

## The Humble Airlock (or Vestibule) Elevated to Useful, and Beautiful Relevance.

Steve Stevens

AT&T BELL TELEPHONE LABORATORIES (Retired)  
Golden, Colorado, USA  
oldbike2@comcast.net

**Abstract:** Building energy scientists are familiar with the charge to “Seal and Insulate” the building envelope to have a new (or upgraded) structure address the needs of our current and future energy and climate realities. Many ASES solar tours cover this as well as adding passive solar and/or active solar designs. Often the “seal” aspect of the design only addresses the structure when its doors are closed. That leaves an issue of “tightness” at entry and exit times for occupants and users. The heat transfer in or out of a building can be dominated by these ingress / egress situations. Airlock entries are an excellent solution. However, can they be complementary to the actual structure, pleasing, and adding functionalities? This case study gives a resounding “YES” answer.

**Keywords:** Airlock, Sealing, Envelope, Vestibule, Function, Energy, Climate, Efficiency

### 1. Introduction:

Before WW II, the “seal” aspect, for times of ingress/egress was often incorporated in home designs with “vestibules.” The White House and Monticello both have a front vestibule. Many commercial buildings have a front or rear vestibule. Often, other entrances do not have airlocks. Also, often, the one door is not totally closed when the other opens, allowing major conditioned air transfer from the building.

Frequently airlocks are only used to store things, as an open supply closet. However, the rooms can add usefulness to a building. I will focus upon a residential application. Vestibules can be designed in from the start; They can also be added to an existing home. In the latter case, they can make a 3-season room even without providing added conditioning. Also, it can provide a 4-season room. I will demonstrate examples of the addition of 14 vestibules to a 1979 ranch style (on walkout) home at 5900 ft elevation in Golden, Colorado. To ensure that the “seal” from drafts was complete, each entrance was not just airlocked, but they were doubly airlocked. This “layering” of the home provided great insulating value as well as sealing.

### 2. Home Transformation Goals:

The original home had frame R-9 walls, now upgraded to R-60+. Also, active solar had been installed on the roof. The bedrooms were located on the north west side. This study project objectives included A) maintain the bedroom egress, B) gain passive solar, while C) limiting summer season radiant gain and D) achieving the highest possible R-value for outer airlocks. In the abstracted view of the plan in *Figure 1*, you see that the north west has no added vestibule.

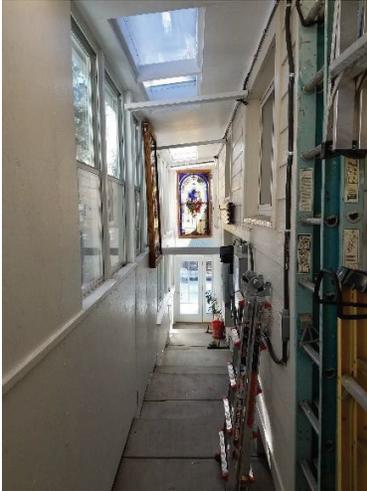
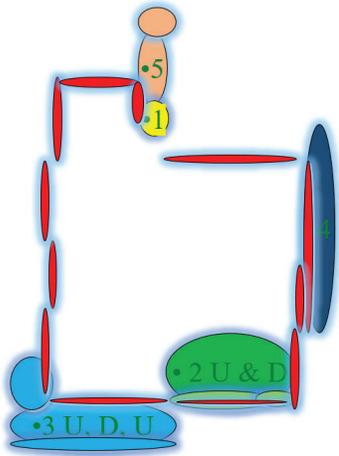
#### 4. The Project:

The project was begun after retirement as a Mathematician / Physicist at AT&T BELL TELEPHONE LABORATORIES in the year 2001. All designs and most labor were by the homeowner. Neighbor help was used when more than 2 hands were needed. Building permits were received, and inspections were all passed. The airlocks were built on hand dug caissons. Post and beam were widely employed with Poly-ISO foam filling cavities and wrapped on the outside. Windows and doors were good quality, scavenged as new Lowes returned "special orders."

#### 5. Results:

The home has NO combustion; only active and passive solar for all energy production / usage. The Natural Gas line was terminated in 2017. In a 12 Month Period: 22.7 MWH PV was produced. Of this 11.4 MWH was surplus, given to the grid to displace fossil fuel usage. Temperatures inside are very comfortable all year, from passive solar and Mini-Splits. Daylighting is extensive. See *Figure 8* for 12-month daily and total energy details.

Acquired new functionalities from these rooms included: Conference room, Gymnasium, Walk in Solar Clothes Dryer, Potting Shed, Greenhouse, Walk in Solar Food Dehydrator, "Climate Change Observation Center," 2 workshops, and a few mud rooms. Also, these additions provided over 600 Sq Ft of south side and 300 sq ft of east side passive solar collection. Additionally, the home powers an electric car.



