

Sustainable Roofing

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Cool Roof Rating Council

Membership meeting

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Learning Objectives

- Understand the importance of system selection and preventative maintenance on the long term performance of roofing assemblies
- Assessing the impact a roof's impact on energy consumption and as a potential platform for energy generation in retail facilities
- Learn about end of service life material management and construction waste minimization

Target Corporation

- A long history of environmental stewardship
 - 1960's: First "Reduce, Reuse, Recycle" initiative: cardboard
 - Today: In-store collection stations for plastic bags, glass, plastic and aluminum containers, cell phones, MP3 players, ink cartridges

Roofs: A Critical Element in Retail Stores



- Typically > $\frac{3}{4}$ of the building envelope
- Cost driver
 - Construction
 - Maintenance
 - Energy
- Leakage – Damaged finishes
 - Wasted inventory
 - Slip hazards for guests

Sustainable Roofing Model

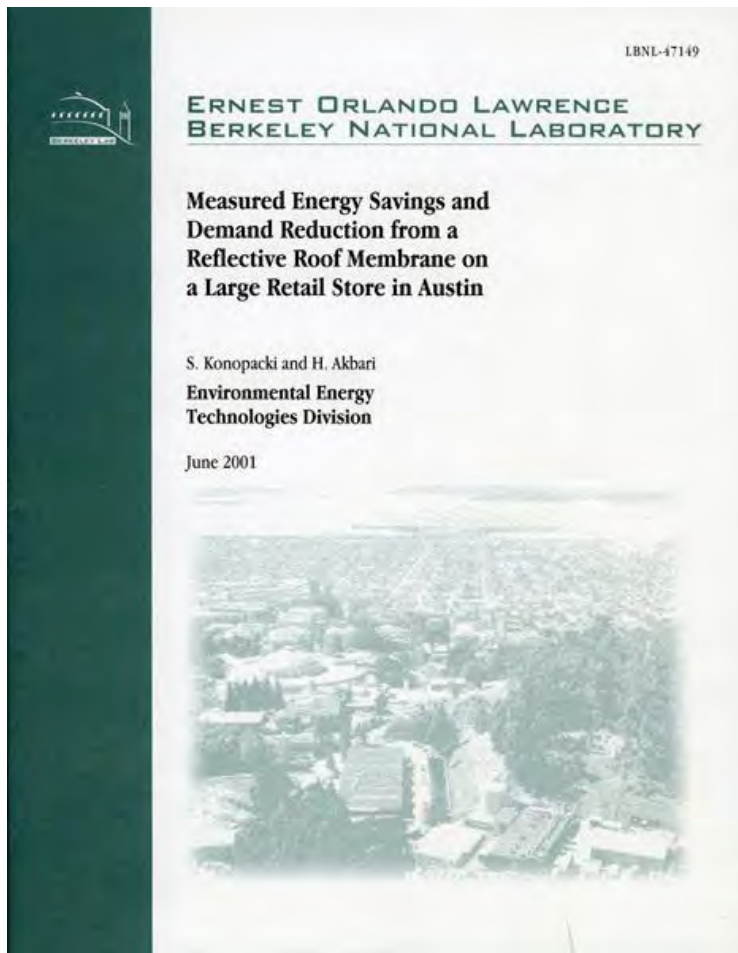


- Reflective membranes to reduce cooling loads, and the Urban Heat Island Effect
- As a platform for solar
- Longest lasting thermoplastic membrane
- Comprehensive, preventative maintenance program
- Re-use of insulation and cover boards

Early 1990s

- Decide on thermoplastic PVC roofing membranes
 - Performance history
 - Seam quality of hot air welding
 - Anticipation of cooling energy savings

