The State Energy Efficient Appliance Rebate Program: An Assessment

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ABSTRACT

In the 2005 Energy Policy Act Congress approved a program to provide rebates for energy efficient appliances. In 2009 in the American Recovery and Reinvestment Act authorized $300 million for this program. This became the first nationwide energy efficient product rebate program – the State Energy Efficient Appliance Rebate Program (SEEARP). All 56 states and territories developed program plans that were approved and funded by the Department of Energy. This paper is an analysis of the projected impact of the SEEARP program based on the approved plans of all 56 states and territories. This paper will explain:

- Total projected rebates
- Projected carbons savings
- Projected energy savings
- Projected water savings
- Projected dollar savings

While these are only projections, they serve as a valuable point-of-reference in exploring the impact of the SEEARP program. Future evaluations of this program will use actual rebate figures and compare projected results to actual and examine the differences.

Introduction

In 2010, all 56 U.S. States and Territories began the unprecedented process of rolling out 56 different State-wide appliance rebate programs. These programs were to provide rebates to consumers for purchasing replacement energy-efficient home appliances, water heaters, and HVAC products.

The State Energy Efficient Appliance Rebate Program or SEEARP was funded by the American Recovery and Reinvestment Act (ARRA) of 2009 and administered by the U.S. Department of Energy (DOE). This stimulus program encourages the replacement of outdated, inefficient home appliances with new ENERGY STAR qualified appliances. Each U.S. State and Territory was given the opportunity to develop and deliver its own rebate program, subject to DOE review and approval.

As the sponsor of this program, DOE has the unique ability to compare the projected sales and resulting energy, carbon, water, and dollar savings that these replacement products would stimulate. This paper will explain more about this unique program and present the projected savings to result from it. These figures will be updated as results from the State-level programs become available.

The paper will offer projections on all of the following outcomes:

- Energy savings
- Carbon savings
- Water savings
- Dollar savings

These figures will be revised as States supply actual data and comparisons between the projected and actual will be presented at the conference. At this time, only national data is available. That is, no data is available disaggregated by State or Territory.

Background on SEEARP

This program began as part of the 2005 Energy Policy Act, through which Congress created the State Rebate Program (Section 124). That legislation enabled the authority for this program but did not authorize any funding for it. It became a fully funded program as part of the 2009 American Recovery and Reinvestment Act (ARRA), also known as the Stimulus Act. Approximately $300 million was allocated nationally. States and Territories received their share of this amount based on a population formula.

The key program **parameters** defined in the legislation included:

- States must deliver the programs
- State must provide monetary rebates (rather than some other type of incentive)
- Rebates must go to residential consumers
- Programs must target purchases that replace an existing product
- Products must be ENERGY STAR appliances

Using these five key principles, DOE developed a Funding Opportunity Announcement (FOA) that outlined the program requirements.

The National Program

The FOA was released by DOE on July 14, 2009 and provided program guidance to the States and Territories, as well as details on the application process, reporting requirements, and other administrative matters. DOE also used a Federal system named FEDCONNECT to update and clarify the FOA to stakeholders in the program.

It stressed five principles or elements for the national program:

The first principle was that rebates be distributed to residential consumers; that term was stipulated to mean "individuals who purchase, use, maintain, and dispose of products or services." The following types of purchasers were specifically excluded: businesses, institutional organizations, CAP agencies, and landlords.

The second principle was that consumers must receive rebates. Rebates were defined to be a specific flow of funds to consumers. This was a function of the authorizing legislation but also served to prohibit up-stream and mid-stream buy-downs. This is an important differentiator for regulated efficiency programs which frequently use these tools as a way to reduce administrative costs. This program – being primarily an economic stimulus one – was aimed at putting money in the hands of the consumer.

The third principle - replacement, was a critical element of this program. Rather than simply incentivizing the purchase of additional appliances that were high-efficiency, this program was designed to incentivize the purchase of those higher-efficiency products in order for them to actually replace older, less efficient products in consumers' homes.

The fourth principle - the appliance, was defined as a product that consumes energy. Elements of the building shell were excluded. DOE also clarified that smaller devices, such as consumer electronics, were not to be promoted under this program. DOE provided a list of 10 recommended ENERGY STAR products – including the major "white good" appliances, water heaters, and HVAC equipment – that States should consider including in their programs. States were granted the freedom to add additional, non-recommended products but approval of these products required substantially more justification and explanation by the State.

The final key element of this program was that it was to be run by the States – not a Federal program and not a utility program. States included the 6 U.S. Territories – American Samoa, the Commonwealth of Northern Marianas Islands, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands. Consequently, there would be 56 distinct and unique programs.

Other important elements of the program included:

- Administrative costs were hard-capped at 25% of total grant award and soft-capped at 20% of total grant award;
- States had to provide a 1-for-1 administrative cost match;
- All funds had to be spent by February 2012

The Individual State Programs

There were three discrete phases to these programs:

- **Planning**: States prepared program plans that met DOE program requirements.
- **Go-to-market:** States began to work actively with market actors – retailers. recyclers and manufacturers - to discuss and plan for implementation.
- **Implementation:** States launch their programs.
- **Close-out**: States award final rebates and complete reporting to DOE.

This presentation will report key findings from the Planning Stage and report out on the projected impact of this program based on approved plans from all 56 states and territories.

Planning

Fifty-six States created 56 different program models. While there were multiple areas where programs converged, there were also some unique areas where programs differentiated themselves.

Some of the key areas where programs converged included:

- **Product types** – of the 56 programs, 51 rebated one or more of the "white goods";
- **Rebate type** – of the 56 programs, 49 offered a mail-in rebate;
- **Timing** – 41 of the 56 programs started in either March or April;

- **Approved products** – all 56 States included one or more of the pre-approved products in their rebate programs. Only 2 requested non-approved products be included.

  Some of the **areas of divergence** include:

- **Targeting** – 2 programs specifically targeted low-income residents, and one targeted disabled residents;
- **Point of sale** or instant rebates – 4 programs provided instant rebates at point-of-sale;
- **Vouchers** – 1 program provided vouchers for nearly the full purchase price of the products;
- **Rebate amounts** – rebate amounts varied considerably from State to State even on the same product;
- **Tiering** – 27 States focused some or all of their rebates on higher-tier products;
- **Layering** or utility partnerships – 50 States incorporated their ARRA rebates into existing utility rebates by supplementing existing utility rebates, layering SEEARP rebates on top of existing utility rebates, or offering new rebates for products not covered by the program.

In designing their programs, States were required to allocate rebate funds to the products for which they chose to offer rebates. That is to say, they had to inform DOE of not only the types of products that they were offering rebates for, but also the anticipated number of rebates that would be distributed for each type of product. This "planning spreadsheet" represents an excellent snapshot of the States' plans for their individual rebate programs and serves as the foundation for the final analysis that shows the difference in the States' planning for rebates and the actual consumer demand for the rebates.

At the end of the planning process, 56 different State programs projected to rebate 1,986,101 high-efficiency products; 1,634,088 home appliances, 161,421 water heaters, and 190,592 HVAC products.

