

PRODUCT PERFORMANCE STUDY

ENERGY CONSERVATION POTENTIAL OF ECOSAFE ODOR ABSORBERS IN REFRIGERATORS

GENERAL PRODUCT BACKGROUND

EcoSafe Labs has developed a 16-ounce breathable, dust-free pouch approved for contact with all food items, with internal ingredients that are FDA approved as a food additive and contain no hazardous material. It has the following unique properties:

ENERGY SAVINGS - The Odor Absorber Pouch is made up of a blend of natural ingredients that are devoid of fibrous materials and very low in silica. It readily adsorbs and releases moisture and acts as a desiccant cooler. Other known minerals and manufactured products do absorb water, but do not release water with great ease. Thus, they do offer desiccant cooling and dehumidification during their absorption cycle. However, they have difficulty in completing the thermodynamic cycle due to their propensity to retain the water they have absorbed. There are manufactured molecular sieves that have the same properties as the EcoFresh® mineral. However, their cost is significantly higher.

In simple terms, the EcoFresh® product controls the dew point and the relative humidity in refrigerators and coolers. This prevents frost build-ups on the refrigeration cooling coils. Refrigeration compressors and defrost heaters require less running time to decrease humidity and frost build-up. This results in an energy savings between 5% and 15% in most refrigeration systems. These avoided costs logically follow the diurnal demand cycle for electrical usage. The resultant energy savings are realized at peak loading when they are most effective.

From data provided by Oregon State University ("OSU"), Portland General Electric, Pacific Gas and Electric, Los Angeles, Department of Water and Power, along with various articles on utility electrical demand, a chart has been developed showing the potential energy saving in dollars per refrigerator per year. Prior testing at OSU indicated that the EcoFresh® Odor Absorber shows an energy saving of between 5% and 15%.

For comparative purposes there is included a chart of estimated energy savings in kilowatt-hours in the Pacific Gas and Electric territory. This data came from PG&E.

The enclosed charts are:

Chart #1 - Based on data provided by the Los Angeles Department of Water and Power, this chart (Attachment A) shows the savings per refrigerator for one year based upon your cost per kilowatt-hour and estimated percent savings realized by the use of the refrigerator packet. The 7.25% savings was determined by OSU in their laboratory and in actual use in a home refrigerator of a family of four. The 10% saving was from a study conducted by using in a walk-in cooler. The 15% saving was from a study by observation conducted in a vending machine.

To figure your average cost per KWH divide the total amount charged for electricity on your current bill by the number of KWH consumed during that period. (i.e. Total electricity charge = \$60.00 and KWH consumed = 400. \$60 divided by 400 = \$0.15 your average cost per KWH.) Look at Attachment A. At \$0.15 per KWH the Dollar Savings Per Year Per Refrigerator are approximately: \$21 @ 7.25% Savings, \$29 @ 10% Savings and \$42 @ 15% Savings.

Chart #2 - This chart (Attachment B) displays the total energy savings by kilowatt-hour in the service area of PG&E. There are 4,403,000 residences and 4,350,164 refrigerators in the PG&E service area. This chart is based upon data provided by PG&E.

To quantify the energy saving in Oregon we commissioned a test at Oregon State University under the control of Dr. Martin Hellickson. Dr. Hellickson is a professor in the Bioresource Engineering Department and a Certified Professional Engineer.

These tests generated approximately 65 megabits of data. The best conclusion we could reach was that the energy savings was somewhere between 7.5% and 15%. However, the volume and scattering of the information points and the resulting correlation factors precluded the use of this data. The volume of the data and the highly differing variability of the conditions, such as, door openings, four children and two adults, outside temperature and humidity, and changing daily usage dictated that the data collected be further analyzed.

Dr. F.L. Bunger, Ph.D., reviewed the data and to find the best correlations between various categories of data that would clearly represent an energy savings that would be easily recognizable and justified. He narrowed his analysis to 10 megabits of data and found the relationship between the "Air Temperature in the Cooling Coil Area" and the "Compressor Run Time" to have correlation factors of 99.5% and 98.3%, respectively.

Based on this data Dr, Bunger developed Attachment C. Over 500 points of random data were used to develop this chart. This chart shows with great confidence an energy savings of 7.27% over the length of the experiment. The result can be extrapolated to an energy savings per household in a given utility service area.

ODOR CONTROL - The packet absorbs certain gases and odors that are prevalent in refrigerators. Many of these gases and their resultant odors transfer between products in the refrigerator. Products, such as eggs, fruit, cheese, milk, butter, oils, fats, meats, bread, and other prepared foods, readily absorb odors from each other and other foods in the cooler or refrigerator. The foods that absorb these odors become off flavor and are not useable. This property of the EcoFresh® Odor Absorber is readily ascertainable after several hours of use.

When EcoFresh® Odor Absorbers have absorbed their maximum capacity in odorous gases, they begin to release the odors back into their environment. This signals the need to replace the pouch.

SHELF LIFE - The Odor Absorber extends the shelf life of fruits, vegetables, meat, and other food products in the refrigerator or cooler via two mechanisms.

