Historic Architectural Review Commission

Agenda Packet
January 12, 2010 – 3:00 p.m.
City Commission Chamber
Old City Hall, 510 Greene Street

Item 5.b.2.

CL2 - Request to install white roof device - #909 Grinnell Street - Victor Cushman (H09-12-22-1428) - Install white roof device for conservation. We are going green.

CITY OF KEY WEST BUILDING DEPARTMENT

Fax 809-3978

CERTIFICATE of APPROPRIATENESS

APPLICATION # H09-12-22-1428

HISTORIC ARCHITECTURAL REVIEW APPLICATION

OWNER NAME: Victor Cushman

DATE:

OWNERS ADDRESS: 720 EMMA AND 2601 S. ROOSEVELT #A106

PHONE #:

APPLICANT'S NAME: Vic Cushman

PHONE #: 292.1551 292 9000

APPLICANT'S ADDRESS: 720 Emma And 2601 S Roosevelt #A106

ADDRESS OF CONSTRUCTION: 909 GRINNELL ST

OF UNITS: 3

THERE WILL BE A FINAL INSPECTION REQUIRED UNDER THIS PERMIT

DETAILED DESCRIPTION OF WORK:
INSTall White ROOF DEVICE FOR CONSERVATION. We're GOING GREEN

RECEIVED

Chapter 837.06 F.S.- False Official Statements- Whoever knowingly makes a false statement in writing with the intent to mislead a public servant in the performance of his or her official duty shall be guilty of a misdemeanor of the second degree punishable as provided for in s. 775.082 or s. 775.083

****

This application for Certificate of Appropriateness must precede applications for building permits, variances and development review approvals. Applications must meet or exceed the requirements outlined by the Secretary of the Interior's Standards for Rehabilitation and Key West's Historic Architectural Guidelines.

Once completed, the application shall be reviewed by staff for completeness and either approved or scheduled for presentation to the Historic Architectural Review Commission at the next available meeting. The applicant must be present at this meeting. The filing of this application does not ensure approval as submitted.

Applications that do not possess the required submittals will be considered incomplete and will not be reviewed for approval.

REQUIRED SUBMITTALS

	TWO SETS OF SCALED DRAWINGS OF FLOOR PLAN, SITE PLAN AND EXTERIOR ELEVATIONS (for new buildings and additions)
	TREE REMOVAL PERMIT (if applicable)
	PHOTOGRAPHS OF EXISTING BUILDING (repairs, rehabs, or expansions)
	PHOTOGRAPHS OF ADJACENT BUILDINGS (new buildings or additions)
	ILLUSTRATIONS OF MANUFACTURED PRODUCTS TO BE USED SUCH AS SHUTTERS, DOORS, WINDOWS, PAINT COLOR CHIPS, AND AWNING FABRIC SAMPLES

Staff Use Only

Date:__________

Staff Approval:

____

Fee Due:
$__________

Date: 12/22/08

Applicant Signature: Victor L. Cushman

HISTORIC ARCHITECTURAL REVIEW COMMISSION USE ONLY

****

Approved ____________ Denied ____________ Deferred ____________

Reason for Deferral or Denial:

HARC Comments:
Not listed in the survey.
Traditional colors of Key West - Roofing metal-
silver paint. (page 35).

Limit of Work Approved, Conditions of Approval and/or Suggested Changes:

Date: __________ Signature: ______________________
Historic Architectural
Review Commission

Staff Report

CL2- **909 Grinnell Street**, Victor Cushman (H09-12-22-1428)
Install white roof device for conservation (we're going green)

The structure located on 909 Grinnell Street is not listed in the survey. According to the Monroe Properties Appraisers website the house was built in 1976. The house is a cbs structure covered with v-crimp metal panels. Although the application states under detail description of work- install white roof device for conservation, the applicant wants to paint the v-crimp roof in white, using a reflecting elastomeric product. The applicant is also proposing to install a device for conservation at the ridge of each side of the roof. Staff was not provided with the device. Applicant will bring a sample of the device to the public meeting.

Guidelines that should be reviewed for this application;

- Exterior colors (page 35);
  - *Traditional colors of Key West; roofing, metal: silver gray-* The proposed color for the three v-crimp metal roofs will be white. Staff understands that the proposed white color differs from the color that is recommended by HARC as appropriate within the historic zones.

For the review of this application staff studied Florida Statutes regarding Energy Conservation and Historical Resources. According to Florida Statutes- *163.04- Energy devices based on renewable resources,* clearly states the following;

(1) Notwithstanding any provision of this chapter or other provision of general or special law, the adoption of an ordinance by a governing body, as those terms are defined in this chapter, ***which prohibits or has the effect of prohibiting the installation of solar collectors, clotheslines, or other energy devices based on renewable resources is expressly prohibited.***

(2) No deed restrictions, covenants, or similar binding agreements running with the land shall prohibit or have the effect of prohibiting solar collectors, clotheslines, or other energy devices based on renewable resources from being installed on buildings erected on the lots or parcels covered by the deed restrictions, covenants, or binding agreements. A property owner may not be denied permission to install solar collectors or other energy devices based on renewable resources by any entity granted the power or right in any deed restriction, covenant, or similar binding agreement to approve, forbid, control, or direct alteration of property with respect to residential dwellings not exceeding three stories in height. For purposes of this subsection, such entity may determine the specific location where solar collectors may be installed on the roof within an orientation to the south or within 45° east or west of due south provided

that such determination does not impair the effective operation of the solar collectors.

