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STATE AND COMMUNITY PROGRAMS

DOE/EERE Emerging Technologies Program Overview

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Program Technology Scope

- New and emerging technologies to ***improve energy efficiency in buildings***
  - ***not yet commercialized,*** but could be commercialized within three years with DOE assistance
  - ***or are commercialized,*** yet still in need of further refinement, performance verification, and support

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Program Approach Scope

All approaches whose purpose is to speed the commercial introduction and early market acceptance, including:

- Field performance evaluation and verification
- Technology demonstrations
- Technology procurements
- Technical information and education projects

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Technology Procurement

- Organize target large volume buyers and market influencers (such as utilities)
- Acquire their intentions to purchase new products meeting technical specifications developed in collaboration with buyers and manufacturers
- Issue an RFP to potential suppliers, requesting bids for new products meeting those specifications
- Select one or more winners, followed by promotions to maximize the purchase of the newly available products

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Technology Procurement (cont.)

By working closely with potential buyers, technology procurement greatly increases the likelihood that products brought to market will be well-received by buyers. And by organizing large volume buyers for new products, technology procurement reduces the risks to manufacturers of new product introduction, and allows them to introduce products at more competitive prices.

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Technology/Project Selection

No single process; selected through combination of :

- Opportunities identified in strategic planning
- Projects proposed by manufacturers
- Opportunities identified through special studies and reviews
- Technology improvements requested by major buyers in key market sectors

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Examples of Past Projects

- Sub-CFL Technology Procurement
- High-Efficiency Washer Field Evaluation
- Super-Efficient Apartment Size Refrigerator
- Commercial Laundry Waste Water Recycling and Heat Recovery System Project
- GFX Field Evaluation

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Sub-CFL Technology Procurement

- Intended to speed commercial introduction of smaller, less expensive compact fluorescent lamps (sub-CFLs)
- Led to development and market introduction of 16 new sub-CFLs

- Exceeded goal of 15 W lamp smaller than 5 inches
- Exceeded goal of one million sales (3.2 million at project close [May 2001])

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High Efficiency Washers Performance Verification

- Field performance verification of high efficiency Maytag clothes washers in Bern, Kansas
- Verified large energy and water savings.
- Received extensive major national media coverage, and laid groundwork for rapid growth in sales of high efficiency washers

Super-Efficient Apartment Size Refrigerators

- Project with NYPA and CEE led to development of new-to-market refrigerator
- Unit 30% better than DOE standards at no incremental cost

- Sales exceeding 100,000 units to housing authorities and other multi-family housing
- Also caused early retirement of over 60,000 inefficient refrigerators

Current Projects

Commercial Unitary Air Conditioner Technology Procurement

Recessed Downlights Technology Procurement

Current Projects (cont.)

Development and Testing of Residential HPWH

Development and Testing of Controller for Hotels

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Current Projects (cont.)

Portable Lamps Design Competition & Technology Procurement

CFL Reflector Lamp Technology Procurement

Demand Hot Water System Field Evaluation

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Focus on Commercial Unitary Air-Conditioners (UACs) Project

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The Market for Commercial UACs

- Packaged cooling systems serve about 15 Billion ft^2
- 2 million out of 4.6 million air-conditioned buildings in the U.S.
- Sales in the 65-135 kBtu/hr capacity range totaled approx. 200,000 units in 2000

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Commercial UAC Opportunity

- Annual energy use: approx. 700 trillion Btu (70 Terawatt-hours)*
- Manufacturers indicate that EER 13 to 14 is possible if significant numbers of buyers are serious about minimum life-cycle cost

* DOE Energy Policy Act Screening Analysis: 65-240 kBtu/h

The High Cost of Low Efficiency

- About 14% of available equipment models are considered high efficiency (EER >11.0)
- Most buyers opt for lower efficiency models with lower first cost
- Owners or occupants pay the higher operating costs, which exceed the incremental cost of more efficient equipment over time

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High Efficiency Packaged HVAC Incremental Cost

	Energy Efficiency Ratio (EER) SEER <5 ton			Incremental Cost $/ton*	
Unit Size	Base Unit	Tier 1	Tier 2	Tier 1	Tier 2
<5 ton	10.0	12.0	13.0	$60	$92
5 to 10 ton	8.9	10.3	11.0	$41	$73
10 to 20 ton	8.5	9.7	10.8	$46	$79
>20 ton	8.5	9.7	10.8	$53	$79