The following State breakdowns of data show the number of programs per product class and per product, as well as the rebate amount range per product. "Programs" in the context of the bulleted figures below refer to total levels of rebates for the same product and not to rebates for the same product provided by individual States (the difference being that some States provided more than one level of rebate for the same product).

State break-down of rebates by product type:

- Appliances – 51 States rebating one or more appliances;
- HVAC – 33 States rebating one or more HVAC products
- Water Heaters – 35 States rebating one or more water heater products

State break-down of white goods rebates:

- Clothes washers – 46, $35 – 300
- Dehumidifiers – 0
- Dishwashers – 35, $25 - $250
- Freezers – 26, $25 - 600

- Refrigerators – 45; $50 - 700
- Room AC – 25; $20 – 200

State break-down of HVAC rebates:

- Air-source Heat Pumps – 22; $199 - 1000
- Boilers – 14 natural gas, 8 oil; $199 - 500
- Central Air – 21; $99 - 1000
- Furnaces – 26 natural gas, 6 propane; 9 oil, $100 - 500
- Ground-source Heat Pumps – 10; $75 -1000

State break–down of water heater rebates:

- Gas Storage – 26; $50 - 300
- Gas Tankless – 30; $100 - 300
- Heat Pump – 24; $50 – 425
- Solar – 17; $125 – 2,000

Rebate levels for these products varied, but generally were higher than utility rebates. This is due in part to the fact that this was economic stimulus money, and as such was not subject to cost-effectiveness tests. DOE also encouraged States to adopt rebate levels that significantly brought down the price premium associated with high-efficiency products.

Projected Results

Measuring the Results

As the overall national program is still largely in the "go-to-market" stage at the time of this writing, it is impossible to do any real analyses on the successes of the 56 various program models.

However, there is sufficient information available on the projected number and denomination of rebates distributed to applicants, disaggregated by product category and product type. This information on projected rebates distributed, and as a result, on the swap-out of less energy-efficient products for more energy-efficient ones, was used together with ENERGY STAR energy-efficiency formulas to calculate various measurements of energy savings.

Products and Product Types

There were three "product classes" (or categories) present in the national program: home appliances or "white goods," HVAC, and water heaters.

Each product type consisted of several specific products:

- Home appliances / white goods were: *room* air conditioners, clothes washers, dishwashers, freezers, and refrigerators.

- HVAC products were: central air conditioners, boiler reset controls, boilers (gas, oil, and propane), and heat pumps (air source and ground source).
- Water heaters consisted of 10 types of water heaters: electric heat pump, gas condensing, gas storage, gas tankless, indirect, propane storage, propane tankless, solar – electric backup, solar – gas backup, and solar – indirect backup.

Note that no data disaggregated by State or Territory program is yet available. All data presented in this paper, therefore, is for the SEEARP program as implemented nationally. Moreover, the data is projected and not finalized.
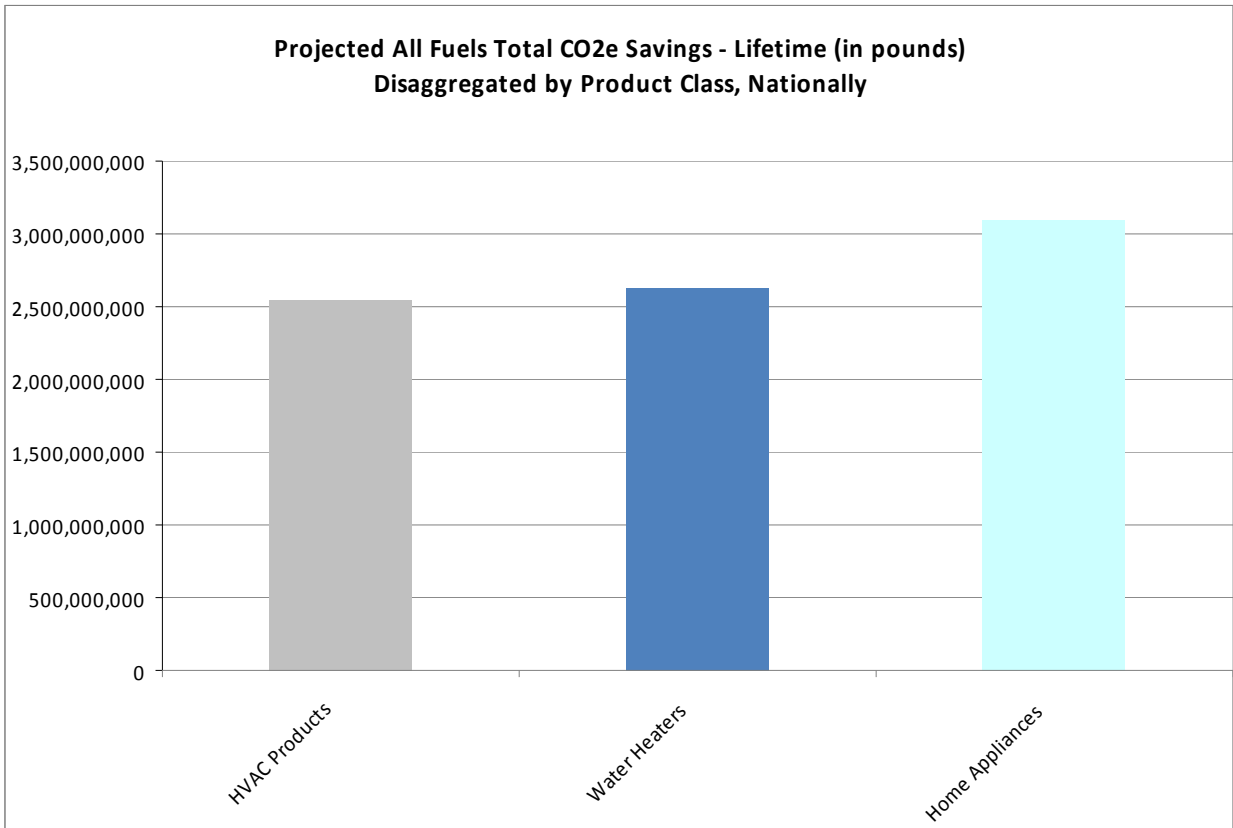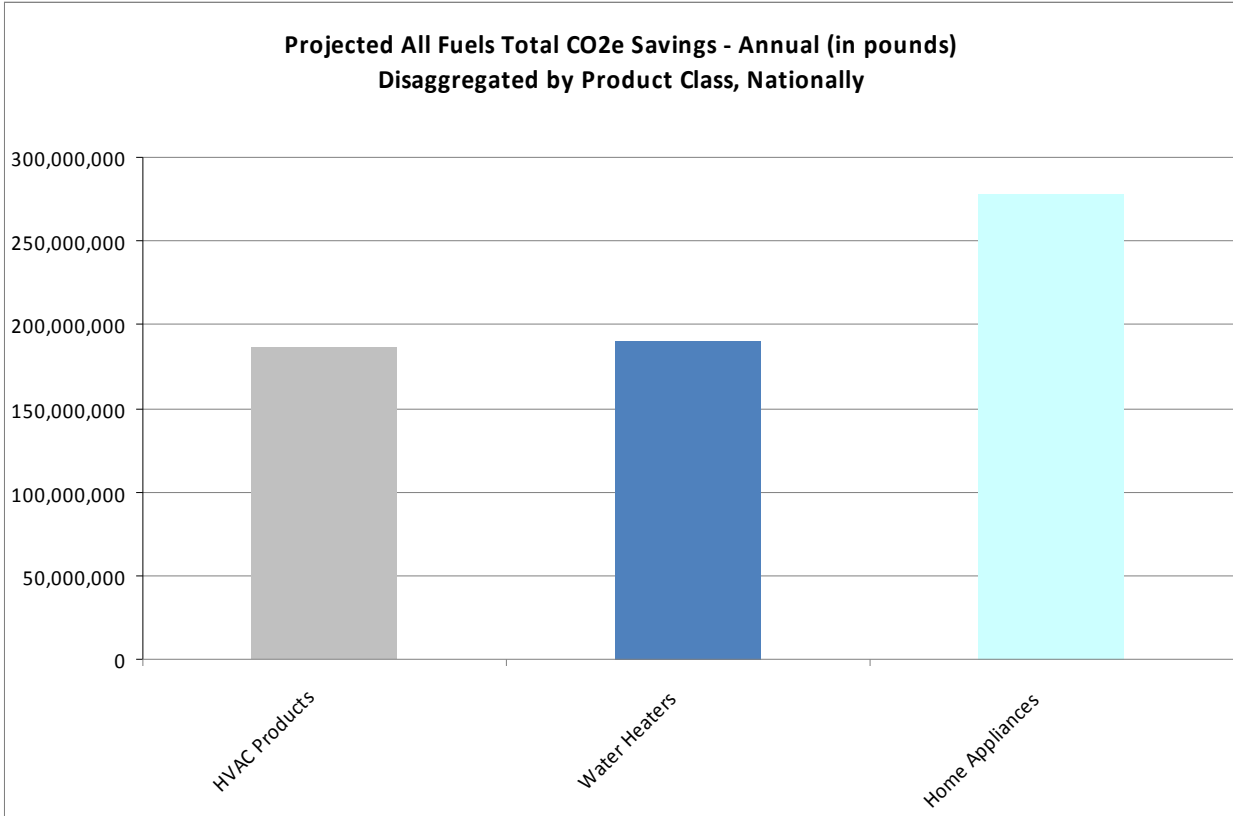
Total Projected Energy Savings: Carbon (Annual and Lifetime)

