits. A variant of community choice aggregation (CCA) could be used. Community choice aggregation is being used to expand renewable energy access broadly, both to increase the range of households and businesses that could benefit by it and also to allow households and small businesses to benefit from more economical supplies if their renewable energy demand is aggregated. The core idea is as follows:

> CCAs are statutorily authorized retail electricity choice programs administered by municipalities, which aggregate the demand of all customers within their jurisdictional boundaries, *enrolling customers on an opt-out basis* (2014 U.S. avg. opt-out is 15%), in order to leverage the negotiation of contracts with retail or wholesale energy providers, as well as energy efficiency installers and renewable energy developers, variously and with differing local rules and regulatory conditions according to state CCA laws and other state-defined retail energy utility industry regulatory structures. Some CCAs also

[124] DSIRE Federal 2015, Business ITC
[125] Makhijani and Mills 2015, Section XI.E, contains a description of the program; references can also be found there.
[126] Maryland PSC 2014, pp. 5-6

> aggregate community gas service for heating. CCAs form in order to control energy sourcing locally, lower and stabilize rates, green their power supplies, and in some cases to make and repay investments in accelerated and expanded energy efficiency measures, and/or develop local renewable energy and energy efficiency projects.[127]

As of March 2015, CCA is available in about 1,300 cities and counties, including Chicago and Cincinnati.[128] The CCA principle could be applied to recipients of energy assistance or applicants for weatherization assistance or both. If successful, it could be expanded to all households eligible for low-income energy assistance. Community choice aggregation can, in principle, be applied to any group of consumers in a region; in other words, geographic continuity is not required so long as all of them are supplied by the same distribution utility (in deregulated areas such as Maryland). Recipients of low-income energy assistance would be automatically signed on to the program, unless they opted out, which is the normal model for community choice aggregation.

The main questions are:

- How can the supply of renewable energy be integrated into energy assistance programs?
- How much would a program cost that supplied half of the electricity requirement by renewable energy if it were made available to recipients of energy assistance?

The Interstate Renewable Energy Council (IREC) has proposed a model that integrates California's program to provide lower-cost electricity to low-income households. This is California's equivalent of Maryland's EUSP but in California's case low-income households get electricity at reduced rates (under a program called California Alternate Rates for Energy, or CARE) rather than bill payment assistance. IREC has suggested a program modification, CleanCARE, under which some of the CARE monies would go towards procuring renewable energy:

> Under CleanCARE, a portion of the funds allocated to the support of CARE customers would be invested in the development of shared distributed generation coupled with energy efficiency, energy storage and demand response. CARE customers electing the CleanCARE option would be allocated program shares that would offset a portion of their monthly bills, with the intent of bringing those bills to levels equivalent to customer bills under the broader CARE program. In this respect, the CleanCARE option would increase opportunities for low-income households to participate in renewable energy options while retaining the average rate levels and benefits of the current CARE program.[129]

The impact on the bill of the low-income recipient would be the same but the impact on renewable energy and carbon dioxide emissions over time could be substantial, especially if, as proposed, the

[127] Local Power 2015, italics added
[128] Local Power 2015
[129] IREC 2013, p. 1

program is coupled with efficiency and conservation improvements. The CleanCARE program proposes to include distributed solar energy but also larger scale and farther located solar and wind resources.[130]

We propose a Universal Solar Access program that is a variant of the CleanCARE program proposed by IREC. The program we propose has a greater emphasis on distributed solar generation and local jobs: solar resources dedicated to the program would generally be distributed and built, so far as physically and legally feasible, in the neighborhoods of the low-income household subscribers.[131] This would create the most job training opportunities and jobs, thereby increasing the non-energy benefits.

We did a calculation of the effects of a Universal Solar Access program with the following features using data for the year 2013:

1. The program would work on the community choice aggregation principle. We assume applicants who are granted assistance would be automatically signed up for the subsidized solar supply, unless they opt out.[132]
2. Participating households would get solar electricity equal to their annual electricity use.
3. Participating households would have the same net electricity bills as they currently do, post-assistance. This was approximately $1,231 per year for 2013. This approach has the goal of not increasing the recipients' net electricity payments under the solar program when compared to the current assistance program. The Universal Solar Access program can also be combined with the Affordable Energy Program; we recommend that, since it is likely to save millions of dollars per year. But the Universal Solar Access program does not have to wait until the completion of the recommended pilot program for the AEP is completed and evaluated (see Section IX).
4. Any remaining electricity costs for the low-income household above the 2013 net bill payment of $1,231 would be covered by a charge on all other ratepayers (in common with the present EUSP program). As the cost of solar declines, the cost of assistance declines.
5. The solar electricity generated would not be part of the renewable portfolio standard (RPS) and would not have renewable energy credits or other financial incentives allocated to it. In other words, the solar electricity for this program would be in addition to the renewable energy mandates under Maryland's RPS.
6. One method of ensuring that low-income households received the most economical solar electricity would be to adopt the approach of the new German solar farm pilot program. A

[130] IREC 2013, p. 2

[131] Maryland's urban utility-scale and rooftop solar potential is about 43,000 gigawatt-hours (NREL Potentials 2012, Tables 2 and 4), or about two-thirds of the state's electricity usage. This does not include parking lots, roads, and other urban areas with "imperviousness greater than or equal to 1%" (NREL Potentials 2012, p. 3). There is therefore no resource problem in supplying about 5 percent of the state's electricity that would be represented by the Universal Solar Access program with exclusively distributed (i.e., rooftop and urban utility-scale) projects that are located on the distribution side of the grid. The solar requirement for universal solar access to current EUSP assistance recipients is about 3 percent of this technical potential.

[132] We do not expect a significant number of low-income households to opt out. This is because the solar electricity generated under the program will be cheaper than both residential rooftop (due to scale) and subsidization. Further, the structures of the homes themselves would not be involved.

maximum price of solar electricity is set and bids are invited to supply it at or under that price cap.[133] The regulated utilities in Maryland as well as non-regulated corporations would be eligible to bid; however, the utilities would not be allowed to include the cost in their rate base. This would likely require a change in the law under which Maryland's wires-only regulated utilities operate, since they are not now allowed to own generation facilities. If non-regulated corporations win particular bids, the power would be purchased under Purchased Power Agreements. Decisions regarding winning bids would be made by the Public Service Commission.

7. The solar generation facilities would be constructed in the low-income neighborhoods where the recipients live, so far as feasible given technical, zoning, and community considerations. Job training for residents would be part of the program. Community participation would be essential to the success of such installations.
8. Recipients would reapply every year to ensure eligibility for low-income electricity bill assistance.

The issue of the duration of the solar subsidy deserves more detailed exploration in the pilot projects. We have suggested an annual application process, since that is the basis of the EUSP program; as proposed here the Universal Solar Access program would be folded into the EUSP program. Similarly, the AEP would require annual evaluation of incomes and energy burdens. Since the realization of universal solar access to all recipients of low-income electricity bill assistance would take some time (we suggest a period of 10 to 15 years), there is little or no risk of stranded solar surpluses under the program until nearly full enrollment is reached. If there are fewer actual recipients than planned, the solar electricity could be marketed as any other electricity under the regulatory authority of the Maryland Public Service Commission (since it would be on the distribution side of the grid).

Given the current cost of utility- and commercial-scale distributed solar installations in Maryland and the fact that solar costs continue to decrease, creating solar generation earmarked for low-income households would likely reduce the cost of the EUSP program, assuming that post-assistance bills remain the same. It would positively impact the Affordable Energy Program even more since the savings would accrue to ratepayers first (until the electricity burden is below the AEP threshold). Low-income households would be protected since their electricity burden would, in any case, be capped at 6 percent for electrically heated homes and at 3 percent for other homes. See Section IX.

A. Cost and structure of the Universal Solar Access program

Solar electricity costs for installations on a megawatt-scale are now low enough to be competitive with residential energy costs in Maryland. In the last quarter of 2014, utility-scale, fixed tilt solar installations cost $1.55 per watt, while non-residential rooftop installations averaged $2.25 per watt.[134] The trend has continued into the first half of 2015, with costs falling by $0.20 to $0.50 per watt.[135] Further, the CEO of First Solar, one of the largest U.S. solar PV companies that both makes panels and builds utility-

[133] Meza 2015
[134] GTM Research and SEIA 2015, bar graphs on pp. 15 and 16
[135] Weiner 2015

scale solar systems, was quoted in the trade press as saying that the installed cost of a tracking, utility-scale solar system in the western United States would be less than $1 per watt; he expects the downward cost trends to continue.[136] $1 per watt is the goal for the year 2020 of the U.S. Department of Energy's SunShot Initiative. The corresponding goal for commercial scale rooftop installations by the year 2020 is $1.25 per watt.[137]

The solar installations built under this proposal would mostly be on a megawatt or multi-megawatt scale, but still mainly installed on the distribution side of the grid and built in urban areas with community participation and consent. The scale makes it likely that most installations would be of the lower-cost ground-mounted variety. Given the likelihood that the program will not begin until 2017 at the earliest, we have assumed an initial cost of $1.75 per watt, declining to $1.25 per watt by 2022, and constant after that date (all in 2013 dollars). Given that costs are likely to continue to decline, this is a rather conservative (high-cost-side) assumption. Looked at another way, the procurement of solar would include a small component of rooftop solar for low-income homeowners with robust enough roofs without materially affecting the cost calculations.[138] Table VII-1 shows the costs per kilowatt-hour of solar energy as delivered to end users that we have used in this analysis.

Table VII-1: Analysis of the costs of solar electricity supply for low-income households (in 2013 dollars)

	Solar installed in 2017	Solar installed in 2022 and thereafter
Capital cost, $/watt	$1.75	$1.25
Investment tax credit rate	10%	10%
Corporate tax rate	35%	35%
Capital cost, $/kWh, with accelerated depreciation	$0.088	$0.063
Operations and maintenance cost, $/kWh	$0.011	$0.011
Distribution and other costs, $/kWh	$0.030	$0.030
Total solar electricity cost, $/kWh	$0.129	$0.104

Source: IEER analysis

Note: We assume that the typical system type and size will be on the order of 1 MWdc. For additional information see notes to Table VII-2.

Table VII-2 shows how the program would look from the point of view of an average recipient of electric bill payment assistance.[139] We have used 2013 data for bill payment assistance budgets and approximate number of recipients. As solar is implemented to cover all recipients, the cost of the program goes down under the assumption that the net bill payment by the recipient of assistance would

[136] Wesoff 2015

[137] DOE 2012 SunShot, p. xix. We recognize, of course, that solar costs are changing fast and are difficult to estimate with precision five or ten or more years in the future. We have used assumptions that include cost reductions that are slower than is anticipated by the authorities cited and indicated by current trends. This enables our conclusions about costs to be robust in the sense that they are unlikely to be higher than estimated here.

[138] The SunShot goal for residential rooftop solar is $1.50 per watt by 2020. (DOE 2012 SunShot, p. xix)

[139] As noted previously, we exclude assistance to cover accumulated arrearages; only annual assistance to pay bills, and heating assistance to households with electric heating are included here.

remain the same. The average annual cost of assistance would go down from about $36 million in 2017 to an average of about $21 million over during the 2017 to 2031 period. If no AEP is implemented, but solar is procured for all recipients of electricity assistance, the cost of assistance would go down to $4 million by 2031. All these calculations assume the same number of electricity assistance recipients as in 2013.

