The Sustainable Materials Management Webinar Series

The Benefits of the Construction and Demolition Waste Recycling Industry in the U.S.

Tuesday January 20, 2015/1:30 – 2:45PM ET

Presenter: Dr. Timothy Townsend, PhD/ P.E.,
Professor of Environmental Engineering
University of Florida

Pennsylvania Recycling Markets Center

NRC NATIONAL RECYCLING COALITION

WE ARE RECYCLING

Promoting The Recycling of Construction and Demolition Materials

CDRA
Construction & Demolition
Recycling Association

It is the mission of the CDRA to:

Provide positive support and representation to the industry and CDRA members in legislative and rule-making venues that impact the recycling business.

Act as an advocate to promote C&D recycling and the recycle business in every manner possible that benefits CDRA members.

Facilitate and sponsor CDRA member interaction between the membership companies and further facilitate interaction between the membership and the many specialized services that can potentially benefit the membership such as equipment, financing, insurance and other specialized third party resources

CDRA Facts

- Founded more than 20 years ago
- Nearly 300 members
- Located across North America
- Almost all are processors of C&D
- C&D World, the Annual Meeting of the CDRA, is March 29-31 in Nashville

C&D White Paper

- We suspected C&D was the largest waste stream in the country
- Not very well studied
- Impetus for C&D White Paper
- Another White Paper on concrete recycling
- Have material specific websites: shinglerecycling.org, drywallrecycling.org, and concreterecycling.org

CDRA

Construction & Demolition Recycling Association

Thank You For Participating

630-585-7530
info@cdrecycling.org
www.cdrecycling.org

The Benefits of C&D Materials Recycling the US

Timothy G. Townsend, PhD, PE
Department of Environmental Engineering Sciences
Engineering School for Sustainable Infrastructure and Environment
University of Florida

January 20, 2015

ttown@ufl.edu
http://pages.ees.ufl.edu/townsend/



Sustainable Materials Management


Presentation Topics

- C&D Materials Overview
- Current State of Practice with C&D Recycling
- Quantifying the Benefits of C&D Recycling
  - Jobs, economic, environmental

"The Benefits of Construction and Demolition Materials Recycling in the United States"

CDRA Construction & Demolition Recycling Association

C&D WORLD Exhibition & Conference

March 29-31, 2015 • Nashville, TN

Concrete

Major Market:

Construction stone
(e.g., road base)

Asphalt Concrete

Major Market:

Hot Mix Asphalt Pavement

Asphalt Shingles

Major Market:

Hot Mix Asphalt Pavement

Wood

Major Market:

Fuel

Drywall

Major Markets:

→ New drywall
→ Land application

Metal

Fines

Major Markets:

