Green Deconstruction

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Objectives

- Define “green deconstruction”
- Provide background for green deconstruction activities
- Describe processes associated with green deconstruction
- Discuss cost considerations and economics
- Describe advantages and disadvantages
- Discuss several examples

Deconstruction is the selective dismantling of building structures to recover the maximum amount of primarily reusable and secondarily recyclable materials in a safe and cost-effective manner.

Restrictions Based on Building Types & Locations

- Surrounding space/buildings
- Entry/egress
- Building materials; i.e., brick is more difficult to salvage and costs more; wood is easier and cheaper
- Hazardous materials (pre-1978 structures are more likely to contain)
- Structures with damage (fire, water, insect)
- Proximity to recycling/reuse facilities
- Structure soundness – always consider; safety first!

Materials for Reuse/Recycle

- Concrete
- Wood
- Asphalt
- Gypsum
- Metals
- Bricks
- Glass
- Plastics

Materials for Reuse/Recycle

- Trees, stumps, landscape debris
- Interior furnishings, equipment, electronics
- Roofing
- Doors
- Lighting fixtures
- Windows
- Plumbing fixtures
- Electrical components
- HVAC components
- Earth, rocks

Debris Quantities

For residential and commercial buildings, the overall estimated percentage of materials are estimated with the following ranges:

Component	Overall Percentage in Material (by weight)	Potential Reuse?	Potential Recycle?	Potential Salvage (Sell)?
Concrete, brick and mixed rubble	40 – 50%	X	--	--
Wood	20 – 30%	X	X	X
Drywall (gypsum)	5 – 15%	--	X	--
Asphalt Roofing	1 – 10%	--	X	--
Metals	1 – 5%	X	X	X
Bricks	1 – 5%	X	X	X
Plastics	1 – 5%	X	X	X
Carpet/Textiles	4%	X	X	X
Cardboard	1%	--	X	--

Benefits

- Potential cost savings through reuse/recycling of materials
- Less burden on landfills and/or disposal facilities, potentially decreasing greenhouse gas emissions (e.g. incineration)
- Reduced need to manufacture or harvest virgin materials
- Tax benefit, by donating recovered materials to qualified 501(c)(3) charities
- Achieve “green” goals and compliance with other agency sustainability directives
- Minimize local environmental impacts and create good will

Benefits, cont.

- Support local recycling and sustainability related businesses
- LEED credits (examples):
  - MR Credit 2.1 – Construction Waste Management: Recycle and/or salvage non-hazardous construction/demo waste
    - Divert 50%: 1 point
    - Divert 75%: 1 additional point
  - MR Credit 3 – Use of salvaged or reused materials
    - 5% of total cost of materials: 1 point
    - 10%: 1 additional point

