Greening The Grounds: Finding Economic & Sustainable Returns

Clean Water & Climate Adaptation Summit 2010
Chaska, Minnesota
September 16, 2010

Richard Murphy Jr. ASLA
President & CEO, Murphy Companies
President, American Society of Landscape Architects – MN Chapter
Past Chair, Council of Supply Chain Management Professionals (CSCMP)

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Perspective
Directions
Presentation Flow

Perspective – Putting our industry into context.

2 Case Studies of Green Practices

✓ Native Prairie Planting – why plant & maintain, economic ROI results.
✓ Stormwater Management – how to be green and economic at the same time. ROI (return-on-investment) period vs. generally practiced wall street periods – length of time issue.
✓ Plus Misc. Green Ideas

Warehousing in Logistics
5 Billion Sq. Ft of warehousing in U.S. (ProLogis)
Warehousing in Logistics
5 Billion Sq. Ft of warehousing in U.S.

Creates a 4.1 feet by 4.1 feet square of space in a warehouse for every man, women and child in the U.S....all 300,000,000 of us...!!!
Warehousing in Logistics
5 Billion Sq. Ft of warehousing in U.S.

Floor area equals a 4 foot walkway from here to the Moon...!!!
Who is Murphy
Supply Chain Logistics Services / 3PL

We are a Service Company

✓ Warehousing, distribution, transportation, value-added, fulfillment, international, etc.

We handle products throughout their life-cycle

✓ From raw materials to in-process goods to finished products to returns for numerous industry segments.

Companies Served:
Fortune 100 to Small Entrepreneurs
Domestic and Global

Industries Served:
Retail / Catalogue / Consumer
Medical / Health Care
Grocery / Food Processing
Beverage
Plastics
Recreational / Camping
Industrial
Forest Products (Paper/Packaging)
International

3PL – “3rd Party Logistics Services Provider”

Logistics Leadership since 1904
Who is Murphy
Supply Chain Logistics Services / 3PL

Murphy Family, 4th Generation (1904)
Square Feet Operated: 2,500,000
Employees: 180

- ISO 9001 Certified / ISO 14001 (pending)
- OSHA - MNSHARP Certified
- ASI Food Certified / Organic Food Certified
- LEED “Gold” Certified (2 facilities)
- Energy Star Certified
- US Customs Bonded – CES, CFS, GO
- FTZ (Foreign Trade Zone)

SKU’s Controlled: 29,000+
Order Activity / Month: 30,000+
Truck Loads Handled / Year: 120,450
Rail Cars Handled / Year: 10,000
How do firms use Murphy
13 Examples

1. Big Box / Mass Merchant Retail - Backroom Support
2. Global Sourcing – Domestic Production
3. Domestic Sourcing – Domestic Production
4. Vendor Consolidation Park
5. Seasonal Space Offsets
6. Domestic Manufacturing Support
7. Regional Distribution
8. Contract Logistics
9. U.S. Distribution
10. Medical Support Logistics
11. Value Added Services
12. Customer Returns Processing
13. Core Competency Strategy
Green example
Customer Returns Processing

What happens to your clothes once they reach the final end of retail

**Clothing** – garments shipped overseas for fibers to be separated and reused.
- A local fashion designer has a clothing line made from re-cycled threads.

**Shoes** – rubber soles are recycled; fabric used as compost.

**Leather Goods** – reprocessed into other leather items.
2 Case Studies of Green Practices

1. Native Prairie Planting vs. Lawn

2. Stormwater Management
A Question I Ask Industry Audiences:

Have you ever given much thought to your facilities?

- Landscape?
- Stormwater?
A Question I Ask Industry Audiences:

Have you ever given much thought to your facilities?

- Landscape?
- Stormwater?

....You Should...!!!
Native Prairie vs. Lawn

Is there a cost difference?
Is there an environmental difference?
Do they look OK?
Northtown Logistics Campus

4700 & 4850 Main St NE, Fridley, MN 55421
Location of cost figures & 500,000 sq. ft. of warehouse.

