

July 7, 2006

United States EPA – Energy Star for Roof Products
ICF Consulting
Attn: Mr. Steven Ryan, Mr. Charles Anderson

Re: Energy Star Program – Draft 2

Dear Steve and Charles:

Thank you for allowing us an extension of time to comment on the very important revision to the EPA's Energy Star for Roof Products Program.

It is our belief that criteria for Energy Star for Roof Products Performance should be consistent with All other Energy Star Program labeling. Products should be rated based on their ability to save energy depending on all factors that affect energy performance.

Regarding the Proposed Adoption of a Fixed 0.75 Minimum Emissivity requirement for All Roof Products:

When reviewing the page named "Energy Star Product Specifications In Development" on the EPA's Energy Star Web-site, the page states "Energy Star identifies products where large gains in energy efficiency and potential pollution reduction can be realized cost effectively". This same page further lists the criteria used when determining whether to develop or revise ENERGY STAR product specifications". The criteria listed on this page are shown below with my comments in bold and in brackets.

- Significant energy savings on a National basis. **<0.75 minimum emissivity does not lead to greater energy savings for the whole nation. On the contrary it leads to greater energy consumption in most heat dominated climates, as well as greater energy consumption for some "Cooling dominated areas" depending on the type of fuel used in the building.>**
- Product performance can be maintained or enhanced with increased energy efficiency. **<Aluminum coatings have a long history of proven performance in cold climates. Furthermore they retain a greater percentage of their original reflectivity than white coatings, without the need for cleaning.>**
- Purchasers will recover their investment in increased energy efficiency. **<Recovery of investment is a function of at least the following 5 factors: Product cost, Installation Cost, Energy Savings, Longevity of roof surfacing option, Longevity of reflectivity. Logic dictates that the less costly a product is, and the less costly to install, the quicker the investment recovery assuming that the other factors have been taken into account. Eliminating products that cost less and can be installed for less hurts the consumer and goes against this mandate. Furthermore application of coatings that require frequent cleaning to perform reduce or eliminate the payback altogether while risking the elimination of the intended energy savings>**
- Energy efficiency can be achieved with several technology options, at least one of which is non-proprietary. **<Limiting Energy Star qualifying products to an emissivity of 0.75 flies in the face of this mandate by eliminating several proven technologies that**

can lead to greater energy savings and cost reduction to the building owner and consumer.>

- Product energy consumption and performance can be measured and verified with testing. **<There is ample data and information available to substantiate that variations in emissivity can benefit or hinder a building's energy efficiency. In the absence of this data it might make sense to adopt a single emissivity factor, however, knowing that the information is available, it makes no sense.>**
- Labeling would effectively differentiate products and be visible for purchasers. **<This mandate can be easily followed by labeling a product based on it's emissivity attributes and allowing the building owner, specifier or roof consultant to calculate what option given all the other related factors, that can lead to the greatest energy savings. Consumers can then plug in the different numbers given their specific circumstances and save the greatest amount of money and energy>**

EPA's cover letter regarding Draft 2, dated April 28, 2006 to Energy Star Roof Partners or Other Industry Stakeholder. Mentions that "EPA is continuing to require a minimum thermal emittance requirement of 0.75 emissivity because of the significant energy savings that could result from high emittance, especially in warmer climates". I would like to request that the study showing this "Significant Savings" be shared with the industry so that we may evaluate and comment on the data. In the absence of this data, using simple tools such as the Government's Energy Calculator (<http://ornl.gov/asci/roofs+walls/facts/coolcalcenergy.htm> and <http://ornl.gov/sci/roofs+walls/facts/coolcalcpeak.htm>) seems to contradict this statement, in fact it actually shows that the opposite is true depending on a variety of factors such as the type of fuel that is used or the climate that the building is located in. Higher emissivity can result in significantly higher energy consumption and costs.

