



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

# Energy Conservation Standards for Distribution Transformers

## ANOPR Public Meeting

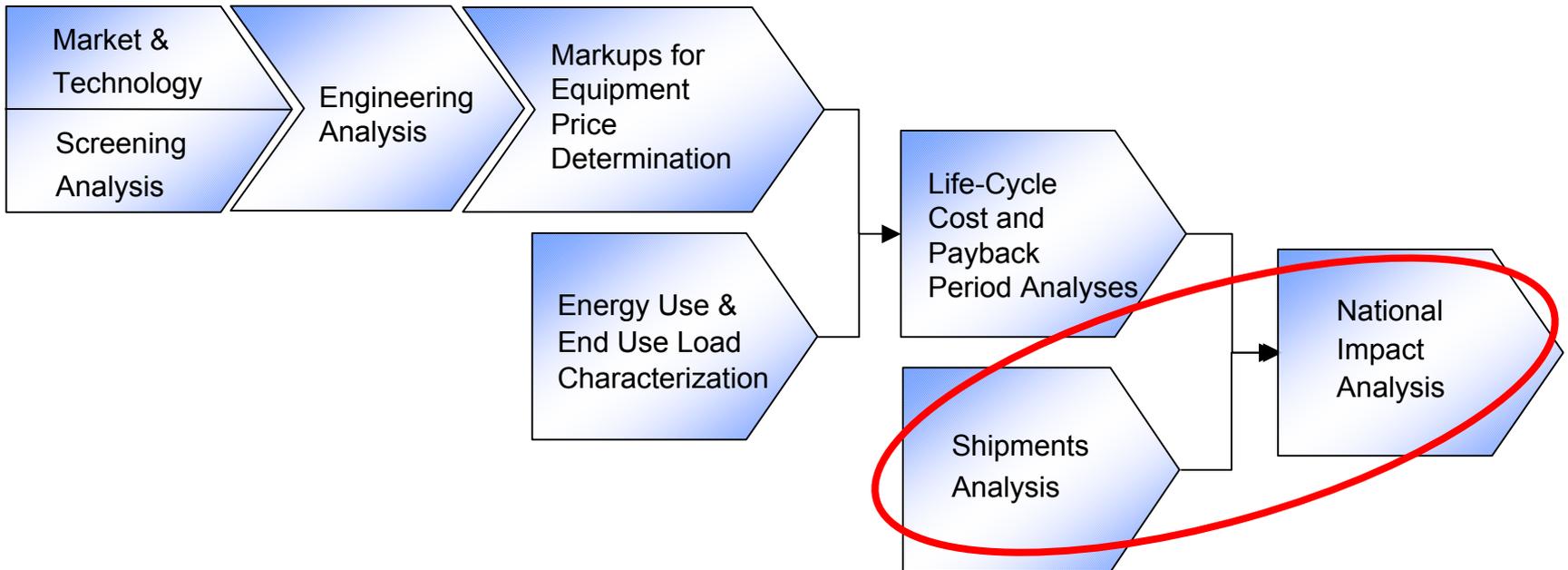
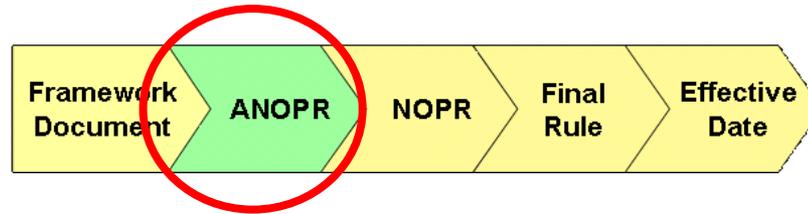
## National Impact Analysis

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

September 28, 2004



# ANOPR Analyses Flow Diagram





## Purpose

### ■ Shipments Analysis

- To estimate distribution transformer shipments over time.