The series of bar graphs below present the projected number of pounds of CO_2e (carbon dioxide equivalent) saved per year as well as over the course of the lifetimes of the rebated appliances. Product lifetimes ranged from 9 years for room air conditioners to 20 years for all three types of solar water heaters as well as propane tankless water heaters. Products are color-coded according to which class they fall under in the graphs.

A grand total CO_2e of almost 655 million (654,907,216) pounds is projected to be saved annually across all three fuels plus electricity, and across all products/product classes from rebates provides by the SEEARP program nationwide. Moreover, a grand total of more than 8.2 billion (8,264,164,563) pounds is projected to be saved over the course of the lifetimes of the products in aggregate.

The breakdown of the above annual figure across the three product classes nationally is shown in the following figure; the lifetime figure follows.

Measured both annually and in terms of lifetime, rebates from home appliances provided greater total projected CO_2e savings than rebates from HVAC products and water heaters.

Projected All Fuels Total CO2e Savings - Annual (in pounds)
Disaggregated by Product Class, Nationally

Projected All Fuels Total CO2e Savings - Lifetime (in pounds)
**Disaggregated by Product Class, Nationally**

The breakdown of the grand total CO_2e savings across the various products rebated is shown below.

In this scenario, projected rebates from clothes washers, in the home appliances product class, provided greater total CO_2e savings, both annually and in terms of product lifetime, than rebates from all other products. The second greatest projected savings in total CO_2e comes from rebates for electric heat pump water heaters (water heater class), if measured annually, and refrigerators (home appliances class), if measured in terms of lifetime. Gas furnaces (HVAC class) provide the third greatest projected savings in total CO_2e both annually and in terms of lifetime.

The breakdown of the total projected CO_2e savings across all products nationally is shown below – first annually and then in terms of lifetime.

