

US EPA ARCHIVE DOCUMENT

Rules of Thumb					
Energy Efficiency in Buildings					
Cost Premiums	Benefits				
	Energy Savings	Cost Savings	Increased Productivity	Economic Development	Other Benefits
• <i>Standard lighting retrofits</i>: \$0.90-\$1.20 per square foot. • <i>High-efficiency packaged and split system A/C equipment</i>: \$100- \$180 per ton more than standard efficiency models. • <i>Premium Efficiency Motors</i> (incremental costs vs. standard replacements): about \$16 per horse power (HP) for 1 HP-10 HP motors; \$8/HP for 11 HP to 100 HP. • <i>Variable frequency drives (VFDs)</i>: \$150-\$200, installed. • <i>Commissioning new buildings</i>: \$0.50-\$3.00 per square foot. • <i>Retro-commissioning buildings</i>: \$0.05 and \$0.40 per square foot.	• <i>Existing buildings</i>: overall consumption reductions of 20% to 30%, with reductions as high as 35%-40%, depending on aggressiveness. • <i>Retro-commissioned commercial building</i>: average savings of 1.7 kWh/ft² and average overall energy savings of 15%. • <i>Lighting retrofits</i>: save 10%-20% of total electric consumption in gas-heated buildings. • <i>High efficiency packaged and split-system cooling equipment</i>: 25% less cooling energy than standard equipment and 10%-15% less than ASHRAE standard. • <i>Building Operator training</i>: 0.35-1.2 kWh/ft² per year.	• <i>Existing buildings</i>: reducing consumption by 20% to 30% can produce savings from 6%-9% of total annual costs. • <i>Converting constant volume HVAC systems to variable air volume systems</i>: can save between \$0.10/ft² to \$0.20/ft² or 10%-21% of HVAC energy costs. • <i>Installing premium efficiency motors and VFDs</i>: Potential energy cost savings are 50-85%. • <i>Peak energy-reducing measures</i>: produce proportionally greater cost savings than those that have mostly off-peak savings. • <i>Commissioning new buildings</i>: average savings of \$0.05/ft². • <i>Retro-commissioning existing buildings</i>: save around \$0.27/ft², resulting in 15% energy savings and a payback period of 0.7 years.	• <i>Existing buildings</i>: improved comfort and better air quality can increase productivity. • <i>Retrofitted buildings</i>: Increased savings from enhanced productivity can equal up to 10 times the energy cost savings. • <i>Existing buildings</i>: 1% productivity improvements can offset entire annual utility costs.	• <i>Existing buildings</i>: For every \$1 spent in local economy, energy efficiency generates 57¢-84¢ more economic activity than does payment of energy bills.	• <i>Existing Buildings</i>: energy efficiency investments can increase asset value by \$2.00-\$3.00 for each \$1.00 spent. • <i>Existing buildings</i>: a lighting power reduction of 40% increases an ENERGY STAR rating by 10 points. • <i>Retro-commissioned buildings</i>: annual non-energy savings, such as extended equipment life and improved air quality, are approximately \$0.26/ft².

Rules of Thumb					
Green Buildings					
Cost Premiums	Benefits				
	Energy Savings	Cost Savings	Increased Productivity	Average Period Payback (years)	Other Benefits
- Green buildings: cost premiums average \$3/ft²-\$5/ft², or less than 2% of initial costs. - New high-performance green buildings: cost premium range from 2%-7%, depending on the specific design features integrated. - LEED green buildings: additional cost of certified projects: 0%-2.5%, Silver 0%-3.5%, Gold 0.5%-5%, Platinum 4.5%+.	- New green buildings: mean savings is 27%; mean value for actual consumption is 1% lower than modeled. - New green buildings: 50% reduced consumption compared to conventional new buildings.	- New green buildings: energy cost savings compared to conventional design as high as \$0.47/ft². - Commissioning new buildings: average savings of \$0.05/ft².	- Installing high-performance lighting: productivity improvements of 0.7%-26% with a median of 3.2%. - Incorporating daylighting: productivity improvements of 0.45%-40%, mean of 5.5%. - Increasing natural ventilation: productivity improvements of 3%-18%, mean of 8.5%.	High-performance buildings: simple payback period can be as short as 2.0 years for offices, 2.1 years for libraries, and 2.6 years for schools.	- GHG emissions reductions: as high as 36%. - Reduced indoor and outdoor water consumption: 30% and 50%, respectively. - Reduced waste consumption: 50%-75%. - Value of non-energy benefits: 25%-50% of the value of annual electricity cost savings.

