Close Windows and Doors when Not in Use (Arc 2.7442)

(The analysis below was extracted from one of the assessment reports by the Clemson University Industrial Assessment Center (IAC). This is only an example recommendation and hence, not all the background information and sources for numbers are included here.)

Est. Electric Consumption Savings	= ***117,573 kWh/y***
Est. Electric Consumption Cost Savings	= ***3950 /yr***
Est. Implementation Cost	= ***$0***
Simple Payback Period	= ***0 months***

Recommended Action:
It is recommended the plant keeps all the dock doors closed when not in use so there is less load on the building heating systems, thus reducing energy consumption.

Background:
The main building has 40 garage doors. Plant management indicated, for convenience, operators currently leave several of the doors completely open throughout operating hours. The building is heated in the winter using HVAC. The open doors allow cold air to move through the building during winter months, thus increasing the heating load on the HVAC.

Plant management also indicated that motor mounts are currently available on these garage doors. Motorized controls would reduce the likelihood of injuries related to collision with partially open doors or strenuous exertion during manual door opening or closing. Reduced infiltration of cold air would also help maintain a higher product temperature, which improves product quality.

Anticipated Savings:
Energy lost is a function of area of the door, difference in temperature between the inside of the building and the surrounding outside the building. During our on-site observation, at least 20 doors were always open. So, it is safe to assume a count of 20 in calculations. The doors were standard dock door sizes, meaning they were 10’ high and 8’ wide. The plant maintenance personnel told that during the 4 months of winter, they maintain the temperature inside the plant 10 F higher than ambient temperature.

The estimated unit electricity consumption saving per degree Fahrenheit annually can be determined as follows:

$$\text{Unit Electricity consumption savings (UECS)} = H = 1.08 \times B \times A \times (t_{in} - t_{out})$$

Where:

H - heat loss expressed in Btu’s per hour
1.08 = (constant) - specific heat of air times density of outdoor air
A = Area of opening in square feet
T_{in} = Indoor temp F
T_{out} = Outdoor temp F

B = CFM (Leakage) rate per sq. ft. 9.0 from Table 6.1 of Infiltration through windows and doors - Handbook of energy audits.

$$UECS = 1.08 \times 9 \times 80 \times 10 = 7776 \text{ Btu's per hour} = 2.3328 \text{ kW}$$

The annual electricity consumption saving can be calculated as follows

Electrical consumption saving (ECS)
= UECS × 7 days/week × 15 weeks/yr. × 24 hours/day × 20 doors

$$ECS = 2.3328 \times 7 \times 15 \times 24 \times 20 = 117{,}573.12 \text{ kWh/yr.}$$

Finally, the estimated annual electric consumption cost savings can be determined based on the unit electricity consumption charge as:

Electric consumption cost savings (ECCS) = ECS × (\$0.0336 / kWh)

$$ECCS = \$\ 117{,}573.12 \times 0.0336 = \$3{,}950.46$$

Implementation Cost:
This is a cultural change and does not require any implementation cost.

Simple payback period:
The *simple payback period, SPP*, is the time required to pass before the estimated total cost savings equal the estimated implementation cost, and is calculated by:

$$SPP = IC/TCS \times 12 \text{ months/yr.}$$

$$SPP = \$0/(\$3950.46/\text{yr.}) \times 12 \text{ months/yr.}$$

$$SPP = 0 \text{ months}$$