Projected All Fuels Total CO2e Savings - Lifetime (in pounds)
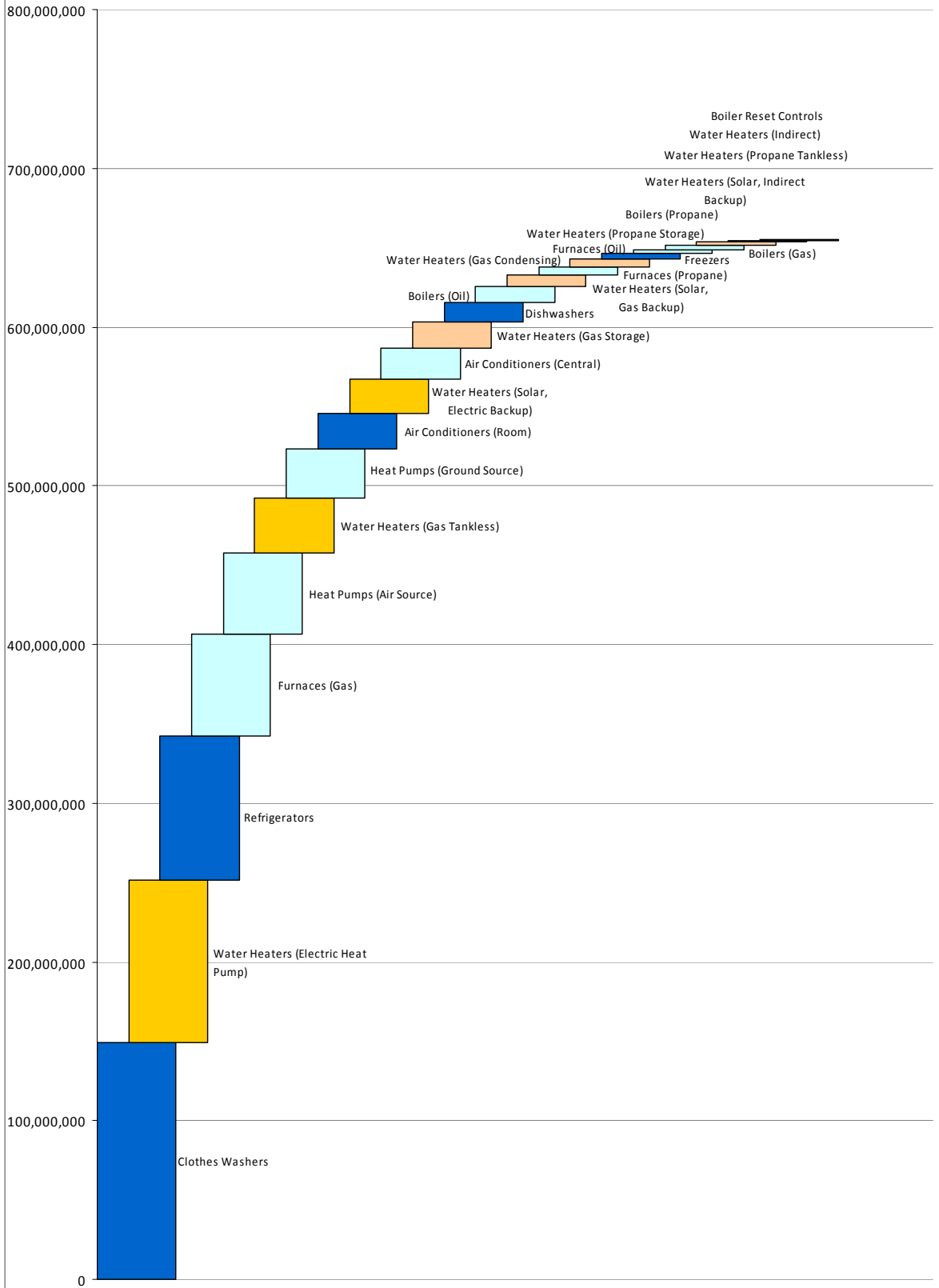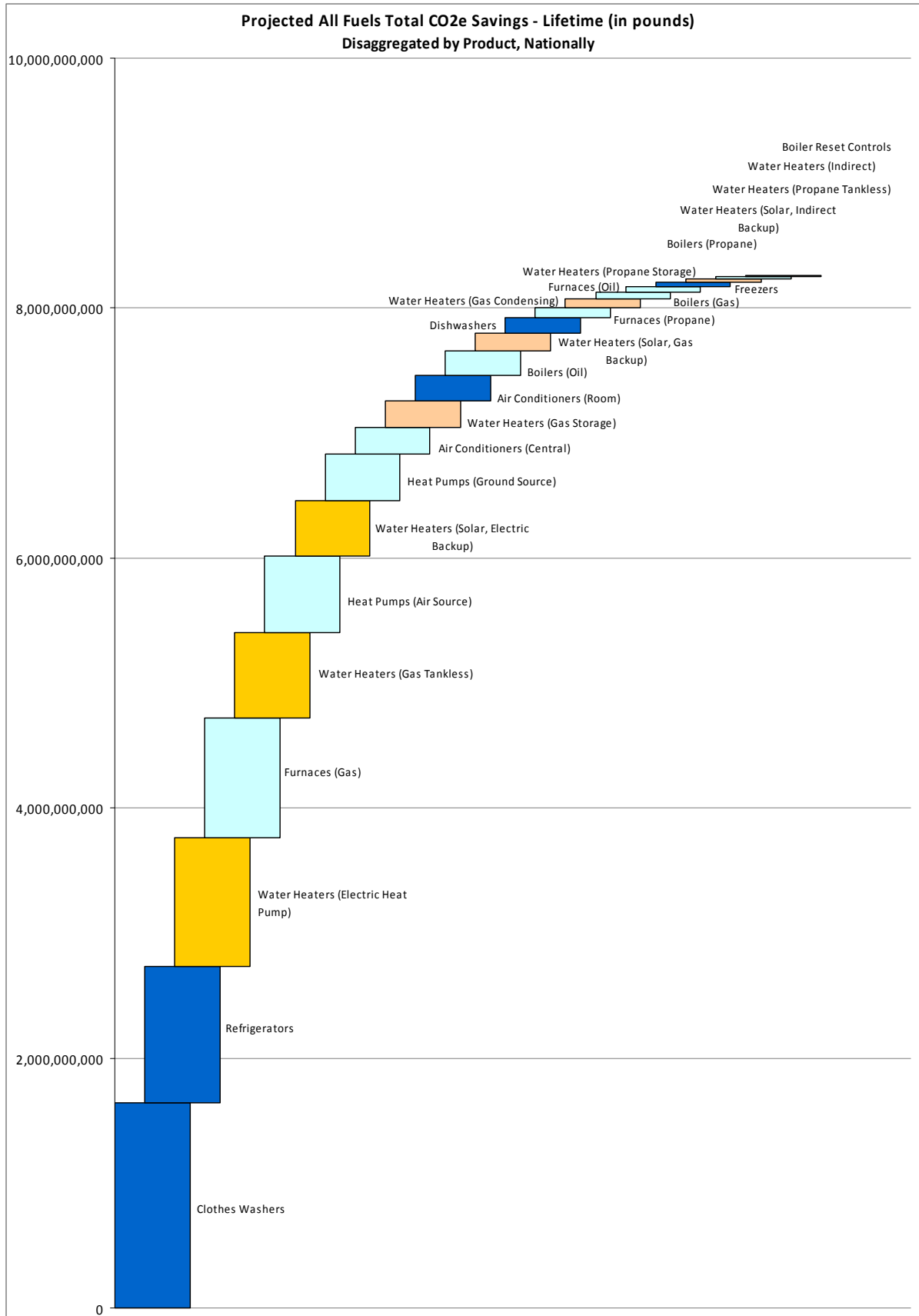**Disaggregated by Product, Nationally**
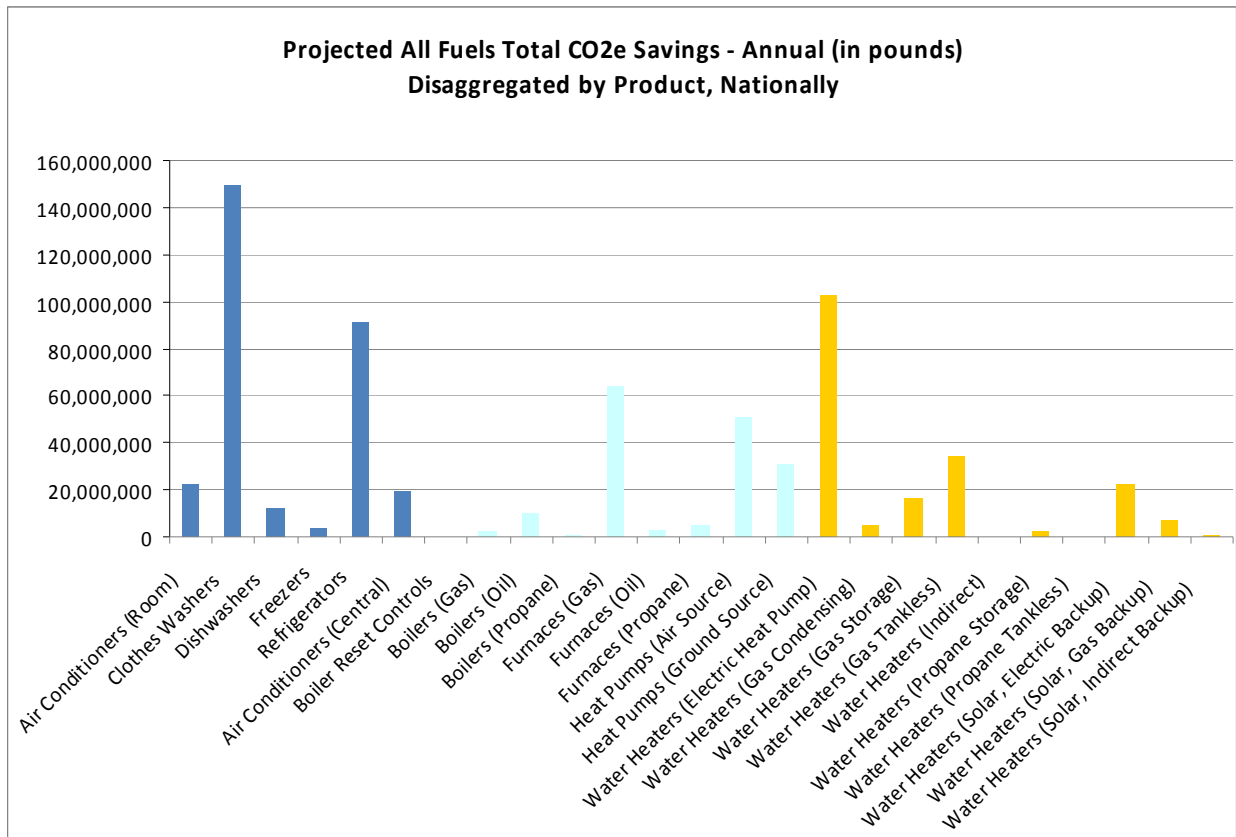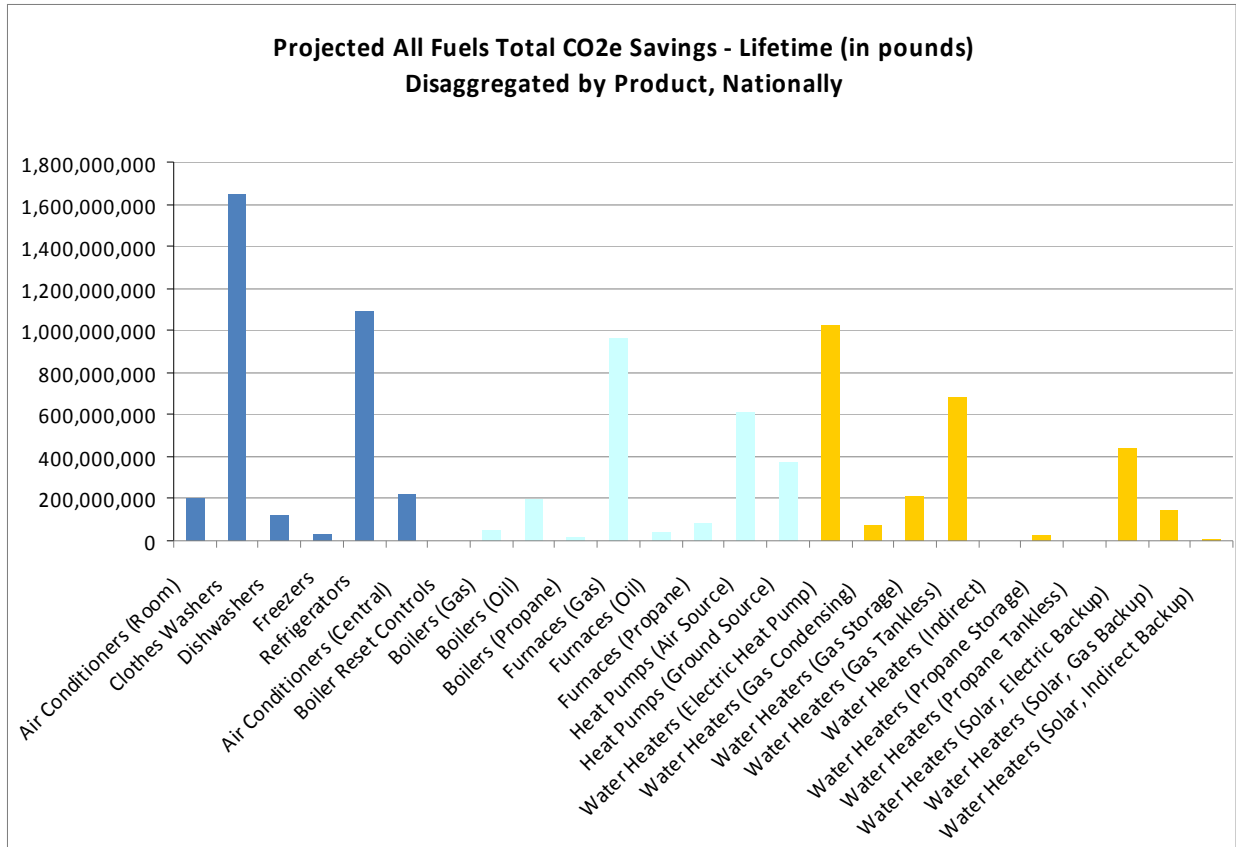
Looking at the data as presented below via stacked bar graphs, one can see that the combination of clothes washers and refrigerators in the home appliance class and electric heat pump water heaters in the water heater class already account for more than half of the almost 655 million total pounds of CO_2e projected to be saved annually.