→ Fill material
→ Landfill cover

Refuse Derived Fuel

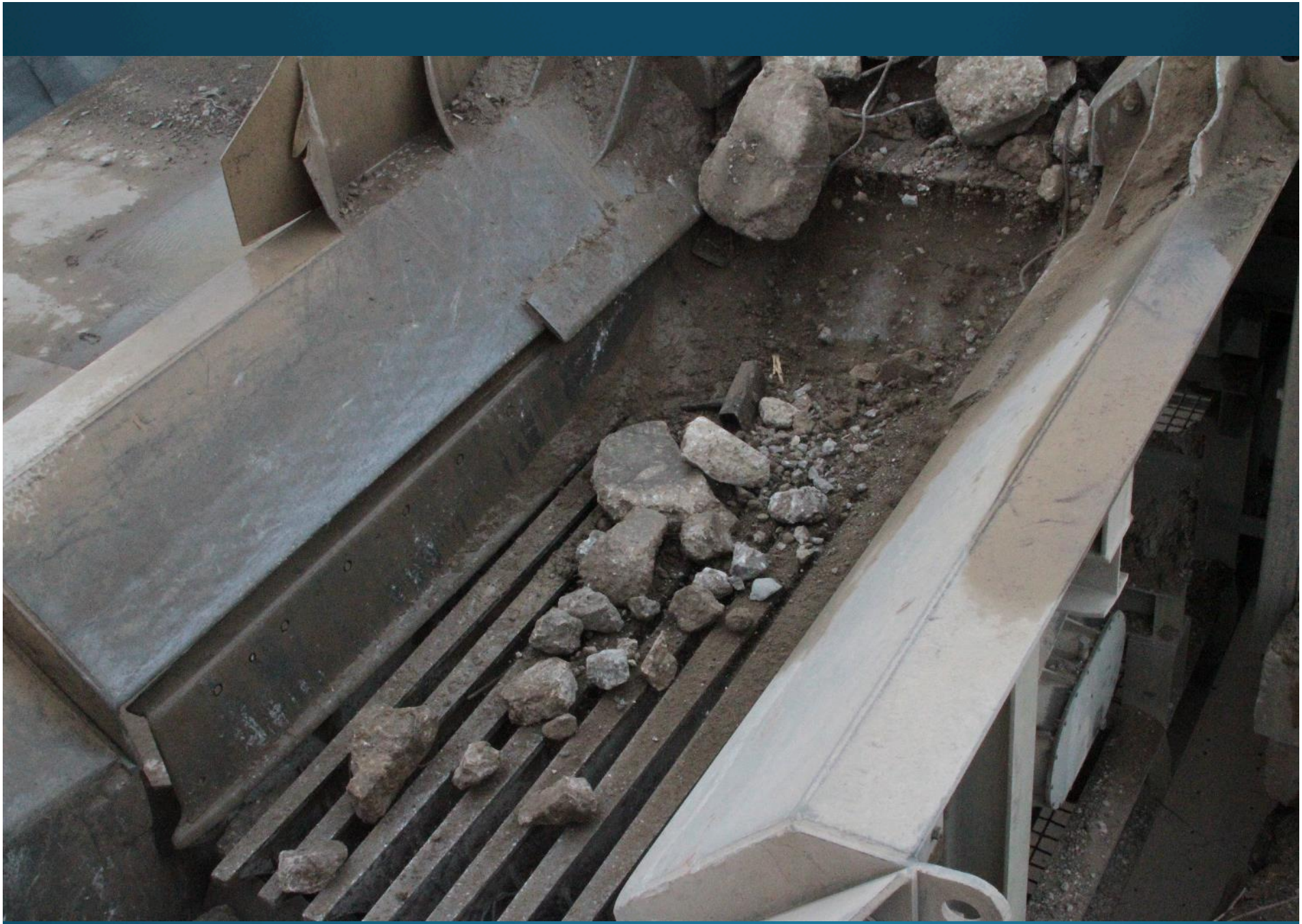
Other Materials

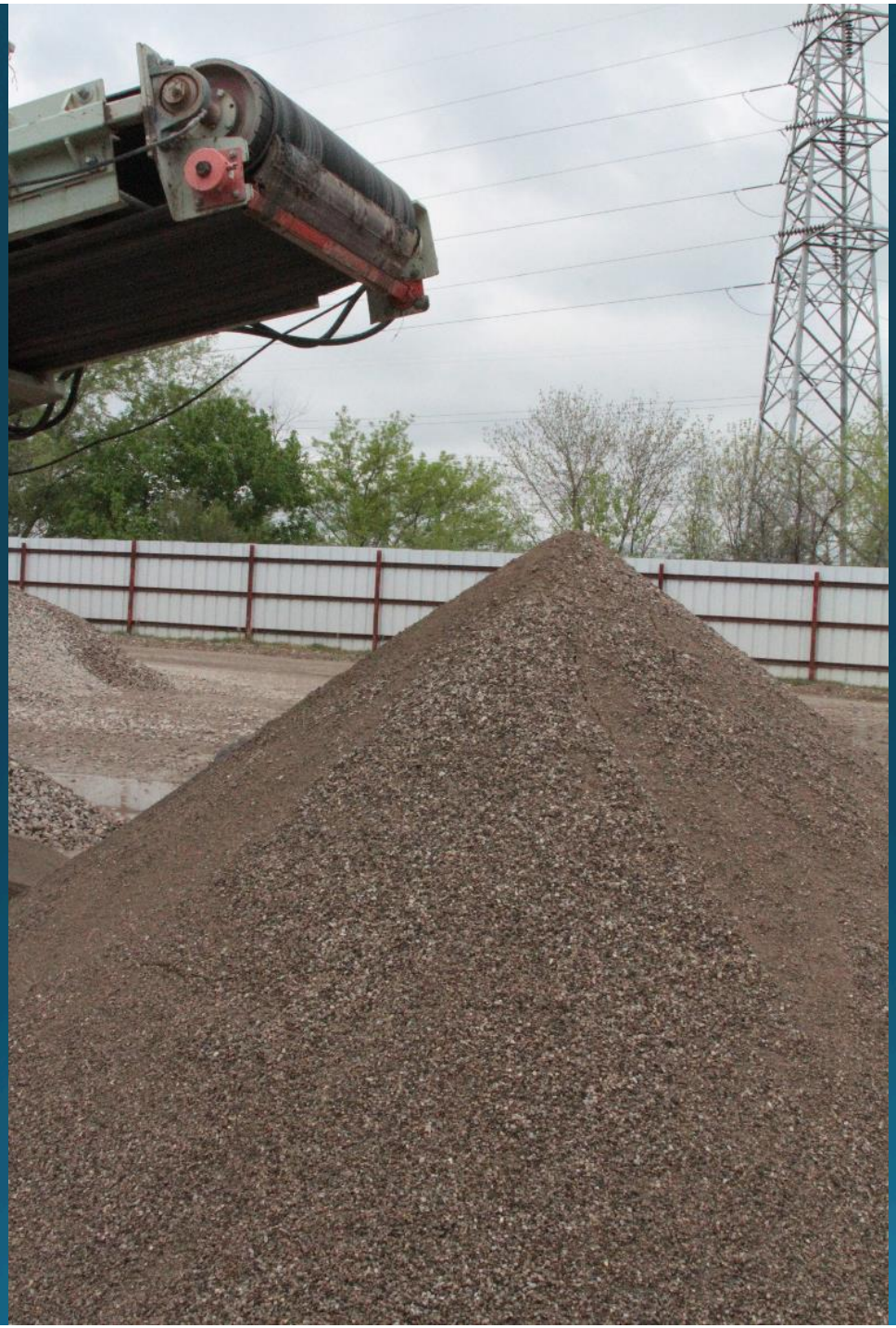
- Cardboard
- Carpet
- Carpet padding
- Plastic
- Green waste

