



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Energy Conservation Standards for Commercial Refrigeration Equipment

ANOPR Public Meeting

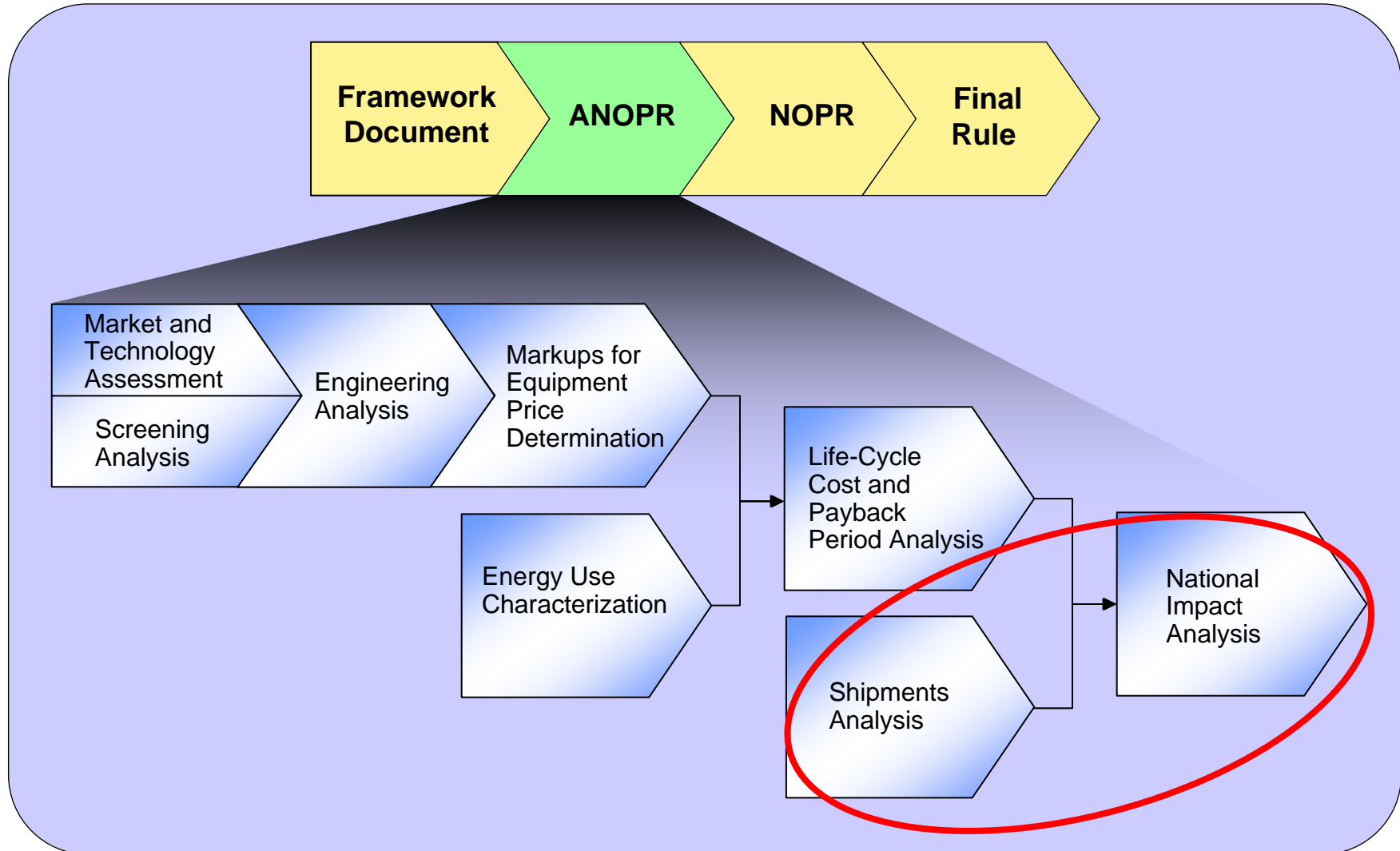
National Impact Analysis

Building Technologies Program
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

August 23, 2007



ANOPR Analyses Flow Diagram





Purpose

■ Shipments Analysis

- To estimate commercial refrigeration equipment shipments over time.