(3) In any litigation arising under the provisions of this section, the prevailing party shall be entitled to costs and reasonable attorney's fees.

(4) The legislative intent in enacting these provisions is to protect the public health, safety, and welfare by encouraging the development and use of renewable resources in order to conserve and protect the value of land, buildings, and resources by preventing the adoption of measures which will have the ultimate effect, however unintended, of driving the costs of owning and operating commercial or residential property beyond the capacity of private owners to maintain. This section shall not apply to patio railings in condominiums, cooperatives, or apartments.

History—s. 8, ch. 80-163; s. 1, ch. 92-89; s. 14, ch. 93-249.

According to the Florida Statutes, Section 196.012, under Definitions for Taxation and Finance, Exemption, there is a definition for "renewable energy source device" or "device", which is;

> *14)* ***"Renewable energy source device" or "device"*** *means any of the following equipment which, when installed in connection with a dwelling unit or other structure, collects, transmits, stores, or uses solar energy, wind energy, or energy derived from geothermal deposits:*
>
> > *(a) Solar energy collectors.*
> >
> > *(b) Storage tanks and other storage systems, excluding swimming pools used as storage tanks.*
> >
> > *(c) Rockbeds.*
> >
> > *(d) Thermostats and other control devices.*
> >
> > *(e) Heat exchange devices.*
> >
> > *(f) Pumps and fans.*
> >
> > *(g) Roof ponds.*
> >
> > *(h) Freestanding thermal containers.*
> >
> > *(i) Pipes, ducts, refrigerant handling systems, and other equipment used to interconnect such systems; however, conventional backup systems of any type are not included in this definition.*

(j) Windmills.

(k) Wind-driven generators.

(l) Power conditioning and storage devices that use wind energy to generate electricity or mechanical forms of energy.

(m) Pipes and other equipment used to transmit hot geothermal water to a dwelling or structure from a geothermal deposit.

It is staff understanding that applying white paint over existing metal v-crimp roof system is not a *renewable energy source device* or *device* as defined in the Florida Statutes. Because staff did not have access to the device mentioned by the applicant we can not make any recommendation to this Commission regarding the proposed device.

Staff wants this Commission to be aware that the Florida Energy Efficiency Code for Building Construction- Chapter 13 includes under Sec. 13-101.5, Exempt buildings- Buildings exempt from compliance with this chapter include those described in Sections 101.5.1 through 101.5.7;

13-101.5.5- Any historical building as described in Section 267.021, Florida Statutes.

Chapter 267 of the Florida Statutes is about Historical Resources. Section 267.021 includes under Definitions, the following for historic property or historic resource;

(3) "Historic property" or "historic resource" means any prehistoric or historic district, site, building, object, or other real or personal property of historical, architectural, or archaeological value, and folklife resources. These properties or resources may include, but are not limited to, monuments, memorials, Indian habitations, ceremonial sites, abandoned settlements, sunken or abandoned ships, engineering works, treasure trove, artifacts, or other objects with intrinsic historical or archaeological value, or any part thereof, relating to the history, government, and culture of the state.

Florida Statutes recognizes and promotes the preservation and conservation of the integrity of historic resources and historic districts.

Staff recommends to this commission to review the proposed device that the applicant will present in the public hearing. This devise must comply with the definition under Florida Statutes, Section 196.012.

Staff Report
Site Photographs
909 Grinnell

Additional Information

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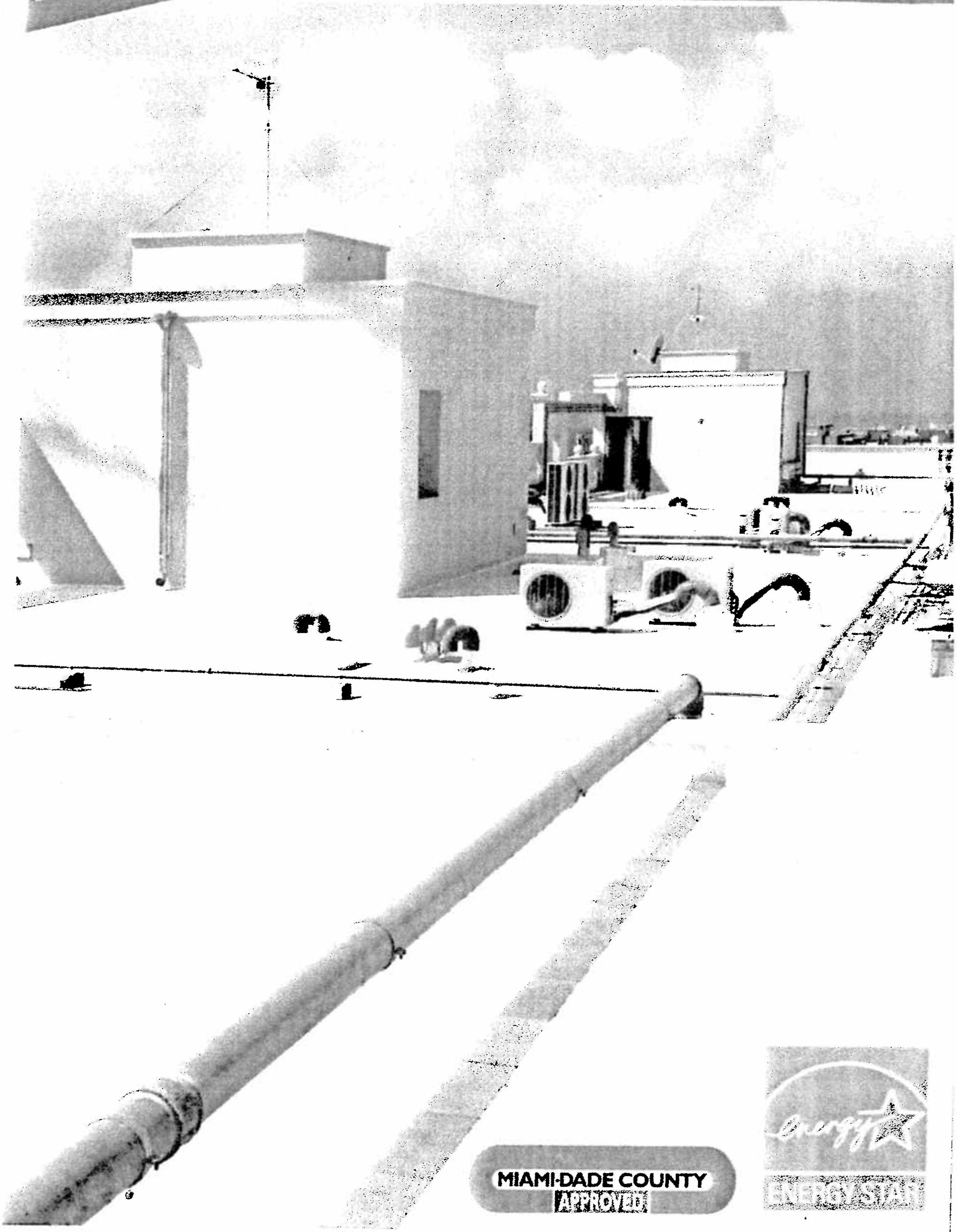