C&D Recycling – State of Practice

Bulk Aggregate Processing Facility


CAT
HOLT
CAT
345E





C&D Recycling – State of Practice

Mixed C&D Processing Facility


KOMATSU


KOMATSU


SWS
2031


Fines


Wood
Fines


Picking Line
Fines


2
EXIT
EXIT
CARDBOARD
CARDBOARD


METALS


VOLVO

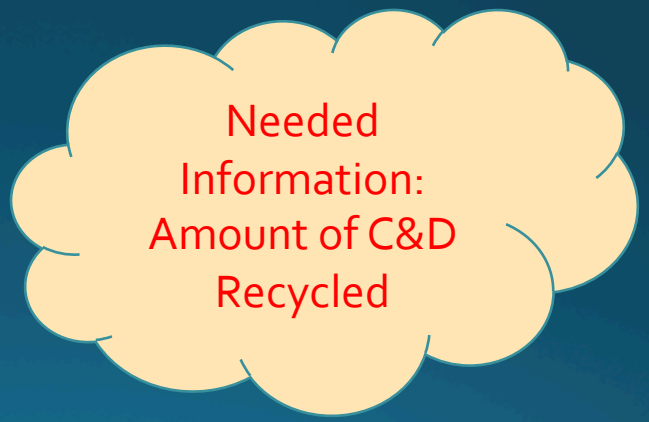
Why Recycle?

Common Cited Benefits of Recycling

- Reduce landfill disposal
  - Protect environment
  - Better utilize land resources
- Save natural resources
- Save energy
- Save money
- Create green jobs

Quantifying the Benefits of Recycling

- Engineers and scientists now have a greater set of tools that we can use to quantify benefits from different waste management processes, including recycling.
- The University of Florida has been working with the CDRA to quantify the benefits accrued by C&D recycling in the US.
- Examples:
  - Landfill capacity savings
  - Energy savings
  - Life cycle environmental benefits
  - Job creation
  - Impact on local economies



How Much C&D is Out There?