Work With LBNL to Quantify Cooling Energy Savings



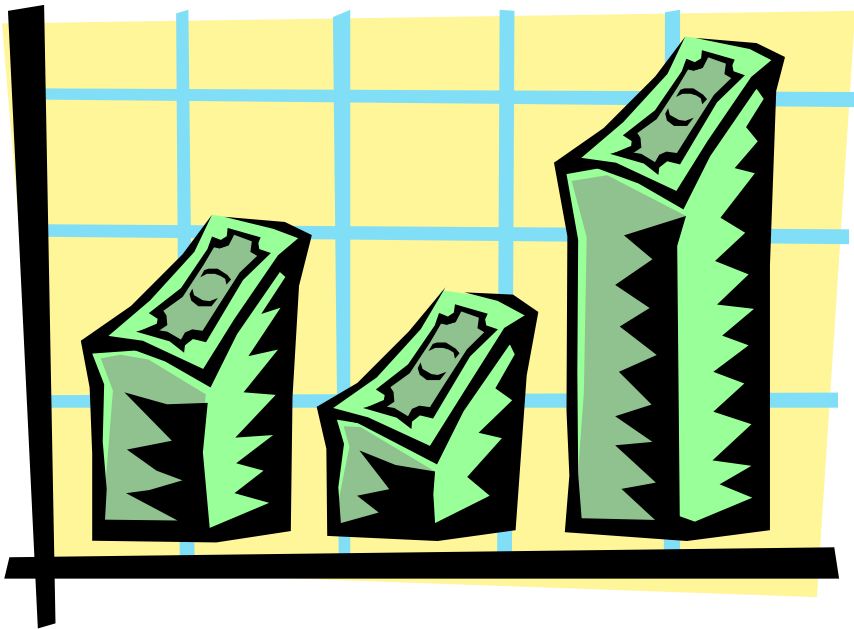
- Sponsored by DOE, EPA
- A Target store was used in one of the first studies to actually measure and quantify the energy savings potential of cool roofs

Some of the Study's Results



- Peak cooling demand reduced by 14%
- Daily air conditioning demand reduced by 11%
- Estimated annual energy savings of \$0.07/ft² (2000)

Applying The Results



- Target used the data generated to develop an internal energy model
 - Model regularly assessed against commercially available software, and modified as required
- Various roof constructions analyzed and modeled
- Validated Target's design decisions

Roof System Design

- Steel deck
- Iso insulation to meet ASHRAE 90.1 in effect at time of construction
 - Will reduce R value as prescribed within ASHRAE in Climate Zones 1 to 3
- Recently began to include high density Iso cover board
- Thermoplastic PVC membrane

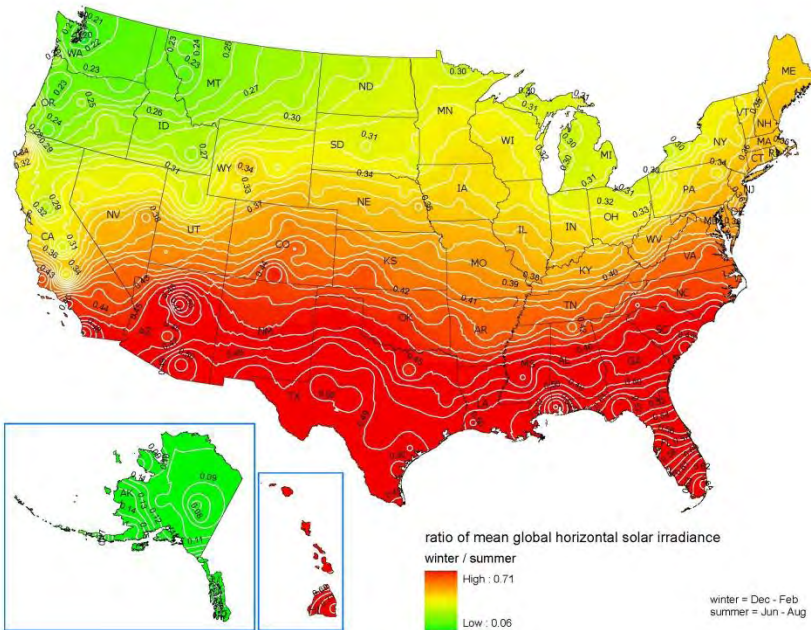


Calculated vs. Actual

- Forecasted energy consumption regularly compared to actual results
- Cooling energy savings associated with cool roofs are significant in all but Northernmost locations, although often slightly lower than projected by the model

Cool Roofs in Cold Climates

- Have not experienced “heating penalty”
 - Have compared white and black in cold climates, no difference in heating energy measured
- No evidence of condensation in insulation, cover boards during membrane replacement



National Presence

- Subjected to various state and local requirements with regards to cool roofs
 - Title 24
 - Chicago Energy Conservation Code
 - Etc.
- Jurisdictions mandating cool roofs constantly increasing
- Maintaining a single, cool roof based, system design avoids need to modify systems to meet local requirements

Cost Drivers

- Energy cost is the biggest single driver
- Utilities and numerous other entities offering incentives to install cool roofs
 - Typically \$1,500.00 to \$5,000.00 per store

Energy & Carbon Management: Renewable Energy

Objective: Evaluate Renewable Energy Opportunities

Standard: Advocate – Projects with positive IRR

Support – Projects with marginal IRR
furthering strategic goals
(Sustainability, Reputation, Carbon)

Scope of Inquiry: Energy sources that regenerate but can be sustained indefinitely

Renewable Energy Opportunities

Solar Landscape

Factors favoring Solar projects

Economic

Growth of Solar – 60% per year since 2000
Decline of Cost – 3.5% per year
Gov Funding – \$5.2B in response to recession

Social/Political

State Mandates for Renewable Energy –
40 States have goals to reduce reliance on
traditional energy sources.

