Sustainable Roofing

M. Fenner, Group Manager
Existing Stores Construction-Building Envelope,
Target Corporation

S. Graveline, Vice President Technical Services
Sika Sarnafil, a Division of Sika Corporation

Cool Roof Rating Council
Membership meeting
June 27, 2012
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 > ¾ 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
  - Mainenance
  - 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?

M. Fenner
Mike.Fenner@target.com

S. Graveline
graveline.stan@us.sika.com