- US EPA 1996 → 135.5 million tons
  - 30-40% recycled
- US EPA 2003 → 170 million tons
  - 48% recycled

Building-related only

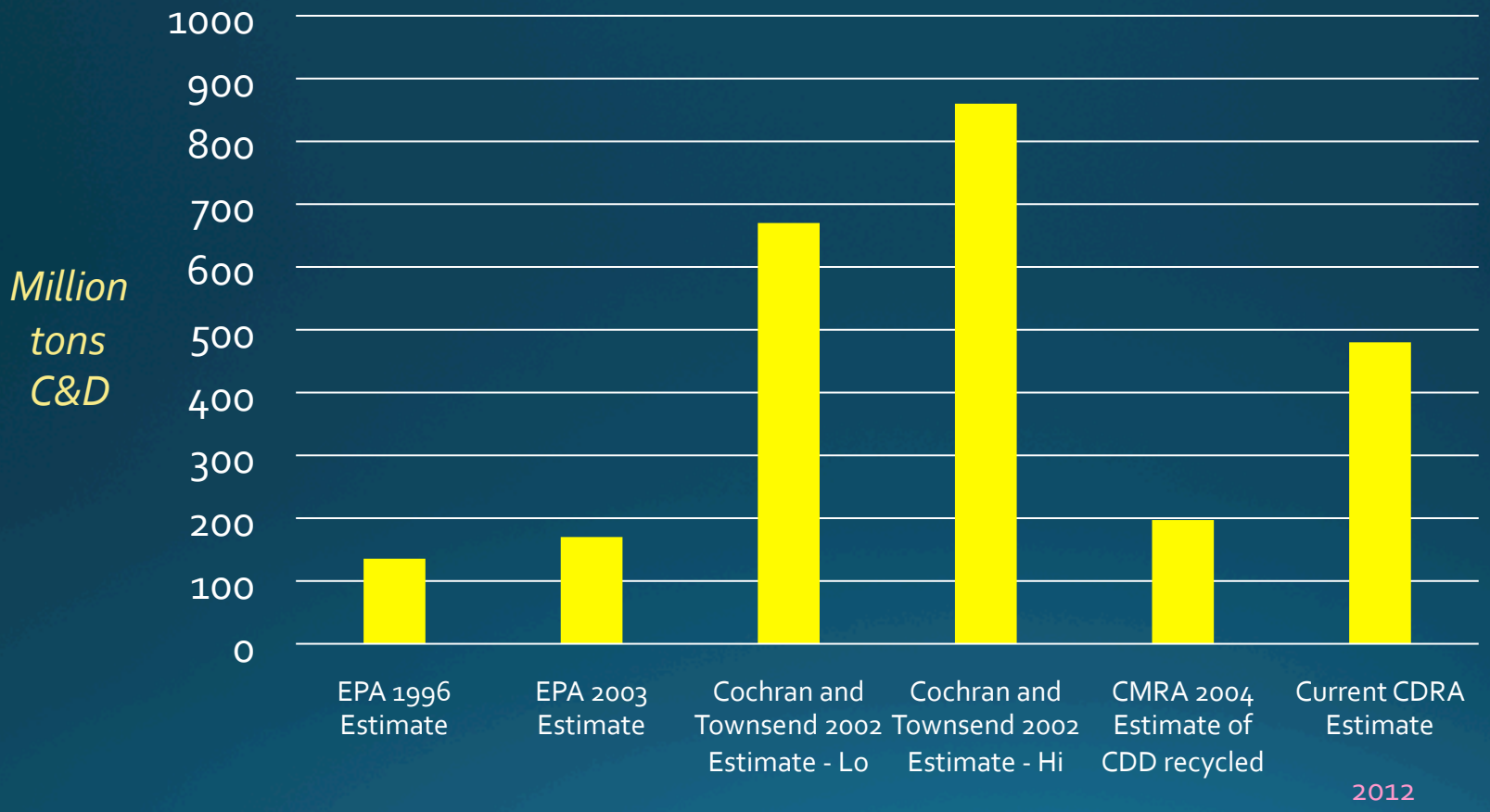
- Cochran and Townsend → 670 – 870 million tons

