METHODOLOGY FOR THE ASSESSMENT OF ENERGY EFFICIENCY PROVISIONS IN ACELA

Introduction

The American Clean Energy Leadership Act of 2009 (ACELA), which passed through the Energy and Natural Resource Committee on June 18, 2009, includes important energy efficiency provisions. ACEEE produced several preliminary, national-level analyses of the various iterations of ACELA as the bill worked toward passage. We update our assessment of the national impacts of the energy efficiency provisions in ACELA.

This document explains the construction of the Excel model used in this analysis and presents the key assumptions that were made in this analysis.

Methodology

The foundation of this model is an assessment of each of the energy efficiency provisions in ACELA at the national level. This analysis projected the aggregate energy, carbon, and economic savings for the bill as a whole.

ACEEE's analysis focuses on provisions from the Clean Energy Technology Deployment (Title I) and Enhanced Energy Efficiency (Title II) titles in ACELA. The approach used to model each provision was developed by research leads at ACEEE.

The next sections provide details on key aspects of the analysis, identifying key assumptions and data sources used.

Federal Legislative Scoring Methodology

For each of the policies mentioned below, this analysis estimates energy savings in 2020 and 2030. Estimates were calculated for electricity use, peak energy demand, natural gas use, oil savings (including motor gasoline, diesel, and home fuel oil), and all energy sources together. This analysis also estimates federal, state/utility, and consumer costs, as well as gross consumer savings (based upon dollar savings from unused energy) and net consumer savings. In general, EIA's *Annual Energy Outlook 2009* (EIA 2009) was used as the reference case. A number of key assumptions were taken from this document. These assumptions included projected energy prices and consumption by sector and by fuel type, power plant heat rates, and carbon dioxide emissions per unit of fuel saved. To estimate peak demand savings, we used the ratio of peak demand savings per unit reduction in electricity sales from an EIA study of demand-side management (EIA 2000).

A few sections of the bill authorize the establishment of a specific program, sometimes with an accompanying funding level. However, these authorizations must be followed by an explicit appropriation of funds, handled by the House and Senate Appropriations Committees. Because we are unsure what amount will be appropriated, where programs require substantial spending, we use funding authorizations, or in absence of a specific authorization, assume continuation of spending at prior levels through 2030.

Interest Rates Used

To calculate annualized net consumer investment values, we amortized consumer investments for each provision in a given year (and in years with savings from prior investments) using a real interest rate of 4.5% and measure lives in Table D-1. 4.5% reflects the average utility cost of capital used in DSM filings and plans excluding the effects of inflation (Nadel 2004). We exclude inflation because all of our financial figures are in constant 2007 dollars. These amortized net investment values were subtracted from the gross savings to calculate net savings.

Table 1. Measure Life Values Used in Calculating Annualized Consumer Cost

Provision	Measure Life
Sec. 201. Industrial EE Revolving Loan Program	13
Sec. 204c. Industrial Research and Assessment Centers	10
Sec. 206 Innovation and Industry Grants	13
Sec. 222 Reforms to Energy Star	10
Sec. 228 Motor Efficiency Rebate program	18
Sec. 241 Building Codes	20
Sec. 242 Multifamily and Manufactured Homes	20
Sec. 243 Building Assessment Centers	10
Sec. 251 Low Income Weatherization	20
Sec. 262 Building Retrofit Program	15
Sec. 281 Building Labeling/Disclosure	5

Key Assumptions Used in Analysis

Industrial EE Revolving Loan Program (Sec. 201)

To calculate electricity savings from the loan program, the investment of $500 million/year for three years was divided by the present value of the cost of saved electricity, and divided by two because ACEEE assumes that only 50% will be funded by appropriations. To calculate total annual savings, a 13 year measure life was used (Energy and Resource Solutions 2005).

To assess the consumer costs, total annual electricity and natural gas savings were multiplied by the cost of saved energy and the federal share of investments subtracted.

Future of Industry Program (Sec. 204)
This provision was authorized in EISA 2007, so ACEEE attributes no new savings to this program. Our estimates of savings from EISA can be found here.

Industrial Research and Assessment Centers (Sec. 204c)

Industrial Research and Assessment Centers (IAC) savings were based upon a ramp-up to 60 centers in 2013 assuming 16-30 assessments/center/year (at present, IACs perform about 16 audits a year, but they can do as many as 30), based on Industrial Assessment Center data. This increase was based on authorizations of $20 million in FY 2010, $30 million in FY 2011, and $40 million for FY 2012 and thereafter. This analysis assumed an average implemented savings of 400,000 kWh and 2,500 mmBtu per audit (IAC 2009). To calculate the cost to industrial plant owners, the national weighted average for installed cost of industrial measures ($0.26 /kWh and ~ $20 /mmBtu) was used (IAC).