The same letter also states that this emissivity factor inclusion is being adopted "in the interest of remaining consistent with other cool roofing programs". I find it perplexing that the U.S. agency charged with rating the energy savings attributes of products feels that it must follow other "cool roofing programs" rather than lead by providing clear measurable and substantiable attributes that can be used along with the other variables that affect a buildings energy performance. If a minimum value of 0.75 emissivity does **not** lead to higher energy savings in all 50 states, why mandate it? I do agree with EPA that emissivity should be rated and used as an Energy savings tool, I disagree however, with the premise that it should be a "fixed" number, regardless of what that number might be.

Verifying, rating and listing emissivity values of different products, rather than mandating a single value, will allow building owners to select the highest energy saving roofing product based on it's Energy Star Rated characteristics given the specific conditions germane to their building. This is what the Energy Program is supposed to help consumers do. Select the highest energy savings possible while providing a reasonable payback or savings.

On the box at the top of Draft 2, Page 6, EPA states "EPA continues to believe that especially for heat dominated climates, higher emittance values provide an opportunity for significant savings." Their conclusion is incorrect, because retention of "heat" in a heat-dominated climate is desirable rather than undesirable. Assuming that the EPA meant to say for "Cooling dominated climates", this conclusion is also incorrect. Higher emissivity does not always lead to greater energy

savings as can be evidenced by using the governments energy calculator where you can see that even for buildings located in Los Angeles, CA that utilize electricity as a fuel can save 3 times the amount of energy when using an aluminum coating for buildings that have no “Peak Energy Use Charges”, and they can save virtually the same amount of energy using aluminum or white coatings in buildings where there is a Peak Energy Use Charge. (See Enclosed 8 State Comparison Chart along with Attached Excel Sheet. This comparison used the Government’s ORNL Energy Savings Calculator).

For the record, Karnak produces both Aluminum Coatings and White Acrylic Coatings. While we have an interest in selling more acrylic white coatings like every other manufacturer, we see no sense in eliminating an option that is cheaper, offers greater savings to consumers, and is more effective in achieving the goals of the Energy Star program. We think that both Acrylics and Aluminum Coatings can offer outstanding energy savings opportunities that must be taken advantage of. Allowing the product attributes and the buildings attributes to dictate the best-suited product for the particular building, is the best and most energy efficient solution. Other factors to be considered are Fire Ratings. Aluminum Coatings have been Fire tested with almost every membrane in the market place. Eliminating them in regions where they offer greater energy savings would create a safety issue, a code violation issue, and a costly burden to industry and consumers.

I understand the current energy calculators take into account the “Heating Penalty” or Peak Penalty that a facility that is coated incurs as a result of the type of roof surfacing. Has any consideration been given to the “Cooling Effect” that putting white coatings on roofs in “Heat dominated” climates would have on surrounding buildings? If EPA calculations show that white coatings when applied to a sufficient number of roofs in “Hot climates” may lower the ambient temperature by at least 5 degrees, then logic dictates that the same white coatings would have a similar effect in “Cold climates” if applied to a sufficient number of roofs, meaning they would lower the ambient temperature by at least 5 degrees, this at a time when we would want the buildings to be warmer, not colder. What effect would this have on the demand for heat on these surrounding buildings? What effect would this have on pollutant emissions due to the higher energy consumption? What effect would it have on buildings located near the “white roof buildings”?

If it is consistency with other “Cool Roofing Programs” that is desired by the EPA, other “Cool Roofing Programs” have already acknowledged SRI which uses a combination of Reflectivity and Emissivity as a more effective Energy Savings tool. These programs take into account other highly relevant factors such as the type of Climate (Heat Dominated or Cooling Dominated), Fuel Type (Electricity, Gas, Fuel Oil), Building Incurs Peak Energy use Penalty? (Yes or No), Insulation Thickness and R Value, Building Type (High rise or Low rise) and Use (Occupied or Non-occupied), etc. and allow “Trade-offs” for the various factors to allow the building owner maximum flexibility to achieve the greatest savings. EPA must take a leadership position on this issue. Following others should not be an acceptable position for the Environmental Protection Agency of the United States.