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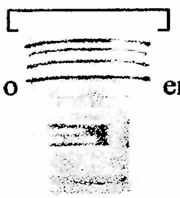
MEETS HARC STANDARDS 'BUT'!

58 to 70% Reflective (NOT ASTM ?)

? EMISSIVITY

NOT ENERGY STAR® COMPLIANT

SILVER DOLLAR WATERBASED ALUMINUM ROOF COATING

Hover o  enlarge

SILVER DOLLAR WATERBASED ALUMINUM

Model: 1309442

Manf#: 6295-GA
UPC#: 025056629500
Manf: GARDNER-GIBSON
Keyword: ROOFCT ALUM WTRBS 4.5 GL

Quantity: 1 Per Unit

Retail Price: $105.59
Regular Price: $95.99
Checkout Price: $86.39

Description:

- **SILVER DOLLAR WATERBASED**
- **ALUMINUM ROOF COATING**
- ***4.5 gallon**
- ***Provides a tough layer of**
- **protection over the roofs**
- **surface**
- ***Seals and waterproofs**
- ***Reflects suns damaging rays**
- ***Preserves the roof surface**
- ***Easy water clean-up**

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Resources

Florida Statute ~ Section 163.04

Energy devices based on renewable resources-

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-llevcial or residen.tial property beyond the capacity of private owners to maintain. This section shall nor apply to patio railings in condominiums, cooperatives, or apartments.

History-s. 8, eh. 80-163; s. 1, eh. 92-89; s. 14, ch. 9.3 .. 249.

Florida Statute ~ Section 163.04

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To be presented at Solar 2004 (National Solar Energy Conference, ASES)
9 – 14 July, Portland, Oregon

BUILDING INTEGRATED PHOTOVOLTAICS (BIPV) AND THE "COOL ROOF"

Tim Ellison
Energy Conversion Devices, Inc.
3800 Lapeer Rd
Auburn Hills, MI 48326

ABSTRACT

A BIPV roof installed on a home with a high degree of roofing insulation and an efficient HVAC system will provide about 25 times the energy savings of a "Cool Roof". The energy entering such a home from the BIPV roof can be pumped out of a well-insulated house using a small (few percent) fraction of the BIPV power with an efficient air conditioning system.

BIPV and Cool Roofs are complementary: BIPV is most appropriate for buildings with a high degree of insulation and efficient HVAC systems, and Cool Roofs provide the greatest benefits in less energy efficient buildings. In reality, most existing buildings built in the last few decades in warm climates have minimal insulation and inefficient HVAC systems. Since many of these building require re-roofing, they present an opportunity to the BIPV installer that addresses the complete building envelope and systems.

INTRODUCTION

Have you dreamed about a Building Integrated PV (BIPV) roof for your home, as I have? And have you recently heard about Cool Roofs? While I have been thinking about a BIPV roof for a long time, I've only recently become aware of Cool Roofs. Cool Roofs are a "hot" topic today:

- Yahoo search on "cool roof"+energy+solar in January 2003 yielded 31 k hits;
- Cool Roofs have an Energy Star Rating;
- There is a Cool Roofs Rating Council;
- Organizations offer rebates for the installation of Cool Roofs.

So – Cool Roofs, which reflect solar radiation, must be important! What about PV – isn't that a product purposely designed to *absorb*, rather than *reflect*, solar radiation? My gosh, a BIPV roof must be the epitome of a "Hot Roof"! Would I want to put such a roof on my house? I don't know if you have ever lived through a high-humidity summer in southern Indiana, but if you had, you would certainly think twice about installing a "Hot Roof" on your home!

- Just how hot is a BIPV roof?
- Would the heat load from this hot roof require more electrical power for air conditioning (a/c) than the BIPV could supply?
- Here's a smart idea (or is it?): should I forget BIPV and instead install a ground-mount PV system and also install a Cool Roof?