Brown areas are native prairie
Photo taken in early spring.
Native Prairie vs. Lawn
Is there a cost difference – YES

Annual Maintenance Costs

<table>
<thead>
<tr>
<th></th>
<th>Prairie Areas</th>
<th>Lawn Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>$4,240</td>
<td>$-</td>
</tr>
<tr>
<td>Mowing</td>
<td>-</td>
<td>$12,015.00</td>
</tr>
<tr>
<td>Watering</td>
<td>-</td>
<td>$8,630.00</td>
</tr>
<tr>
<td>Fertilization</td>
<td>-</td>
<td>$1,005.00</td>
</tr>
</tbody>
</table>

**Total Cost:**
- Prairie: $4,240
- Lawn: $21,650

**Cost / Acre:**
- Prairie: $707
- Lawn: $5,167

Manicured Lawn costs 7.3x more to maintain than native prairie plants!

“Since 1994 we have saved over $480,000 while being green…!!!”
Prairie Maintenance

Key to success...!!!

Provided since day one by

Prairie Restorations of Princeton, MN
web-site: www.prairieresto.com

Services include site visits 4-6 times per growing season and burning every 2-3 years.

Brown areas are Native Prairies
Native Prairie vs. Lawn

Is there a cost difference - **YES**

### Installation Cost Comparison

<table>
<thead>
<tr>
<th></th>
<th>Install Cost 6 Acres</th>
<th>Install Cost vs. Prairie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prairie</td>
<td>$34,320</td>
<td>-</td>
</tr>
<tr>
<td>Seeded Lawn*</td>
<td>$48,000</td>
<td>1.4x</td>
</tr>
<tr>
<td>Sod*</td>
<td>$111,000</td>
<td>3.3x</td>
</tr>
</tbody>
</table>

* Lawn costs include 1st year watering, mowing and other misc. expenses, but no sprinkler irrigation install costs.
Native Prairie vs. Lawn

Is there a cost difference – YES

ROI of Prairie vs. Lawn Installation

<table>
<thead>
<tr>
<th></th>
<th>Maint. Cost</th>
<th>Prairie Install Cost</th>
<th>Savings per Year of Prairie vs. Lawn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawn</td>
<td>$ 31,002</td>
<td>$ 34,320</td>
<td>$ 26,762</td>
</tr>
<tr>
<td>Prairie</td>
<td>$ 4,240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost Difference</td>
<td>$ 26,762</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.28 Years

Site: 4700 & 4850 Main St NE, Fridley, MN 55421
Actual data from Murphy expense records
Native Prairie vs. Lawn
Is there an environmental difference - YES

- Native plant materials selection.
- No watering required, or significantly less in dryer climates.
- No fertilization required.
- Roots are deep and assist stormwater infiltration.
Native Prairie vs. Lawn
Results of Native Plantings – “Wildlife”

Fox, Deer, Eagles, Hawks, Numerous Bird Species, Ducks, Fish

- Eagles dive into water and pull out fish!
- Pictured right is a 12 point buck at the 7033 Fridley Facility, Fall 2009.

Former EPA Superfund site cleaned and developed by Murphy in 1999.

7033 Central Ave NE, Fridley, MN 55432

7 acre native prairie surrounding retention and ground water pond. Site where Eagles dive for fish.
Native Prairie vs. Lawn
Environmental Metrics

Carbon Sequestration Benefits
14 Acres of Native Prairie
✓ 24.93 MtCO$_2$e/Year
  • i.e. 55,125 lbs / yr.

Carbon Sequestration Benefits
732 Trees
✓ 275 Oaks, 274 Maples, 183 Spruce/Pines
✓ 1,534.27 MtCO$_2$e/Year
  • i.e. 3,382,481 lbs / yr.
Native Prairie vs. Lawn
Do they look OK?

Neighbors love it...!!!

✓ Urban Design Center, U of MN, uses our campus as "best-of" for industrial design.

Start-up Issue....

✓ Prairie plants do not meet city lawn height ordinances!
✓ Needed a variance in 1994 with first one.
✓ Former Landscape Architecture student of mine was Fridley’s Assistant City Planner and understood what we wanted to achieve and allowed us to proceed - the rest is history!

Photos show native prairies at Murphy’s Campuses - 14 acres total at four facilities.

**Edge**

Key element in working with Prairies in urban areas.

Without an edge prairies are very, very rough looking.

Note flowing line ("edge") between prairie and lawn.

Typical look with no edge. Note roughness visual quality. Gets worse as plant height increases.