### ■ National Impact Analysis

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

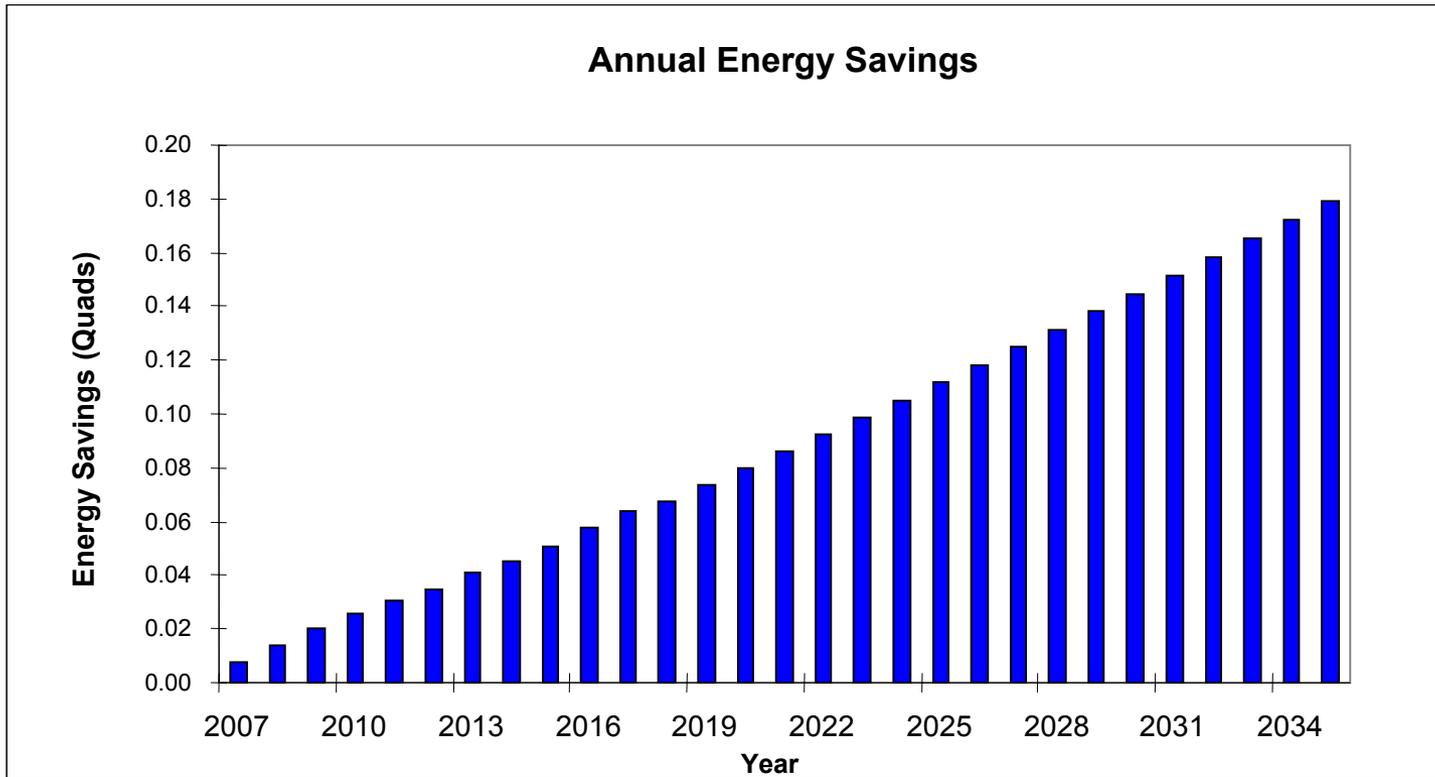


## Issues for Public Comment

- **The 0.75 Scaling Rule (ANOPR Issue #5b)**

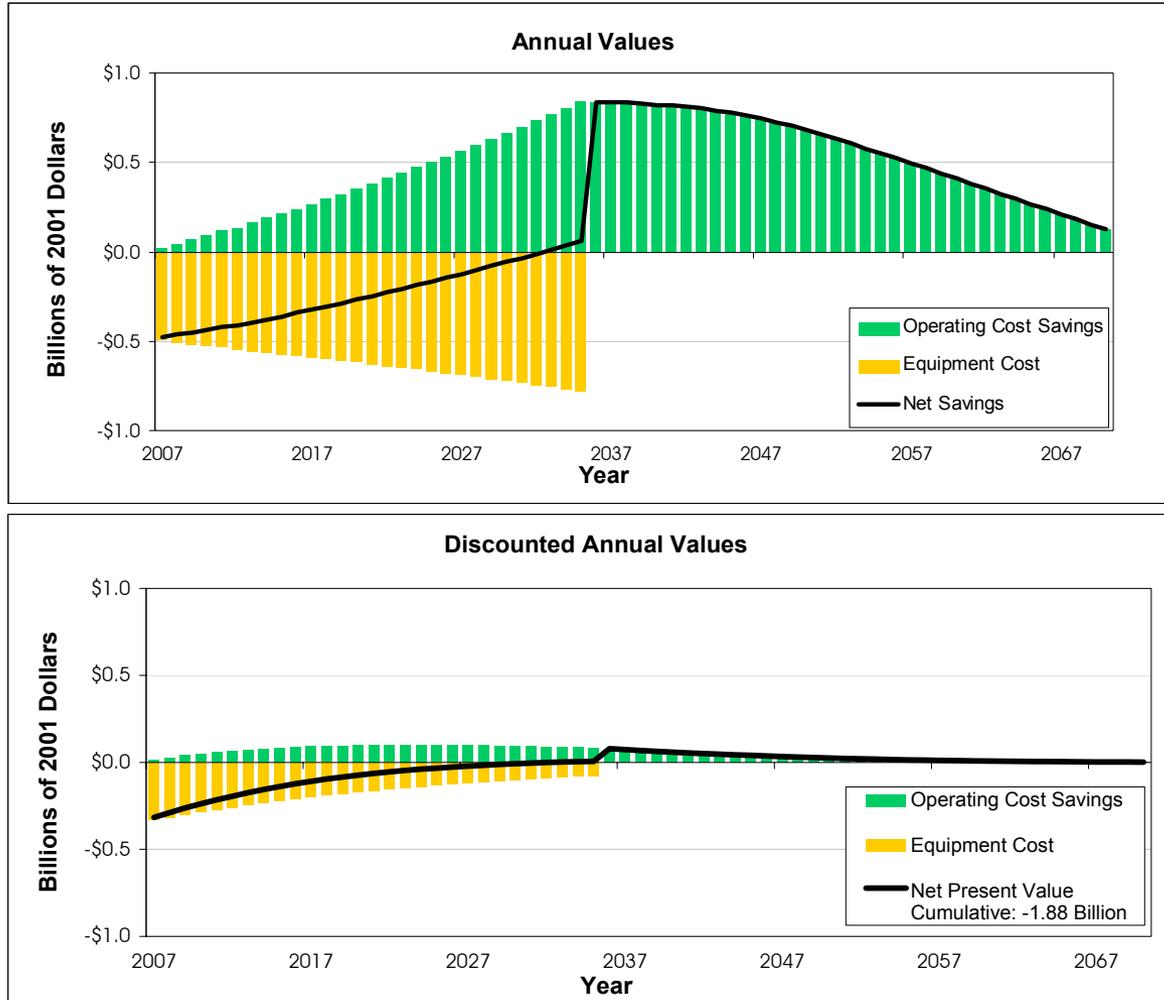


# Example of National Energy Savings Results: Product Class 1 – Liquid-immersed, Single-phase (CSL 3)



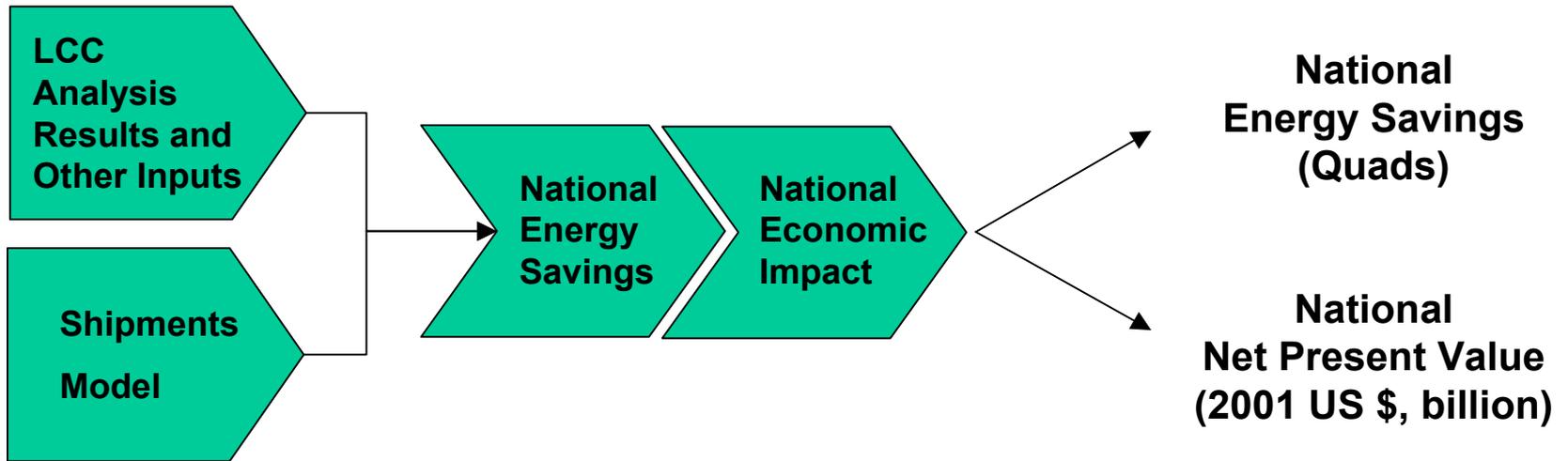


# Example of Net Present Value Results: Product Class 1 – Liquid-immersed, Single-phase (CSL 3)





## Process Flowchart





## Shipments Model

Input	Assumptions
<b>Shipments Backcast</b>	For 2001: Third party estimate. For years 1977-2000: Proportional to Bureau of Economic Analysis' (BEA) manufacturing quantity index for distribution transformers. For years 1950-1976: Proportional to Energy Information Agency's (EIA) electricity sales data.
<b>Shipments Forecast</b>	For 2001: Third party estimate. For Years 2002-2035: Proportional to Annual Energy Outlook (AEO) 2003 electricity sales data.
<b>Dry-type/Liquid-immersed Market Shares</b>	Proportional to EIA's commercial/industrial electricity sales market share.
<b>Regular Replacement Market</b>	Equipment lifetime distribution – same as in LCC analysis Mean lifetime of 32 years.
<b>Long-term Purchase Price Elasticity</b>	For liquid-immersed transformers: <ul style="list-style-type: none"><li>• Low: 0.00</li><li>• Medium: -0.04</li><li>• High: -0.20</li></ul> For dry-type transformers: <ul style="list-style-type: none"><li>• 0.00</li></ul>