These were some of the questions I had when I first became aware of Cool Roofs. In this paper I will attempt to answer these questions.

I begin by first providing a simple overview of Cool Roofs, and then show the energy impact of a Cool Roof in comparison to a BIPV roof. It is pointed out that the benefits of a Cool Roof are seen most clearly on homes with poor insulation or other building defects.

1. COOL ROOFS – AN OVERVIEW

The temperature increase of a roof can be estimated by scaling linearly from a bench mark of a 50 °C temperature rise for an object with a Solar Reflectance (R) of 0.05 and IR emissivity of 0.9, with convection and radiation heat transfer coefficients of 12.4 and 6.1 W/(m^2-°C), respectively and an insolation level (radiation from the sun) of 1 kW/m^2. Since nearly all roofing materials, with the exception of bare metal, have high emissivities of about 0.9, an approximate rule of thumb is that roof typically heats up by a bit less than 1 °F over the ambient temperature for every percent of this radiation that is absorbed by the roof:

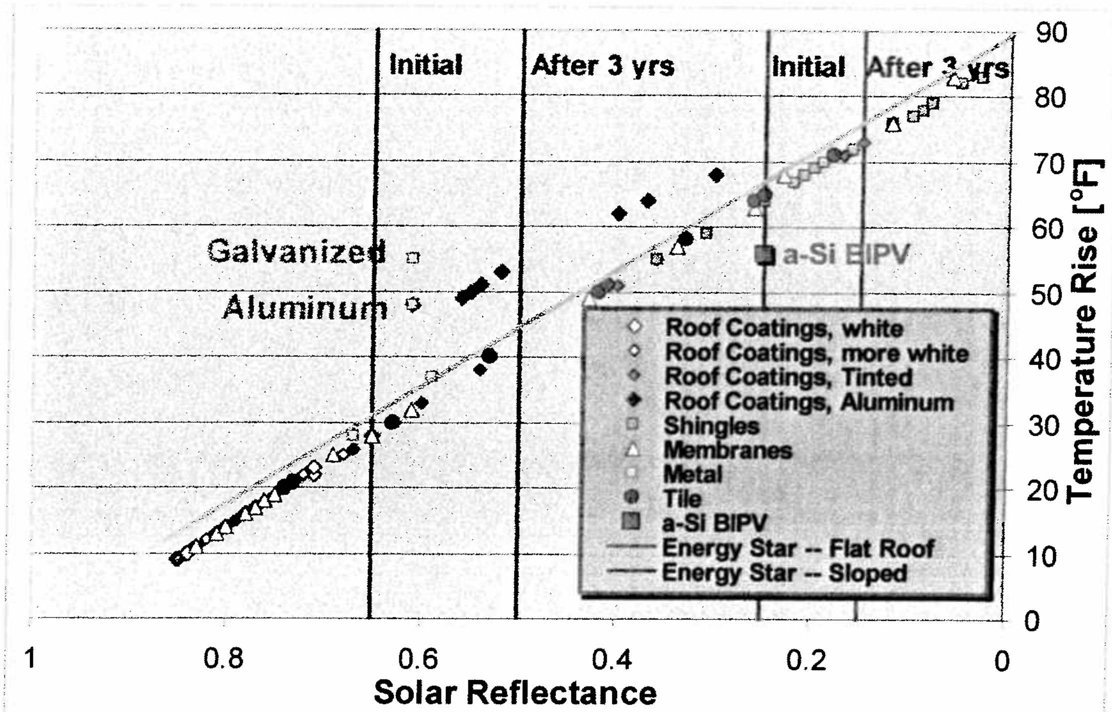

Fig. 1. Temperature rise (ΔT) vs. solar reflectance (R) for roofing products in LBL's Roofing Database. The thick light blue line shows Eq. 1.

$$\Delta T \approx 0.5\,^{\circ}\mathrm{C} \times (1 - R) \qquad [1]$$

where ΔT is the temperature increase over ambient in °C, and R is the Solar Reflectance, or the percentage of radiation reflected by the roof. So a perfectly reflecting roof would stay at the ambient outside temperature, and a perfectly absorbing roof would increase to about 90 °F above ambient – to almost 200 °F, just below the boiling point of water, on a very hot summer day!

Figure 1 shows the calculated ΔT for a large range of roofing products taken from the Lawrence Berkeley Laboratory's (LBL) roofing data base Website. In Fig. 1 we see that almost all roofing products fall on a straight line in temperature rise vs. solar reflectance space since most products have high far infrared emissivities of about 0.9. There are only a few deviations from this line: bare metals with low emissivities, such as galvanized steel and aluminum, lie above this line; BIPV is the single strange exception lying *below* the line since this roof has high emissivity and also carries power away from the roof in the form of electricity. We have placed this point 8 °F below the line corresponding to about 80% coverage of an 8% efficient amorphous silicon BIPV product. Other PV products (e.g. crystalline or polycrystalline) with higher conversion efficiencies would fall even further below this line.