*Source: Adapted from Northeast Utilities “Cool Choice” Program

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Technology Options for Improving Commercial UACs

- Increased effective heat transfer surface area
- Increased effective heat transfer coefficient
- Improved compressor efficiency
- Improved fan efficiency
- Improved capacity control
- Electronic expansion device
- Liquid overfeed technology

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Buyers

Interest in purchasing or promoting higher-efficiency equipment expressed by:

- National accounts (Wal*Mart, 7-Eleven, McDonalds)
- Armed services (Defense Logistics Agency)
- ESCO's (Siemens, Enron Energy Services)
- Energy efficiency/market transformation programs (NY State Energy R&D Authority, Consortium for Energy Efficiency)

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Request for Proposals

- Drafted RFP in consultation with Defense Logistics Agency and other buyers
  - Detailed minimum specifications
  - Life-cycle cost formula and simulator
- Issued, January 2002
- Proposals received March 29, 2002
- Currently negotiating ordering agreements with winners

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Evaluation Criteria

- Equipment must meet Consortium for Energy Efficiency (CEE) Tier II levels:
  - Min. EER 11.0
  - Min. IPLV 11.4
- Winners selected based upon minimum life cycle cost

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HTTP://WWW.PNL.GOV/UAC

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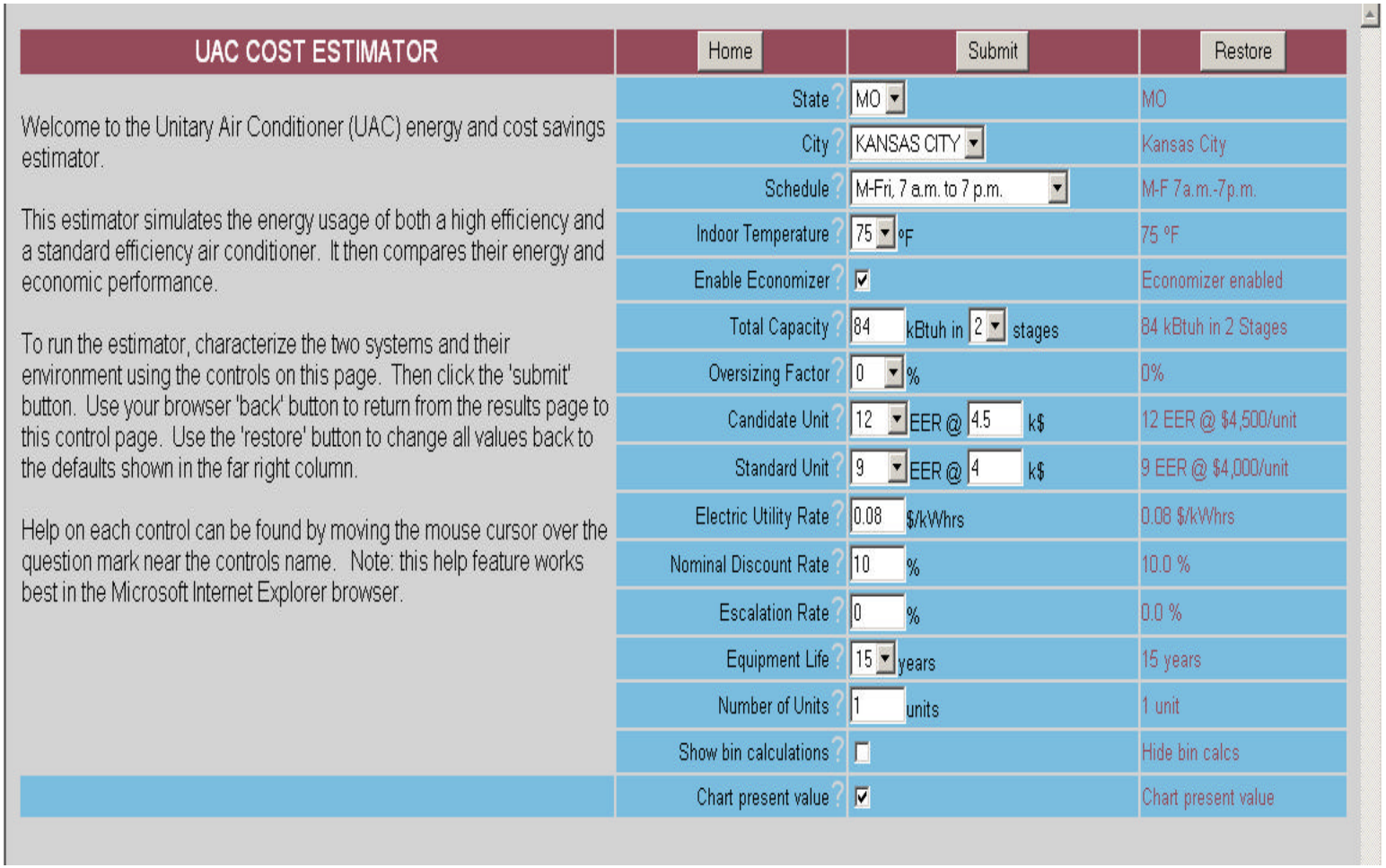
UAC Cost Estimator: Basics