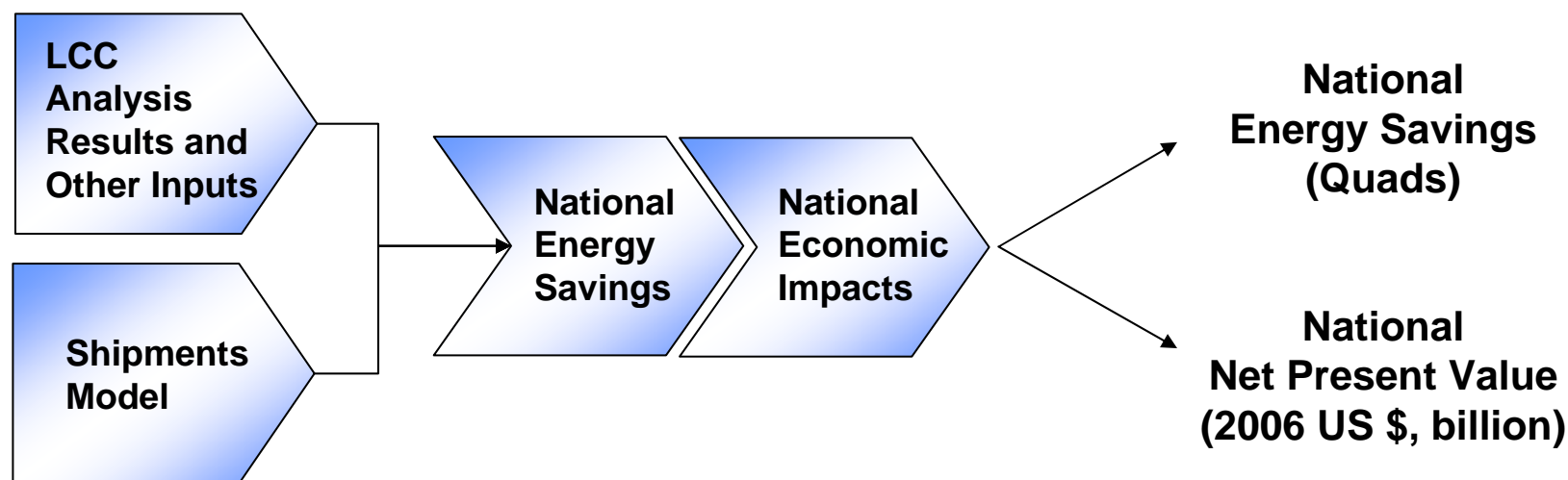
■ National Impact Analysis

- To estimate the National Energy Savings (NES) from commercial refrigeration equipment efficiency standards at different levels.
- To estimate the national economic impact on the nation (or the Net Present Value (NPV)) from equipment efficiency standards at different levels.

Correction Note: The NPV results shown in the TSD and presented in these slides differ from what is provided in the ANOPR as they include the impact of corrections to the fuel escalation rates that were made subsequent to the preparation of the ANOPR.



National Impact Analysis Process



- National energy savings calculated for period from 2012-2042 (30 years)
- NPV calculated for period from 2012-2052



ANOPR Issues for Public Comment

- **Characterizing the National Impact Analysis Base Case (Issue #10)**
- **Base Case and Standards Case Forecasts (Issue #11)**
- **Differential Impact of New Standards on Future Shipments by Equipment Classes (Issue #12)**



Shipments Model Inputs

Input	Data Source/Description
Commercial Building Data	
Forecasted New Construction: 2005-2030	U.S. DOE-EIA, <i>2006 Annual Energy Outlook, Food Sales Buildings</i>
Forecasted Stock: 2005-2030	U.S. DOE-EIA, <i>2006 Annual Energy Outlook, Food Sales Buildings</i>
Forecasted New Construction: 2031-2042	<i>Extrapolation of last 10 years growth from U.S. DOE-EIA, 2006 Annual Energy Outlook, Food Sales Buildings</i>
Market Saturation Data (percent of floor space with commercial refrigeration equipment) and Replacements	
New and stock saturation	Assumed identical for stock and new construction
Replacements driven by Equipment Lifetime	From Life-Cycle Cost Analysis (10 year average lifetime)
Shipments by Product Class	
Relative Shipments by Product Class	From 2005 ARI shipment data converted to linear feet of equipment using estimated average equipment class dimensions