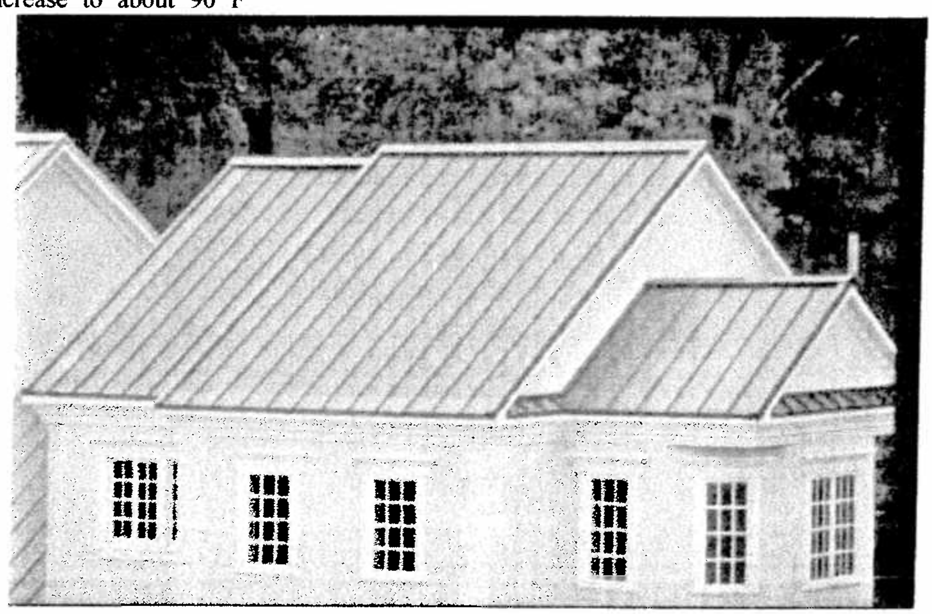

Fig. 2. First metal roofing a-SI BIPV installation [NAHB RC 21st Century Townhouse Project in Maryland].

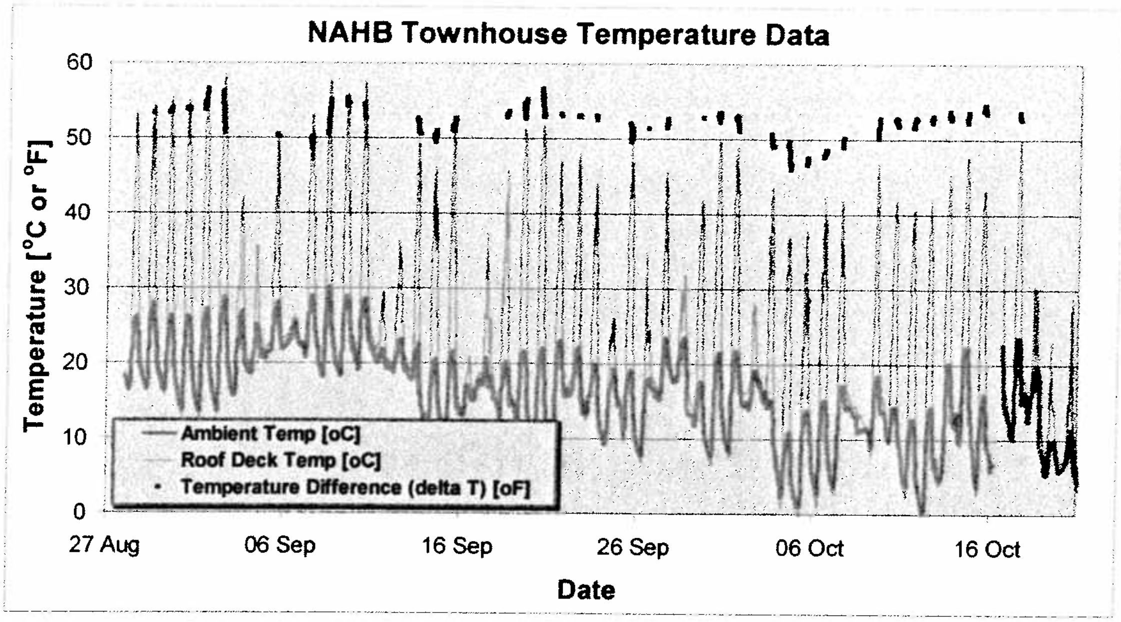

Fig. 3. Recorded ambient (blue thick line) and roof deck temperatures (red thin line) [°C] at the National Association of Home Builders Research Center 21st Townhouse Project in Maryland which has an a-Si BIPV metal roof. The temperature rise data have been filtered to include only data with high insolation (> 800 W/m^2), are scaled to 1 kW/m^2, and are heavily averaged. [Aside: careful inspection shows that on nights following days of high insolation (indicating a clear sky), the roof temperature falls below the ambient temperature; and on nights following days of low insolation (indicating cloud cover), the roof deck typically remains at temperatures above the ambient. This may be the effect of "radiative" cooling to the night sky].

From Fig. 1 we would expect to see about a 55 to 60 °F temperature rise for an a-Si BIPV roof – about the same as a galvanized metal roof. This is in good agreement with observation. Fig. 3 shows the measured ambient, roof deck, and temperature rise of an a-Si BIPV array at the National Association of Home Builders Research Center Home Park in Maryland, pictured in Fig. 2.