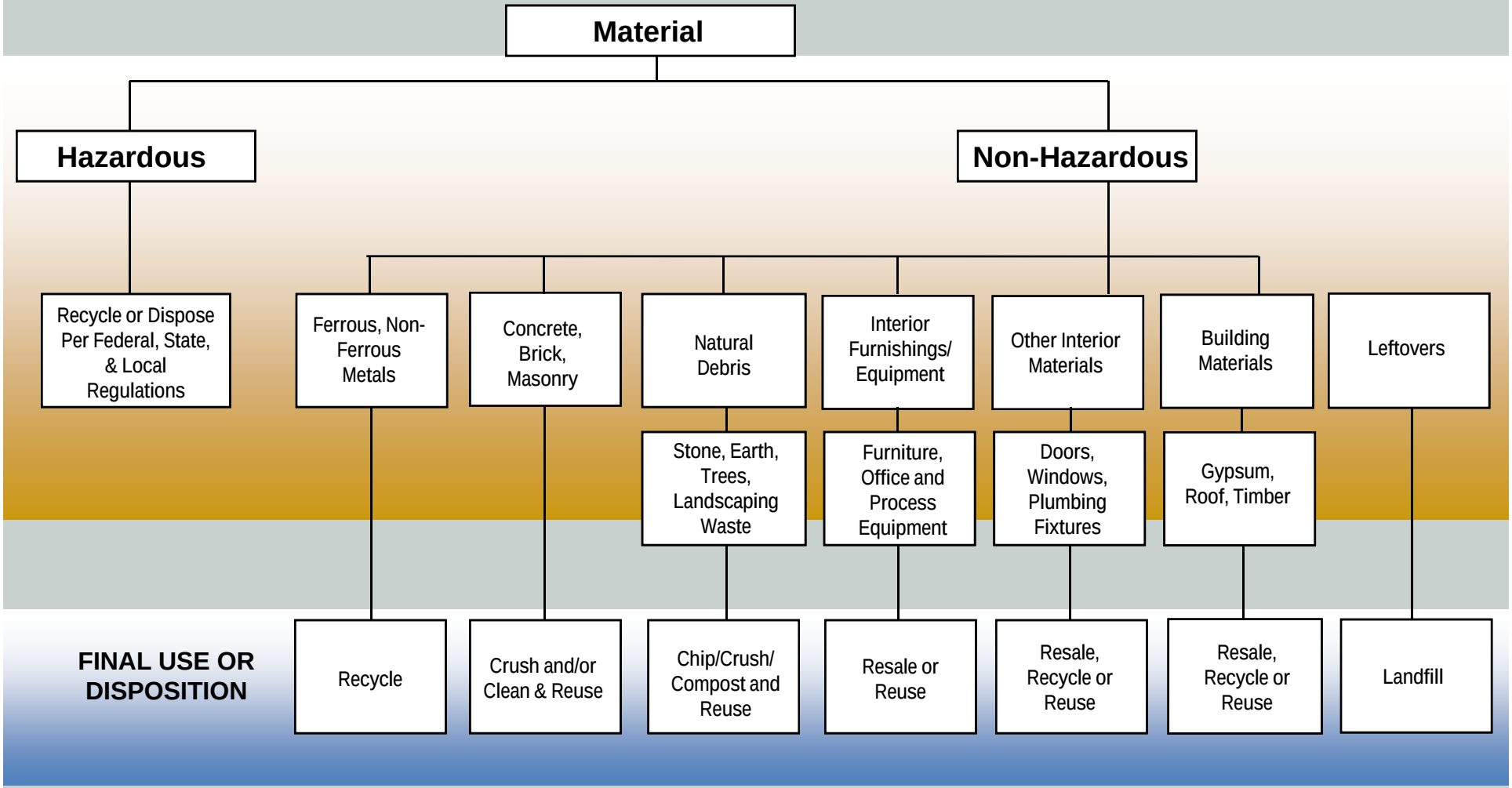
Disadvantages

- Project duration longer due to material separation
- Increased labor costs due to material separation
- Materials must be considered for end use up front to ensure proper processing
- Potential material handling challenges
- Higher level of risk for worker H&S

Considerations

- Build the elements into project approach
  - Discuss with all stakeholders
  - Determine final goals
  - Discuss impact on cost, schedule, operations
  - Capture procedures in quality, waste management and work plans
- Current market values and trends for materials
- Documentation is critical
  - Particularly if trying to achieve LEED status
  - Cannot be done after the fact

Deconstruction Segregation



Contract Management

Potential options:

- Owner contracts out the deconstruction work but retains ownership of the salvaged materials.
- Owner allows contractor to receive salvaged materials as "in-kind payment," thereby reducing the cost of the deconstruction contract.
- Owner allows contractor to retain salvaged materials and reduce rate based on resale revenues.
- Owner contacts non-profit contractor (i.e., Habitat) to perform deconstruction for a fee and owner donates salvaged material to non-profit.