Note straight line ("edge").

Note flowing line / edge between prairie & lawn.
Edge

*Much like a picture frame gives order to a busy painting, a cut lawn edge does the same for a prairie.*
Native Prairie vs. Lawn
Do they look OK?

Not only do neighbors love them
We have been robbed twice!

One 4th of July a van was seen pulling away from the property with plants in back. Police arrested the individual.

- Contacted Ron Bowen of Prairie Restorations for a value per police request he responded: “they’re priceless!”
- These were 7 year old plants with deep roots.

Summer 2009 an elderly couple were seen digging up plants. Unfortunately not caught.
Facility Design
Stormwater Regulation Impacts

Few outside profession realize growing impact…!!!
EPA mandated cities to control their stormwater – quantity & quality
  ✓ Regulations required cities to comply with no additional Federal Funds, thus local fees.

Stormwater fees growing
  ✓ 1400+ cities to date nationwide.
  ✓ Minneapolis - $3,400 per acre (i.e. $0.12 per sq. ft. of warehouse). Most DC/warehouses use 20+ acres; cost is $68,000+/yr.
Minneapolis Logistics Campus
Stormwater Project
701 24th Ave SE, 55419

Highly urban site
Buildings dating from 1904 – 1980’s
24/7 busy logistics operation.

Kasota / Rollins Ave.

24th Ave SE still a combined storm / sanitary line.
Minneapolis Logistics Campus
Stormwater Project

22 Acres
95% impervious before project
✓ 58% building, 37% pavement
✓ Nearly 100% of Stormwater running off site.

5% green space
✓ New suburban regulations often require 25-40% green coverage

Note lack of green space in photo…
Minneapolis Logistics Campus
Stormwater Project

Goal #1 – reduce or eliminate stormwater fee of $68,000.

Goal #2 – solve roof rain downspout issue of emptying into combined storm/sanitary city system.

Goal #3 – we are here for the long haul, therefore, be a good corporate citizen and do the right thing.

Goal #4 – leverage environmental leadership in our strategy.
Minneapolis Logistics Campus
Stormwater Project

Two Solutions Explored

1. Underground Storage

- Modern, suburban, industrial sites use open retention basins (see photo below).
- Tough in 1) existing urban sites, 2) densely developed industrial parks, or 3) very expensive sites that need greater building coverage to meet financial requirements such as retail malls.
- Often forces use of underground retention systems - very expensive (see photos on right).
Minneapolis Logistics Campus
Stormwater Project

Two Solutions Explored

2. Permeable Pavements - Concrete, Asphalt & Pavers

- Great idea - unfortunately, serious concern whether they are capable today of withstanding the constant grinding & shear stress from truck's turning while pulling back into docks.
Minneapolis Logistics Campus
Stormwater Project

Solution

- Steered all stormwater by gravity feed to NW corner of site.
- 1 large open retention basin.
- 2 Bio retention basins & 1 rain garden.
- Pipe sizing to allow some retention capacity.
- Roofs used for temp storage & slow release.
- Underground system dropped; city refused to grant grandfather provision if reg’s changed over 5 year period. Cost was $300,000.
- High grade native prairie design in retention and rain gardens.

Key Person: Rebecca Kluckhohn, P.E.
Email: rkluckhohn@wenck.com
Minneapolis Logistics Campus
Stormwater Project

Basic Water Flow Design

Key:

- Main Retention Pond
- Bio Retention Basins
- Surface and underground pipe flow
- Underground only flow
- Overflow release to area storm system
- Prairie grass infiltration area
Minneapolis Logistics Campus
Stormwater Project

Net Result

100% stormwater fee credit
$68,000 annual savings
50% federal depreciation deduction*

* NOTE: this was not known about till after completion.

NOTE: Original design generated approximately 78% stormwater fee credit.