2. Energy Implications of a BIPV Roof

We now know the approximate temperature rise of an a-Si BIPV roof. Let us now calculate the heat load on a house and the consequent power implications. We use the following model:

- A house with the complete roof covered by a-Si BIPV;
- A roof insulation of R-30 [30 (BTU/hr-ft^2-°F)$^{-1}$, i.e., [0.2 W/m^2-°C conductance]. This value of roof insulation is typical of what is required by the California Title 24 Building Standards, but a minimum in cooler climates where highly-insulated homes might have up to twice this value of roofing insulation.
- An air-conditioning system with the minimum Energy Star SEER (Season Energy Efficiency Rating) of 12 BTH/h/W (corresponding to a Coefficient of Performance of 3.5).
- We also assume that the air conditioner runs at all times the sun is shining – thus *overestimating* the heat-load on the house.
- We assume, for simplicity, that the ambient temperature is the same as room temperature – thus *underestimating* the heat load on the house.
- We assume Nothing Funny – e.g., no leaky, un-insulated air-conditioning conduits placed in the hot attic outside the home's insulation envelope.

From this simple set of assumptions one can calculate the heat load on the home from the BIPV array. As shown in Fig. 4, we see that only about 1% of the heat from the sun enters the home – and only a negligible portion (4%) of the PV power needs to be diverted to the air conditioning unit to pump this heat out of the house. So, for a BIPV application do you need to worry about whether your roof is cool? Not at all – *for our set of assumptions* – which include a well-insulated roof and efficient HVAC system.

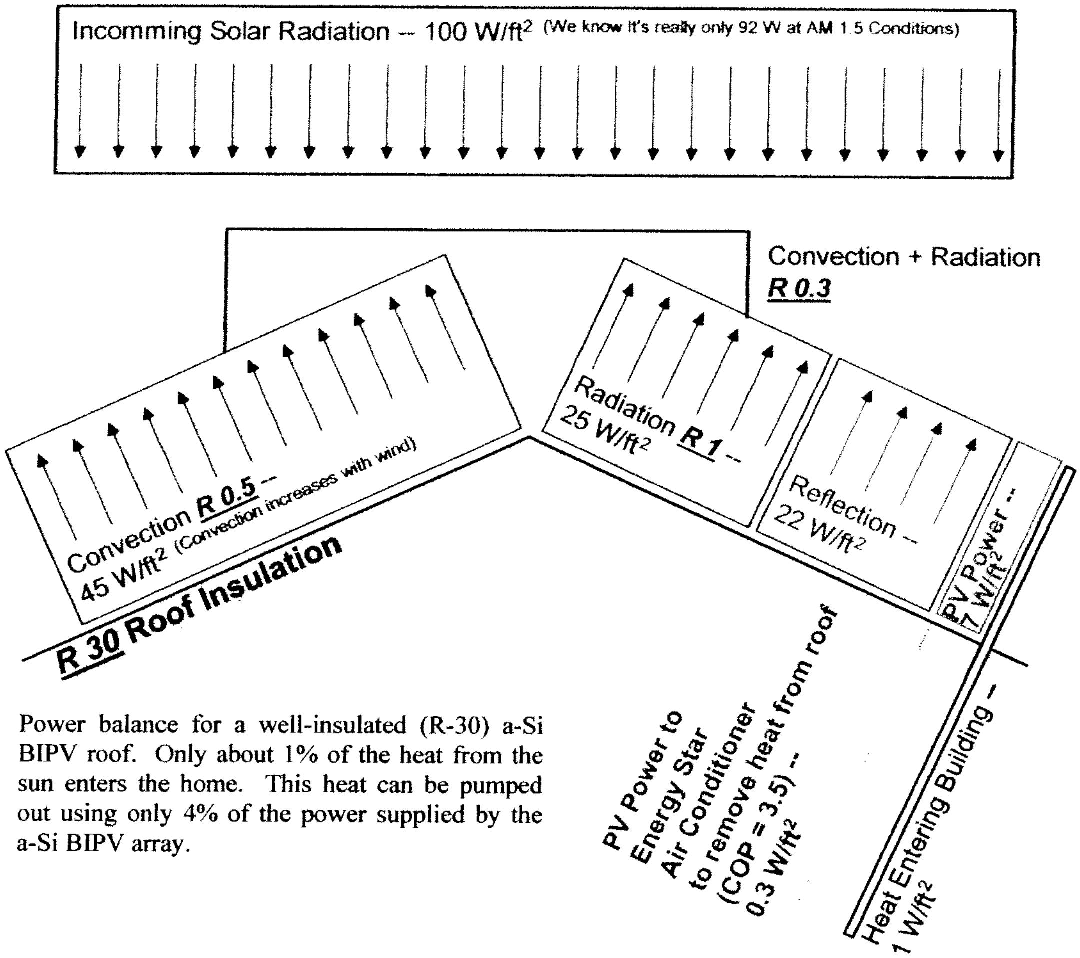

Fig. 4. Power balance for a well-insulated (R-30) a-Si BIPV roof. Only about 1% of the heat from the sun enters the home. This heat can be pumped out using only 4% of the power supplied by the a-Si BIPV array.

3. BAD SCIENCE DISCLAIMERS

In the previous section I showed that heat from the a-Si BIPV roof would negligibly impact the energy use in your home. However, this would not be true in homes that are not consistent with our set of assumptions. For example, let us assume you have little or no roof insulation (R-2 instead of R-30); let us further assume you have a relatively inefficient air conditioning system with a COP of 2 rather than 3.5. In such a case *all* the PV power would be needed to pump the heat from the roof out of the house. Things would be even worse if you have leaky air conditioning ducts in the hot attic.