Table VII-2: EUSP Bill Assistance total and per recipient in 2013 and average assistance with a Universal Solar Access program implemented over 2017-2031

	Total bill assistance per year	Bill assistance per recipient	Post-assistance bill paid by recipient
Current program, 2013 costs	$36.2 million	$325	$1,231
Average annual program cost for solar implemented over 2017-2031	$21.4 million	$190	$1,231

Notes: 1. The cost of solar energy in the first year of the program (assumed to be 2017) was computed as follows: Urban utility solar PV capital cost: $1.75 per watt; federal tax incentive: 10 percent; accelerated depreciation of 85 percent of the post-tax-incentive cost over 5 years (worth $0.094 per watt in present value at a tax rate of 35 percent and a discount rate of 8 percent); operation and maintenance cost: $0.011 per kWh. Generation per year: 1,286 kWh AC per kWdc capacity; 20 year installation life; 8 percent weighted average cost of capital. Net cost of generation: about $0.099 per kWh. A distribution cost of $0.03 per kWh was added. Total solar cost in 2017: $0.129 per kWh.
2. The program would include more solar generation each year at a rate that all assisted households would be getting solar energy by 2031. Costs of new solar installations are estimated to decline from $0.129 per kWh in 2017 to $0.104 per kWh in 2022; they are assumed to be remain constant at $0.104 for installations built after that. The average electricity rate each year for all recipients is the weighted average of normal electricity cost and the solar cost, according to the proportions of each that are supplied in any year. The solar cost is weighted by date of installation of the solar. Overall, this approach gives the average electricity cost to all recipients in any year during the implementation of the solar program. Weighted costs of electricity supply to low-income households would decline from $0.134 per kWh in 2017 to $0.109 per kWh in 2031 due to the implementation of the solar program.
3. Normal electricity cost (i.e., without the solar program) for residential customers: $0.134 per kWh. It is assumed to remain constant (in 2013 dollars) during 2017-2031.
4. Annual average usage by low-income EUSP recipients: 11,596 kWh per year. In the solar plus EUSP example, all electricity for the low-income household is supplied by solar PV.
5. The cost share of ratepayers is flexible according to the cost of solar. The low-income household electricity bills are kept constant, with any remaining costs covered by ratepayers. As solar costs decline, the excess costs decrease as well. At $1.75 per watt (the cost used in this example), ratepayers cover a portion of the solar costs (about 19 percent in this example). At about $1.30 per watt, no assistance is needed to maintain the post-assistance bill at the 2013 level of $1,231.
6. This solar program as proposed here would be outside the renewable portfolio standard framework. No solar renewable energy credits or other state or utility credits would be applied to it.

Of course, the funds saved could be used to increase assistance per recipient or expand the coverage. Or the funds could be used to expand efficiency programs, further reducing the need for assistance. The direction of the program is clearly such that it could be integrated with the Affordable Energy Program whose costs would decline as a result. Some of the funds saved could also be used for job training and other investments in the communities were low-income people live. That may require a broadening of the scope of assistance for which EUSP funds can be used.

The net impact on ratepayers is very likely to be a substantial cost savings. In this context, we should stress that the cost calculations do NOT assume a continuation of the 30 percent federal investment tax credit. Rather, we assume a 10 percent investment tax credit, which will still be available for non-residential installations after 2016. At the time of the finalization of the calculations for this report (August 2015), there is no provision for federal tax credits for residential solar installations after December 31, 2016.

We recommend that universal solar access be integrated with the Affordable Energy Program. Along with energy efficiency measures, it would reduce the costs of the AEP over time. We will explore this in Section IX.

Offering Universal Solar Access to current EUSP households would allow increases in local jobs and increase neighborhood collateral benefits like reduction of air pollution, improvement of health, as well as reduction of CO_2 emissions. If the program is implemented over 15 years, the cumulative CO_2 emission reductions to 2030 would be about 10 million metric tons, assuming electricity sector emissions at the 2011 rate. The corresponding undiscounted value the CO_2 reduction (@$42 per metric ton[140]) would be about $420 million.

A Universal Solar Access program would provide a variety of benefits:

1. It would allow distribution utilities the opportunity to put distributed solar in their portfolios (*but NOT in their rate base*), provided they can offer it competitively (possibly through a subsidiary of the distribution utility). This could help overcome the utilities' reluctance to envision large amounts of distributed solar, since they fear loss of revenue.
2. It would allow strategic and economic combinations of distributed solar generation with distributed energy storage, enabling to lower costs for all customers.
3. It would allow for the development of solar microgrids, including public purpose microgrids that would supply power to essential community facilities in the event of prolonged outages, such as those accompanying extreme weather events like Hurricane Sandy in 2012 or the derecho storm in Maryland (and environs) in the summer of 2012.
4. There would be collateral benefits of jobs and other neighborhood value improvements that cannot be realized with simple energy bill assistance.
5. The Universal Solar Access program would be a complement to the low-income efficiency programs that are already being implemented in Maryland (and that need to be expanded).

[140] The medium value estimated in Itron NEBs 2014, Table 2-7 (p. 2-23).

B. Considerations relating to distributed solar facilities

In any case, a program along the lines recommended above would require the construction of solar facilities. To the extent possible they should be in the neighborhoods where the people to be served live. There is more than enough technical potential to supply all households in Maryland with 100 percent distributed solar, provided one includes utility-scale solar in urban areas under the rubric of "distributed solar." Figure VII-2 shows the technical potential for distributed solar generation in Maryland.

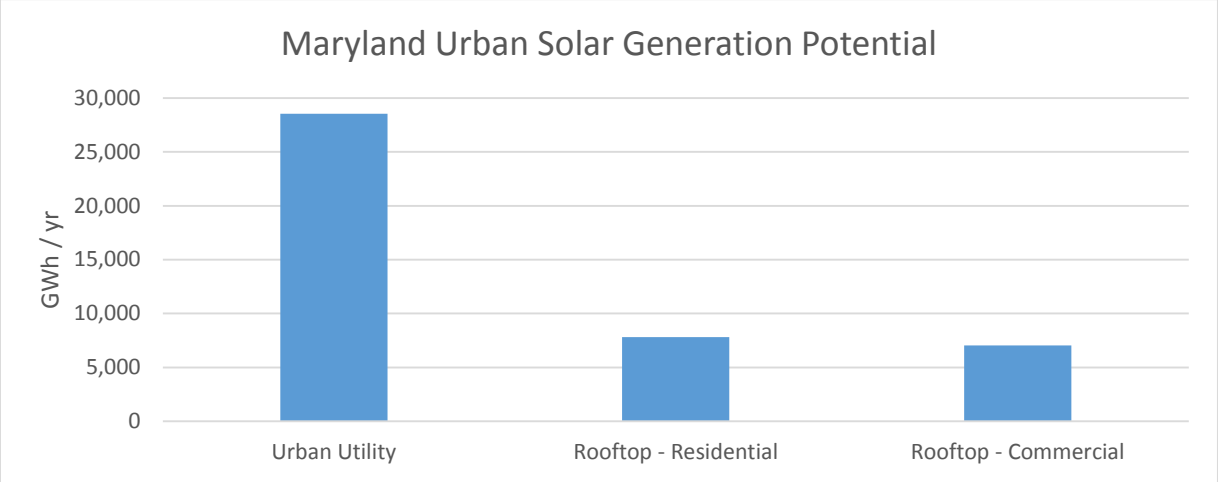

Figure VII-2: Urban solar generation potential in Maryland. Source: NREL Potentials 2012, Table 2, provides urban utility-scale potential; Table 4 provides a total rooftop potential. Note: The reference used in NREL indicates that residential and commercial potential are about equal (Denholm and Margolis 2008, Figure 4 (p. 8)).

Of course, it should be noted that Figure VII-2 shows technical potential. For instance, developed areas indicated by impermeable surfaces were excluded from NREL's calculation of urban utility-scale potential. However, as the NREL study notes, the practical potential, called the "market response" also depends on other factors like investor response and regulatory issues.[141] The maximum amount of distributed solar potential that can be realized will depend on many local factors that should be evaluated in detail. On the other hand, we have not included the generation potential of solar canopies over parking lots; this could be substantial. We will provide a recommendation in this regard in the report on the Maryland energy sector as a whole.

In addition, if the solar is to be built in neighborhoods where the recipient communities are located, then there must be a process of community participation in the decisions as to where the facilities will be built. Low-income families already face many challenges and insecurities. Putting large installations in their neighborhoods without community participation may risk non-acceptance by the community and failure of the project. On the other hand, the Baltimore pilot project discussed above shows that projects that address the needs on a holistic basis can, in the right circumstances, result in

[141] NREL Potentials 2012, Figure 1 (p. 1)

benefits that are considerably beyond those yielded directly by the investments in the properties themselves.

Even if the areas suitable for solar projects are much more restricted than indicated by the technical potential, that potential is so large that it may be possible to accommodate most of the Universal Solar Access program in low-income neighborhoods themselves. Further, low-income areas exist in both urban and rural parts of Maryland. Building distributed solar should also be possible in the relatively sparsely populated areas in Western Maryland and on the Eastern Shore. Mapping the specific areas where distributed solar facilities can be built and matching them with the areas where assistance is most needed would provide a powerful tool for creating jobs, reducing assistance costs, and improving the environment at the same time.

A technical note is in order. Megawatt-scale distributed solar energy projects may, in some cases, require modifications to and investments in the distribution system in order to ensure safety and reliability. Such investments are likely to be required in any case as Maryland moves towards an efficient and renewable electricity system. Technical issues associated with the larger transformation will be discussed in an overall report related to the transition to a low-emissions energy system in Maryland.

1. Procurement of solar electricity for the program

We propose that the solar energy procurement be integrated with the Affordable Energy Program. This means that it would be separate from other renewable energy programs that are part of the Renewable Portfolio Standard. But, by its very nature, it would provide CO_2 emission reduction benefits and the associated climate protection.

We propose that solar generation for the program be procured each year under the supervision of the PSC. A maximum price for purchase of solar over 20 years would be set each year for that year's procurement. Companies would be invited to bid competitively. Wires-only utilities would be allowed to bid on the same basis as any other enterprise. Regulated utilities would NOT be allowed to put the cost of these solar installations into their rate base. This would ensure that (i) utilities have a shot at participating in the solar business and (ii) that utilities do not have an unfair competitive advantage over non-utility companies.

The structure for solar procurement for the program suggested here would make it separate from the renewable portfolio standard process. Among the advantages of this separation are:

1. It removes the Universal Solar Access program from the politics of the renewable portfolio standard.
2. It allows wires-only utilities to own the solar, though they would have to bid competitively to do so. This would be contingent on the solar they would create (if their bids are accepted) being on the distribution side of the grid. They may have to set up for-profit subsidiaries to bid.
3. The proposal would also allow community-based for-profit corporations to bid on and, if successful, own the solar installations. It is possible in principle that non-profit corporations

could also do so but it may be difficult or impossible for them to avail themselves of the 10 percent federal tax credit (the level starting in 2017) and accelerated depreciation allowances.

4. Renewable energy credits are not necessary to provide universal solar access to all current recipients of energy assistance provided it is done on an appropriate scale.
5. It removes the Universal Solar Access program from the net metering issues. Eventually net metering will have to be changed to some "value of solar" system. That is going to take time and it will involve controversy. Adding a distribution charge to the solar electricity cost should (at least in principle) remove any objection utilities may have to universal solar access for low-income households.