Moreover, not only do clothes washers account for the single largest annual (almost 150 million pounds) and lifetime (more than 1.6 billion pounds) projected savings in CO_2e, but they also involve a significant projected savings in water, which is not reflected in the CO_2e measurement (see the section on water savings for that data). However, this data should not be misconstrued to mean that clothes washers as a product save more energy.

To achieve these energy savings metrics, a formula was used that multiplied energy savings per unit by the projected number of units rebated (purchased by consumer/sold by retailers). Therefore, the projected CO_2 savings for each product above is driven hugely by the number of refunds issued for that product nationwide. Home appliances were much more popular than HVAC products and water heaters among SEEARP programs (with clothes washers being most popular of all) but delivered fewer savings per unit as compared to HVAC products and water heaters. This should be taken into account when looking at all other types of energy and cost savings presented here.

Projected All Fuels Total CO2e Savings - Annual (in pounds)
Disaggregated by Product, Nationally

Boiler Reset Controls
Water Heaters (Indirect)
Water Heaters (Propane Tankless)

Water Heaters (Solar, Indirect Backup)

Boilers (Propane)

Water Heaters (Propane Storage)

Water Heaters (Gas Condensing)

Furnaces (Oil)

Boilers (Gas)

Freezers

Furnaces (Propane)

Boilers (Oil)

Water Heaters (Solar, Gas Backup)

Dishwashers

Water Heaters (Gas Storage)

Air Conditioners (Central)

Water Heaters (Solar, Electric Backup)

Air Conditioners (Room)

Heat Pumps (Ground Source)

Water Heaters (Gas Tankless)

Heat Pumps (Air Source)

Furnaces (Gas)

Refrigerators

Water Heaters (Electric Heat Pump)