Many of the studies that show tremendous energy savings from Cool Roofs are performed on exactly such buildings: those constructed with what I would consider to be poor building practice. Is that "bad" science? Not at all! Such building practice may not be to present code, but it is the reality! Most homes and buildings in warm climates have been built with what today is considered to be inadequate insulation, low efficiency HVAC systems, and poorly-placed ducts. While these "deficiencies" could be addressed individually, on many buildings the roof has been designed to be replaced on an almost regular basis. As such, a Cool Roof may be one of the most cost-effective conservation measures which can, to a large extent, ameliorate many of the effects of "poor building practice". The need for re-roofing of existing buildings is also a great opportunity for BIPV, which is also primarily installed on existing structures. The installation of a BIPV roof on existing below standard structures, however, should be undertaken as a part of an over-all building efficiency improvement, including the insulation, HVAC, and lighting systems.

CONCLUSIONS

BIPV and Cool Roofs are complimentary. For a well-insulated home with an efficient HVAC system, a BIPV roof might typically provide about 25 times the energy savings of the best Cool Roof in hot climates where air conditioning is considered as a necessity. Cool Roofs, on the other hand, are extremely cost-effective for poorly-insulated homes which might also have other building deficiencies.

Many roofs require periodic replacement or service. These roofs provide an excellent opportunity for Cool Roofs, as well as for BIPV as a part of a package that addresses the buildings future maintenance costs, insulation, HVAC and lighting systems.

Cool Roofs and PV are a funny combination … a "Cool" PV roof is somewhat of an oxymoron … like asking whether your sailboat has low wind resistance. For a poorly insulated building with an inefficient HVAC system, the sun shining down on absorbing roofs in our cities is a problem; for well-insulated buildings with efficient HVAC systems, a radiation absorbing BIPV roof is the solution.

I close this paper, after the acknowledgements, with pictures showing the beauty of BIPV buildings.

ACKNOWLEDGEMENTS

Thanks to Dirk Lievens for bringing Cool Roofs to my attention and for many interesting discussions. Also thanks to Paul Berdahl at LBL for measuring the Solar Reflectance and emittance of a sample of United Solar's a-Si BIPV material. Thanks to Joe Wiehagen at the NAHB Research Center for the data on the NAHB RC Townhouse array. Thanks to Tom Moran at United Solar Ovonics for teaching me the reality of buildings, as opposed to the model and code for buildings! Also, many thanks to Tami Hoffman at United Solar Ovonic for pictures of BIPV arrays.

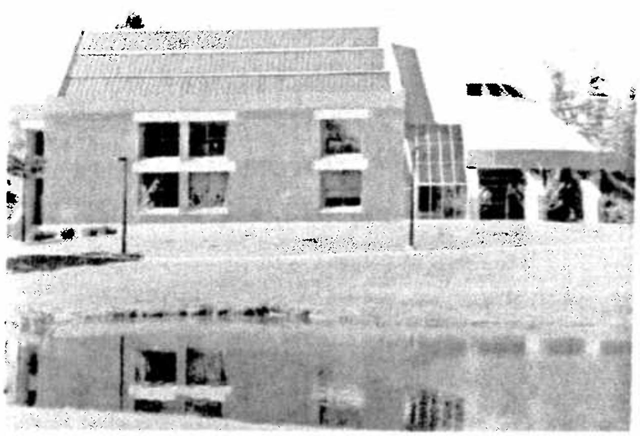

Fig. 5. An a-Si metal roofing BIPV installation at Aquinas College in Michigan.

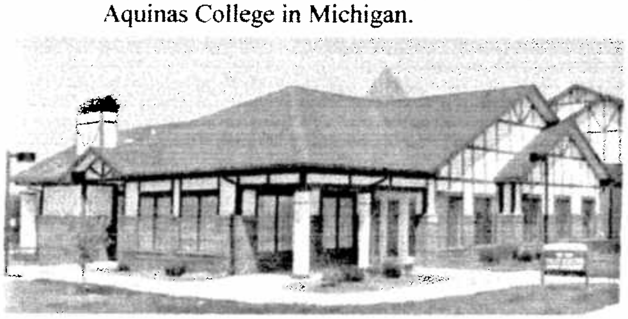

Fig. 6. An a-Si PV shingle roofing BIPV installation at Oakland University in Michigan.

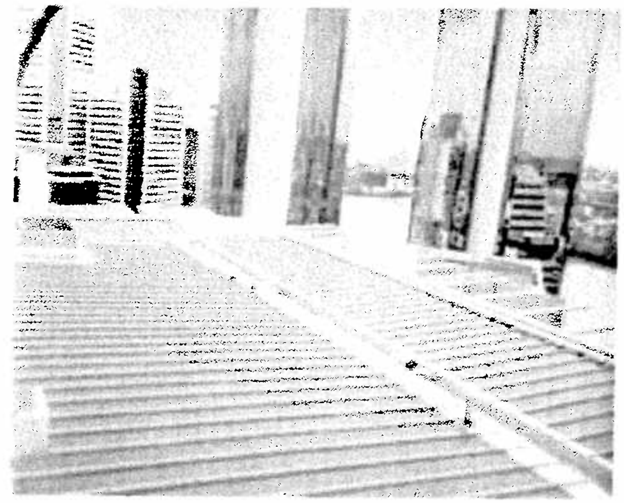

Fig. 7. An a-Si metal roofing BIPV installation in Brisbane Australia (called the "Smartest Building in Austrailia").