The last point is worth exploring in more detail. Solar has become an intense arena for conflict in some areas with regulated utilities and merchant electricity generating companies. There is much talk of a "death spiral" for utilities who fear that the increase of distributed solar would erode their revenues and their very business model, which attaches a transmission and distribution charge to every kilowatt-hour sold.[142] Net-metered solar electricity reduces the electricity that flows through the utility's wires and so reduces the revenues. Merchant generating companies, of course, stand to lose business as more and more households and businesses generate larger fractions of the electricity they use "behind the meter" – that is, for direct consumption on the premises where the electricity is generated. The utility simply does not "see" this electricity.

The actual financial impact of distributed solar generation is at present very low. The cumulative residential capacity as of the end of 2013 in Maryland was just 28 megawatts, which amounted to just 0.05 percent of Maryland's electricity consumption. A 2014 study done by Lawrence Berkeley National Laboratory estimated that at a distributed, "customer-sited" solar PV penetration of 2.5 percent of electricity use, the rate increase would only be 0.2 percent for a northeastern utility operating in an environment where generation has been deregulated.[143] Maryland's distributed solar is a long way from this target.

It is generally acknowledged that net metering should be converted to a "value of solar" structure, but what that value should be remains a matter of debate and includes huge disparities in estimated value. There is no question that the value of solar is considerably higher than the wholesale generation rate advocated by the CEO of Exelon.[144] But whether it is as high as the 33.7 cents per kilowatt-hour estimated in a recent study published by the Maine Public Utilities Commission[145] should be a matter of careful study prior to determination of a reasonable and equitable value of solar in Maryland. Moreover, that debate should occur in the context of the need to revamp the role of utilities to serve as a platform

[142] For a brief description of the issue with references see Makhijani 2015, Section I.A
[143] LBNL 2014, p. ix. The study used Massachusetts data in its calculations (Section 3.2). Maryland's per unit costs are somewhat higher than the model used in the study, which took Massachusetts for its case study.
[144] See Makhijani 2015, Section I.A, for citations and discussion.
[145] Maine PUC 2015, Figure ES-2 (p. 6)

for a host of services, along the lines now being considered by the New York Public Service Commission as part of its process of "Reforming the Energy Vision".[146]

Despite these facts, it is the political reality that Maryland does not have a broad virtual net metering law that would allow widespread community ownership. The 2015 pilot program is a start in that direction that could benefit low-income households as well if it is made permanent. **It is important to include low-income households in community net-metering projects during the three-year pilot phase.**

It will also take time to investigate and decide how the structure and function of distribution utilities should be changed, where community solar might fit into such a structure, and how generation from such facilities would be valued. **The proposal for Universal Solar Access made here would allow low-income households to access solar without waiting for the results of prolonged regulatory processes.** It would nonetheless require changes in the law and regulations to modify the Electric Universal Service Program and to allow wires-only utilities to bid competitively on solar resources built expressly for this program, either directly or through subsidiaries. Ideally it would be combined with the restructuring of assistance to limit energy burdens to 6 percent of income, which would require restructuring of both the EUSP and MEAP programs.

VIII. Collateral benefits ("non-energy benefits") of the Affordable Energy Program

A reduction of energy bills and, over time, a reduction of the need for assistance are not the only benefits of efficiency programs. The collateral benefits, also called "non-energy benefits" (NEBs, for short) are important to include, particularly when looking at the costs of various programs.[147] The importance of NEBs, like improved health, reduction in greenhouse gas emissions, improved comfort, and longer structure life have been increasingly recognized in recent years. Quantifying and incorporating them into efficiency programs presents significant challenges, but even partial consideration shows that taking NEBs into account can make a significant difference to program design and evaluation.[148] There are also important non-energy benefits of a well-structured energy assistance program and solar energy access for low-income households.

Malone (2014) has pointed out that non-energy benefits of efficiency can be viewed from three perspectives – the utility, the participant (or consumer), and society, as seen in Table VIII-1 below:

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[146] New York PSC 2015. The Maryland Public Service Commission has set a similar proceeding as a condition of the merger of Exelon and PHI. See Maryland PSC 2015, p. 76.

[147] We should note that "non-energy benefits" include energy benefits in some cases. In the usual procedure, only energy benefits relating to the entity being regulated are taken into account. Very often only electricity-related benefits are counted, since efficiency programs are largely run with electricity ratepayer funds. Increasingly, natural-gas related benefits are taken into account, since natural gas distribution is regulated. But fuel oil and propane, being unregulated, are usually ignored.

[148] Neme and Kushler 2010, p. 5-305

Table VIII-1: Non-Energy Benefits of efficiency programs from various perspectives[149]

Utility Perspective	Participant Perspective	Society Perspective
- Reduced arrearages - Reduced carrying costs on arrearages - Reduced bad debt	- Improved safety - Improved health - Reduced O&M costs - Increased worker and student productivity - Increased comfort - Reduced water use - Improved aesthetics	- Environmental externalities - Health care cost savings - Reduced reliance on fossil fuels

Figure VIII-1 shows how including some quantification of non-energy benefits can change the benefit-cost picture for efficiency dramatically in some cases. The utility cost test relates to utility costs and benefits; the Total Resource Cost (TRC) test includes both utility and participant costs; it is shown without and with the inclusion of non-energy benefits.

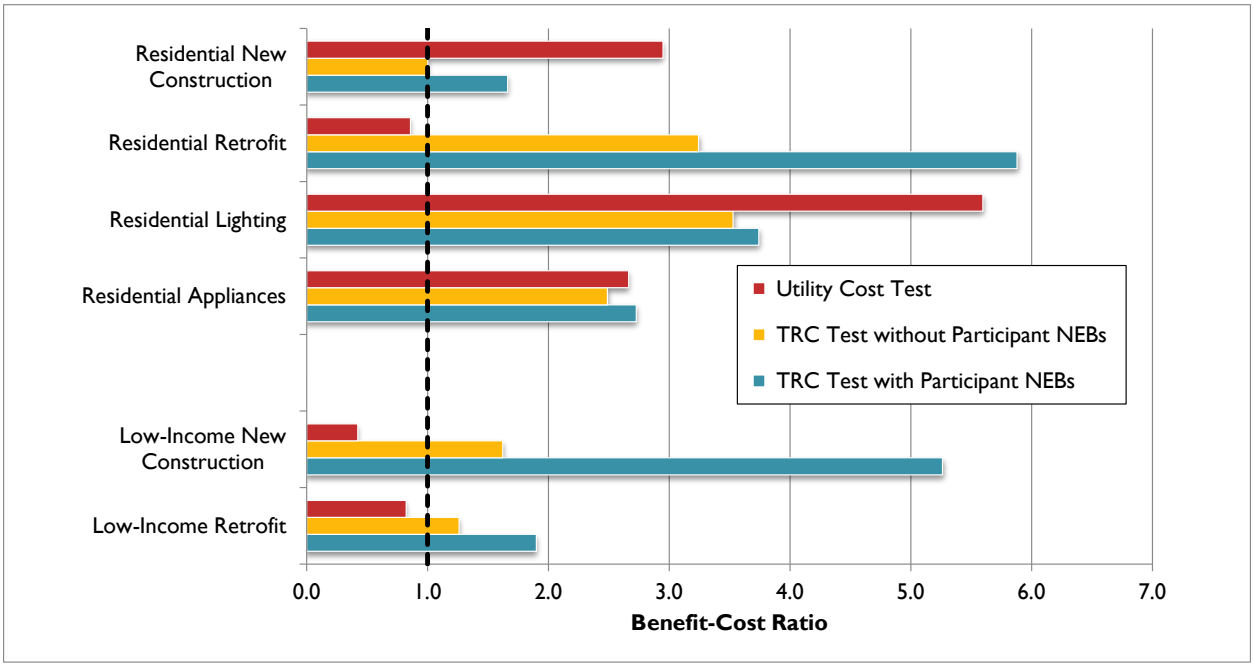

Figure VIII-1: Effect of including non-energy benefits in evaluating efficiency: actual results from Massachusetts. Source: Woolf 2015, slide 8

Figure VIII-1 shows that in many important cases, like lighting and electrical appliances, benefit-cost ratios are always greater than one, independent of the test. However, in cases where efficiency entails significant investments, tests that do not include non-energy benefits often have benefit-cost ratios less than one. Conventional economics based on such tests would then reject such investments. But the real world benefits show the conventional view to be both economically and socially narrow and incorrect.

[149] Quoting Malone 2014, slide 5

The most striking feature of Figure VIII-1 is that residential retrofits, including in low-income housing, show high benefit-cost ratios when non-energy benefits are included and often fail the benefit-cost test when they are not. When low-income households have more money for rent and food and medicine, and when mold is cleared from their homes in the course of retrofitting them, there are fewer emergency room visits, fewer evictions, and fewer absences from work (and hence higher labor productivity). We examine the issue of the non-energy benefits of the Affordable Energy Program in detail in light of the Maryland PSC's order in July 2015 to consider such benefits in efficiency programs, including in programs directed at low-income households.

A. The Maryland PSC's July 2015 EmPOWER efficiency order

The Maryland Public Service Commission opened the door to integration of non-energy benefits into energy efficiency programs in its July 2015 order (No. 87082) on Maryland's efficiency program known as EmPOWER. Among other things, PSC ordered a "Societal Cost Test" (SCT) as the primary screening test along with widely used Total Resource Cost (TRC) test, which was the main screen prior to the order. The latter includes the program costs to the utility and to the participant in the efficiency measure (such as purchase of a more efficient appliance with a rebate from the utility), but, except for the reduction in the participant's energy bill, it does not include many other benefits to the participant and to society at large. The PSC argued that if participant costs are included, so should participant and social benefits:

> However, we are not persuaded that the TRC should remain as the *only* screening tool on a prospective basis; on the contrary, we concur with parties such as PE [Potomac Edison] that note, "[t]he TRC test alone fails to consider the cost-effectiveness of investments from a nonparticipating ratepayer point of view." Indeed, the Coalition [of Maryland Energy Efficiency Advocates] contends that failing to account for "benefits that accrue to participants and non-participants alike, such as reduced air pollution and the corresponding reductions in adverse health effects" mischaracterizes the true cost-effectiveness of energy efficiency investments. A failure on our part to consider a broader societal impact stemming from the implementation of energy efficiency programs would ignore the codified intent of the General Assembly "to provide affordable, reliable, and clean energy for consumers of Maryland." This directive is not limited to only those consumers who participate in an energy efficiency program, just as the benefits of energy efficiency investments do not accrue only to direct program participants. We concur with MEA that the **directive of the General Assembly to the Commission requires a societal viewpoint as the primary orienting framework**, and thus we direct the use of both the TRC *and* the SCT as assessment tools for purposes of conducting preliminary cost-effectiveness screening.[150]

The PSC also concluded that Maryland law requires the consideration of non-energy impacts to society in a variety of areas, including jobs and the environment and even much farther than that:

[150] Maryland PSC EmPOWER 2015, pp. 5-6, bold emphasis added

> In order to determine whether a proposed program or service encourages and promotes the efficient use and conservation of energy, the Commission is explicitly directed by statute to consider non-energy categorical *impacts on jobs and on the environment*, and more broadly to rely on energy efficiency as a resource *to assist with the provision of affordable, reliable, and clean energy* to Maryland ratepayers.[151]

Finally, the PSC also noted that efficiency programs directed at low-income households should take the same approach as the overall EmPOWER program both to ensure that ineffective programs are eliminated and effective programs with important non-energy benefits are considered:

> With respect to limited-income programs, which constitute a separate and distinct sub-portfolio of programs, … simply waiving the requirement that the limited-income programs undergo cost-effectiveness screening may do our ratepayers a disservice by failing to maximize the benefits of the energy efficiency investment. However, requiring that the limited-income sub-portfolio "pass" cost-effectiveness screening may do our ratepayers a similar disservice by too greatly limiting these critical program offerings. Therefore, we accept the recommendation of the Coalition [of Maryland Energy Efficiency Advocates] that, while cost-effectiveness screening of the limited-income sub-portfolio shall be required *in the same manner as with respect to the other EmPOWER sub-portfolios*, the results of the limited-income sub-portfolio screening shall serve as a point of comparison to other jurisdictions and past programmatic performance rather than as the basis for precluding certain limited-income program offerings.[152]

Clearly, the PSC now requires that non-energy benefits be included when evaluating efficiency programs, including for low-income households. The specific order applies to EmPOWER efficiency programs, but there is nothing in the reasoning that would preclude it from being extended to the inclusion of non-energy benefits of assistance programs, including the Affordable Energy Program or Universal Solar Access program for low-income households. The same reasoning applies to them: if we are going to include the costs of these programs, then the benefits must be considered too.