Consumers, Taxpayers and Industry look to the EPA’s Energy Star For Roof Products Program to provide meaningful measurable reasonable criteria for energy savings. The Energy Star for Roofing Products program can achieve this by providing the attributes and tools necessary to estimate the “Most Efficient Energy Solution” for the entire United States given the type of Climate (Heat Dominated or Cooling Dominated), Fuel Type (Electricity, Gas, Fuel Oil), Building Incurs Peak Energy use Penalty? (Yes or No), Insulation Amount, Building Type and Use etc.? The adoption of a fixed minimum value of 0.75 for emissivity helps only buildings

located in warm regions of the United States, and even then – not always. It is our opinion that a fixed emissivity does a great disservice to the credibility of the Energy Star Program, the states located in cold, heat-dominated climates of the U.S. and the environment.

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Thank you once again for allowing us the opportunity to present our views and comments.

Sincerely,

Chris Salazar
Vice President Sales & Marketing – Karnak Corporation

CC: Mr. Steven J. Ryan – EPA Energy Star, RCMA Roof Coatings Manufacturers Association

Buildings where the source of energy is

ELECTRICITY

4 "Cold Region" States and 4 "Hot Region" States Comparison

COLD REGIONS (Heat Dominated)		Building with <u>NO PEAK</u> Energy Charges HIGHEST ENERGY SAVINGS per Sq. Ft. of Roof is achieved with:		Building <u>WITH PEAK</u> Energy Charges HIGHEST ENERGY SAVINGS per Sq. Ft. of Roof is achieved with:
Chicago		Aluminum Savings = \$0.004 (White incurs a PENALTY of -\$0.072)		Aluminum Savings = \$0.072 (White incurs a PENALTY of -\$0.006)
Minneapolis, MN		Aluminum Savings = \$0.029 (White incurs a PENALTY of -\$0.095)		Aluminum = \$0.061 Savings (White incurs a PENALTY of -\$0.028)
New York, NY		Aluminum Savings = \$0.058 (White incurs a PENALTY of -\$0.038)		Aluminum = \$0.090 Savings (White saves \$0.029)
Seattle, WA		Aluminum Savings = \$0.029 (White incurs a PENALTY of -\$0.102)		Aluminum = \$0.060 Savings (White incurs a PENALTY of -\$0.040)

NOTE 1: Aluminum saves energy and money in ALL of these regions for buildings where source of energy is Electric

NOTE 2: Coating roofs white in these regions incurs substantial PENALTIES, meaning they increase energy consumption

HOT REGIONS (Cooling Dominated)		Building with <u>NO PEAK</u> Energy Charges HIGHEST ENERGY SAVINGS per Sq. Ft. of Roof is achieved with:		Building <u>WITH PEAK</u> Energy Charges HIGHEST ENERGY SAVINGS per Sq. Ft. of Roof is achieved with:
Los Angeles, CA		Aluminum Savings = \$0.045 (White savings = \$0.013)		White = \$0.087 Savings (Aluminum savings = \$0.080)
Miami, FL		White = \$0.183 Savings (Aluminum savings = \$0.090)		White = \$0.257 Savings (Aluminum savings = \$0.124)
Phoenix, AZ		White = \$0.180 Savings (Aluminum savings = \$0.113)		White = \$0.261 Savings (Aluminum savings = \$0.149)
Atlanta, GA		Aluminum Savings = \$0.087 (White savings = \$0.033)		Aluminum Savings = \$0.121 (White savings = \$0.104)

NOTE 3: Even in "Cooling Dominated Climates" Aluminum is the ideal Energy Savings Vehicle in 3 of the 8 possibilities above

NOTE 4: Aluminum Coatings do NOT incur any penalties in any of these regions. Meaning they always save energy.

NOTE 5: in 11 out of the 16 roof configurations above, Aluminum performs better than white and would be eliminated if 0.75 emissivity was adopted.