Innovation and Industry Grants (Sec. 206)
To calculate energy savings from these grants, it was assumed that half of the savings would be natural gas savings and half the savings would be electricity savings. $10 million/year of investment from 2012-2030 (the bill specifies 'such sums', this was based on past funding of the NICE3 (and Inventions and Innovation) industry grant program**s**) was translated into energy savings using a rate of 2.5 Tbtu saved/million$, based on the historic savings rate as result of DOE's NICE3 program. This was divided by 2 to reflect the fact that the IOF program was extraordinarily successful, and that any new program may not have the same level of success. In addition, savings were delayed by 5 years to reflect the delay between the grants' distribution and realized energy savings.

Reforms to Energy Star (Sec. 222)
We calculated the consumption of major appliances that would be eligible to join ENERGY STAR as smart grid products as a result of this provision, including space heating and cooling, water heating, refrigeration, cooking, washers and dryers, freezers, dishwashers, and color televisions. ENERGY STAR products make up about 25% of the current total appliance market, so electricity savings of 5% were applied to one-third of this portion of sales (because one-third of Smart grid equipment categories would be affected by the reforms), and natural gas savings of 2% were applied for natural gas (ACEEE estimates).

Portable Light Fixtures and Commercial Furnace Standards (Sections 224 and 227)

Energy savings from appliance standards were estimated using a complex spreadsheet created by ACEEE for the Appliance Standards Awareness Project (ASAP). The methodology and assumptions are detailed in an ACEEE/ASAP joint report, *Ka-BOOM! The Power of Appliance Standards: Opportunities for New Federal Appliance and Equipment Standards* (Neubauer et. al. 2009).

Motor Efficiency Rebate program (Section 228)

Estimates from the Motor Efficiency Rebate program in the bill were made using a spreadsheet developed by Rob Boteler of Emerson Motor Company (Boteler 2009).

Building Codes (Section 241)

For commercial codes, we calculated the amount of electricity and natural gas consumed on average per square foot of commercial space. Those buildings affected by the code are new stock, so we used new additions as the amount of square footage participating, and then applied 35% electricity savings and 25% gas savings for an average of 30% in 2010 and 55% electricity savings and 45% gas savings for average of 50% in 2016. Each improvement in codes was delayed by an implementation period of two years (so the 30% savings begin in 2012), accounting for time for states to adopt and begin enforcing the codes. We also assumed that 60% of buildings would correctly implement the codes, increasing the implementation percentage by 5% every year. Each time a new level of savings is required by the bill, the percent of implementation moves back down to 60% and increases by 5% until the next standard is required[1].

For residential codes, we calculated new additions to the residential stock of Single-Family Homes by subtracting the difference in the new stock from the previous year, and included an assumption that 1/100 of the stock would be lost to demolition each year (EIA 2009g). The amount of electricity and natural gas/home was calculated by dividing the delivered electricity and natural gas consumption by the number of homes. The same implementation assumptions for commercial buildings were used for residential buildings.

Section 241 specifies that federal costs for this provision will be $100 million for FY2009-2013. ACEEE assumed that this funding level will be maintained until 2030.To assess the consumer costs, federal investment was subtracted from the savings from reduced energy bills, assuming a payback period of 7 years.

Multifamily and Manufactured Homes (Section 242)

The calculations were based upon a spending estimate of $50 million in the first year of the program, ramping up to $500 million by the 5th year, and continuing at $500 million to 2030 (Section 242 specifies “such sums as are necessary; these spending amounts are based upon an ACEEE proposal). We assumed that each federal dollar would be matched by a participant dollar.

To calculate the energy savings, we assumed savings of 1202 kWh of electricity per apt and 32 MMBtu of fuel per apartment. Total annual savings were calculating with a 20-year measure life.

Building Assessment Centers (Section 243)

Building Assessment Center (BAC) savings were based upon a ramp-up to 75 centers in 2016 assuming 26 assessments/center/year, based on Industrial Assessment Center data. This is a new program, so the number of centers will initially be zero. This analysis calculated electricity, natural gas, and fuel oil use per square foot and assumed a mean commercial building size of 13,900 sq. ft. and energy savings of 10% (ACEEE estimate) to calculate savings from each assessment (EIA 2009).

[1] These compliances rates are 10% less than ACEEE’s estimates of building codes savings in ACES because of the lower funding rates in ACELA.

Low Income Weatherization (Section 251)

The federal cost of low-income weatherization was calculated using 1% of allowance value (as specified in Section 131). We assumed that 40% of the energy savings would come from saved electricity and 60% would come from saved natural gas, and that there would be a 10-year payback for electricity and natural gas measures (ORNL 2005).