In its EmPOWER order of July 2015, the PSC ordered the specific inclusion of three distinct NEBs in EmPOWER program screening:[153]

- Benefits due to reduced emissions of air pollutants: "business-as-usual" due to reduced air emissions benefits.
- Reduced arrearages in bill payments
- Itron quantified business-as-usual valuation of non-energy comfort benefits for residential customers and reduced operations and maintenance costs for commercial and industrial customers.

This is a rather limited list, as contrasted with the expansive language that the PSC used in its analysis of NEBs. But that is only because the consideration of NEBs is at a very early stage in Maryland. The PSC

[151] Maryland PSC EmPOWER 2015, p. 14, italics added
[152] Maryland PSC EmPOWER 2015, pp. 9-10, italics added
[153] Maryland PSC EmPOWER 2015, p. 31. The benefits due to reduced air pollution are essentially health benefits.

appears to be proceeding cautiously as regards the quantitative aspects for that reason. The PSC also left the door open for changing the list of NEBs and their valuations:

> Given that work is ongoing in this important area of research, we find that it is appropriate at this time to adopt the business-as-usual value equivalents of the Itron quantified NEBs for the categories of air emissions, comfort, C&I O&M, and reduced customer arrearages. We find that the inclusion of these specific NEBs in the TRC test and the SCT as described above will enhance the parity of cost-effectiveness screening and assist us in completing the necessary statutory inquiries. Should the parties *develop additional quantifications of Participant, Utility, or Societal NEBs* moving forward, or should the parties seek to revise the valuation of the NEBs directed by our Order today, the parties may present such analysis in conjunction with planning for future program cycles. [154]

In the spirit of this invitation from the PSC to explore "additional quantifications" of non-energy benefits and new valuations, we explore some non-energy benefits of the Affordable Energy Program as well as of the Universal Solar Access program for low-income households that we recommend.

B. Non-Energy Benefits of the Affordable Energy Program

The non-energy benefits of the Affordable Energy Program to low-income recipients could be so large as to reduce the net costs of the AEP below current assistance programs. Preventing loss of homes and associated increases in shelter and health costs are among the more important non-energy benefits that would accrue to low-income families directly, but also to society more broadly. We address these issues in some detail.

A 2011 national survey found that significant numbers of families receiving assistance lose their homes as a result of energy bills they cannot afford. They are evicted or foreclosed out of their homes. Many move with friends or family; many become homeless or use shelters for the homeless:

> This section examines housing problems that [survey] respondents have faced in the past five years due to unaffordable energy bills. Table IV-21A shows that 31 percent skipped a mortgage payment, 14 percent moved in with friends or family, six percent were evicted, and four percent moved into a shelter or were homeless. While four percent reported that they had a mortgage foreclosure in the past five years, three percent reported that they had a foreclosure in the past year. [155]

In all, the survey indicates that almost one-fourth (24 percent) lost their homes over a five year period – or about 5 percent each year. This assumes that each of the categories of home loss is mutually

[154] Maryland PSC EmPOWER 2015, pp. 15-16, italics added
[155] NEADA 2011, p. 38

exclusive. However, it is possible that some of those foreclosed or evicted would have moved in with family or friends. Hence the net figure over five years may be less than 24 percent.

Three percent reported having been foreclosed in the past year and four percent reported foreclosure over five years. The gap between three percent of respondents being foreclosed within the past year compared to only four percent over five years may be due variations in foreclosures or due to recall issues regarding dates in the course of the survey or both. We will treat the more recent data for the past one year, when it is available, as more indicative of the likely events.[156] In the case of foreclosures, we use the national data to assume that three percent of energy assistance recipients who owned their homes are foreclosed in a typical year.

It is important to stress that these figures are for households who got assistance at least in one of the five years, with most getting assistance in more than one year, and 20 percent received assistance in each of the five years.[157] Another way of looking at it is that the survey described problems of households whose energy burdens were already reduced from what they would have been without energy assistance.

The problems are more severe among the more vulnerable segments of the low-income population. For instance, the fraction of those who were evicted or had foreclosures in the survey group overall was 10 percent (over five years). That number rose to 18 percent for those with the lowest incomes, in the range of 0 to 50 percent of the federal poverty level. Fifteen percent of households with a child under 18 years of age were evicted or faced foreclosure; in contrast, it was 9 percent among households that did not have any vulnerable category of person in the home.[158] The extremely poor, families with children, and the elderly are among the groups that are preferentially selected for energy assistance. Other data also indicate that the problem of energy burdens and loss of homes is severe. In St. Paul, "[t]wenty-six percent of evictions were due to utility cut offs."[159]

In Maryland, about 34,000 (31 percent) of 2013 electricity bill assistance recipients owned their homes; for heating assistance recipients, the figure was 35,000.[160] National data for all income groups indicate that about 70 percent of homeowners have mortgages. Maryland data by county indicate that the percentage of homeowners with mortgages varies, by county, from 60 to 80 percent, approximately.[161]

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[156] There are other areas where the data for the past year are not fully consistent with five-year recall. For instance, 41 percent of respondents said they went without medical or dental care in the past year, but only 37 percent reported going without medical or dental care in the past five years (NEADA 2011, Table IV-24A (p. 41)). Recall of the past year may be better, since more recent, than recall of such things over a five-year period. We will place greater emphasis on survey results from the past year, when available.

[157] NEADA 2011, Table V-2A (p. 47)

[158] NEADA 2011, Tables IV-21A through IV-21C (pp. 38-39). Data by vulnerability category are in Table IV-21B.

[159] HUD Office of Environment and Energy Website 2015

[160] Maryland PSC 2013, Appendix A, Attachment G (pdf p. 41)

[161] Zillow 2015. See the interactive map by county at http://www.zillow.com/blog/more-homeowners-are-mortgage-free-than-underwater-108367.

Assuming that three percent of energy assistance recipient mortgage-holders are foreclosed each year, we can estimate that about 700 (rounded) households in Maryland were foreclosed in 2013.

Evictions of renters occur at higher rates than foreclosures; further, the percentage of assistance recipients who rent is about 69 percent. Putting these data together leads to an inference that roughly 2,000 to 3,000 households from among energy assistance recipients would lose their homes to evictions and foreclosures in a year similar to 2013. Some fraction of these families actually become homeless and need additional public services, such as shelter and more frequent and intensive medical care. Others would move in with family or friends; they have nonetheless lost their homes and have become dependent on others, who also face unexpected costs.

It is essential to emphasize again that the survey data relate to those who get energy assistance and whose energy burdens are significantly reduced as a result. Only about a third of those who are eligible for assistance in Maryland get it. We have found no data on the degree to which high energy burdens costs induce loss of home among low-income households who are eligible for, but do not get, energy assistance.

For the purposes of this report, we assume that one percent of energy assistance recipients – about 1,100 households per year[162] -- will be prevented from becoming homeless due to high energy burdens if the Affordable Energy Program is implemented.

Reduction of homelessness and the higher health expenditures associated with it would be a key non-energy benefit of implementing the proposed AEP. It is therefore important, in view of the Maryland PSC's invitation to include relevant non-energy benefits, to estimate what homelessness costs. A 2010 study by the U.S. Department of Housing and Urban Development of the costs of homelessness found that the costs of housing a homeless family for one month in Washington, D.C., ranged from $1,251 per month for permanent supportive housing to as much as $3,698 per month in case of the highest emergency shelter costs. Costs for sheltering individuals were generally lower than those in Washington, D.C.; they ranged in various states from $408 per month to $1,817 per month depending on the type of shelter and location. These figures indicate annual costs of about $5,000 to well over $40,000.[163] The range of costs for Washington, D.C., is more likely to be representative of the urban and densely populated suburban areas, while the range from other states representative of the less densely populated areas. We use the low end of the range of Washington, D.C., costs as a reasonable estimate to represent statewide monthly shelter costs for Maryland where most people live in urban and suburban areas. This also makes approximate allowance for the fact that not all homeless persons use shelters every day.[164]

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[162] Rounded to two significant figures.
[163] HUD 2010, Exhibit 1 (p. ES-4)
[164] Basic Maryland data on homelessness in Maryland can be found in the Needs Assessment part of the Maryland's housing development plan at http://www.dhcd.state.md.us/WEBSITE/About/PublicInfo/Publications/Documents/2010-2015homelessneeds.pdf (Maryland DHCD Homelessness).

Homelessness increases other costs as well, notably health care costs. There is clear evidence that such costs are huge, as demonstrated in a study of 6,494 patients in the Boston Health Care for the Homeless Program:

> Homeless individuals had high health care expenditures—$2036 per member per month compared with $568 per month for all MassHealth members. Almost half of total annual expenditures were incurred by 10% of the study population…. The 2 highest categories of health care expenditure were hospitalizations and ED [Emergency Department] visits, which represented 40% and 11% of total expenditures, respectively.[165]

Among other things, the rate of diabetes was extremely high:

> Diabetes mellitus was an example of a disease made much worse by the social circumstances of homelessness, including limited access to nutritious food, an irregular meal schedule, inability to refrigerate insulin, and challenges of carrying needles. The prevalence of diabetes mellitus was extremely high in this population (18%) compared with the general population (8.3%).[166]

The actual annual health care cost for a displaced household is likely to be higher, because the *added* health expenditures of $1,468 per month are for a single individual, while there are, on average, 2.85 persons per household.[167] However, among the homeless, the average household size is about 2.[168] Homeless people are sheltered in various ways: from emergency shelters (days to weeks), transitional housing (which can extend many months) and long-term shelters, which can extend to one or more years. We estimate that the average stay is about 7 months.[169] On this basis, and assuming 2 persons per average homeless family, we arrive at a value of about $28,000 per homelessness prevented when shelter and added health costs are taken into account.

There are many other categories of cost, once people become homeless. The American Roundtable to Abolish Homelessness estimates that when all costs are taken into account, the range of costs to society of one homeless person is between $35,000 and $150,000 per year.[170] For a two person family, this would mean $70,000 to $300,000 per year. Using the estimate of an average duration of homelessness

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[165] Boston Health Care for the Homeless 2013, p. S314. 71 percent of the study population were men (p. S313)
[166] Boston Health Care for the Homeless 2013, p. S314
[167] The health care expenses for the homeless were estimated to average $2,036 per person per month; for the control group of low and medium income people, the average expenses were estimated at $568 per month per person, making for a difference attributable to homelessness of $1,468 per month. (Boston Health Care for the Homeless 2013, p. S314)
[168] Calculated by IEER from data in National Alliance to End Homelessness 2015
[169] Calculated by IEER from data in National Coalition for the Homeless 2009. The average is weighted over single people and families who become homeless.
[170] Mangano 2013, slide 18

of 7 months, we get a range of $40,000 to $170,000 for total costs of homelessness per family made homeless.