Energy-Efficient Product Procurement – All Products				
Cost Premiums	Benefits			
	Energy Savings	Energy Cost Savings	Average Payback Period (years)	Emission Reductions
Energy-efficient as opposed to conventional products: cost premium varies with each product, but most often the difference is slight.	Energy-efficient product procurement: savings of 3%-12% of total building energy consumption.	Energy-efficient product procurement: energy cost savings of 4%-17% relative to total commercial energy costs.		1 MWh of electricity saved: through energy-efficient product procurement equals emissions reductions of: 1,364 pounds of CO₂ 5.6 pounds of SO₂ 2.2 pounds NO_x

Rules of Thumb			
Energy-Efficient Product Procurement – By Type of Product			
Product Category	Effective Date of Current Specification	Percent Savings Compared to Conventional Product	Cost-effectiveness (payback period)
Appliances			
Dehumidifiers	October 2006	15%	0 years (typically no retail cost premium)
Dishwashers	January 2007	40%	0 years (typically no retail cost premium)
Refrigerators and freezers	April 2008	15%	4 years (refrigerators) 6 years (freezers)
Room air conditioners	November 2005	10%	Not available
Room air cleaners	July 2004	45%	0 years (typically no retail cost premium)
Electronics			
Battery charging systems	January 2006	35%	0 years (typically no retail cost premium)
DVD products	January 2003	60%	0 years (typically no retail cost premium)
External power adapters	January 2005	35%	0 years (typically no retail cost premium)
Televisions	November 2008	25%	0 years (typically no retail cost premium)
Envelope			
Roof products	December 2007	Not available	< 4 years
Lighting			
Compact fluorescent lamps	January 2004	75%	< 1 year
Office Equipment			
Computers	July 2007	25% - 50%	0 years (typically no retail cost premium)
Copiers	April 2007	65%	0 years (typically no retail cost premium)
Monitors	July 2007	25%	0 years (typically no retail cost premium)
Multifunction Devices	April 2007	20%	0 years (typically no retail cost premium)
Printers, fax machines, and mailing machines	April 2007	15%	0 years (typically no retail cost premium)
Scanners	April 2007	50%	0 years (typically no retail cost premium)

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Energy-Efficient Product Procurement – By Type of Product			
Product Category	Effective Date of Current Specification	Percent Savings Compared to Conventional Product	Cost-effectiveness (payback period)
Heating and Cooling			
Air source heat pumps	April 2006	5%	< 5 years
Boilers	April 2002	5%	< 1 year
Ceiling fans	September 2006	45%	0 years (typically no retail cost premium)
Furnaces	October 2006	15%	< 3 years
Geothermal heat pumps	April 2001	30%	< 5 years for new construction
Light commercial HVAC	January 2004	5%	< 1 year
Ventilating fans	October 2003	70%	0 years (typically no retail cost premium)
Commercial Food Service			
Commercial dishwashers	October 2007	30%	2 years
Commercial fryers	August 2003	15%	2 years (for typical unit)
Commercial ice makers	January 2008	25% - 30%	4 years (for typical unit)
Commercial solid door refrigerators and freezers	September 2001	35%	1 year
Other			
Water coolers	May 2004	45 %	0 years (typically no retail cost premium)
Vending machines	April 2004 August 2006 (rebuilt machines)	40 %	< 1 year

