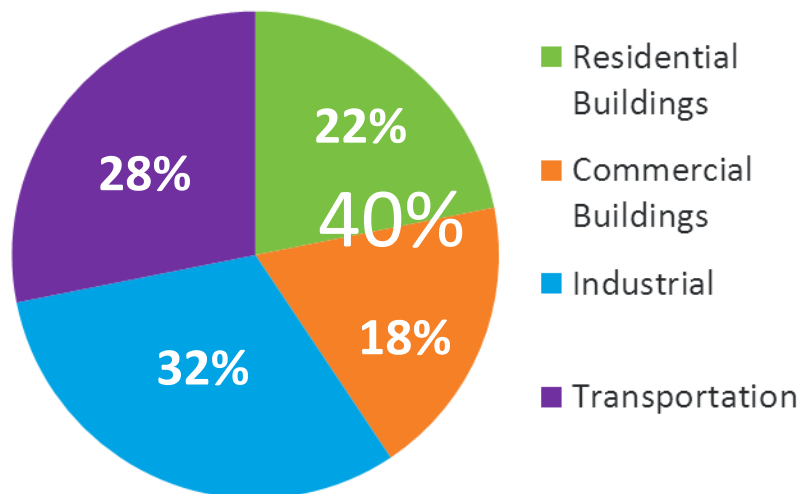




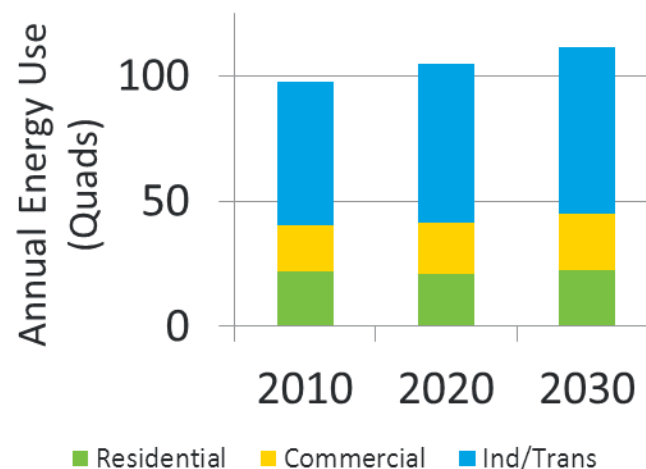
**United States Methodologies for
Assessing Non-Energy Benefits of
Efficiency Measures**

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U.S. Primary Energy Consumption



Total U.S. Energy Consumption



Examples of US Efficiency Programs where non-energy benefits are important

Assessed by a Mix of Quantitative and Qualitative Methods

- **Appliance and Equipment Standards** – regulatory impact analyses
 - Environmental – both conventional pollutants and CO2
 - Manufacturers – asset value
 - Utility -- impacts on capacity, impacts on system reliability or peak discussed
 - Employment – direct and indirect
- **Weatherization Assistance Program** for low-income – annual budget debates
 - Employment/economic stimulus benefits
 - Direct fuel payments v weatherization
 - Health??
- **High efficiency buildings programs**
 - Sometimes raise other health/performance issues
- **Vehicle Fuel Economy Standards** – regulatory impact analyses
 - Vehicle safety v. fuel economy
 - Vehicle emissions
 - Oil security/price benefits (eg, ~\$10-20 per barrel)
- **Industrial energy technology development** -- productivity

- **Energy affordability and low-income households**
 - Supporting/enabling cost-based pricing
 - Direct fuel bill assistance v. home weatherization assistance
 - Home comfort and health (but generally not quantitative)
 - Home improvements and energy-related improvements
- **Economic stimulus: Local employment opportunities and home improvement products industry (generally short term)**
 - Medium skill (short term training required)
 - Oriented to construction/home improvement industry
- **Health/safety and environmental benefits (and costs)**
 - Range of potential health benefits, and some health and safety risks
 - Quantify impacts of reduced energy-related pollution (mainly outdoor air)
 - Non-quantitative impacts on Indoor Air Quality (ensuring adequate ventilation; avoiding mold/moisture problems)
 - Quantify climate-related benefits (~\$10-70 per ton of CO₂)
- **Business and industrial productivity**
 - Energy intensive v non-energy intensive industries/businesses
 - Improved energy/building/operations management
 - Advanced manufacturing technologies

- **Prestige/market value of “Green” labeling of energy efficient buildings** (eg, USGBC LEED certificates)
 - Uncertain market value of improved efficiency
- **Utility system reliability/productivity benefits**
 - Utility benefits, when long-run marginal costs are not reflected in rates (ie, when users are subsidized) ...can be substantial
 - Demand responses to short term crises and load management.....benefits can be substantial, but not usually “efficiency”
 - Longer term impacts on peak loads and system utilization...small, depending on use loads
 - Long term impacts on system reliability, absent other constraints.....insignificant
- **Macroeconomic outcomes**
 - Accelerated declines in energy and ghg emission intensity
 - but efficiency just part of the picture
 - Economic productivity/growth: small and vary with economics of efficiency
 - Employment, direct and indirect impacts: small and vary with economics
 - Quality of life?

Summary of Proposed Transformer MEPS Impacts

- Energy Savings:
 - 1.58 quads over 30 years (2016-2045)
 - Eliminate the need for 2.4 GW of generating capacity by 2045
- Cost Savings:
 - Cumulative Net Present Value ranges from \$2.9 billion (7% discount rate) to \$12.1 billion (3% discount rate).
- Environmental Benefits:
 - CO₂ emission reduction of 122.1 Mt
 - NO_x emission reduction of 99.7 kt
 - Hg emission reduction of 0.819 ton
- Industry NPV (% change) : (7.1) to (1.0)
- Employment impacts, eg, for Liquid Immersed: 2016 (short term): -2750 to -440; 2020 (long term): -2040 to 360
- Utility impacts: sales, capacity and prices (negligible)

Summary of Annualized Benefits and Costs of Proposed Transformer Standards

	Discount Rate	Primary Estimate*	Low Net Benefits Estimate*	High Net Benefits Estimate*
		Monetized (million 2010\$/year)		
Operating Cost Savings	7%	631	594	659
	3%	1,026	950	1,075
CO ₂ Reduction at \$4.9/t	5%	58.6	58.6	58.6
CO ₂ Reduction at \$22.3/t	3%	244	244	244
CO ₂ Reduction at \$36.5/t	2.5%	389	389	389
CO ₂ Reduction at \$67.6/t	3%	742	742	742
NO _x Reduction at \$2,537/ton	7%	7.78	7.78	7.78
	3%	12.4	12.4	12.4
Total†	7% plus CO ₂ range	697 to 1380	660 to 1343	726 to 1409
	7%	883	846	911
	3% plus CO ₂ range	1097 to 1780	1021 to 1704	1146 to 1829
	3%	1,283	1,207	1,331
Costs				
Incremental Product Costs	7%	302	338	285
	3%	308	351	289
Total Net Benefits				
Total	7% plus CO ₂ range	400 to 1083	327 to 1010	445 to 1128
	7%	581	507	626
	3% plus CO ₂ range	789 to 1472	670 to 1353	857 to 1540
	3%	975	855	1,043

- **Impacts on the benefit/cost assessment of efficiency investments/programs are important**
 - Quantitative monetary effects (mainly CO₂-related): usually +10-30% to energy cost savings
 - Other, non-monetary impacts not always positive
 - Beware of overselling non-energy benefits