Clothes Washers

Projected All Fuels Total CO2e Savings - Lifetime (in pounds)
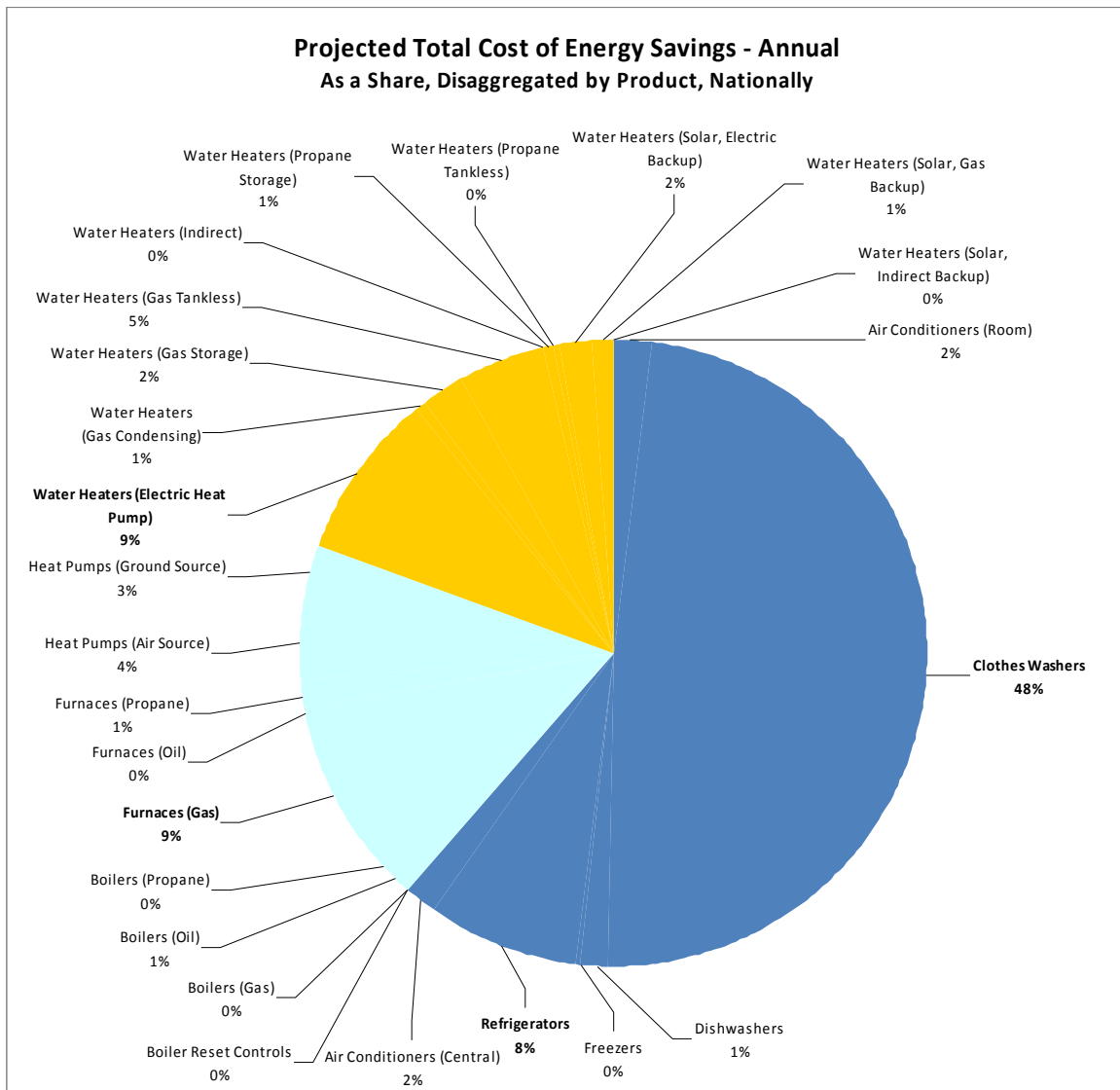## Disaggregated by Product, Nationally

Total Financial Savings (Annual and Lifetime)

The pie graphs below illustrate the projected money saved on the cost of energy (including water) both annually as well as over the course of the lifetimes of the rebated appliances (see section on carbon savings for information on the range of product lifetimes).

A grand total of almost $85 million ($84,765,990) in energy costs is projected to be saved annually across all products/product classes from SEEARP rebates distributed nationwide. Moreover, a grand total of almost $880 million ($879,928,073) is projected to be saved over the course of the lifetimes of the products in aggregate.

The pie graph below shows that 48% of the projected total annual financial savings on energy cost, resulting from the use of products that were purchased through these rebates, comes from clothes washers – a share that is significantly larger than that of any other product. The top four products delivering projected annual savings on energy cost are bolded.

Projected Total Cost of Energy Savings - Annual
As a Share, Disaggregated by Product, Nationally

- Water Heaters (Propane Storage) 1%
- Water Heaters (Propane Tankless) 0%
- Water Heaters (Solar, Electric Backup) 2%
- Water Heaters (Solar, Gas Backup) 1%
- Water Heaters (Indirect) 0%
- Water Heaters (Solar, Indirect Backup) 0%
- Water Heaters (Gas Tankless) 5%
- Air Conditioners (Room) 2%
- Water Heaters (Gas Storage) 2%
- Water Heaters (Gas Condensing) 1%
- **Water Heaters (Electric Heat Pump) 9%**
- Heat Pumps (Ground Source) 3%
- **Clothes Washers 48%**
- Heat Pumps (Air Source) 4%
- Furnaces (Propane) 1%
- Furnaces (Oil) 0%
- **Furnaces (Gas) 9%**
- Boilers (Propane) 0%
- Boilers (Oil) 1%
- Boilers (Gas) 0%
- Boiler Reset Controls 0%
- Air Conditioners (Central) 2%
- **Refrigerators 8%**
- Freezers 0%
- Dishwashers 1%

In other words, almost half of the projected dollars that consumers will save each year as a result of purchasing and using appliances through the SEEARP program will be from clothes washers. Put into context, clothes washers were a component of SEEARP programs in 46 States and Territories (11 States had two separate levels of rebates on clothes washers, almost all of these pairs differing based on efficiency level) and 20% of projected SEEARP consumer spending nationally went to purchasing clothes washers. Electric heat pump water heaters and gas furnaces (both at 9% of total projected cost savings) and refrigerators (at 8% of total cost savings) rank at a very distant second and third place, respectively, in this measure. In addition, home appliances, or "white goods," as a whole account for about 60% of the total projected savings in the cost of energy from SEEARP.