“As-built” drawings resulted in a 102% net credit.
## Minneapolis Logistics Campus
### Stormwater Project

**ROI Period**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site:</td>
<td>22 acres</td>
</tr>
<tr>
<td>% impervious:</td>
<td>95%</td>
</tr>
<tr>
<td>Project Cost (Design + Const.)</td>
<td>$580,000</td>
</tr>
<tr>
<td>Annual Storm water Fee</td>
<td>$68,000</td>
</tr>
<tr>
<td>Payback in Years</td>
<td>8.53</td>
</tr>
<tr>
<td>Immediate 50% Depreciation:</td>
<td>$290,000</td>
</tr>
</tbody>
</table>

*+ Federal Stimulus Package*

**ROI Payback Period**

- 8.5 yrs simple pre-tax basis
- 7.0 yrs after Fed Credit & tax basis
Minneapolis Logistics Campus
Stormwater Project

Logistics Leadership since 1904
Native Prairie Costs - 1 acre

Project management/mobilization $800
Site preparation (includes spraying, tilling, harrowing) $2,825
Seed and seeding as specified $3,770

Erosion blanket (3,200 sq yds of SC150 @ $1.60 yd installed) $5,120
Erosion blanket (1,700 sq yds of S150 @ $1.25 yd installed) $2,125

Wildflower seedlings (5,750 installed @ $2.00/plant) $11,500
Sod flats (100 installed @ $14.00/flat) $1,400
Turf sodding as needed (800 sq yds @ $3.85/yd) $3,080

Total $30,620

Year  Projected Management Procedures
1.  2009 - Complete site mowings to control annual weed canopy (2 or 3 mowings as needed).
2.  2010 - Complete site mowing; Integrated Plant Management (IPM) - spot spraying, spot mowing, hand weeding, etc.(3-5 visits are typical)
3.  2011 - Spring burn to encourage native plant growth and to help deter the presence of non-native and woody species plus IPM.

Estimated maintenance costs
Growing season 2009..............$1,700
Growing season 2010..............$2,200
Growing season 2011..............$2,200
Major Retention Basin
NW Corner of Site
Photos show 1st summer plant growth
Major Retention Basin
NW Corner of Site

Photos show 2nd summer plant growth
Case 2 - Stormwater

Major Retention Basin
NW Corner of Site

Top 1\textsuperscript{st} summer; Bottom 2\textsuperscript{nd} summer

Overflow dam within catch basin.
## Major Retention Basin
### NW Corner of Site

**Bio-retention Pond – Northwest Corner**

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Wildflowers</th>
<th>oz./project area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>17,000 sq. ft</strong></td>
<td><strong>Short dry mix:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Short dry mix:</strong></td>
<td>53% Little bluestem, 32% Side oats grama, 10% Blue grama by PLS weight.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3% June grass, 1% Kalm’s brome, 1% Poverty oats grass by bulk weight.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Mixed height mesic mix:</strong></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>32% Big bluestem, 28% Little bluestem, 22% Indian grass, 10% Side oats grama, 3% Canada wild rye, 2% Switch grass by PLS weight.</td>
<td>1% Kalm’s brome, 1% June grass, 1% Sand dropseed by bulk weight.</td>
</tr>
<tr>
<td></td>
<td><strong>Tall wet mix:</strong></td>
<td>1½</td>
</tr>
<tr>
<td></td>
<td>43% Big bluestem, 10% Canada wild rye, 8% Switch grass, 4% Indian grass, 4% Little bluestem by PLS weight</td>
<td>12% Cord grass, 10% Blue joint grass, 2% Fringed brome, 2% Virginia wild rye, 2% Wool grass, 2% Green bulrush, 1% Giant bur-reed by bulk weight.</td>
</tr>
</tbody>
</table>