In order not to overestimate the cost savings produced by the AEP, we are not using the higher range of $40,000 to $170,000 in costs of homelessness. Rather, we take into account only the shelter and added health care costs of homelessness. This amounts to about $28,000 per year per family rendered homeless and in need of shelter and added health care. This is admittedly a preliminary number that may well be on the low side when considering the various avoided costs that are not included.

We should also note that many health problems far beyond those due to homelessness are attributable to high energy burdens. The 2011 NEADA survey found that about one in eight households receiving LIHEAP funds were still so cold that a member of the household became ill enough to have to go to the doctor or to the hospital; among households with at least one child under 18, that fraction was 19 percent. In addition, 3 percent of the households also had someone who needed a doctor or hospital visit because the house was too hot.[171] This indicates that the magnitude of the health problem associated with high energy burdens is considerably greater than the added health care costs associated with homelessness alone. We have not attempted to estimate these added health care costs associated with high energy burdens.

Data from a multi-year project by the Green and Healthy Homes Initiative in Baltimore, evaluated by the University of Baltimore, clearly shows a dramatic fall in foreclosure notices after GHHI efforts "to repair and improve housing in economically challenged communities"[172]. Out of a total of 580 houses pre-intervention, there were 57 total foreclosure notices to 49 different households (some received more than one notice in the study period). Post-assistance, the numbers were 7 total notices to 6 households out of a total of 580.[173] **This means over 8 percent of the households received notices prior to participation and only about 1 percent received such notices after participation – more than an eight-fold decrease.**

We note that the GHHI is a comprehensive program that involved efficiency and weatherization retrofits, other improvements in home safety and indoor environment (such as lead abatement), and attention to the specific needs of the household and the structure in question.

There are some limitations to the use of the Baltimore data in the statewide context. First, we do not have data on how many foreclosure notices resulted in actual foreclosures and therefore homelessness in the Baltimore GHHI project. Second, the project was comprehensive in terms of its attention to various aspects of health and energy. It would not be correct to attribute all of the reduction in foreclosure notices to energy investments alone. Third, the houses in the project were in clusters;[174] it is difficult to extrapolate from that to rural low-income areas, such as those in Western Maryland and on

[171] NEADA 2011, Tables IV-25A and IV-25B (pp. 43-44)
[172] GHHI 2013, p. 3
[173] GHHI 2013, Table 8 (p. 12)
[174] GHHI 2013, Figure 1 (p. 6)

the Eastern Shore. In less densely populated areas, there may be less of a demonstration effect in investments in some homes lifting up a whole neighborhood to the same extent.

Admittedly, there is considerable uncertainty in the estimate of the non-energy benefits arising from prevented homelessness. A carefully designed pilot program, with hundreds of homes in each of the areas of Maryland with a high fraction (more than 10 percent) of families applying for assistance (the two westernmost counties (Garrett and Allegany), the City of Baltimore, and the Eastern Shore) would provide reliable data on the expected extent of the non-energy benefits from reduced costs related to shelter and health care for the homeless.

Our calculations of the non-energy benefits of the AEP do not take into account a number of other non-energy benefits, such as increased rent and mortgage payment rates, increased electricity and gas bill payment, reduced arrearages, etc.

It should be noted that many non-energy benefits are quantifiable in financial terms; however, they accrue to a wide spectrum of governmental and private parties. For instance, the reduced costs of homelessness would, to a large extent, be reflected in lower expenditures by the Bureau of Homeless Services, which is situated in Maryland's Department of Human Resources. But heating assistance is now provided by the federal government, via its Low-Income Heating Assistance Program (LIHEAP). While this is also administered by the same Maryland Department, it is a different office with a different budget. Further, a part of the assistance is from electricity ratepayers, whose interests are overseen by the Public Service Commission, and in the case of residential customers, also by the Office of People's Counsel.

Sorting out how to integrate the various assistance programs and budgets will be a complicated matter. If the net costs of the Affordable Energy Program are indeed lower than at present (for a fixed number of recipients), then a tax increase should not be necessary in principle. But how would the putative reduction of expenses in one bureau (homeless services) be reflected in increased resources for another (heating assistance)?

To complicate the picture further, the reduction in health care costs would, in large measure, be experienced by the Department of Health and Mental Hygiene. Other reductions in health care costs would be experienced by hospitals that provide services to the indigent. Similarly, lower expenses for collection of unpaid rent and utility bills as well as actual higher collections would be experienced by landlords and utilities. Bringing all these non-energy benefits under one umbrella and especially into a coherent funding stream that reflects the benefits to various parties of the AEP will be a major policy challenge. But that should not obscure the fact that the non-energy benefits of an AEP would likely be very large.

Development of appropriate quantification of non-energy benefits and estimation measures to integrate costs and quantifiable benefits should be part of a pilot project process, so that by the time Maryland is ready for full implementation, there can be clarity on the magnitude and distribution of both costs and benefits across the various parties involved. That would help illuminate the funding streams for the Affordable Energy Program to the extent that its direct costs are higher, before non-energy benefits are

taken into account. Table VIII-2 shows the three non-energy benefits of the AEP with and without a solar energy program that are quantified in this report.

Table VIII-2: Non-energy benefits of the AEP, with and without solar

	AEP no solar	AEP with solar (2017)	AEP with solar (2031)
Air pollution reduction, medium estimate	$0	$946,327	$14,194,905
CO_2 reduction benefit	$0	$1,903,214	$24,391,008
Non-energy benefits of AEP, no solar (rounded)	$32,000,000	$32,000,000	$32,000,000
Total non-energy benefits for AEP with solar (rounded)	$32,000,000	$35,000,000	$71,000,000

Source: Itron NEBs 2014, for value of a unit of air pollution reduction and CO_2 emission reduction. For the rest, IEER analysis,

Notes: 1. We have used the Itron-recommended middle estimate of air pollution reduction benefit of 1.1 cents per kWh (Itron NEBs 2014, Table 6-1 (p. 6-2)) and the second lowest of four estimates of CO_2 pollution social cost of $42 per metric ton (Itron NEBs 2014, Table 2-7 (p. 2-23))

C. Other non-energy benefits

There are many non-energy benefits that we have not quantified here. Some are difficult to quantify in the specific context of high energy burdens. A very important one relates to life expectancy. We have seen that thousands of low-income households may become homeless partly as a result of high energy burdens. The reduction of life expectancy is one important result. Homeless people have a life expectancy in the range of 42 to 52 years compared to 78 years for the population as a whole.[175] For statistical purposes (similar to an insurance calculation), the EPA considers the value of a life to be $7.4 million in 2006 dollars, which equals about 8.6 million in 2013 dollars, or about $110,000 per year of life expectancy reduced. While this includes a variety of factors, including lost wages, the EPA recommends that this value be used "regardless of the age, income, or other population characteristics of the affected population…."[176] It is clear that improving life expectancy may be an important non-energy benefit of the Affordable Energy Program.

Low-income Marylanders would also benefit from being better able to pay for transportation to work and for food and medicine – benefits that were noted by the PSC staff in its paper on the AEP.

A very different type of non-energy benefit would accrue to utilities, landlords, and banks. Utilities would benefit from more consistent bill payments and improved bill collection efficiency.[177] With more money available for rent, landlords would collect from more low-income households more regularly. The same would apply to banks and others holding mortgages taken out by low-income homeowners. It is not that such problems would disappear. Far from it. As we noted at the outset in the preface, that the financial problems of low-income households are many and complex. But energy costs constitute

[175] National Coalition for the Homeless 2009 Health
[176] EPA FAQs 2015.
[177] Maryland AEP 2012, p. 31

one critical piece of the problem; the Affordable Energy Program with solar and efficiency would address that piece in a structural way.

IX. Affordable Energy Program – Overall Assessment

We can now put together the pieces of costs and benefits of the Affordable Energy Program, efficiency, universal solar access, and non-energy benefits that we have quantified. This will allow us to compare the costs of the current assistance program to the AEP with and without solar and with and without non-energy benefits. We also make a preliminary calculation for the case where the number of recipients of assistance would double. Admittedly, this is just a heuristic, even exploratory, calculation. We used 2013 as the base year for cost comparisons. Total EUSP and MEAP costs in 2013 were about $121 million, including administrative costs of about $10 million.[178] About $26 million of the heating assistance was for households that heat with fuels other than electricity or natural gas.[179] We assume that this assistance would remain the same with or without the AEP, since only electricity and natural gas are regulated by the PSC (see Section V). We also assume that, with appropriate legislative and regulatory changes, federal funds that now go to assisting low-income households that heat with electricity or natural gas would become available to the AEP.

It is important to address the issue of administrative costs. We have assumed that administrative costs of the AEP would be double what the costs were in 2013, even though the structure of the AEP indicates that administrative costs would likely be lower. We use an estimate of double the cost for two reasons: first, it allows some resources to be allocated to emergencies as part of the AEP. Assistance to reduce or wipe out bill arrears would be phased out under the AEP. The larger administrative amount is a placeholder for emergency assistance (for instance, if a family member becomes unexpectedly unemployed or seriously ill). Second, the PSC staff used an estimate of about $30 million for administration of the AEP, about 7 times that of the EUSP and about 3 times that of all assistance programs. A part of the reason was that some amount of this money would be available for a one-time arrearage retirement when the AEP is put into place. We have not made any estimate of this element, since arrearage assistance would not be a routine part of the AEP. Whatever is needed at the start of the program would be a one-time funding need.[180] However, some provision does need to be made for emergency assistance. Hence we have added about $10 million per year for this purpose, assuming that the AEP and the present program would have comparable administrative costs. For comparison, arrearage assistance in 2013 was about $16 million.[181] Routine arrearage assistance responds to a composite of problems including high energy burdens, unanticipated medical costs, or loss of a job. Routine arrearage assistance would be eliminated (after an adjustment period) under the AEP; hence, one would expect the costs associated with only the emergency assistance part to be considerably lower than the overall arrearage assistance costs of the current program We used our estimates of energy use

[178] Rounded value estimated from: Maryland PSC 2013, Appendix A, Attachment H for administrative cost and Attachment J for MEAP cost; Maryland EUSP Annual Report FY2014, Attachment L for EUSP cost.
[179] Maryland PSC 2013, Appendix A, Attachment J
[180] Maryland AEP 2012, pp. 3, 27-28
[181] Maryland EUSP Annual Report FY2014, Attachment L

for heating in the various types of low-income households (Section II.A above) to arrive at estimates of the cost of the AEP.[182] For the initial, baseline calculation we assumed that the number of recipients would be the same as in 2013. A reasonably good estimate of cost is possible on this basis since we know the average income of the recipient group, in addition to having a reasonably detailed energy use picture. Of course, there are some uncertainties in our calculations since the detailed energy use picture for different fuels was built up from state, regional, and national data. Ideally, state data would be available and the use of regional and national data would not be necessary.