Chart of Choices

Calculator #1 (For roofs with NO PEAK Charges ->

<http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm>

Calculator #2 (For roofs WITH PEAK Charges ->

<http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcPeak.htm>

CITIES	Inulat. R Value	Coating Color	Refl.	Emmis.	Summer Cost of Electr. (\$/KWh)	A.C. Efficiency	Fuel Type	Heat Electric (\$/KWh)	Heat Gas	Heat Fuel	Heat Sys. Efficiency	Peak Charges	Electr Peak Demand Charges	Electr Peak Duration (Months)	* Savings \$ Per Sq. Ft. Per Year	Cooling Savings or Penalty \$ per Sq. Ft.	Heating Savings or Penalty \$ per Sq. Ft.	* Savings \$ Per sq. ft. per Yr. Adjusted for 3 year refl.
FACILITIES WITH NO PEAK CHARGE PENALTIES																		
Los Angeles, CA	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.042	\$0.051	(\$0.009)	\$0.030
Los Angeles, CA	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.028	\$0.022	\$0.006	\$0.019
Los Angeles, CA	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000	\$0.000
Los Angeles, CA	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.013	\$0.051	(\$0.038)	\$0.009
Los Angeles, CA	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.045	\$0.022	\$0.023	\$0.043
Los Angeles, CA	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000	\$0.000
Los Angeles, CA	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.040	\$0.051	(\$0.011)	\$0.029
Los Angeles, CA	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.029	\$0.022	\$0.007	\$0.021
Los Angeles, CA	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000	\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		
Los Angeles, CA	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.116	\$0.051	(\$0.009)	\$0.074
Los Angeles, CA	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.062	\$0.022	\$0.006	\$0.035
Los Angeles, CA	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)
Los Angeles, CA	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.087	\$0.051	(\$0.038)	\$0.074
Los Angeles, CA	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.080	\$0.022	\$0.023	\$0.035
Los Angeles, CA	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)
Los Angeles, CA	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.114	\$0.051	(\$0.011)	\$0.074
Los Angeles, CA	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.064	\$0.022	\$0.007	\$0.035
Los Angeles, CA	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)
FACILITIES WITH NO PEAK CHARGE PENALTIES																		
Chicago, IL	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.029	\$0.061	(\$0.032)	\$0.022
Chicago, IL	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.030	\$0.027	\$0.003	\$0.024
Chicago, IL	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000	\$0.000
Chicago, IL	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	(\$0.072)	\$0.061	(\$0.133)	(\$0.050)
Chicago, IL	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.040	\$0.027	\$0.013	\$0.055
Chicago, IL	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000	\$0.000
Chicago, IL	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.023	\$0.061	(\$0.039)	\$0.017
Chicago, IL	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.031	\$0.027	\$0.004	\$0.025
Chicago, IL	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000	\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		
Chicago, IL	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.096	\$0.061	(\$0.032)	\$0.071
Chicago, IL	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.062	\$0.027	\$0.003	\$0.032
Chicago, IL	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)
Chicago, IL	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.006)	\$0.061	(\$0.133)	\$0.066
Chicago, IL	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.072	\$0.027	\$0.013	\$0.032
Chicago, IL	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)
Chicago, IL	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.081	\$0.061	(\$0.039)	\$0.066
Chicago, IL	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.063	\$0.027	\$0.004	\$0.032
Chicago, IL	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)