Benefits

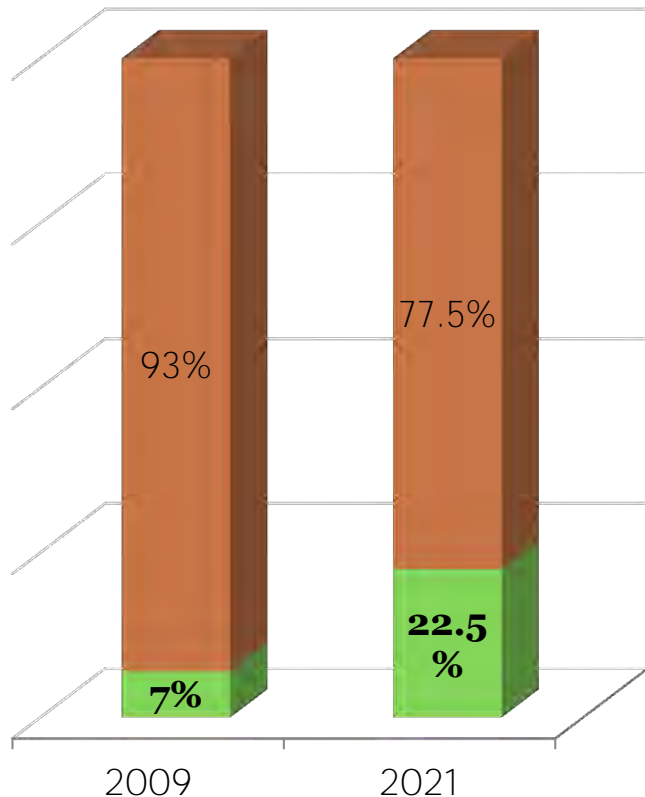
Two Key Value Streams –

- a) Savings from avoiding utility costs
- b) Value of Renewable Energy Credit (REC's)
created.

What's a REC?
Value of avoiding
pollution
(\$ or reputational)

New Jersey Background Information

NJ Legislative Mandate:
22.5% of energy generation to come from **renewable** sources by 2021



Utilities meet this requirement in 1 of 2 ways:

1. Direct Utility Investment



2. Incentivized Customer Investment



Solar Energy

- We're currently harvesting **solar energy** at 26 stores in New Jersey, California and Hawaii.



In 2012 additional stores may be added around the U.S.

Team Overview

Cross-Functional Team that provides oversight on Renewable Energy Projects in the areas of

- Coordination
- Evaluation/Recommendation
- Installation
- Monitoring

Core Team Roles

- Energy Mgmt* Strategy coordination; Performance monitoring
- Procurement Vendor qualification; RFP coordination
- Real Estate Real Estate (land usage, taxes, etc.) considerations
- Architecture Architectural & design considerations
- Engineering Engineering (mechanical & electrical) considerations
- Roofing Structural & re-roofing considerations
- Facilities Mgmt Repair & ongoing maintenance (incl. agreements)
- Sustainability Coordination w/Sustainability initiatives
- Govt. Affairs Legislative & legal landscape
- Public Partnerships Identification, application, and negotiating incentives
- PD Finance Financial analysis & reasonability checks

Evaluate & Recommend

- Maintain a flexible evaluation & recommendation process due to unique nature of renewable projects, balancing
 - Speed
 - Visibility
 - Financial Reasonability
 - Operational Considerations
- As an outcome, it is important to understand how projects fit within
 - Renewable Portfolio
 - Energy Strategy
 - Store/DC Project Approval
 - Sustainability/Reputation

Monitor

- Provide Ongoing Monitoring in the areas of
 - System output VS. expectations
 - System maintenance issues/concerns
 - Total investment measurement
 - Cumulative return
 - System return vs. initial expectations & other TGT systems
 - % of facility load reduction
- Assessment of Competitive Landscape

Thermoplastic PVC Roofing

A long track record on Target buildings



- Began using 20 years ago
- Became primary membrane 10 years ago
 - Consistent specifications
 - Higher quality installations
 - High degree of institutional familiarity, knowledge