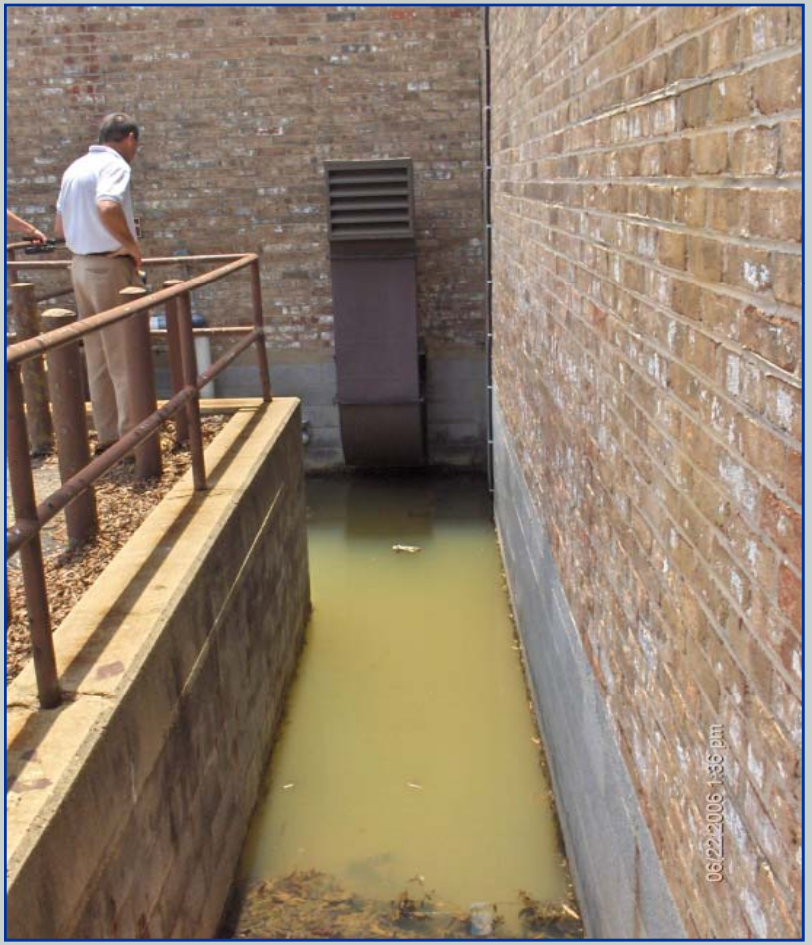
References: DOA, 2007

Procedures for Implementation

- Site walk with stakeholders
- Survey and plan for hazardous materials
- Health and Safety (Deconstruction has higher level of risk for worker H&S)
- Find markets for recycling/reuse of materials
- Determine deconstruction goals
- Define methods for Green Deconstruction
- Set project parameters – budget, schedule, quality
- Implement and monitor

Hazardous Materials

- Historical Data Review
  - Past building usage
  - Waste management practices
- Physical Verification Survey
  - Asbestos-containing material (ACM)
  - Lead-based paint (LBP)
  - Light ballasts (PCBs)
  - Lights and switches (mercury)
  - Water in basements and sumps
  - Mold



Finding Markets for Recycling/Reuse of Materials

- US EPA Waste Website: http://www.epa.gov/epawaste/conserve/rrr/imr/cdm/bytype.htm
- Local recycling centers, websites
- National bulletin board for buyers and sellers of salvaged or surplus building materials - www.recycle.net, www.greenguide.com, and www.rbme.com
- www.craigslist.org
- Habitat for Humanity, Goodwill or other non-profits
- Local garage sales, flea markets or auctions

Deconstruction Methods

Deconstruction methods can be:

- Soft Skimming
  - *Salvage selected components prior to demolition (e.g., doors)*
- Manual
  - *Requires extensive time (therefore more labor costs), but yields highest amount and quality of salvageable material*
- Panelized
  - *Roof, wall, floor sections are removed more quickly than manual methods but reduces salvageable material due to damaged components*
- Mechanical
  - *Mechanical removal of material, such as use of a manlift to disassemble siding, etc.*
- Combination thereof

References: DOA, 2007, NYWM, 2009

Simplified Economics

- *Demolition:*

  Demolition labor +
  Demolition equip +
  Disposal cost +
  Permitting +
  Other

  = Total Demolition Cost

- *Deconstruction :*

  Deconstruct labor +
  Deconstruct equip +
  Permitting +
  Other -
  Revenue from salvage
  (estimated @ 50% of material value)

  = Total Deconstruction Cost

Reference: Dantata, et. al, 2004; information from Deconstruction Institute website

Economic Evaluation

Items	Deconstruction (Reuse and/or Recycle)	Demolition
Labor	Higher labor costs (hand labor required)	Traditional demolition labor force
Equipment	May require specialized equipment	Traditional demolition equipment
Transportation	Reduced waste transport	May be high depending on distance to appropriate disposal facilities
Permits	Demolition permit Asbestos permit	Demolition permit Asbestos permit Disposal permits
Tipping Fees	Avoided or reduced	Can be high depending on area and type of waste
Taxes	Tax credits for deconstruction	Taxes on transport and disposal
Return Value	Revenue from sale of salvaged items, reduced tipping fees, tax deduction for donated items, save $$ on fill	Minimal, if any
Potential Loss	Schedule extension, higher labor costs	May need to purchase more raw materials if reconstruction at same location

References: Dantata, et. al, 2004; Guy, 2006; DOA, 2007.