The first is accomplished through the control of humidity. When air in the refrigerator reaches dew point, dew is deposited on the products in the unit. This water deposited on a food product becomes a substrate for bacteria and fungus growth. The food product putrefies. The result is decreased shelf life. The Odor Absorber through its adsorption of moisture prevents the unit from reaching its dew point. However, it does not over dry the air and cause loss of moisture in the food products.

The second mechanism is accomplished through the absorption of certain gases, specifically ethylene. Researchers in the field of fruit, flower, and vegetable preservation, have established irrefutably the role of ethylene gas in the chemistry of plants. This ever present gas behaves in plants similar to a hormone triggering animal behavior. Ethylene will trigger the various life stages, such as growth, flowering and defoliation, ripening and spoilage. In most cases, the ethylene is a product of the life chemistry of the plants and their fruit.

In bananas and tomatoes, the ethylene can accelerate the ripening process and cause early spoilage. In cycle vegetables like lettuce, ethylene shock can cause brown spots. Apples are heavy producers of ethylene causing premature ripening and spoilage. By absorbing ethylene and other gases, the shelf life of food products can be significantly extended. Studies by the University of California, Division of Agriculture and Natural Resources, and the University of California Davis are available to support these findings.

REGENERATION - The material in each Odor Absorber can be active for many years. However, the Odor Absorbers will absorb their maximum capacity in odorous gases at different rates. The packets may be regenerated by placing them in a dry environment for several days, or by solar recharge in the sun.

DISPOSAL - The packet and its ingredients are approved for disposal with normal household waste.

ADVANTAGES OF THE ECOFRESH ODOR ABSORBER TO ITS USERS

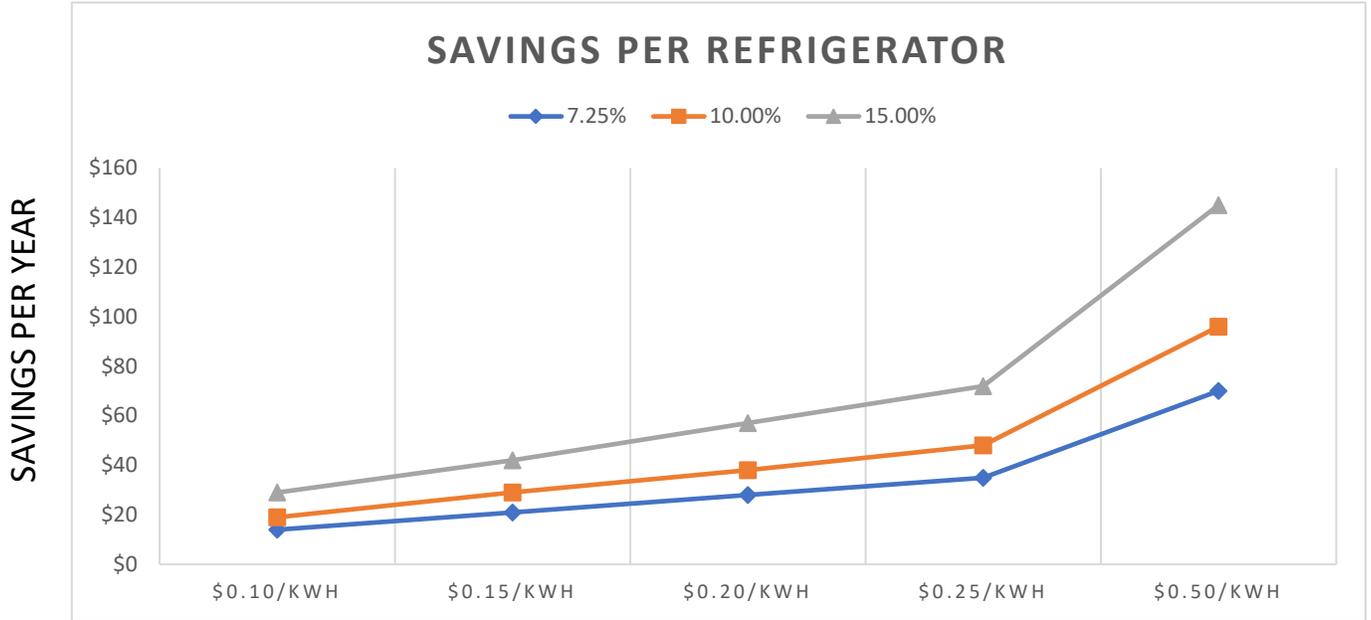
When the Odor Absorber is used in a refrigerator or cooler, it saves energy at its peak loading, controls odors, and extends shelf life and freshness of foods. To the customer, they can readily observe the odor control and preservation of food stuffs in their refrigerator or cooler. The energy savings can be readily calculated over a period of time by comparison of past utility bills.

Customers will realize a simple way to save electrical energy. In addition, the customer will visually notice the extended shelf life of food products in the refrigerator or cooler. This is a savings for the customer that is readily apparent. Additionally, the customer will notice the new, fresh smell from their refrigerator. The customer has another readily noticeable benefit from the Odor Absorber usage.

IN SUMMARY

The EcoFresh® Odor Absorber customer realizes an energy savings that safely controls odors and extends the shelf life and freshness of food products in their refrigerators and coolers.

ATTACHMENT A



COST PER KILOWATT HOUR (KWH)

ATTACHMENT B