Life Cycle Asset Management System

- All stores surveyed 4× / year by store staff
- Data logged, repairs or other follow-up actions initiated as required
- Stores within a couple of years of their predicted service life scheduled for corporate inspection
- Decision made on when to re-roof
- Budgeted for and executed well before failure

Proactive Approach



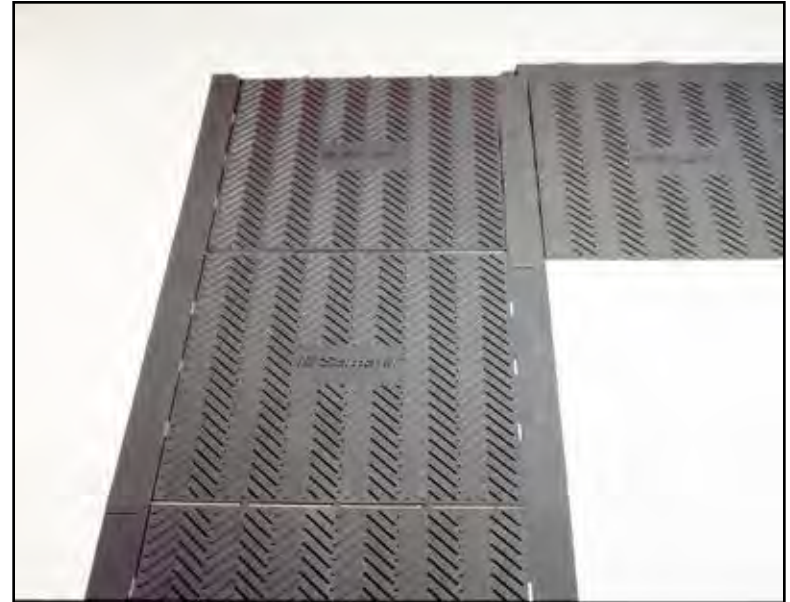
- Minimize interruptions of store operations due to roofing issues
- Thermal insulation and cover board still in serviceable condition
 - 730 m³ (26,000 ft³) of waste avoided per store
 - Significant cost savings
 - Reuse of valuable materials

Room for improvement?

- The membrane being removed was being sent to landfill
- 14,000kg (31,000 lbs) from a typical store
- Membrane recycling?

Since the Late 1990s Production Trimmings, Scrap

- Converted into 100% pre-consumer recycled content accessories like walkway pads and membranes