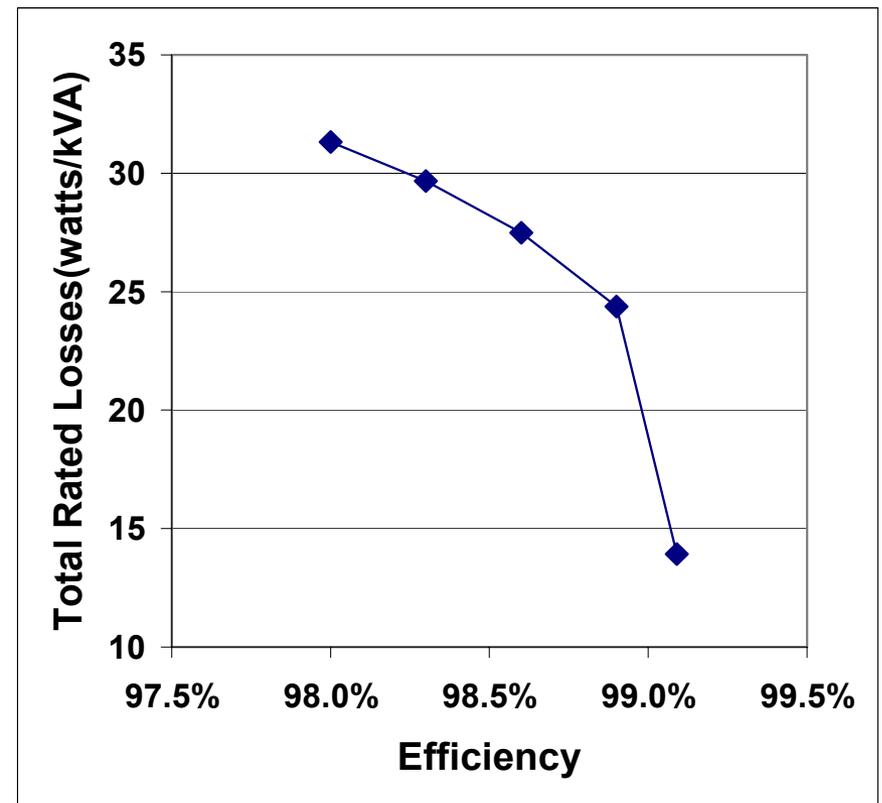
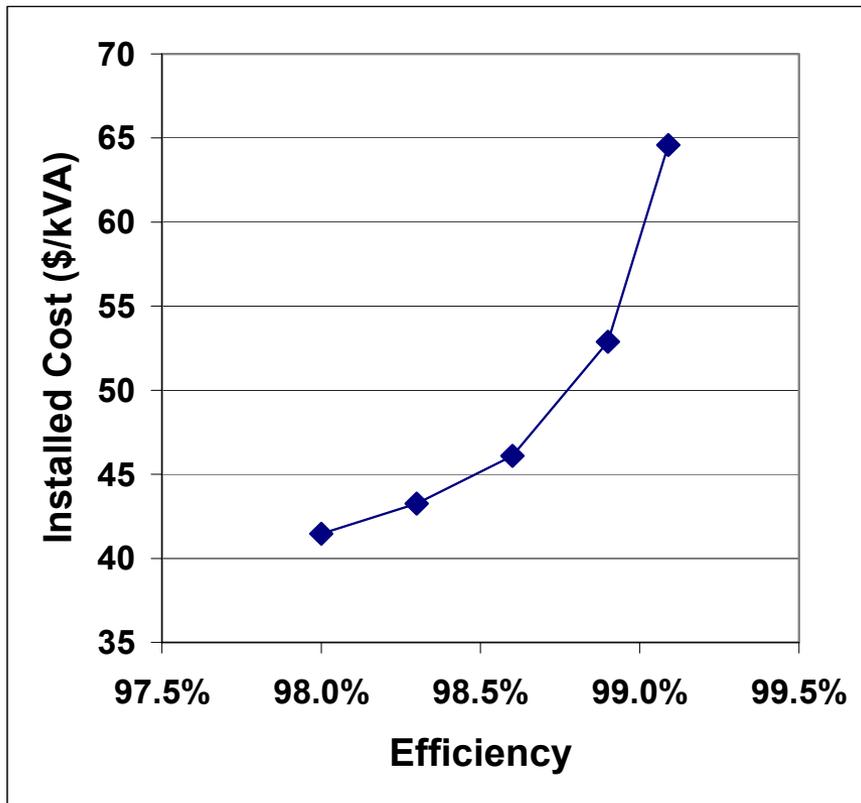


## Inputs

- **Energy Prices**
  - Marginal energy prices from LCC with trend from AEO
- **National Discount Rate**
  - 3% and 7% real from Office of Management and Budget's (OMB) Regulatory Analysis Guideline A-4
- **Installed Cost**
  - Increase in equipment price and installation cost due to standards (LCC average value)
- **Annual Electricity Consumption**
  - Average annual electricity consumption for each design line from LCC
- **Primary Energy Savings**
  - Calculated from site savings using site-to-source factors from NEMS-BT (Building Technologies version of National Energy Modeling System)
- **Transformer Loading**
  - Root mean square of the hourly transformer loading relative to the transformer capacity from LCC
- **Load Growth**
  - Fractional increase in load since a transformer was installed (estimated from LCC load growth rate)
- **Size Scaling of Losses and Costs**
  - 0.75 power scaling rule was applied to project losses and costs from one representative unit to transformers of other sizes within the same design line



## Input Examples to the National Impact Analysis: Per Unit Installed Cost and Total Rated Losses for Design Line 7





## The 0.75 Scaling Rule (ANOPR Issue #5b)

Used to translate LCC representative unit energy consumption to product class-specific energy consumption.

Used to translate LCC representative unit equipment costs to product class specific equipment costs.

**The Department seeks stakeholder comments on the application of the 0.75 power scaling rule.**



## Other National Impact Issues

**The Department seeks comments and recommendations from stakeholders on any other aspects related to the National Impact Analysis.**



## Other ANOPR Issues

**The Department seeks comments and recommendations from stakeholders on any other aspects of the Distribution Transformer ANOPR analysis.**