AFFORDABLE ENERGY PROGRAM COSTS AND BENEFITS

The direct cost of the AEP per year would be about $30 million more than the current program, or about $1.03 per month per residential electric customer. With solar energy and heat pump water heater investments, the cost would be less than those of the present program by 2031. There would also be tens of millions of dollars in reduced costs of shelter and medical care because of reduced homelessness and better air quality, among other social benefits. The net cost over the long term would likely be considerably less than the present cost of assistance for the same number of assistance recipients – a conclusion that may also hold if program participation increases

In line with the proposed structure of the AEP, we calculated its cost for an average recipient family as follows:

- For households with electric heating, the energy burden would be limited to 6 percent. Costs above 6 percent would be covered by assistance funds (a mixture of federal heating and state assistance funds, including EUSP funds);
- For households with any other heating fuel type, the electricity bill burden would be limited to 3 percent. Electricity bill costs above 3 percent would be covered by assistance funds;
- Natural gas bills would be limited to 3 percent of income for households with natural gas heating. The rest (costs above 3 percent) would be covered by assistance funds;
- For households with heating other than electricity or natural gas, the total amount of assistance would remain constant at about $26 million per year, which was the 2013 assistance level for such households.
- Administrative costs and emergency assistance in the AEP would amount to about double the administrative costs of the current assistance program (EUSP plus MEAP).

Under these assumptions, the cost of the Affordable Energy Program would be about $150 million per year, almost $30 million more than current assistance programs if the number of recipients were the same as in 2013. If the entire amount were added uniformly to the bills of residential electric ratepayers only, the added amount would be about $1.03 per month. This does not take into account any cost

[182] The heating degree days in Maryland, as reflected in Baltimore-Washington Airport data, were about the same in 2010 and 2013. The analysis in Section II is for 2010 data, while the analysis for the AEP is for 2013 data. The slight error introduced by this is small compared to other uncertainties.

reduction from acquisition of solar energy for low-income households, efficiency investments, or non-energy benefits.

If solar were acquired for all assistance recipients, phased in over a 15-year period, as described in Section VII, the cost per household electric bill in 2031 (when all recipient households would have 100 percent solar energy[183]) would be slightly less than the present program ($0.06 per month less per residential ratepayer). Additional savings would accrue by a systematic implementation of the heat pump water heater program.[184]

A. Gross and Net Costs of the AEP

The net costs become lower than present costs when non-energy benefits are added. We provide the results of our analysis below in a series of tables.

Table IX-1 shows the total annual costs of the present program, of the AEP without and with solar (implemented fully by the year 2031), and the added costs. It also shows the total non-energy benefits for the three categories quantified in this report: reduced homelessness and associated health care costs, reduced air pollution, and reduced CO_2 emissions.

Table IX-1: Gross and net costs of the AEP compared to 2013 assistance costs, $/year

	AEP no solar (2017)	AEP with solar (2017)	AEP with solar (2031)
Total 2013 assistance costs	$121,000,000	$121,000,000	$121,000,000
Total AEP costs	$150,000,000	$149,000,000	$122,000,000
Added AEP costs over present program	$29,000,000	$121,000,000	$1,000,000
Non-energy benefits	$32,000,000	$35,000,000	$71,000,000
Net costs (negative (in red) = cost savings)	($3,000,000)	($7,000,000)	($70,000,000)

Source: for 2013 costs: Maryland EUSP Annual Report FY2014, Attachments H and L and Maryland PSC 2013, Appendix A, Attachment H. For AEP costs and benefits: IEER analysis

Notes: 1. All quantities in constant 2013 dollars

2. Assumes the same number of beneficiaries as in 2013. All values are rounded to the nearest million dollars per year.

3. For solar energy costs see Section VII.A

4. It is assumed that the solar program would be implemented in 15 years, starting in 2017.

5. See Table VIII-2 for details on non-energy benefits.

6. Many non-energy benefits are not quantified – see Section VIII.C.

[183] This is not actual electricity from solar but that the total acquisition of solar energy would correspond to the total electricity use of low-income assistance recipients.

[184] See Section VI. No fuel switching is assumed. Heat pump water heaters would be installed without cost to the low-income household (or landlord) in place of existing electric resistance water heaters. Ratepayers would recover their investment via reduced costs of the Affordable Energy Program.

Table IX-2 shows the results of our analysis in the form of added costs of the AEP per electric residential ratepayer, assuming that the entire added cost of the AEP would be borne by residential ratepayers. It also shows net non-energy benefits per residential ratepayer. Since these benefits would not actually accrue to ratepayers directly, we have not shown a net monthly cost per ratepayer. This calculation is an illustration only. There are a number of policy issues that must be sorted out since benefits do not accrue to electric ratepayers alone but to taxpayers and other parties. See Section IX-B below and Section VII.B and VIII.C above.

Table IX-2: Incremental costs of the AEP, with and without solar, dollars per residential electric ratepayer per month. Numbers in parenthesis in red mean net benefits

	AEP no solar (2017)	AEP with solar (2017)	AEP with solar (2031)
Added AEP electric bill cost	$1.03	$1.00	($0.06)
Non-energy benefits with solar, $/month	($0.11)	($0.25)	($2.36)

Source: Table IX-1

Note: We assume that the number of ratepayers will grow at the rate of Maryland population growth of in the 2010-2014 period (0.89 percent per year).

Over the implementation period of the solar program assumed here, the added costs decline from $1 per month to less than the costs of the current program, if universal solar access is implemented. The net costs are even lower, due to the substantial non-energy benefits.

B. Number of assistance recipients

One of the issues that has been raised in connection with the AEP is that it may result in a large increase of applicants and beneficiaries, since the program, in effect, would cover energy payments above 6 percent of gross income by third parties, including ratepayers. This is quite possible, perhaps likely. However, the benefits would also increase as the number of beneficiaries rises. The balance between increased costs and increased benefits of a larger number of assistance recipients is, at present, unclear.

The current assistance program is oriented to the neediest of the low-income group, according to criteria that include income and whether there are children, old, or ill members in the household. In 2013, only about one-third of assistance recipients had incomes in the range of 110 to 175 percent of the federal poverty level. We do not know the detailed income distribution of the non-applicants. However, it is reasonable to assume that the increase in applicants would likely be from the higher part of the income range of those eligible compared to present recipients.

We might therefore anticipate that the amount of assistance needed would be lower, on average, per household than that calculated for the AEP for current recipients in Section IX.A above. Many households who do not apply may already have bills less than six percent of their gross income. In that case they would not get any funds from the AEP (though they may remain eligible for emergency assistance).

The same line of reasoning indicates that the non-energy benefits calculated for the population of current recipients may also be lower for those not now receiving assistance. Specifically, the benefits due to reduction of homelessness and associated shelter and health costs, may also be lower. Hence the lower costs per added recipients may be offset to some extent by the lower non-energy benefits. However, the non-energy benefits due to a broadening of the Universal Solar Access program would go up proportionately to the number of recipients as a first approximation.[185]

We made a simple calculation assuming that both costs and benefits would be the same per household as at present if the number of recipients increases. In other words, if the number of beneficiaries doubles, the costs and non-energy benefits would also double. The result of the calculation is shown in Table IX-3; the estimates assume that a solar energy supply program would be implemented for all recipients.

Table IX-3: Costs and benefits of doubling the number of assistance recipients, based on extrapolation of estimated AEP costs for current recipients

	AEP no solar (2017)	AEP with solar (2017)	AEP with solar (2031)
Direct AEP incremental cost (over 2013), $/year	$179,000,000	$177,000,000	$117,000,000
Non-energy benefits, $/year	$64,000,000	$70,000,000	$142,000,000
Net added cost for double the number of recipients, $/year	$115,000,000	$107,000,000	($25,000,000)

If we assume the added costs for the AEP with double the participants is borne entirely by residential ratepayers, the initial added direct cost would be about $4 per month. The direct added costs becomes smaller over time as the solar program is implemented. We conservatively assume that solar costs will not decline after 2022. This produces costs on the high side. Yet the net costs of a program with universal solar access and a larger number of recipients should be less than the cost of the current program by the year 2028. It is important to remember that the net costs above do not factor in a number of non-energy benefits.

Despite its admitted shortcomings and uncertainties, Table IX-3 indicates that the long-term net cost of the Affordable Energy Program will not be greater than the cost of present assistance, even if the number of recipients increases significantly. This conclusion depends most importantly on two things: (i) that a program of acquisition of solar energy is implemented for all low-income households as described in Section VII, and (ii) that non-energy benefits of reduced CO_2 emissions and air pollution as well as reduced costs of homelessness and associated shelter and health costs are taken into account.

[185] This assumes that the energy consumption per additional household is, on average, the same as that of current recipients.

A big policy issue is how the quantifiable net benefits can be used to generate revenues to meet the added direct costs of the AEP.

C. Policy considerations relating to the Affordable Energy Program

The AEP is a sound approach on which to reorganize energy assistance. The PSC made an excellent start when it initiated a review of the program; the analysis of the PSC Staff, done in collaboration with the Office of People's Counsel, provides the starting point for policy implementation. However, a central issue that needs to be addressed is the manner in which federal heating assistance funds are to be integrated into the AEP. While this was an understandable omission from the PSC Staff's analysis, there is no question that the federal government allows the use of heating assistance funds for programs like the AEP, provided they are structured according to federal guidance.[186] The evaluation in this report shows that the incremental cost of the program for current recipients would be far lower than estimated by the PSC staff when this is done – on the order of $1 per month. The cost would decline if a program of solar energy provision using the approach of community choice aggregation is added to the AEP. The added cost of the AEP for current recipients would be about the same or lower than the current program by the time universal solar access is fully implemented.

Below we discuss the importance of five policy arenas in which action is needed to achieve energy justice and climate protection goals.

Policy issue 1 – Integration of federal funds into the AEP

Our review shows that federal funds can be integrated into the type of Affordable Energy Program developed by the PSC Staff in 2012. Other states, such as Ohio, have done it for many years. Sorting out the policy approach, jurisdictional issues, and mechanisms for compliance with federal rules for such integration should be a high priority.

Policy Issue 2 – Acquisition of solar energy for low-income households

Solar energy can be economically acquired for low-income households if done on a community choice aggregation principle under the supervision of the PSC. A universal solar access program should be done independently of renewable portfolio standards or renewable energy credits. It is economical in its own right and would reduce assistance costs. Legislation to direct the PSC to require utilities to acquire solar energy via purchased power agreements for the Electric Universal Service Program. This would allow a scale of solar implementation that would enable cost-savings, while providing climate protection as well.

Given the drastic declines in the cost of solar energy and the fact that megawatt-scale solar is already comparable to or less than the retail cost of residential electricity, it is strongly desirable from every point of view to commence the acquisition of solar energy along community choice aggregation principles for recipients of energy assistance. Besides economic and environmental considerations,

[186] LIHEAP 2010

there is an aspect of remedying the near-total exclusion of low-income households from access to solar energy. This exclusion has many complex causes; yet the solution is rather straightforward. Solar energy acquisition for low-income assistance recipients does not need to wait for a full-blown adoption of the AEP.

Policy issue 3 – Actions regarding solar energy

It is necessary to map out where distributed solar can be built on a significant scale in compliance with local zoning and community considerations. At the same time, distribution utilities need to map out the areas where interconnection of solar on a megawatt scale would most help the distribution system and where upgrades and other investments may be needed. This should be done statewide with collaboration from local jurisdictions.

A very different set of policies will be needed for encouraging private investment in increasing the efficiency of the homes where low-income families live. The available state, utility, and federal funds are rather limited, raising questions as to how to best use these funds as well as existing regulatory authority to achieve significant efficiency gains in low-income households.