Post-consumer membrane recycling



- In Europe since 1994

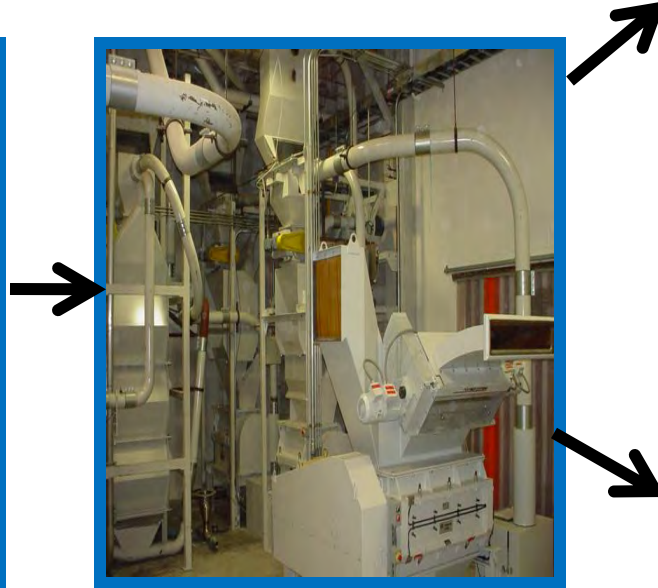


- In North America since 2005

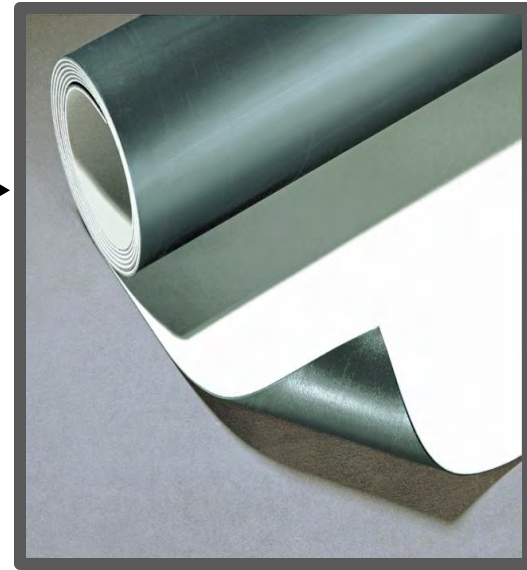


- Target Silver Springs MD 2007

State-of-the-Art Grinding Equipment



Newest Generation Production Lines



Up to 15% by weight pre-consumer
recycle content

Handling Learning Curve



- 610 mm (2') optimize shipping, but increase labor



- Palletizing unwieldy

Best Solution to Date



- Membrane cut 915 mm (26in.) to 990 mm (29in.) wide
- Rolls about 15 m (50ft.) in length
- Can tack weld ends as required
- Load in Gaylords



- Original fasteners and plates left in place
- New scraps recycled with old roof membrane
- Pallets, packaging, etc. recycled separately



- Contractors palletizes full gaylords
- Loads them for shipping
- Manufacturer arranges for shipping to processing plant

Material Processing



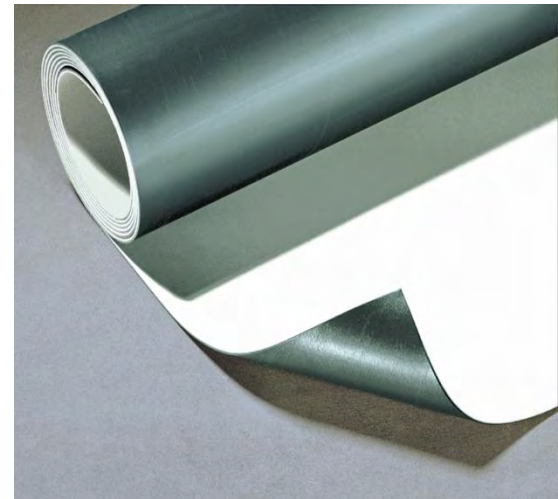
- Materials pulverized into fine powder and forwarded to membrane manufacturer



Recycling into Finished Goods

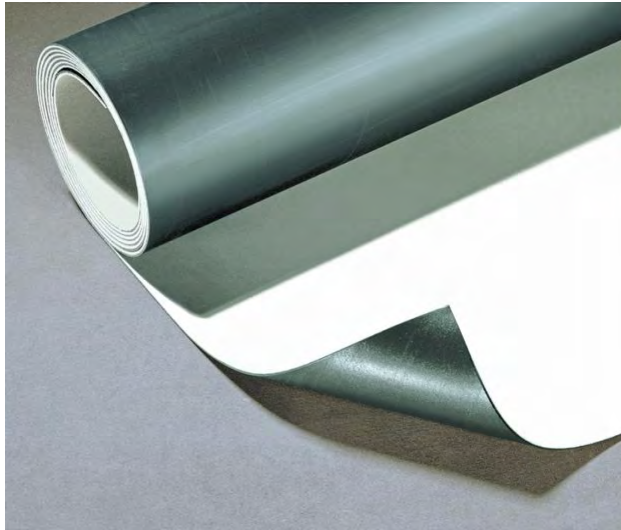


All materials (Including competitors membranes)



Manufacturer's own materials

Post-Consumer Recycling



- Materials being recycled back into new membrane
- No “downcycling”
- Currently limited to loose laid membranes
- Foresee adhered membranes being recycled in the next 2-5 years

Third Party Certification



First, only, low slope roofing material with 3rd Party Certified Recycle Content

Program Recognition

- Commonwealth of Massachusetts Office of Energy and Environmental Affairs Citation
 - “...Groundbreaking resource recovery program for roofing materials...”
 - “...Literally taking recycling to new heights...”
- Society of Plastics Engineers
 - Plastics Recycling Technologies and Applications Award, 2011

Target Program to Date

- 68 roofs recycled
 - Approximately 795,000 m² (8,600,000 ft²) of membrane
 - Approximately 1,000,000 kg (2.4m lbs)
- 15 different states
- At least cost neutral to Target Corporation

Evolution of the Program

- Further reduce handling
- Increase amount of material per truck load
- Expectation is to recycle all roof membranes going forward

Balancing Objectives

- Optimize installed cost
- In order to achieve best long term return on investment
 - Durability
 - Performance
 - Energy Efficiency
 - Maintenance
 - End of Service Life



Model for Sustainability



- Long lasting roof membrane
- Cool roofing for energy savings and reduction of the UHIE
- Platform for energy generation
- Proactive maintenance program to insure longevity
- Reuse insulation and cover board
- Recycle aged membrane into new membrane

QUESTIONS ?

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