Savings by product do not change very significantly as a proportion of total savings when they are measured in terms of lifetime rather than annually. The graph below illustrates this.
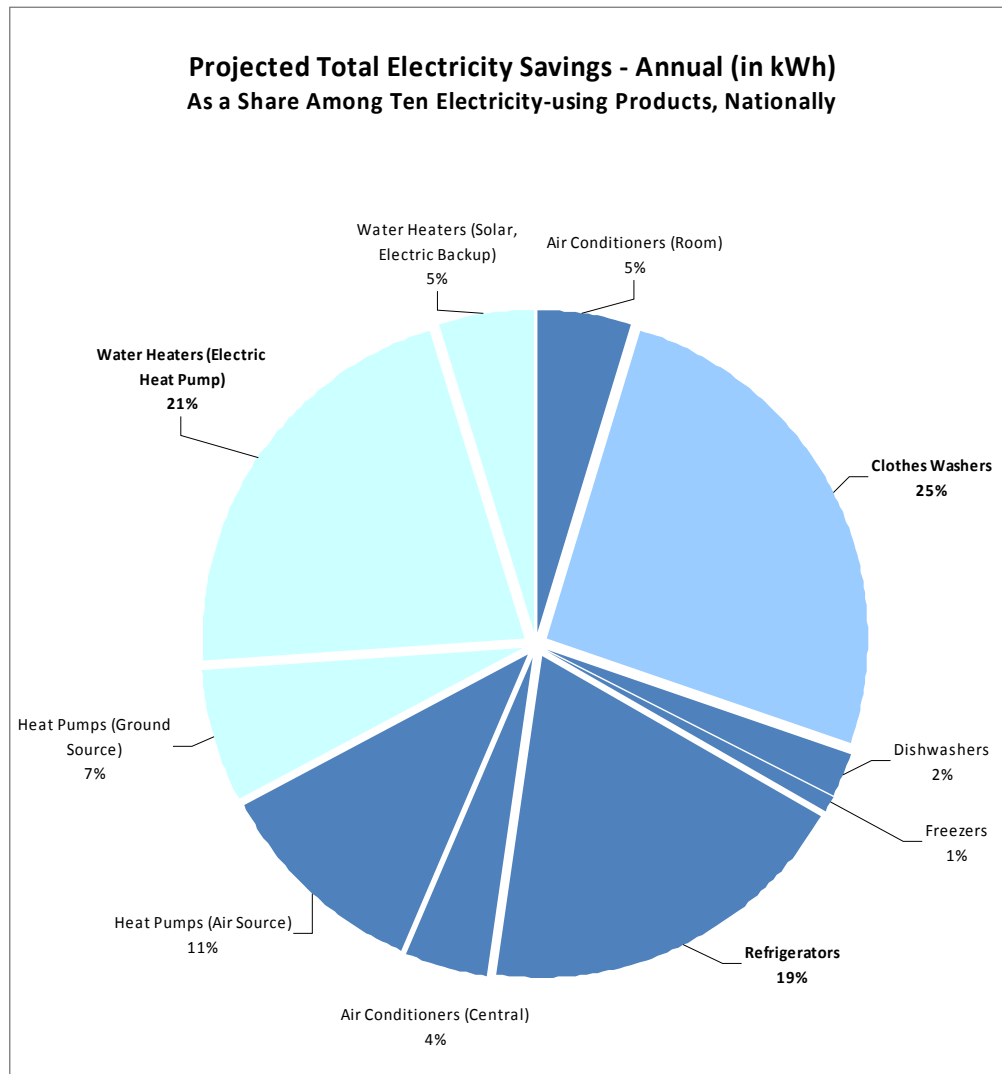

Projected Total Cost of Energy Savings - Lifetime
As a Share, Disaggregated by Product, Nationally
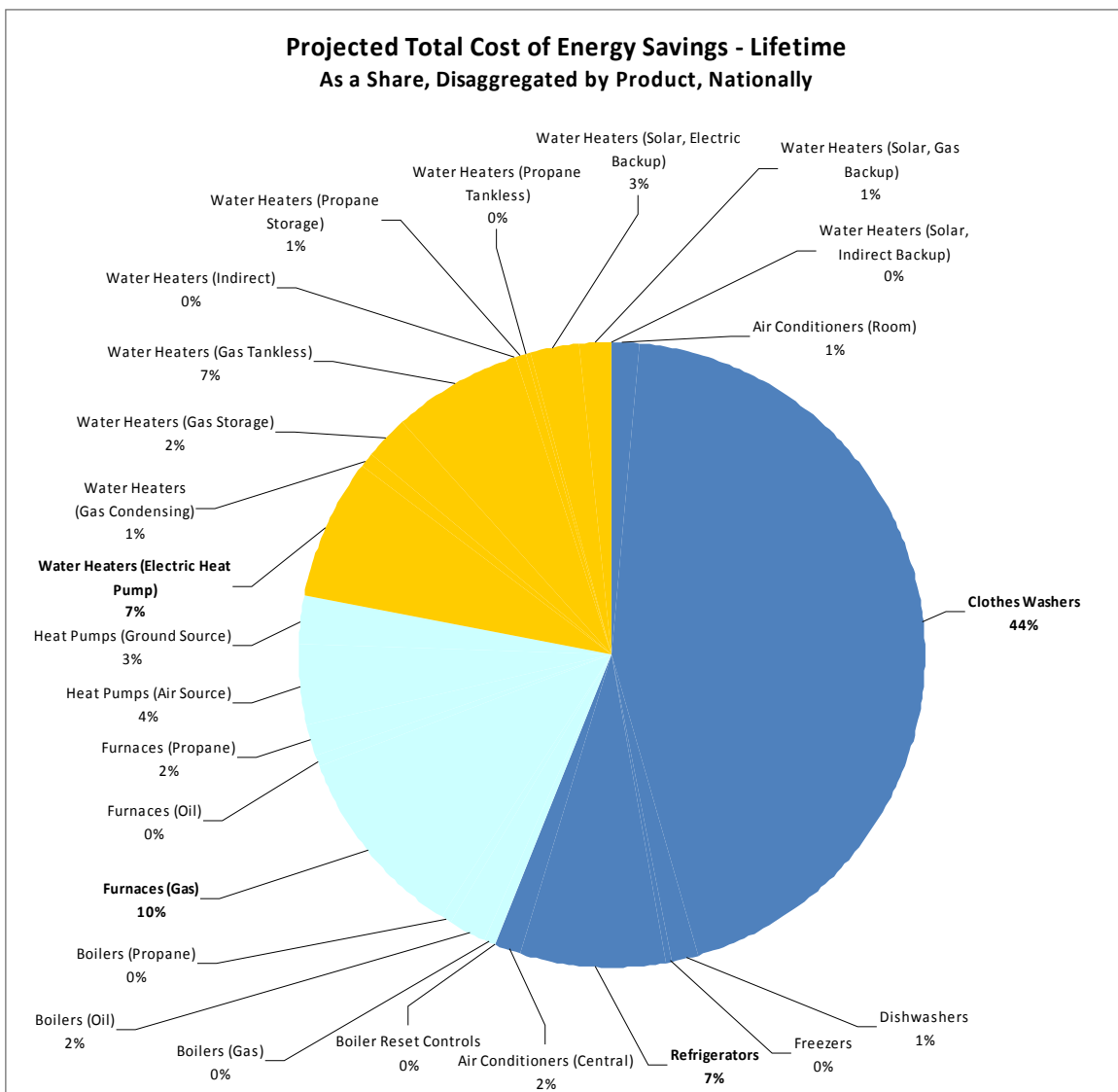
Other Total Projected Energy Savings (Annual and Lifetime)

Electricity. Ten of the 25 products involved in the rebate program use electricity, including all five products in the home appliances class. Among the ten HVAC products, only central air conditioners, air-source heat pumps, and ground-source heat pumps use electricity. Among the ten types of water heaters, only electric heat pump and solar, electric backup water heaters use electricity.