MA Deconstruction Case Study

- Objective of study (Dantata, et al.):
  - Evaluate impact of certain cost perimeters on deconstruction
- Results:
  - Deconstruction costs may be 17–25% higher than demolition
  - Major costs that affected deconstruction (ranked in order of impact on cost)
    - Labor cost – productivity and hourly rate
    - Disposal cost
    - Resale value of salvaged components

Results from MA Case Study, cont.

- Results, continued:
  - Essential to perform sensitivity analysis for location where project performed
  - There is a potential “break even” point for when deconstruction costs = demolition costs
  - Breakeven point based on

    (1) decreased labor rates,

    (2) increased labor productivity rate,

    (3) high local tipping fees, and/or

    (4) increased salvage or reuse values

Schedule Impacts

Deconstruction will require more time than traditional demolition

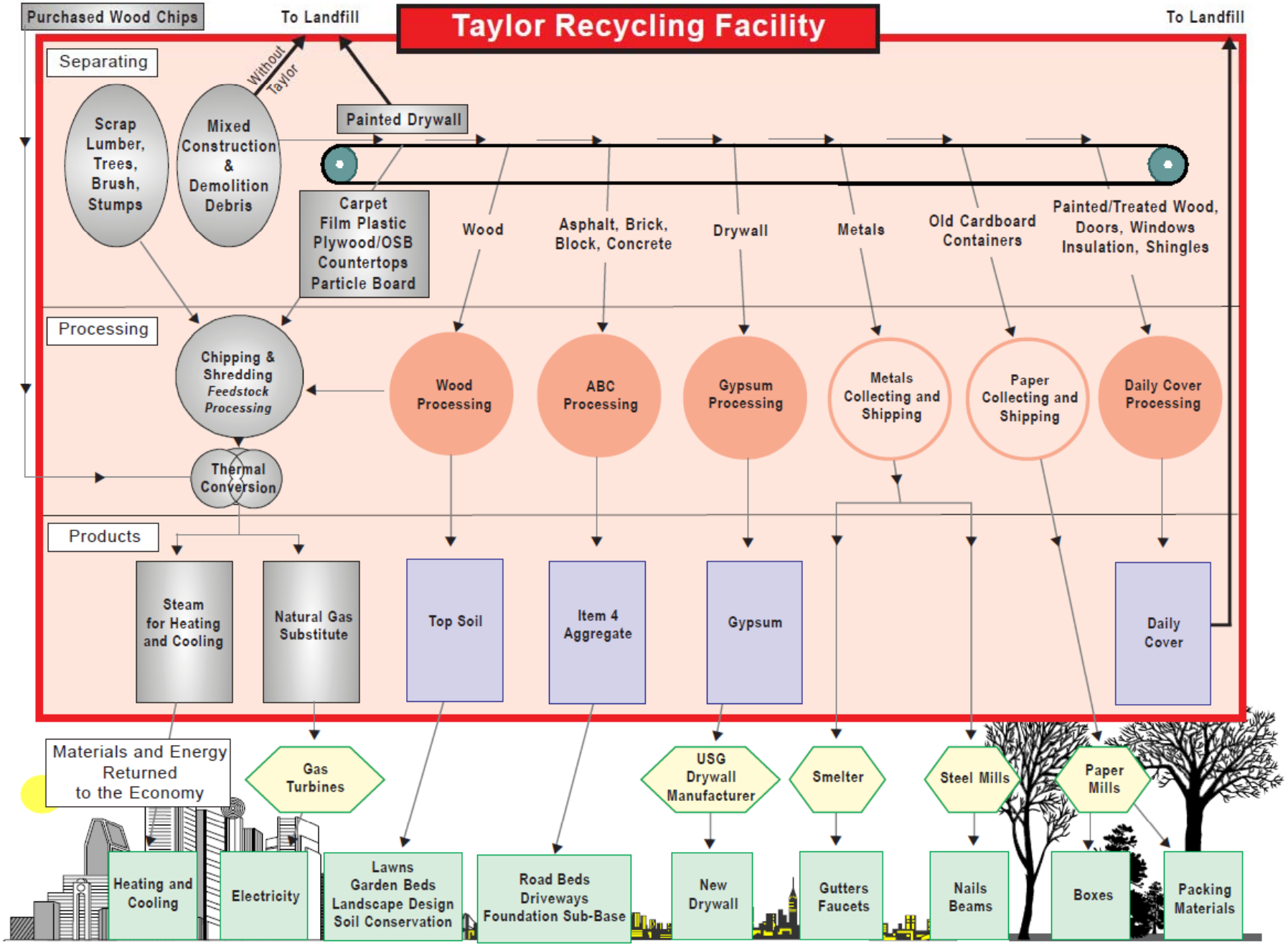
- According to MA study: increased deconstruction cost may be higher than demolition cost due to a longer schedule.
- Handling and Separation– additional man hours required to separate materials, remove nails, etc.
- Transport of waste – may not be necessary and may save some time