| Wildflowers | oz./project area |
|-------------|
| **Short dry mix:** | 1% Purple prairie clover, 17.5% Hoary vervain, 17% Black-eyed Susan, 8% Leadplant, 8% White prairie clover, 7% Stiff tickseed, 3% Upland goldenrod, 3% Golden Alexander, 2% Heath aster, 2% Azure aster, 2% Bush clover, 2% Wild bergamot, 2% Showy penstemon, 2% Gray goldenrod, 1% Yarrow, 1% Fragrant giant hyssop, 1% Stiff goldenrod, 1% Showy goldenrod, 0.5% Common milkweed, 0.5% Dotted blazing star, 0.5% Prairie rose, all by bulk weight. |  |
| **Mixed height mesic mix:** | 16% Black-eyed Susan, 15% Hoary vervain, 14% Purple prairie clover, 7% White prairie clover, 6% Common ox-eye, 6% Leadplant, 4% Wild bergamot, 4% Stiff goldenrod, 3% Fragrant giant hyssop, 3% Smooth aster, 3% Tall blazing star, 3% Showy goldenrod, 3% Golden alexander, 2% Heath aster, 2% Azure aster, 2% Stiff tickseed, 2% Upland goldenrod, 1% Yarrow, 1% Canada tick trefoil, 1% Bush clover, 1% Gray goldenrod, 0.5% Common milkweed, 0.5% Stiff sunflower, all by bulk weight. | 8 |
| **Tall wet mix:** | 15% Blue vervain, 12% Joe-pye weed, 12% Tall blazing star, 8% Blue flag iris, 6% Black-eyed Susan, 5% Mountain mint, 4% Boneset, 3% Sweet flag, 3% Canada tick trefoil, 3% Giant sunflower, 3% Common ox-eye, 3% Ironweed, 3% Golden alexander, 2% Swamp milkweed, 2% Smooth aster, 2% New England aster, 2% Purple prairie clover, 2% Great St. John’s wort, 2% Arrowhead, 2% Upland goldenrod, 2% Stiff goldenrod, 1% Marsh marigold, 1% Grass-leaved goldenrod, 1% Culver’s root, all by bulk weight. | 4 |

If you want this level of planting detail for each area please send e-mail request to richard@murphywarehouse.com
Bio Retention Basin
Rollins / Kasota Ave
NW Corner of Site
Bio Retention Basin
Rollins / Kasota Ave
North Side of Site
Rain Garden
24th Ave SE
SE Corner of Site
Other Murphy Green Projects & Practices

LEED and Energy Star Certification of three facilities.
- Two LEED GOLD Certified facilities (July 2010) – sites discussed in prairie section and built in 1994 and 1996.
- Minneapolis Logistics Campus under LEED Certification review for early 2011 – site discussed under stormwater section and built in 1904 up to 1980s. When certified will contain oldest building (1904) so certified in Minneapolis.
- Energy Star Certification (September 2010) – two buildings fall within top 1% for lowest energy use (scored 99 & 98 on 100 point scale)

ISO 14001 Certification - Environmental Performance & Management.

Dock Plate “Winter Insulated Blanket” program
- To reduce “ice cube” impact of cold steel dock plates. In place since 2003.
- Major impact on employee comfort level (+10°F) and 10% reduction in heat costs.

Lighting
- Starting early 1990’s Murphy has followed and upgraded lighting as new technology arrives.
- Paybacks have averaged 14-16 months.
- In one case replaced only 5 year old fixtures for benefit.
Other Murphy Green Projects
Solar Power at 3 Facilities
140 KW of power

ROI of 4 Years...!!!
40-50% of power used...!!!

Minnesota Solution Provider
tenKsolar

Jim Losleben, 952-303-7600, jlosleben@tenksolar.com

- Run at lower voltage – increases efficiency and solves fire department issues with live systems.
- Solved “shadow problem” – shading a portion of panel now doesn’t shut system down!
- Meets Minnesota’s new law to receive state grants for using MN manufactured panels.
- Murphy installing 3 systems Fall 2010
- 1st started on Sept 14th.
Why does Murphy voluntarily do green projects and practices?

Their leader is a Landscape Architect – “what can we say”

As a 4th generation family business we are in for the long haul.

We believe it’s important to be a leader - being green is important today and will grow more so soon.

Major corporations (our customers) have / will have within a few years “Green” Initiatives.

✓ They need assistance from their Carriers, 3PL’s, Suppliers, etc. to contribute to their “greenness” measures.

In the long run green practices are showing financial paybacks.

✓ But, in many cases you must be willing to take the longer term view.
✓ Murphy’s stormwater project ROI period: 7.0 years (after Fed credit & taxes).
✓ Murphy’s native prairies ROI period: less than 1.2 years
✓ Murphy’s lighting retrofit ROI period: 0.8 – 1 ½ years.
✓ Murphy’s three 2010 Solar Energy Projects ROI: 4 years. w/out Subsidies: 25+ Years.
  ✓ Feasibility and short ROI period result of three major support programs: Federal, State (MN Manufactured Equip.) and Xcel grant.
✓ Typ. Wall Street Firm ROI period: 2 - 3 years, maybe 4.
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Misc. **Green** Trends in Logistics Industry

Wall Street and Green Measures
Fuel Price Impacts on Logistics
U.S. Network Design - “*More is Less*”
Green Roofs
Energy Creation Measures
Wall Street Impact on Green

Many investors see “green” practices as reflection of good management practices.