Shipments Model Results

Equipment Class	Thousands of Linear Feet Shipped by Year and Equipment Class								
	2012	2015	2020	2025	2030	2035	2040	2042	Cumulative
VOP.RC.M	423	446	490	538	591	649	714	742	17574
VOP.RC.L*	0	0	0	0	0	0	0	0	0
VOP.SC.M	28	30	33	36	40	44	48	50	1182
VCT.RC.M	30	32	35	38	42	46	51	53	1255
VCT.RC.L	420	443	487	535	587	645	709	737	17456
VCT.SC.I	10	11	12	13	14	16	17	18	430
VCS.SC.I	3	3	3	3	4	4	4	5	107
SVO.RC.M	323	340	374	411	451	495	545	566	13405
SVO.SC.M	43	45	49	54	59	65	72	75	1769
SOC.RC.M	81	86	94	104	114	125	137	143	3379
HZO.RC.M	50	52	57	63	69	76	84	87	2060
HZO.RC.L	156	164	181	198	218	239	263	273	6476
HZO.SC.M	4	4	4	5	5	6	6	6	152
HZO.SC.L	8	8	9	10	11	12	13	13	315
HCT.SC.I	34	35	39	43	47	52	57	59	1397

* Estimated shipments of this class were zero. The industry requested that this equipment class be included in the rulemaking



Inputs

■ Shipments

- Annual linear feet of equipment by equipment class from shipments analysis

■ Total Installed Cost

- National average cost per linear foot by equipment class and efficiency level taken from LCC analysis

■ Repair and Maintenance Costs

- Average annualized values per linear foot by equipment class and efficiency level taken from LCC analysis

■ Annual Energy Use

- National average annual energy use per linear foot by equipment class and efficiency level

■ Market Shares by Efficiency Level

- Estimated for base case using commercial customer risk-premium factors from EIA NEMS model and CRE LCC analysis results
- Developed for each standards case using a roll-up approach -- base-case market shares below a standard level are “rolled into” the market shares at the standard level



Inputs (cont.)

■ Efficiency Trends

- Future trends in average equipment efficiency improvement over time not forecast due to lack of historical market data

■ Energy Prices Escalation

- 2012 weighted-average CRE electricity prices taken from LCC analysis
- Future electricity prices adjusted using *2006 Annual Energy Outlook (2030-2042 estimated using 2020-2030 forecast trends)*