Example Projects

- Fort Drum Army Installation
- Austin Energy Holly Power Plant
- Garrison Street Station

Fort Drum Army Installation

- Active US Army installation 10 miles NE of Watertown, NY
- Created a Demolition and Recycling plan for controlled demolition of structures, with building debris trucked to a recycling facility
- 95% of the material from two buildings was recycled
- Fort Drum earned credits to meet the DoD's 40% diversion rate for solid waste
- Also earned solid waste diversion credits based on their success in meeting material recycling goals


Taylor Recycling Facility
Purchased Wood Chips
To Landfill
To Landfill
Separating
Without Taylor
Painted Drywall
Scrap Lumber, Trees, Brush, Stumps
Mixed Construction & Demolition Debris
Carpet
Film Plastic
Plywood/OSB
Countertops
Particle Board
Wood
Asphalt, Brick, Block, Concrete
Drywall
Metals
Old Cardboard Containers
Painted/Treated Wood, Doors, Windows Insulation, Shingles
Processing
Chipping & Shredding
Feedstock Processing
Thermal Conversion
Wood Processing
ABC Processing
Gypsum Processing
Metals Collecting and Shipping
Paper Collecting and Shipping
Daily Cover Processing
Products
Steam for Heating and Cooling
Natural Gas Substitute
Top Soil
Item 4 Aggregate
Gypsum
Daily Cover
Materials and Energy Returned to the Economy
Gas Turbines
USG Drywall Manufacturer
Smelter
Steel Mills
Paper Mills
Heating and Cooling
Electricity
Lawns
Garden Beds
Landscape Design
Soil Conservation
Road Beds
Driveways
Foundation Sub-Base
New Drywall
Gutters
Faucets
Nails
Beams
Boxes
Packing Materials

Austin Energy Holly Power Plant

- Decommission and demolish a 45-year-old plant located in a densely populated area
- The City's goal is to maintain a substation and redevelop the remainder of the property as parkland along a lake

- Scope of work includes:
  - Decommissioning of the power plant and related structures
  - Equipment and materials salvage and recycling
  - Utility isolation
  - Environmental assessment
  - Land improvements to prepare the property for redevelopment.

Austin Energy
Holly Power Plant (cont.)

- Equipment Reuse and Sales Plan included the following:
  - Preliminary estimates for equipment value between $7 million and $12.5 million.
  - Sale of equipment should provide the maximum investment recovery.
  - Lag time for new power production equipment orders is 24 to 36 months. Reuse of the equipment by Austin Energy provides the maximum value.

- Equipment Salvage:
  - A total of approximately 13,640 tons of equipment is available for salvage if the equipment is not sold.
  - Scrap steel has ranged from $75 to $375 per ton in the past 12 months.
  - Peak scrap prices typically occur between April and July yearly.

Garrison Street Station

- Car dealership on Garrison Street in Denver
- Construct LEED-certified building with retail/ commercial use.
- Deconstruction Objectives:
  - Minimize material entering landfills by maximizing materials to be recycled and/or reused.
  - Minimize site disturbance.

Garrison Street Station, cont.

- Documentation is a critical part of process
- Asbestos abatement first
- Potential Materials for Reuse/Recycling:
  - Concrete, asphalt, steel rebar, steel framing members, usable abandoned office furnishings and interiors, HVAC equipment, copper, fencing, garage doors, windows, doors, and exterior bricks

Resources

- *Journal of Green Building*
- LEED Reference Guides (Version 3 now available)
- Deconstruction Institute: http://www.deconstructioninstitute.com/
- *A Guide to Deconstruction.* Bradley Guy, Deconstruction Institute, in association with the University of Florida Center for Construction and Environment. January 2003.
- ARMY Public Works Technical Bulletins

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Questions?