- Supply Chain Logistics industry undergoing many changes to meet these new expectations.

“Eco”

....Economics
....Ecology
Wall Street Impact on Green
McDonalds Changing Sign Color in Europe
Target Green Next?

Make Change. Save Green.
Go eco-friendly with Target for smart, affordable solutions.
Fuel Prices
We all know what recently happened

U.S. No 2 Diesel Retail Sales Price

-$2.99

($/Gallon)

Source: Department of Energy, August 11, 2010
Global sourcing network evaluation becoming more important

When to move from Offshoring to Inshoring

Source: MIT 10-2008
Global sourcing network evaluation

Case Study 1 - impact of fuel prices and rising Asian labor cost.

Sourcing Strategies: 2003 and 2008

Source: MIT 10-2008
Network Design

Last 15 yrs trend has been fewer & bigger warehouses. 3 - 5 Total.

- TQM, ERP, JIT, Lean & lower fuel cost driven

Serious consideration being given to increasing number of warehouse points.

- Where 3-5 network of warehouses was cost effective, today many are looking at becoming a 6-10 network of warehouses.
- Impact of higher local delivery cost (vs. long haul cost) is changing networks.

Source: New Age of Trade. Cushman & Wakefield, 2009
Network Design - “More is Less”

Oil price vs. inventory carrying and facility costs

Moving from $125/barrel to $150/barrel changes the optimal number of DC’s from 5 to 7. In particular, you can think of Las Vegas being replaced by Los Angeles, Albuquerque, and Portland.

“DC” stands for Distribution Center / Warehouse
Network Design - "More is Less"

Network Cost + Carbon Footprint Reduction

Trade-Off Curve between number of DC’s, costs, service and carbon footprint

More DC’s result in less carbon!

1.6% cost increase; 20% distance decrease 11% reduction in carbon

Source: MIT 10-2008
Urban Heat Island Impacts
Potential solution - green roofs

Minneapolis Library
Green roof temperature statistics
Situation: 90-degree day
- Green Roof: 92° F
- White Roof: 125° F
- Dark Ballast: 145° F
- Black Roof: 170° F
Green Roof

Benefits

Cooling aspects – for buildings & urban areas

- Even a 50 foot ring around air intake vents proving beneficial...!!!
  Temp difference often 30 degrees.

Roofs become water retention basins

- Delayed runoff the result
- Runoff rate from storm surge into stormwater system delayed
- Reduces size and cost of site infrastructure

This graph records the cumulative rainfall and runoff from the Green Roof and the Reference Roof during a 34mm rain event over a 15h period in October 2001. The green roof delayed runoff and reduced runoff rate and volume.
Green Roof
Challenge today – EXPENSIVE

Often 2-3x cost of normal roof
✓ Therefore rarely seen on private projects.

Today government buildings are where they are seen:
✓ Normal white roof: $5.00 per sq. ft.
✓ Green roof: $8+ per sq. ft. w non-watered plants
✓ Green roof: $14-25+ per sq. ft. w watered plants

Roof membrane life is longer since it is protected from solar rays
✓ Normal roof: 20-25 years.
✓ Green roof: 40-50 years est'ed.
Energy Creation – Wind

Wind power units – individual fans, horizontal row of blades, & stand alone tower units.

Horizontal wind power units – research in Chicago on units mounted in horizontal row of blades at roof edge to capture air flow rising up and over building, and to better handle turbulent urban air patterns.
Energy Creation - Solar Power

Roofs - Large available flat areas “just sit there.” Solar panels not great load factors.

Commercial solutions include:

- **“Solar Energy Service Provider”** - 100% responsibility to design, build, own and operate the asset - including all upfront purchase and installation costs.
- To solutions where building owner owns the solar assets and provider design-builds the system.

![Staples Store, CA](image-url)

**2 Solar Providers:**
- AMERICAN CAPITAL ENERGY
- SunEdison

(Logistics Leadership since 1904)
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