■ Electricity Site-to-Source Conversion Factors

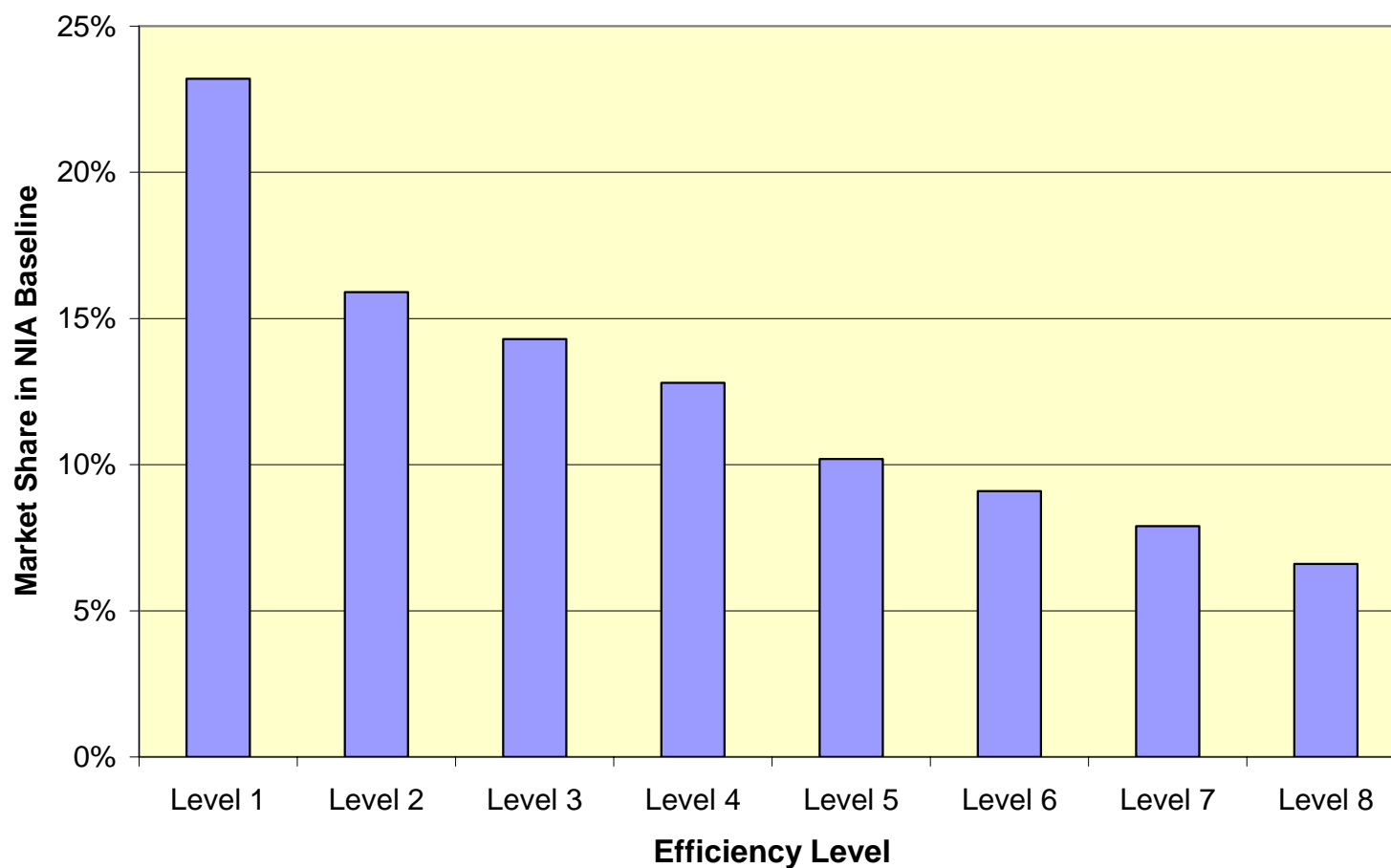
- Conversion factors forecast using *2006 Annual Energy Outlook (2030-2042 estimated using 2020-2030 forecast trends)*
- Factors vary annually and account for generation, distribution, and transmission losses

■ Discount Rate

- 7% and 3% real from OMB's Regulatory Analysis Guideline A-4
- Future expenses discounted to 2007, reported in 2006\$



Example Base Case Market Shares by Efficiency Level VOP.RC.M





Characterizing the National Impact Analysis Base Case (Issue #10)

- Base case market shares by efficiency level are developed using a economic model
- DOE does not have data with which to calibrate these market shares to actual shipments by efficiency level.

DOE invites comments on the proposed economic-based approach for estimating market shares.