FACILITIES WITH NO PEAK CHARGE PENALTIES																			
Miami, FL	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.187	\$0.188	(\$0.001)		\$0.136
Miami, FL	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.087	\$0.087	\$0.001		\$0.050
Miami, FL	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Miami, FL	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.183	\$0.188	(\$0.004)		\$0.134
Miami, FL	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.090	\$0.087	\$0.003		\$0.053
Miami, FL	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Miami, FL	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.186	\$0.188	(\$0.001)		\$0.136
Miami, FL	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.087	\$0.087	\$0.001		\$0.050
Miami, FL	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		CSDS	
Miami, FL	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.260	\$0.188	(\$0.001)	\$0.074	\$0.191
Miami, FL	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.122	\$0.087	\$0.001	\$0.035	\$0.069
Miami, FL	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Miami, FL	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.257	\$0.188	(\$0.004)	\$0.074	\$0.188
Miami, FL	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.124	\$0.087	\$0.003	\$0.035	\$0.072
Miami, FL	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Miami, FL	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.260	\$0.188	(\$0.001)	\$0.074	\$0.190
Miami, FL	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.122	\$0.087	\$0.001	\$0.035	\$0.069
Miami, FL	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
FACILITIES WITH NO PEAK CHARGE PENALTIES																			
Minneapolis	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.019	\$0.054	(\$0.036)		\$0.014
Minneapolis	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.025	\$0.023	\$0.001		\$0.021
Minneapolis	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Minneapolis	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	(\$0.095)	\$0.054	(\$0.149)		(\$0.068)
Minneapolis	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.029	\$0.023	\$0.005		\$0.049
Minneapolis	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Minneapolis	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.011	\$0.054	(\$0.043)		\$0.009
Minneapolis	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.025	\$0.023	\$0.002		\$0.023
Minneapolis	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		CSDS	
Minneapolis	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.085	\$0.054	(\$0.036)	\$0.067	\$0.063
Minneapolis	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.057	\$0.023	\$0.001	\$0.033	\$0.040
Minneapolis	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Minneapolis	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.028)	\$0.054	(\$0.149)	\$0.067	(\$0.017)
Minneapolis	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.061	\$0.023	\$0.005	\$0.033	\$0.067
Minneapolis	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Minneapolis	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.077	\$0.054	(\$0.043)	\$0.067	\$0.058
Minneapolis	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.058	\$0.023	\$0.002	\$0.033	\$0.042
Minneapolis	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
FACILITIES WITH NO PEAK CHARGE PENALTIES																			
New York, NY	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.050	\$0.077	(\$0.028)		\$0.036
New York, NY	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.040	\$0.035	\$0.006		\$0.030
New York, NY	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
New York, NY	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	(\$0.038)	\$0.077	(\$0.116)		(\$0.026)
New York, NY	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.058	\$0.035	\$0.023		\$0.066
New York, NY	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
New York, NY	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.044	\$0.077	(\$0.034)		\$0.032
New York, NY	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.041	\$0.035	\$0.007		\$0.033
New York, NY	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		CSDS	
New York, NY	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.117	\$0.077	(\$0.028)	\$0.067	\$0.086
New York, NY	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.073	\$0.035	\$0.006	\$0.033	\$0.049
New York, NY	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	\$0.000
New York, NY	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.029	\$0.077	(\$0.116)	\$0.067	\$0.023
New York, NY	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.090	\$0.035	\$0.023	\$0.033	\$0.085
New York, NY	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	\$0.000
New York, NY	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.111	\$0.077	(\$0.034)	\$0.067	\$0.082
New York, NY	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.074	\$0.035	\$0.007	\$0.033	\$0.051
New York, NY	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	\$0.000

FACILITIES WITH NO PEAK CHARGE PENALTIES																			
Seattle, WA	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	(\$0.160)	\$0.011	(\$0.027)		(\$0.011)
Seattle, WA	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.010	\$0.004	\$0.006		\$0.014
Seattle, WA	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Seattle, WA	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	(\$0.102)	\$0.011	(\$0.112)		(\$0.072)
Seattle, WA	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.029	\$0.040	\$0.025		\$0.050
Seattle, WA	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Seattle, WA	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	(\$0.011)	\$0.022	(\$0.033)		(\$0.016)
Seattle, WA	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.012	\$0.004	\$0.007		\$0.016
Seattle, WA	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		CSDS	
Seattle, WA	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.046	\$0.011	(\$0.027)	\$0.062	\$0.035
Seattle, WA	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.042	\$0.004	\$0.006	\$0.031	\$0.032
Seattle, WA	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Seattle, WA	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.040)	\$0.011	(\$0.112)	\$0.062	(\$0.026)
Seattle, WA	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.060	\$0.004	\$0.025	\$0.031	\$0.069
Seattle, WA	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Seattle, WA	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.040	\$0.011	(\$0.033)	\$0.062	\$0.030
Seattle, WA	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.043	\$0.004	\$0.007	\$0.031	\$0.035
Seattle, WA	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)