Figures 1, 2, and 3: Figure 1 diagrams the home envelope with superinsulated wall (r-60 or better) before the added airlocks. Figure 2 provides a view North from the original entry through the inner and outer added airlocks (Labeled # 1 and # 5 in Figure 1). Figure 3 provides a view South from addition #5 (Dark Blue in Figure 1).



*Figure 4:* The South Side Passive Solar Conference Room (Green addition 2 in Figure 1) set for Christmas Dinner. To the right side of the main Conference room, is the Walk in Solar Clothes dryer.

*Figure 5:* One of the 2 workshop airlocks in the lower 2<sup>nd</sup> addition.



Figures 6, and 7: The Greenhouse and Gymnasium rooms in the 3<sup>rd</sup> vestibule addition (Light blue in Figure 1.) The drop-down ladder shown leads up to the Passive Solar Plenum – also acting as the passive solar food dehydrator, turning grapes into raisins.

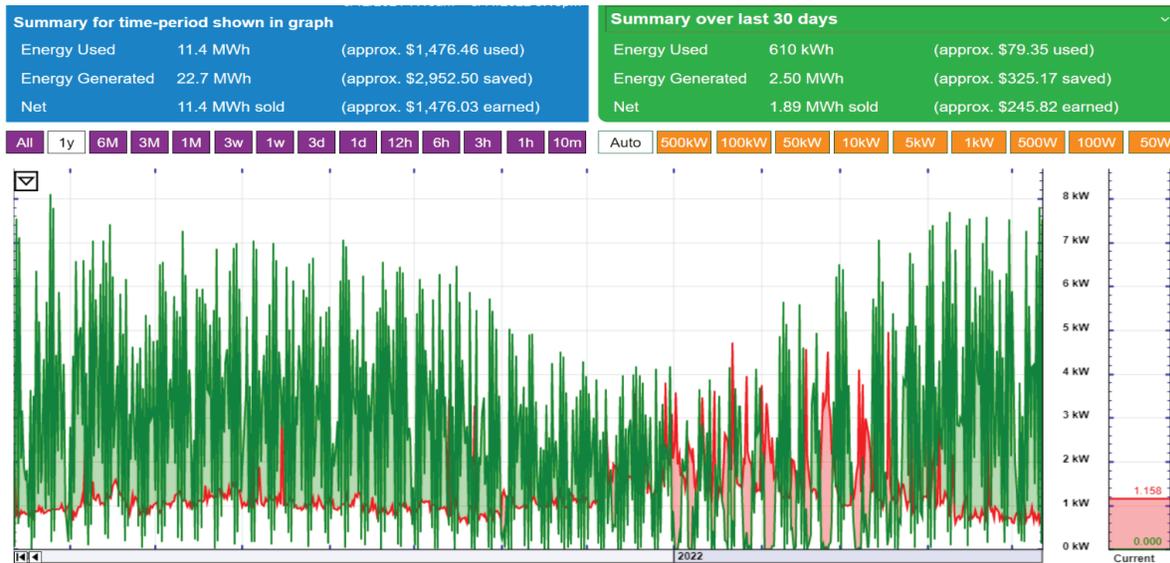


Figure 8: The 12-month energy Production and Usage of the home after conversion. Green is daily production. Red represents usage. Heavy winter usage with snow on the PV panels shows as dominant red.

## 6. Conclusions:

In doing an energy wise home design, or an energy wise upgrade to an existing home, you can easily plan for added building functionality as well as added aesthetic appeal. You can add passive solar collection. You can add super insulation of the walls. You can add these all relatively economically while you address the climate needs, in your area of influence, of future generations. In this case study, the expenses for the addition of these airlocks, adding 1400 sq ft, and 14 new (some small) rooms, was less than the cost of a typical middle class retired golfer (including quality golf clubs, an annual trip to a winter golf resort, and other club expenses). When done, the house is carbon free. When done, your Pride is elevated. When done, your conscience is relieved that you are not the guilty old person who destroyed your offsprings futures.

#### 7. Guiding Moral Value:

In doing this work, as well as advocating for this kind of “retirement recreation,” the author wishes to acknowledge a guiding moral value: I prioritize the future livability of my Grandchildren’s climate and therefore the continuation of my gene pool above the profits of the many facets of the Golf, Cruise, and Entertainment industries. Typically, a retiree does take on a “Non-productive” hobby, rather than earth saving hobbies. While golfers tend to have their scores (unhappily) rise, as they age, my “carbon score” has gladly fallen to very negative numbers. This joyfully goes against the interests of many industries. My Intended climate morality transformation is to **Democratize Climate Responsibility**. This is akin to **Crowd Sourcing for Democratization of Funding**.

#### 8. Acknowledgments:

The author wishes to gladly acknowledge the financial support of the Lowes stores through their business practice of selling “Cull” lumber at ~ 75% discount, as well as “Special Order Return” windows and doors at a 90% discount. A quick hand planing of lumber will restore 90% of cull boards to “Like New”. Also, the windows and doors which were custom ordered and then did not fit an existing hole in a wall, will exactly fit the custom “hole” you make for it.