Policy issue 4 – Increasing the effectiveness of efficiency investments

Below we discuss the primary areas where investments in efficiency improvements of low-income households could be improved.

a) Rental housing

The lack of investment across a large portion of rental housing to bring it up to code appears to be a significant problem both in itself and because it creates a disincentive for landlords to grant permission for energy efficiency auditors to enter - even though the property improvements would be at no cost to the proprietor. Yet, landlords use public funds via the office of the sheriff, for instance, to evict renters who are behind on their payments. **State and local regulatory authority should be able to prohibit use of public resources to evict tenants from properties that are not in compliance with Maryland's livability code.** This can also leverage investment. Of course this also raises the risk of landlords simply abandoning properties, especially in the case of small landlords who lack funds for improvements. Incentives in the form of low-cost financing and/or green bank financing could help to alleviate this problem.

b) Heat pump water heaters

Heat pump water heaters, used to replace existing electric resistance water heaters, have a very short payback time. For rental properties, where the utility rebate would be available, the landlord would have a payback time of about 2 years. **Green bank financing can be made available for investments in heat pump water heaters, so that no capital outlay above the cost of replacement of the existing water heater type would be needed.** A program to replace all resistance water heaters with heat pump water heaters over 10 years would materially reduce the cost of the AEP. Of course, this would require

green bank financing or some similar instrument to be established in Maryland. Existing Property-Assessed Clean Energy (PACE) programs could also be used for rental properties.

c) Replacing oil and propane heating systems with efficient electric heat pumps

It is economical to replace oil and propane heating systems with efficient electric systems such as cold climate heat pumps. The main issue here is the higher upfront capital required. For rental properties it can be addressed via PACE or green bank financing. The same can be done for low-income households who own their homes, provided the total utility bills and tax or loan payments do not exceed utility bills without efficiency improvements. This may limit investments to structures that are sound and that meet other criteria for investments that will have a low likelihood of default.

An important obstacle is that the EmPOWER efficiency program's funds used for low-income efficiency investments cannot be used for fuel switching; in other words using these funds to invest in conversions from oil or propane to efficient electric systems in low-income households is prohibited. No such prohibition exists when rebates are given for HVAC systems to non-low-income households. For instance, such households can get both utility and state rebates to go from oil, propane, or natural gas heating systems to geothermal heat pumps. An investment of public funds to improve low-income household efficiency should be made on the merits, without an eye to preserving markets for any particular fuel. Moreover, switching from fossil fuel heating to efficient electric systems is, in any case, necessary in the long term to achieving goals for reduction of greenhouse gas emissions. [187] In light of these observations, the following policies would help reduce the costs of assistance programs as well as CO_2 emissions:

- Modify EmPOWER rules to permit fuel switching for HVAC and water heating systems.
- Make green bank and commercial PACE financing available to landlords for efficient electric HVAC systems like cold climate heat pumps and geothermal heat pumps.
- Require all new low-income housing to be net-zero energy. This means that housing must be very efficient, with standards at, or close to, passive house construction – that is, very low energy use. It also means on-site solar energy generation, supplemented by off-site generation, if dictated by space considerations. Maryland's aggregate net metering can be extended to cover low-income rental housing. This would make solar energy both cheaper and more accessible to such housing developments.

None of the above measures require new state or utility money, other than some funds committed to project design and measurement and verification.

[187] Makhijani and Mills 2015

Policy Issue 5 -- Revenues for the AEP

We have shown that the non-energy benefits of an Affordable Energy Program are so large that they could offset the increased direct costs of the AEP for a given number of recipients and even for a larger number of recipients. However, the allocation of costs and benefits needs to be evaluated. Some of the non-energy benefits accrue to ratepayers, via reduced arrears and higher bill collection efficiency. A variety of other parties would also benefit: including landlords, via increased rent collection, and government offices and departments, including those that have budgets for shelter and health care for the homeless. Gas utilities would also benefit in a manner similar to electric utilities. Fuel oil and propane dealers would benefit from the increased ability of low-income customers to pay their bills since the electric bill payments of those customers would be at most 3 percent of gross household income, freeing up income to pay their other bills. Businesses would benefit from increased spending power of low-income families on food, medicines, and transportation.

Deciding how the measurable non-energy financial benefits of the AEP in a variety of areas can be channeled into an equitable set of revenue streams for the AEP is a major policy challenge. In other words, we can approach the policy challenge of funding the direct added costs of the AEP in two ways:

- Raise the added revenues from electricity and natural gas ratepayers;
- Find innovate policy approaches or use existing mechanisms to convert portions of the quantifiable non-energy benefits into revenue streams that can be channeled to fund the increased direct costs of the AEP.

If the new revenues are raised only from residential electric ratepayers and if the AEP is coupled with solar energy acquisition, the initial added monthly costs would be about $1 per month, decreasing over about a decade to zero, provided the number of assistance recipients remains the same. Some of the added cost could reasonably be shifted to natural gas ratepayers since the AEP would reduce natural gas bills; this would cover about 7 percent of the added direct cost of the AEP.

Costs could also be spread out over all electricity ratepayers, rather than attributed only to the residential sector. In that case, the increase in residential ratepayer bills would be reduced by a little more than 50 percent. Such a proposal might raise objections from the commercial and industrial sectors; however, it should be noted that the increase in bills in these sectors would be less than half a percent. Moreover, the increased spending power of low-income people would reflect itself in the marketplace, benefiting commerce in the state.

Given the magnitude of the non-energy benefits, it is important to explore possible approaches to convert the quantifiable ones into funding streams for the AEP. Among the possible approaches would be to:

- Monetize the CO_2 emission reductions associated with solar energy acquisition for low-income households. This could become a significant stream of revenues as the federal Clean Power Plan is implemented.

- Find ways to translate some of the increased revenues or decreased costs in the private sector (both for-profit and non-profit) into funding to offset the increased direct costs of the AEP. Some of the increased rent and utility revenues or decreased health care costs could contributed to AEP revenue streams.
- Create revenue streams for the AEP that reflect the past inequities of renewable energy programs that have nearly excluded low-income households.

The direct costs may increase significantly if the number of recipients increases much above the present level.

We explore some examples of revenue streams outside the energy sector.

Since non-energy benefits in the health care sector would be very large, we cite a proposal that has been put forward by the Community Innovators Lab of the Massachusetts Institute of Technology. This could be applied in a modified form to the AEP.

The Community Innovators Lab has suggested an approach for broader investment in healthcare that could be one way of developing the needed revenue stream without resorting to additional charges to the electricity ratepayer. The approach is novel and worth exploring. We therefore quote the paper outlining the basic idea at some length:[188]

> The 2010 Affordable Care Act included a new provision requiring tax-exempt hospitals to develop community health needs assessments, participatory processes, implementation plans, and evaluation procedures in order to justify and maintain their tax-exempt status. Additionally, the Internal Revenue Service (IRS) has in the past several years prescribed a transparent reporting regime and signaled that increased scrutiny of "community benefits" compliance is on the horizon. Further, the IRS has indicated that a broad range of activities, including community organizing, may qualify as "community benefits."
>
> ….Patterns of community benefits vary by both state and by the degree of pressure on hospitals, but most experts believe that hospitals will choose to spend between 3-5% of revenues on CBAs in an effort to insulate themselves from IRS challenge. Last year, the top 50 non-profit hospitals had annual revenues of $214 billion. Under the 3-5% regime, between $6.4 billion and $10.7 billion would be available for community development each year from the top 50 non-profit hospitals alone, in an effort to meet their non-profit status requirements. If we consider the more than 2,800 additional non-profit hospitals in the U.S., the aggregate numbers will be much higher.
>
> A 2009 IRS survey of 500 large hospitals showed that total community benefits expenditures were allocated to the following activities: 56% toward uncompensated

[188] MIT CoLab 2013, pp. 1-2

care; 23% toward medical education and training expenditures; 15% toward medical research; and 6% toward community programs. When the Affordable Care Act is fully implemented by 2014, it could well reduce the number of uninsured patients and thus total hospital expenditures on charity care. This means more community benefits dollars will be freed up to flow out into surrounding communities, and hospitals will have to invest more aggressively in addressing the negative social and physical conditions that lead to poor health, rather than in simply treating patients.

These developments offer a major opportunity for progressive activists to convince tax-exempt hospitals to invest a portion of their "community benefit" funds in efforts that:

1. Engage community residents in a planning process about their future with local institutions and organizations such as schools, businesses, labor unions, and others;

2. Introduce green infrastructure and economic development programs and processes that leverage the buying power of community institutions (such as hospitals, schools, and housing complexes) to create local service and manufacturing jobs to supply goods and services that local institutions buy; and

3. Build multi-stakeholder partnerships between community groups, participating local businesses, local government, and trade unions to guide and expand local economic development and policy/political initiatives.

Such novel approaches may allow the generation of new revenue streams that are not new income taxes and not new charges to residential (or non-residential) electricity ratepayers.

Another approach would be to convert some of the non-energy benefits that would accrue to some government departments into funds for the AEP using a carbon pricing scheme now used by many corporations. The basic approach, used by a variety of companies from oil companies and airlines to information technology companies, is to require each department in a company to account for its carbon emissions and to apply a carbon price to those emissions.[189] Funds corresponding to the carbon price are transferred to a central account where investments are made in renewable energy and carbon offsets. Since the amount of money transferred corresponds to a department's carbon emissions, each department has an incentive to become more efficient and reduce its emissions. At Microsoft, the carbon price is set according to the company's requirements for investments in renewable energy and carbon offsets.[190] Figure IX-1 shows the scheme that Microsoft uses to generate revenues and make investments to reduce its carbon footprint.