FACILITIES WITH NO PEAK CHARGE PENALTIES																			
Atlanta, GA	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.094	\$0.113	(\$0.019)		\$0.068
Atlanta, GA	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.062	\$0.054	\$0.008		\$0.043
Atlanta, GA	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Atlanta, GA	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.033	\$0.113	(\$0.081)		\$0.024
Atlanta, GA	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.087	\$0.054	\$0.032		\$0.080
Atlanta, GA	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Atlanta, GA	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.090	\$0.113	(\$0.023)		\$0.065
Atlanta, GA	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.064	\$0.054	\$0.009		\$0.046
Atlanta, GA	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		CSDS	
Atlanta, GA	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.166	\$0.113	(\$0.019)	\$0.072	\$0.121
Atlanta, GA	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.096	\$0.054	\$0.008	\$0.034	\$0.062
Atlanta, GA	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Atlanta, GA	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.104	\$0.113	(\$0.081)	\$0.072	\$0.077
Atlanta, GA	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.121	\$0.054	\$0.032	\$0.034	\$0.100
Atlanta, GA	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Atlanta, GA	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.162	\$0.113	(\$0.023)	\$0.072	\$0.118
Atlanta, GA	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.098	\$0.054	\$0.009	\$0.034	\$0.065
Atlanta, GA	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
FACILITIES WITH NO PEAK CHARGE PENALTIES																			
Phoenix, AZ	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.216	\$0.214	(\$0.008)		\$0.151
Phoenix, AZ	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.096	\$0.091	\$0.005		\$0.055
Phoenix, AZ	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Phoenix, AZ	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.180	\$0.214	(\$0.034)		\$0.132
Phoenix, AZ	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.113	\$0.091	\$0.022		\$0.077
Phoenix, AZ	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
Phoenix, AZ	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.204	\$0.214	(\$0.010)		\$0.149
Phoenix, AZ	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.097	\$0.091	\$0.006		\$0.056
Phoenix, AZ	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	No	N/A	N/A	\$0.000	\$0.000	\$0.000		\$0.000
FACILITIES WITH PEAK CHARGE PENALTIES																		CSDS	
Phoenix, AZ	10	White	80	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.287	\$0.214	(\$0.008)	\$0.081	\$0.210
Phoenix, AZ	10	Aluminum	60	40	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	\$0.133	\$0.091	\$0.005	\$0.036	\$0.075
Phoenix, AZ	10	Black	5	90	0.10	2.0	Gas	N/A	0.70	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Phoenix, AZ	10	White	80	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.261	\$0.214	(\$0.034)	\$0.081	\$0.191
Phoenix, AZ	10	Aluminum	60	40	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	\$0.149	\$0.091	\$0.022	\$0.036	\$0.096
Phoenix, AZ	10	Black	5	90	0.10	2.0	Electric	0.10	N/A	N/A	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)
Phoenix, AZ	10	White	80	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.285	\$0.214	(\$0.010)	\$0.081	\$0.209
Phoenix, AZ	10	Aluminum	60	40	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	\$0.134	\$0.091	\$0.006	\$0.036	\$0.076
Phoenix, AZ	10	Black	5	90	0.10	2.0	Fuel Oil	N/A	N/A	0.85	0.7	YES	10	6	(\$0.004)	\$0.000	\$0.000	(\$0.004)	(\$0.004)

LEGEND				
*	=	* Savings relative to a "black" roof		
CSDS	=	Cooling Season Demand Savings		

NOTE: Add to Letter a note that with the "Aged" reflectance coming into the picture. Plugging in the values could yield some really interesting facts

Uses 60% aged reflectance for white with Emittance of 90%

Uses 45% reflectance for Alum. With 40% Emittance