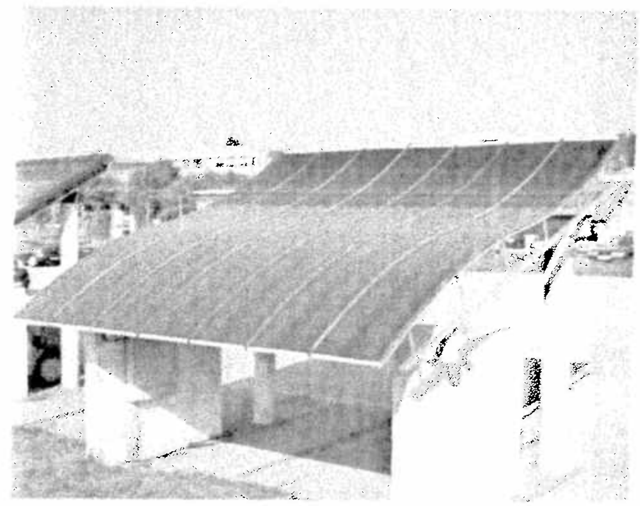

Fig. 8. An a-Si car port BIPV installation.

Fig. 9. A residential a-Si metal roofing BIPV installation in California.

Fig. 10. An a-Si PV shingle installation at Fairfield University in Conneticut.

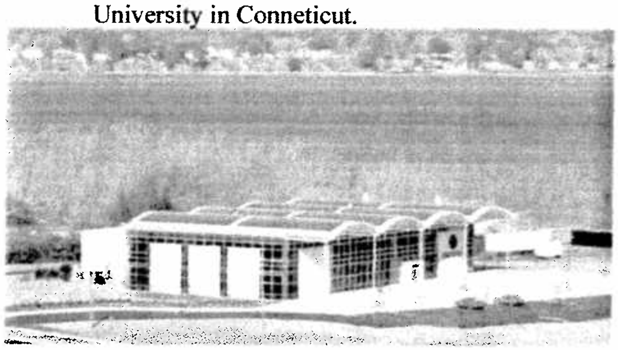

Fig. 11. An a-Si flexible membrane roofing BIPV installation at the Grand Valley State Energy Center in Muskegon Michigan.

Fig. 12. An a-Si metal roofing CA residential BIPV installation.

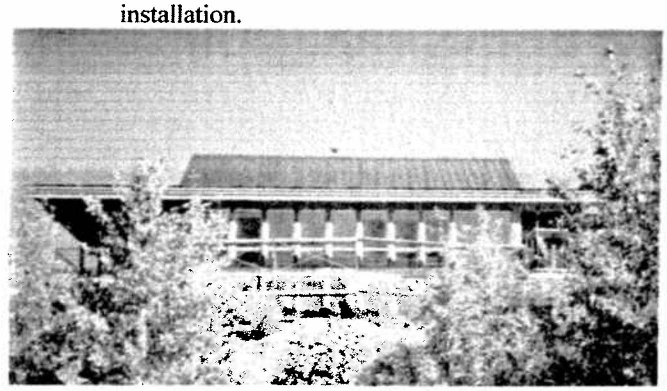

Fig. 13. An a-Si metal roofing BIPV installation.

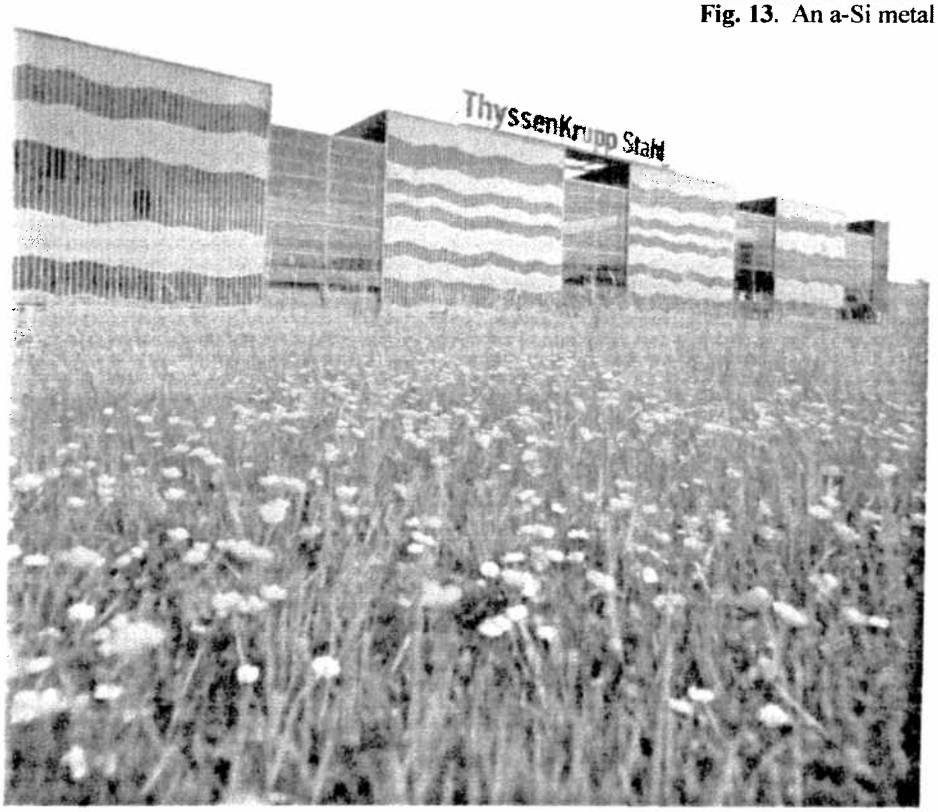

Fig. 14. An artistic use of a-Si flexible "peal and stick" BIPV laminates on the Thyseen Krupp building next to the Rhine.