- Web-based at http://www.pnl.gov/uac
- For 1-stage or 2-stage equipment
- Based on specific climate conditions for 237 US cities
- Takes part-load efficiency into account
- Relatively simple, non-technical inputs
- Estimates LCC, simple payback, rate of return, savings-to-investment ratio

Data Input Form



UAC COST ESTIMATOR

Welcome to the Unitary Air Conditioner (UAC) energy and cost savings estimator.

This estimator simulates the energy usage of both a high efficiency and a standard efficiency air conditioner. It then compares their energy and economic performance.

To run the estimator, characterize the two systems and their environment using the controls on this page. Then click the 'submit' button. Use your browser 'back' button to return from the results page to this control page. Use the 'restore' button to change all values back to the defaults shown in the far right column.

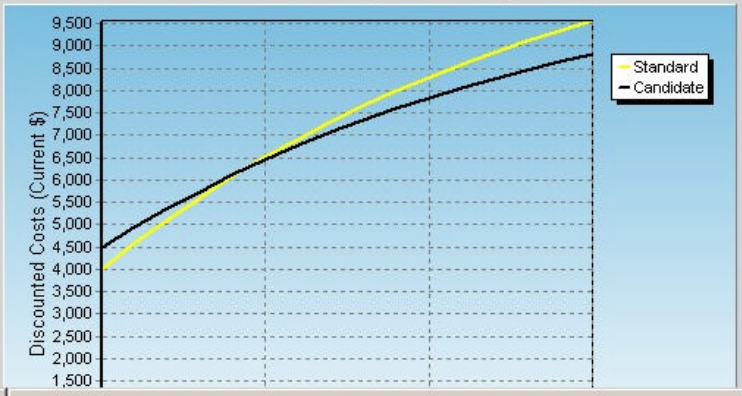
Help on each control can be found by moving the mouse cursor over the question mark near the controls name. Note: this help feature works best in the Microsoft Internet Explorer browser.

Home	Submit	Restore
State	MO	MO
City	KANSAS CITY	Kansas City
Schedule	M-Fri, 7 a.m. to 7 p.m.	M-F 7a.m.-7p.m.
Indoor Temperature	75 °F	75 °F
Enable Economizer	☑	Economizer enabled
Total Capacity	84 kBtuh in 2 stages	84 kBtuh in 2 Stages
Oversizing Factor	0 %	0%
Candidate Unit	12 EER @ 4.5 k$	12 EER @ $4,500/unit
Standard Unit	9 EER @ 4 k$	9 EER @ $4,000/unit
Electric Utility Rate	0.08 $/kWhrs	0.08 $/kWhrs
Nominal Discount Rate	10 %	10.0 %
Escalation Rate	0 %	0.0 %
Equipment Life	15 years	15 years
Number of Units	1 units	1 unit
Show bin calculations	☐	Hide bin calcs
Chart present value	☑	Chart present value