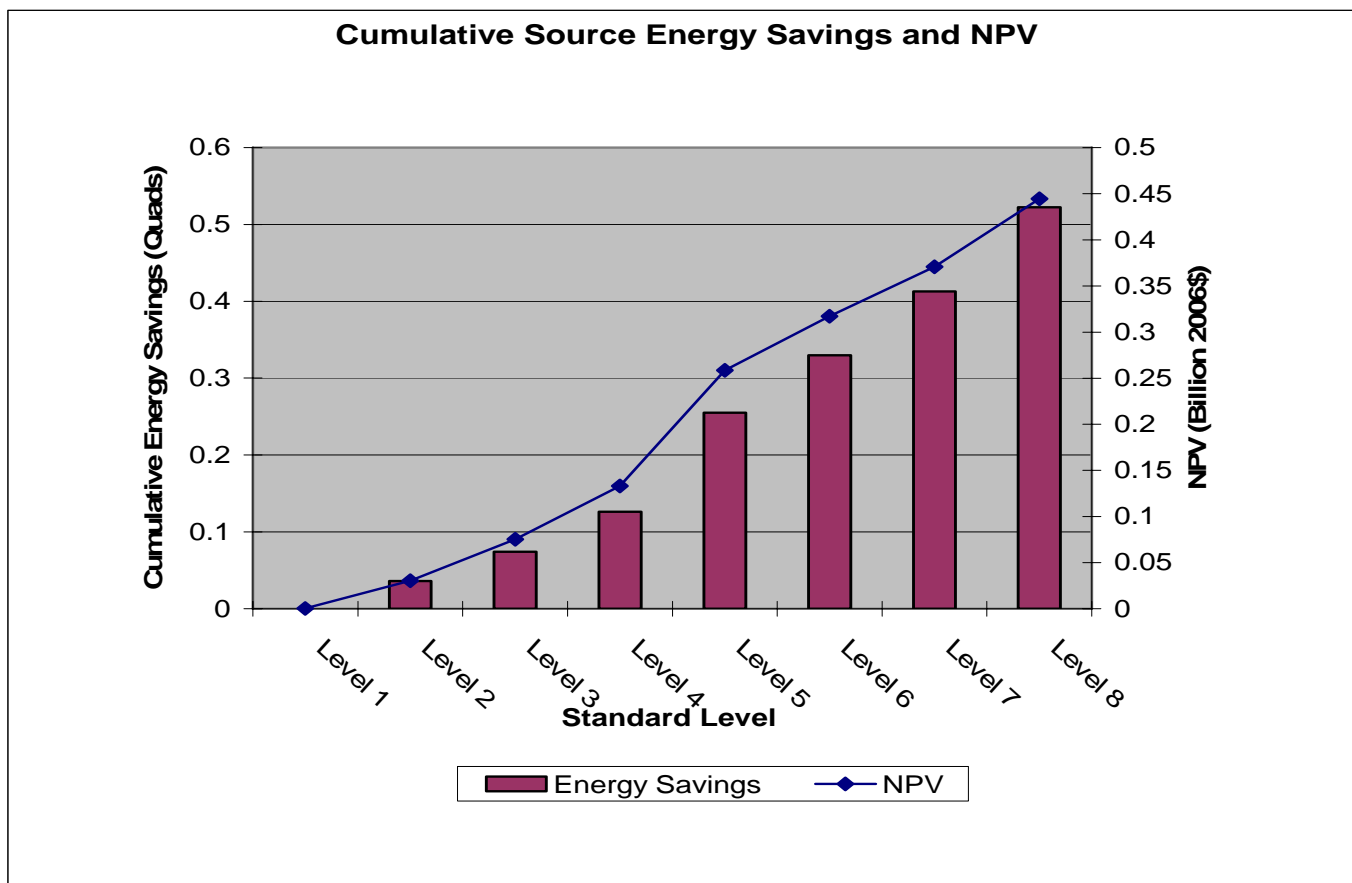
Base Case and Standards Case Forecasts (Issue #11)

- **DOE did not have historical data to indicate how equipment efficiencies have changed over time or might change in the future.**
- **Forecasted market shares for efficiencies above the candidate standard level remain frozen at the 2012 efficiency level until the end of the forecast period**

DOE invites comments on its basis for the forecasted base case and standards case efficiencies and its prediction on how standards impact efficiency distributions in the year that standards take effect.