The pie graph below shows that clothes washers are projected to save 25% of the over 298 million total kWh (kilowatt-hours) in electricity projected to be saved annually by rebated products. Electric heat pump water heaters and refrigerators, at 21% and 19% of the share, respectively, followed clothes washers in greatest annual total projected electricity savings.
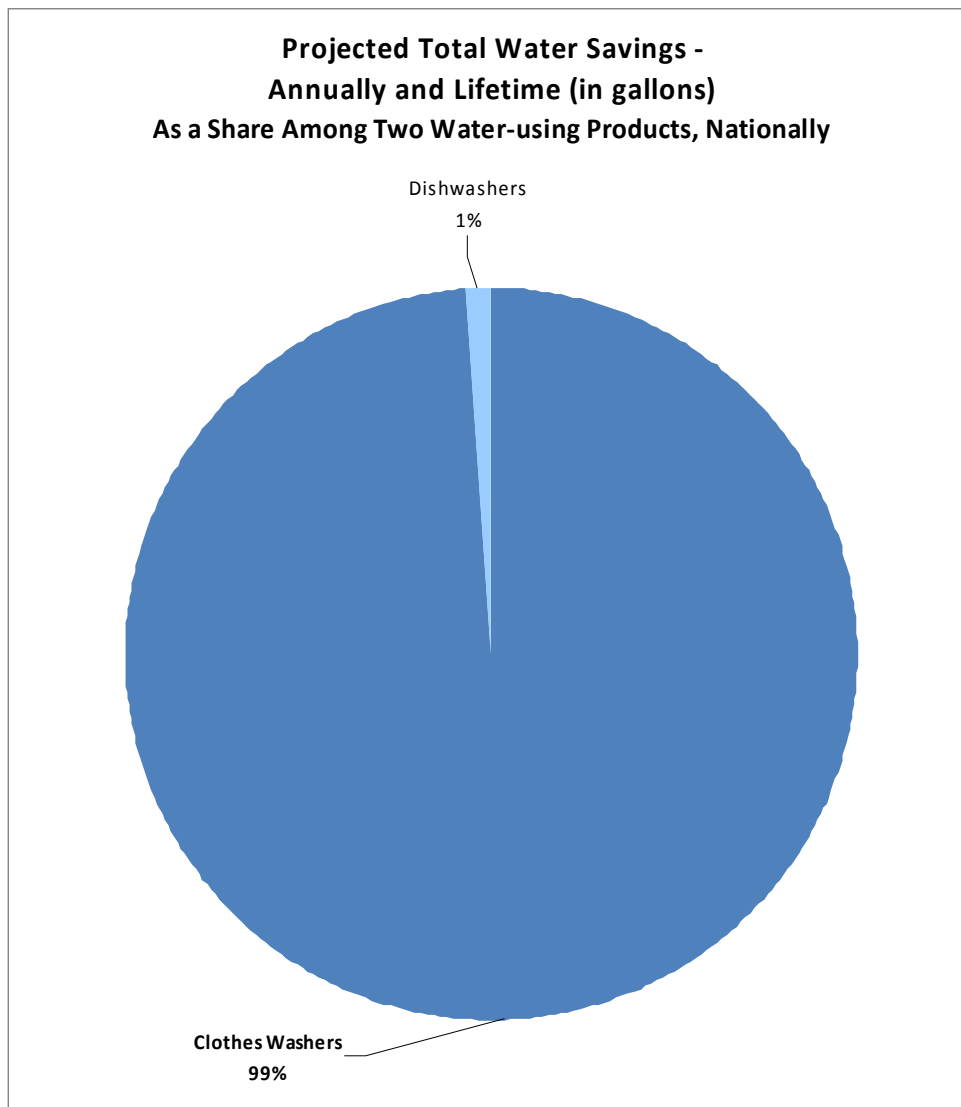
Over aggregate product lifetime, the projected grand total saved was over 3.4 billion kWh. The share of projected electricity savings per product was virtually identical between annual and lifetime measures. In general, home appliances accounted for 51-52% of the total electricity savings (depending on whether measured annually or in terms of product lifetime). The top three products delivering projected annual electricity savings are bolded.

Projected Total Electricity Savings - Annual (in kWh)
As a Share Among Ten Electricity-using Products, Nationally

- Water Heaters (Solar, Electric Backup) 5%
- Air Conditioners (Room) 5%
- **Water Heaters (Electric Heat Pump) 21%**
- **Clothes Washers 25%**
- Heat Pumps (Ground Source) 7%
- Dishwashers 2%
- Freezers 1%
- Heat Pumps (Air Source) 11%
- **Refrigerators 19%**
- Air Conditioners (Central) 4%

Water. Only two rebated products provide any water savings – clothes washers and dishwashers, both in the home appliances class. Over 3.9 billion gallons of water are projected to be saved annually and about 43.3 billion gallons are projected to be saved over the aggregate lifetime of the products that were rebated.

However, the share of total water saved in gallons is quite dissimilar between the two products, with clothes washers accounting for the vast majority (99%) of the projected total number of gallons of water saved from the SEEARP program. This proportion is the same for both annual and lifetime measurements of water savings.

The discrepancy lies in that, dishwashers - which also were allocated about 40% fewer total rebates than clothes washers and on which 29% fewer consumer dollars were spent compared to clothes washers - will save a projected total of almost 45 million gallons of water annually (450 million gallons measured over lifetime), compared to clothes washers, which will save a projected total of almost 3.9 billion gallons of water annually (42.8 billion gallons measured over lifetime). The pie graph below illustrates this.

**Projected Total Water Savings -
Annually and Lifetime (in gallons)
As a Share Among Two Water-using Products, Nationally**

Dishwashers
1%

Clothes Washers
99%

Conclusion

The ARRA State Energy Efficient Appliance Rebate Program (SEEARP) was the first national energy-efficiency rebate program of its kind. This presentation will provide the audience a detailed understanding of the administration and execution of this program, and most importantly, of the outcome of this program in removing old and inefficient appliances from the grid and replacing them with newer and more efficient appliances.

Our main findings concerning projected energy and cost of energy savings were the following:

A total of 1,986,101 rebates with a total value of $265,162,862 were distributed as part of the national rebate program, contributing to $2,197,532,580 of overall consumer spending.

As a result of these rebates:

- 298,462,846 kWh of electricity will be saved each year (projected)
- 3,417,859,892 kWh of electricity will be saved within the next two decades (projected)
- 3,940,398,563 gallons of water will be saved each year (projected)
- 43,299,385,793 gallons of water will be saved within the next two decades (projected)
- 654,907,216 pounds of CO_2e (including 474,595,728 pounds from electricity generation) will be saved each year (projected)
- 8,264,164,563 pounds of CO_2e (including 5,434,853,035 pounds from electricity generation) will be saved within the next two decades (projected)
- $84,765,990 (including $33,636,763 from electricity costs) will be saved by consumers each year (projected)
- $879,928,073 (including $328,666,617 from electricity costs) will be saved by consumers over the next two decades (projected)

Home appliances or "white goods" dominated the SEEARP program and this is reflected in the specific projected data showing energy and energy cost savings included in this paper. One home appliance in particular – clothes washers – was responsible for a large share of the savings in energy and energy cost. This was in great part due to the prevalence of this product among the various rebate programs implemented by States and Territories.