Building Retrofit Program (Section 262)

Estimates of savings from Home Retrofits were based upon an assumption of $300million in 2012, $600 million in 2013, and $1 billion/year in federal spending from 2014-2030. The number of participating homes was calculated by assuming that administrative costs account for 15% of the SEED funds and that retrofits cost $3,000 per home. Energy savings were determined using estimates of 1,709 kWh[2] of electricity saved per home and 30.6 MMBtu[3] of natural gas saved per home, derived from NYSERDA home performance program results, but adjusted to reflect national average weather conditions (Jones 2009). We allocated the Btu savings using national figures for consumption of distillate fuel oil and natural gas.

For Commercial Retrofits, we assumed the building retrofit funds would be equally allocated between residential and commercial retrofits. To calculate participation levels, we calculated the cost of the retrofits for 1 billion square feet, assuming a federal retrofit cost of $0.75/sq. ft., and used this amount per square footage to the amount of funding for commercial retrofits. Electricity, natural gas, and distillate fuel oil consumption and savings were calculated per square foot using EIA (2009) total commercial consumption and total commercial square feet data, and 30% savings were assumed for electricity and 20% for natural gas and distillate fuel oil. The federal cost was calculated based upon the amount of funding assumed for REEP. Consumer costs were calculated by assuming a 1:1 ratio of federal to consumer costs, given a total cost of $1.50/square foot (Osborn et al. 2002).

Building Labeling/Disclosure (Section 281)

To calculate the number of homes participating in building labeling, we assumed a ramp-up to 1 million homes per year in 2013, and multiplied by the ratio of new households to total households (EIA 2009g) to reflect that the provision only applies to new construction. A measure life of 16 years for electricity measures as a result of labeling and 20 years for natural gas and fuel oil savings was used in residential buildings. The amount of electricity and natural gas consumption per home was calculated by dividing the delivered electricity and natural gas consumption by the number of homes.

Similar approaches were used to calculate commercial building labeling savings, using the consumption per square foot of commercial space, and participation levels ramped up to the product of 1 billion square feet in 2013, and the percent of new square footage to reflect that the provision only applies to new construction. We used a measure life of 13 years for the electricity, natural gas, and fuel oil measures that result from labeling programs. Five percent savings were assumed from the program for both commercial and residential buildings.

To calculate the federal costs, ACEEE estimated a cost of $50 million per year for the program, with $25 million/year for residential labeling and $25 million/year for commercial labeling. We used a 3-year payback period for all measures in calculating the consumer investments.

References:

[ACEEE] American Council for an Energy-Efficient Economy. 2007. “Triple Play: New Energy Bill Saves Three Times As Much as 2005 Act.” Press Release, December 6. http://www.aceee.org/press/0712energy-bill.htm. Washington, D.C.: American Council for an Energy-Efficient Economy.

EIA. Energy Information Administration. 2009. *Updated Annual Energy Outlook 2009 Reference Case Service Report, April 2009*. DOE/EIA-0383(2009). http://www.eia.doe.gov/oiaf/aeo/. Washington, D.C.: U.S. Department of Energy.

[2] N.Y. is 934 kWh/home — we increase by an 1.83 multiplier based on US/NY avg. cooling
[3] N.Y. is 40.2 mBtu — we discount by 24% based on NY/US avg. heating degree

_____. 2000. *Electric Utility Demand Side Management 1999*: *Executive Summary*. http://www.eia.doe.gov/cneaf/electricity/dsm99/dsm_sum99.html. Washington, D.C.: U.S. Department of Energy.

Electricity Performance Standard Statewide Fast-track screening analysis. 2009. Personal communication with S. Nadel.

Energy and Resource Solutions. 2005. "Measure Life Study: Prepared for The Massachusetts Joint Utilities." www.ers-inc.com. Haverhill, MA: ERS, Inc.

[IAC] Industrial Technologies Program, Energy Efficiency and Renewable Energy. 2009. Industrial Assessment Centers Database, Rutgers University. http://iac.rutgers.edu/database/ Piscataway, NJ: U.S. Department of Energy.

Jones, John (NYSERDA). 2009. Personal communication with S. Nadel. January and February.

Nadel, Steve. 2004. "Supplementary Information on Energy Efficiency for the National Commission on Energy Policy." *NCEP Technical Appendix Chapter 3: Improving Energy Efficiency*. http://www.bipartisanpolicy.org/library/report/technical-appendix-chapter-3-improving-energy-effciency. Washington, D.C.: American Council for an Energy-Efficient Economy.

Neubauer, Max. Andrew deLaski, Marianne DiMascio and Steven Nadel. *Ka-BOOM! The Power of Appliance Standards: Opportunities for New Federal Appliance and Equipment Standards*. ACEEE Report A091. Washington, D.C.: American Council for an Energy-Efficient Economy.