BIN CALCULATIONS

ODB	OWB	OH	OHR	IHR	IWB	IRH	IH	Hours	NV-Gain	V-Gain	T-Gain	E-Cap	Load	CapCF	LF1	C-Eff1	RT1	LF2	C-Eff2	RT2	PowCF	E_COff	E_COn
60.0	51.2	21.2	0.0063	0.0063	57.2	32.9	24.9	197	12.7	-4.6	8.1	-41.3	0.0	1.025	0.000	0.000	0.000	0.000	0.000	0.000	0.676	175	0
65.0	56.4	24.4	0.0081	0.0081	60.1	42.2	26.8	223	23.1	-3.1	20.1	-27.6	0.0	1.043	0.000	0.000	0.000	0.000	0.000	0.000	0.745	198	0
70.0	61.4	27.8	0.0101	0.0101	63.1	52.5	29.0	248	33.6	-1.5	32.1	-13.9	18.2	1.065	0.407	0.852	0.478	0.000	0.000	0.000	0.812	168	337
75.0	64.2	29.9	0.0108	0.0108	64.2	56.4	29.9	241	44.1	0.0	44.1	0.0	44.1	1.057	0.994	0.998	0.996	0.000	0.000	0.000	0.854	108	717
80.0	67.8	32.7	0.0123	0.0123	66.3	64.0	31.5	323	54.6	1.5	56.1	0.0	56.1	1.064	1.000	1.000	1.000	0.256	0.814	0.314	0.906	99	1,346
85.0	72.8	37.1	0.0152	0.0152	70.0	78.5	34.6	240	65.1	3.1	68.2	0.0	68.2	1.102	1.000	1.000	1.000	0.473	0.868	0.544	0.974	49	1,263
90.0	75.8	40.0	0.0167	0.0167	71.8	86.0	36.3	170	75.6	4.7	80.2	0.0	80.2	1.108	1.000	1.000	1.000	0.724	0.931	0.778	1.019	17	1,078
95.0	77.3	41.5	0.0169	0.0169	72.1	87.2	36.5	52	86.0	6.2	92.3	0.0	92.3	1.086	1.000	1.000	1.000	1.023	1.000	1.023	1.049	0	386
100.0	76.8	40.9	0.0153	0.0153	70.1	78.9	34.7	4	96.5	7.8	104.3	0.0	104.3	1.026	1.000	1.000	1.000	1.421	1.000	1.421	1.059	0	36

RESULTS	Candidate	Standard	Savings
Annual Energy Consumption (kWhrs)	5,977	7,698	1,721
Annual Operating Cost ($)	478	616	138
15 Year Life Cycle Cost ($)	8,825	9,571	746
Annualized Cost ($)	976	1,058	82
Net Present Value ($)	746		
Simple Payback (yrs)	3.6		
Rate of Return (%)	27.5		
Savings to Investment Ratio (SIR)	2.49		



DEFINITIONS

ELV : Elevation at specified location
P : Standard pressure corrected for elevation
S&I : Solar and Internal gains
ODB : Outside dry bulb (F)
OWB : Outside mean coincident web bulb (F)
OH : Outside enthalpy (Btu/lb dry air)
OHR : Outside humidity ratio
IHR : Inside humidity ratio
IWB : Inside wetbulb (F)
IRH : Inside relative humidity (%)
IH : Inside enthalpy (Btu/lb dry air)
HOURS : Number of hours that this outside condition occurs during the sp
NV-GAIN : All loads excluding ventilation (kBtuh)
V-GAIN : Ventilation load
T-GAIN : Total load
E-CAP : Economizer capacity. This is based on the fan capacity (reduced
LOAD : The remaining net load after economizer is considered.
CAP_CF : DOE-2 capacity correction factor to account for operating condi
LF1 : Load fraction for stage 1 (Load / Available capacity)
C-EFF1 : Partload efficiency degredation factor for stage 1
RT1 : Runtime for stage 1 = LF1 / C-EFF1
LF2 : Load fraction for stage 2 (Load / Available capacity)
C-EFF2 : Partload efficiency degredation factor for stage 2
RT2 : Runtime for stage 2 = LF2 / C-EFF2
PowCF : DOE-2 system power correction factor to account for operating c
E_COff : System energy consumption when compressor is off, i.e. inside u
E_COn : System energy consumption when compressor is on (kWhrs)

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UAC Plans for the Future

- Sign agreements with winners in June 2002
- Expect to begin sales at most six months later
- Defense Logistics Agency to list winners, promote them through maintenance repair and operations program, and offer leasing
- Consortium for Energy Efficiency to consider new efficiency level for utility incentives based on procurement
- Possible Phase II RFP for more advanced equipment

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Contacts for More Information:

http://www.eren.doe.gov/buildings/emergingtech/

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