[189] CDP North America 2013
[190] Microsoft 2012

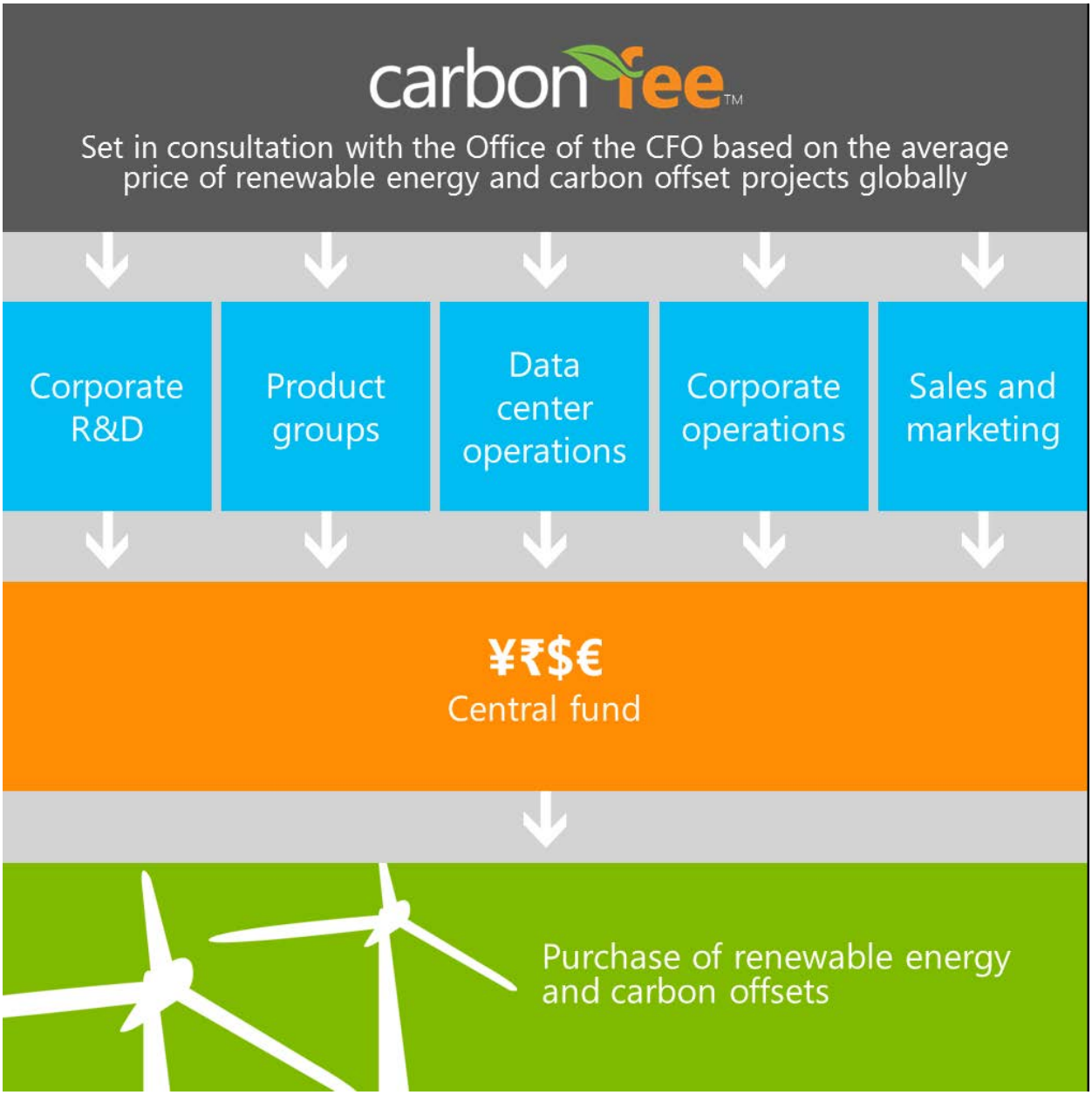

Figure IX-1: Microsoft Corporation's scheme of internal carbon pricing and carbon reduction investments
Source: Microsoft 2012, p. 12 (Used with permission from Microsoft.)

This scheme could be applied to generate funds for the AEP. Each department, such as the Department of Housing and Community Development or the Department of Human Resources, that would have non-energy benefits would pay into a common fund according to its carbon emissions and the portion of the non-energy benefits that are sought to be monetized for energy assistance.

There is also the traditional approach of raising revenue: income taxes. They should not be ignored for a part of the revenues needed to implement the AEP. We recognize that the general political climate in

Maryland (and in most of the country) runs counter to suggestions of increased personal or corporate taxation, especially as it might concern assistance to low-income households. But there is a reasonable case to be made that they should at least be considered in the context of the AEP. Private revenues to corporations would increase because the low-income households would have increased purchasing power, for instance for buying more food, medicine, and transportation fuel. Landlords and utilities can expect to increase their revenues as well. Since assistance to low-income households would be the direct reason for these increased revenues, there is a case that some of the benefits should accrue to the budget as well. Further, government departments dealing with health care and shelter costs for low-income families would see somewhat reduced pressures on their budgets. One way of reflecting that reality would be to raise some of the added revenues needed for the AEP through a state income tax surcharge.[191]

All of these approaches can be evaluated while the pilot program we recommend clarifies the scope, costs, and benefits associated with implementing the AEP.

We should note that the Universal Solar Access program does not need new revenues; it only needs to be authorized and implemented.

D. A Pilot Program

We recognize that implementation details of an Affordable Energy Program need to be worked out, especially as combined with universal solar energy access and expanded efficiency investments. Therefore, we recommend a pilot program be carried out so as to establish a statewide program on a sound footing.

The pilot program should be implemented in in the three areas of Maryland that have high energy assistance needs, but which are quite different from one another in other ways: the two westernmost counties (Garrett and Allegany), Baltimore City, and the low-income counties on the Eastern Shore. The pilot in each area should be of sufficient scale – at least several hundred low-income assistance recipients – in order to empirically establish the cost of the program, provide reliable estimates of the likely participation, establish the procedures needed for integrating universal solar access and efficiency with the AEP, and make estimates of the collateral benefits of the program in terms of better health, lower homelessness, etc. In deciding the size of the pilot in each area, it will be important to have a size that will allow a statistically reliable determination of the likely participation and costs in each of the income brackets (0 to 50 percent, 50+ to 110 percent, 110+ to 150 percent, and 150+ to 175 percent of the federal poverty level income).

The pilot program in each area should include a representative mix of homeowners and renters. Methods to overcome barriers by landlords who are reluctant to allow access to rental properties

[191] State personal income tax revenues amounted to about $7.7 billion in 2013 (Maryland Comptroller 2013, p. 13). Each 0.1 percent tax surcharge would therefore result in $7.7 million in revenue. This revenue stream would grow with personal income while the need for assistance per recipient would decline with increasing implementation of solar energy access.

should be tested. Finally, the case-manager approach recommended by the Department of Human Resources should also be tested.

X. Energy justice and jobs

The efficiency and solar programs recommended here would create a significant number of jobs in Maryland. Making estimates of jobs is quite difficult and different models yield widely varying results.[192] Making estimates of in-state impacts is even more difficult because it requires the separation of in-state and out-of-state labor for any investment. For instance, lighting expenditures would be mostly out-of-state and would have small in-state jobs impacts in Maryland but significant global jobs impacts. In contrast, weatherization expenditures involve local labor for installation, as do changes in heating and air-conditioning (HVAC) equipment. Similarly, solar energy investments have a large component of local labor for design and installation, even though the hardware, including the solar panels, would not be in-state for the vast majority of states, including Maryland, unless Maryland can attract solar manufacturing investment by making a commitment to procure a large amount of solar through universal solar access for low-income households, an expanded solar renewable portfolio standard, or both.

Additionally, it is important to include indirect jobs effects: the jobs created when there are net in-state spending increases. For instance, essentially all the money spent to acquire fossil fuels in Maryland goes out of state to the places that produce them. When less money is spent on natural gas or electricity or fuel oil, there is more money available to spend on general household or business requirements. **For instance, an assessment in Massachusetts, which has a situation similar to Maryland in that fuels are almost all imported, found that one million dollars of expenditures on fuel oil, natural gas, or electricity created only 1.0, 0.7, or 1.1 jobs in-state, respectively.[193] In contrast, a million dollars of general household spending created 9.1 in-state jobs.** At the same time, ratepayers who pay for efficiency programs have less money to spend on general expenditures, demonstrating that a net assessment is important.

A. Efficiency sector jobs

Jobs associated with efficiency investments include

- direct jobs created by the investment,
- supply chain jobs,
- indirect jobs due to the stimulation of the economy,
- jobs created when people spend the money they save on energy on other goods and services (which are, on average, more job intensive).

[192] Bower et al. 2012
[193] Breslow 2011, slide 9

Some estimates also take into account offsetting factors such as the jobs that would be created if the money spent on energy investments were spent on other types of investments.

The Pacific Northwest National Laboratory of the Department of Energy has compiled the various estimates made by different methods into a single study published in 2014.[194] The American Council for an Energy Efficient Economy has published net jobs estimates for efficiency investments as well.[195] The State of Vermont, which has its own energy efficiency utility (Efficiency Vermont) did its own assessment of net in-state jobs created due to its efficiency programs.[196]

Estimates vary widely depending on the methods used and the types of jobs considered. It is particularly complex to sort out jobs that would be created in-state as distinguished from total jobs as a result of a particular investment. This is because supply chain jobs as well as jobs created due to the stimulus of added spending are only partly in-state; the rest are dispersed across the country and in other countries as well.

For the purposes of illustration, we assume a program of efficiency improvements in low-income households getting assistance implemented over 15 years, with $5,000 invested in each household. The ACEEE and PNNL estimates range from about 450 net jobs to about 1,150 net jobs; the higher estimate does not include the offsetting estimate of the jobs that could have been created by investing the same money in areas other than energy efficiency. Vermont's analysis, based on its own experience, gives an estimate of about 1,600 in-state jobs. In all cases, these would be jobs that are steady jobs that would endure for 15 years, the assumed duration of the investment program.

B. Solar sector jobs

There is ample empirical data for estimating solar jobs. There would be a redirection of energy expenditures from a mix of electricity imports and in-state fossil fuel and nuclear generation to electricity generated entirely in the state by new solar installations. We estimate that the solar electricity procured for the program in the manner described in Section VII. would free up money for expenditures in other areas.

The solar industry estimates that 15.5 jobs per megawatt of installed capacity were created by the solar industry in the United States for capacity installed in 2014.[197] This represents a mix of residential-, commercial-, and utility-scale installations, with most of the capacity being in the latter two categories. Since residential installations are more labor intensive per unit of capacity, we will use 12 jobs per megawatt for purposes of this report.

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[194] Anderson et al. 2014
[195] ACEEE 2011
[196] Bower et al. 2012
[197] Solar Foundation 2015, p. 3. The number of jobs per megawatt declined from 19.5 in 2012 to 15.5 in 2014 since efficiency in installation and other cost reductions meant reduced labor requirements.

Using the cost structure for the solar access program described in Section VII, we estimate that low-income household electricity bills will be lower by about $23 million per year, on average over the 2017-2031 period, at the end of which all assistance recipients would be getting 100 percent solar electricity. This would create almost 200 jobs, based on Massachusetts data that indicates about 8 additional jobs per million dollars of additional money used for general rather than energy expenses.[198]

Table X-1 shows the distribution of solar energy jobs in the United States in 2014 for the various types of work involved. Note that most solar panel manufacturing was not in the United States in that year. However, there are many other types of manufacturing jobs involved in solar, including inverters, installation hardware, wiring, etc. Note that manufacturing represents less than one in five jobs in the U.S. solar industry.

Table X-1: Distribution of solar jobs in the United States, 2014, by job type.

	Jobs	Share
Installation	97,031	55.8%
Manufacturing	32,490	18.7%
Sales and distribution	20,185	11.6%
Project developers	15,112	8.7%
All other	8,989	5.2%
Total	173,807	100.0%

Source: Solar Foundation 2015, Table 1 (p. 6)

Maryland has no significant solar panel manufacturing facilities. In light of that, Table X-1 indicates that about three-fourths of the U.S. jobs would be in-state, assuming that all installation and sales and distribution jobs and half of the project developer jobs and half of all other jobs are in-state. We assume that for the proposed Universal Solar Access program about two-thirds of U.S. jobs will be in-state (instead of three-fourths for the average of installations of all sizes).[199]

On this basis we estimate that about 570 jobs (rounded) in would be created in Maryland for supplying all current energy-assistance recipient households with 100 percent solar from distributed solar facilities that would be of a commercial- or utility-scale (hundreds of kilowatts to a few megawatts each). In addition, other jobs would be created if the solar energy is procured at a price lower than the grid because households would have lower electricity bills. As noted above, this amounts to almost 200 jobs. A total of 700 to 800 in-state jobs would therefore be created by providing all assistance recipients with solar electricity. There would be another 250 to 300 jobs elsewhere in the United States.

Overall, we estimate that the combination of solar and efficiency investments for 2013 assistance recipients would create at least 1,000 steady jobs and possibly as many as 2,000 jobs (over 15 years).

[198] Breslow 2011, slide 9

[199] Some jobs are also in other countries since a large fraction of solar panels is imported.

We have rounded the numbers in this section in order to reflect the uncertainties inherent the jobs estimates themselves.

Finally, we note that it is possible to use policy commitments that give investment certainty to leverage manufacturing investment. For instance, in 2014 CPS Energy, the municipal utility owned by the City of San Antonio in Texas, leveraged its commitment to build 400 megawatts of solar to bring the first solar manufacturing plant to Texas. But it requires a substantial and firm commitment to build such a partnership. A Universal Solar Access program could provide that certainty.

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