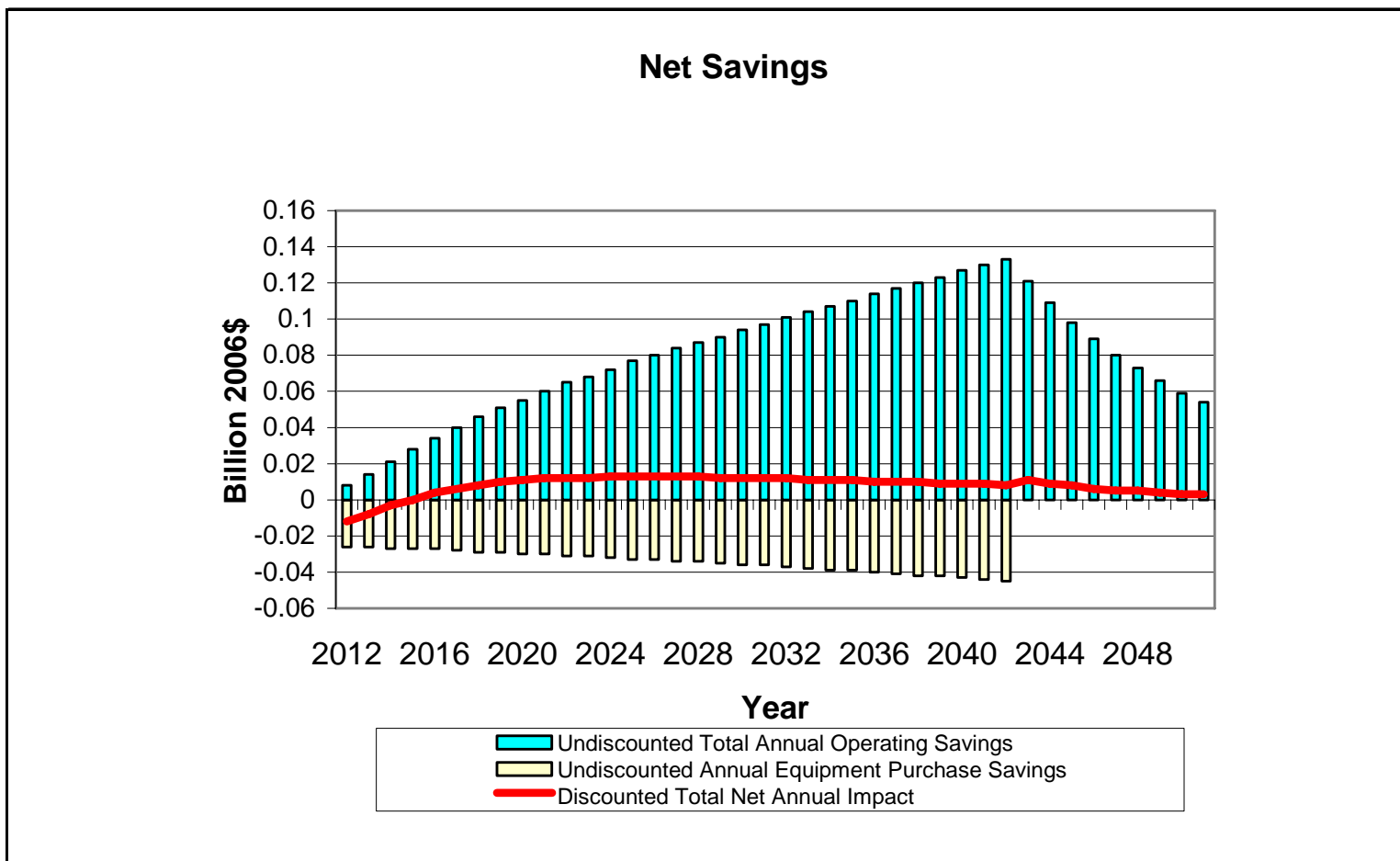


Example Cumulative Energy Savings and Net Present Value by Efficiency Level (VOP.RC.M)





Example Net Present Value Results: (VOP.RC.M, EFF Level 6, 7 percent discount rate)





ANOPR NIA Results

- **National Energy Savings (2012-2042) range from 0.12 quads at Level 2 to 1.73 quads at maximum efficiency level analyzed (15 equipment classes)**
- **Range of NPV Savings was from \$120 million to \$1.4 Billion depending on levels selected for all product classes at 7% discount rate**
\$360 Million to \$4.3 Billion at 3% discount rate
- **Approximately 86% of estimated potential NPV savings and 84% of energy savings comes from 4 product classes (VOP.RC.M, VCT.RC.L, SVO.RC.M, HZO.RC.L)**



Differential Impact of New Standards on Future Shipments by Equipment Classes (Issue #12)

- **The shipments model used by DOE presumes that the relative market shares between equipment classes remains constant over time**
- **DOE is concerned that higher standards set for specific classes of products could shift the market to use other equipment that may have greater energy consumption**
- **DOE seeks stakeholder input on how the standards-setting process can reduce or eliminate these potential market shifts**

DOE invites comments regarding whether higher standard levels in specific equipment classes are likely to cause commercial refrigeration equipment customers to shift to using other, less-efficient equipment classes for displaying merchandise.



Other Issues

DOE invites comments and recommendations from stakeholders on any other aspects related to the National Impacts Analysis.