Rules of Thumb			
Green Power Purchases			
Cost Premiums	Benefits		
	Energy Savings	Energy Cost Savings	Emission Reductions
• <i>Green power</i>: about 2¢/kWh. Premiums vary by utility but range from 0.2¢/kWh-17.6¢/kWh • <i>Renewable energy certificates (RECs)</i>: 1¢/kWh (in ME) - about 5¢/kWh (in MA). Solar REC prices in NJ are the highest at 25¢/kWh • <i>RECs offered by a certificate marketer</i>: 0.5¢/kWh - 7.5¢/kWh, with an average of 2.3¢/kWh. RECs are also available at \$5.50/ton CO₂ to \$12/ton CO₂, with an average of \$9.80/ton CO₂.	• N/A	• <i>Utility green power programs</i>: For some utility green power programs, the premium can be negative, thus reducing energy bills. These premiums have been as low as -0.13¢/kWh	• <i>Purchasing 1 MWh of green power is equivalent to:</i>^d – 0.14 passenger cars not driven for one year; – 0.52 acres of pine or fir forests storing carbon for one year; – 16 tree seedlings grown for 10 years; – 0.21 tons of waste recycled instead of landfilled; and – 71 gallons of gasoline.

Rules of Thumb			
Clean Energy Supply			
Total Costs	Benefits		
	Energy Savings or Energy Generated	Cost Savings	Emission Reductions
• <i>Small-scale CHP plant:</i> installed cost of \$1.60/W for systems less than 500 kW, and about \$1/W for systems between 0.5 MW and 5 MW. Installed costs for on-site CHP systems average around \$2.90/W in California. • <i>Solar photovoltaics:</i> average shipment price in 2004 was \$3.00/W; the average price in 2005 was \$3.20/W.^c Total costs, including the inverter, installation, and balance of system range from \$6-\$9 per peak Watt. Installed costs for PV modules average around \$8.70/W in California and \$7.90/W in New Jersey. • <i>Small wind turbine:</i> including installation, ranges from \$14,700-\$20,800 for a low-range model; \$28,100-\$59,600 for a mid-range model; and \$105,000 and \$115,000, respectively, for two elite models. Installed costs for on-site wind generation average around \$3.60/W in California.	• <i>CHP systems:</i> energy savings as high as 40%. • <i>10 kW solar PV system:</i> generates 9,700 kWh/year to 16,800 kWh/year, depending on the location of the system. • <i>Wind turbine with 84-foot tower and 7-foot diameter (rated at 900 W):</i> generates 96 kWh/month at an average wind speed of 10 mph and 155 kWh/month at 12 mph. • <i>Wind turbine with 140-foot tower and 50-foot diameter (rated at 65 kW):</i> generates 3,674 kWh/month at 10 mph and 5,992 kWh/month at 12 mph.	• <i>CHP systems:</i> as high as 40% of the cost of operating separate heat and power systems. • <i>10 kW solar PV system:</i> from about \$600-\$1,400 per year, depending on the geographic location of the system. • <i>900W wind turbine:</i> cost savings range from \$9/mo. - \$14/mo per installed turbine. • <i>65 kW wind turbine:</i> range from \$330/mo - \$540/mo. Per installed turbine.	• <i>CHP systems:</i> equivalent to about 2.6 lbs NO_x/MWh, 5.8 lbs SO_x/MWh, and 1,200 lbs CO₂/MWh. • <i>10 kW solar PV system:</i> from 12,000 lbs-20,000 lbs of CO₂, 10 lbs-90 lbs of SO_x, and 4 lbs- 90 lbs of NO_x per year. • <i>Single 10-meter wind turbine with 750 kW capacity with wind speeds ranging between 12.5 and 13.4 mph:</i> 2.36 million lbs of CO₂, 13,800 lbs of SO_x, and 8,600 lbs of NO_x in one year.