Building and Non-building related

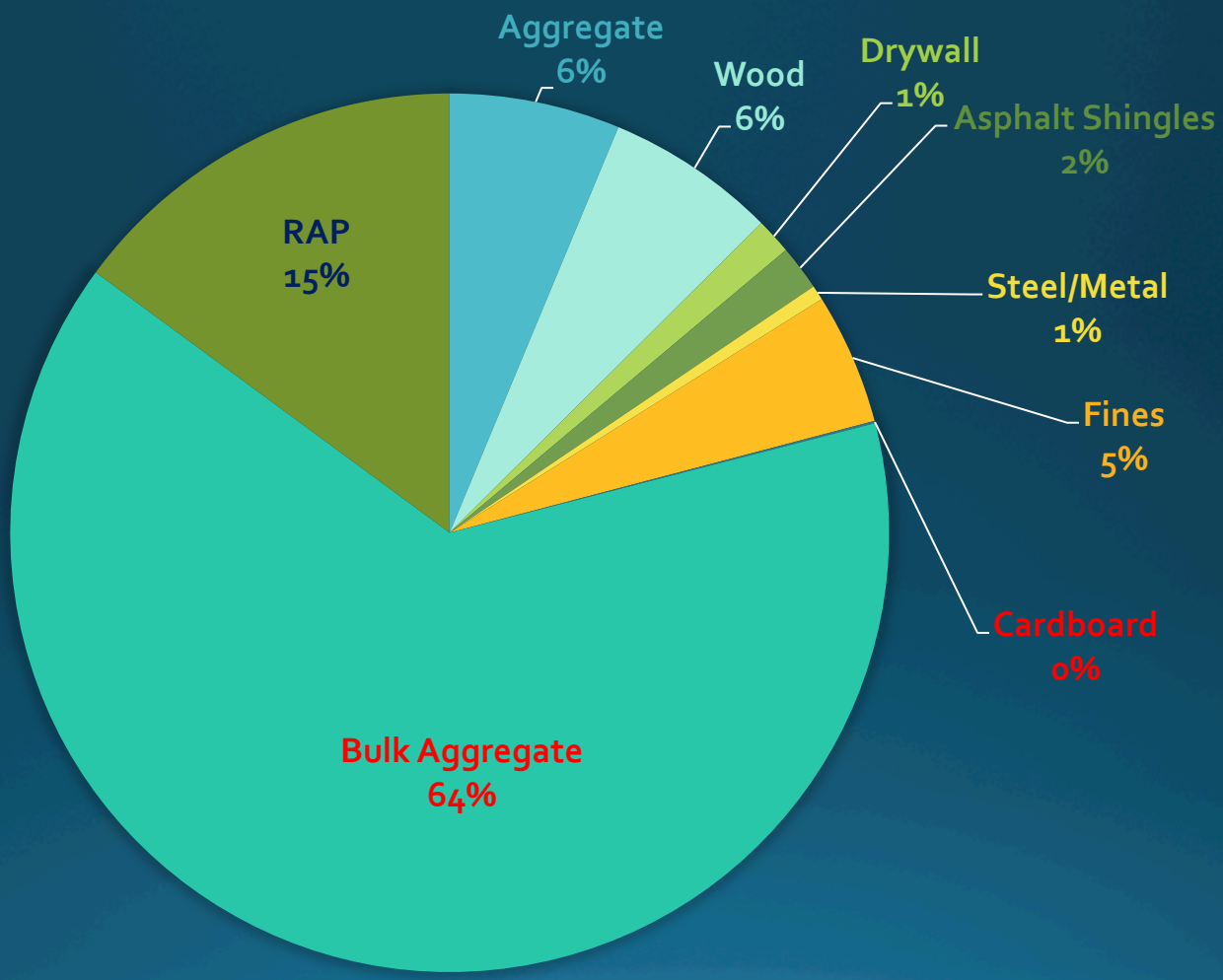
Current Approach

- Mixed C&D
- Bulk Aggregate
- RAP

Range of National C&D Generation Estimates

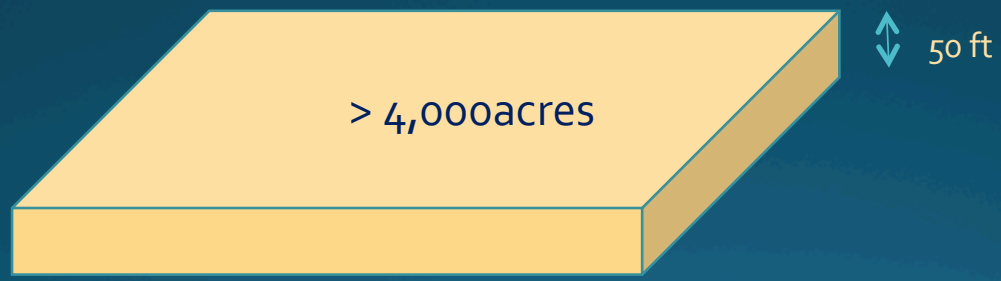


2012 C&D Composition Estimate



Landfill Capacity Savings → US in 2012

- Assume 350 millions tons of C&D recycled
- Assume landfill depth of 50 ft
- Landfill area saved in one year → Over 4,000 acres



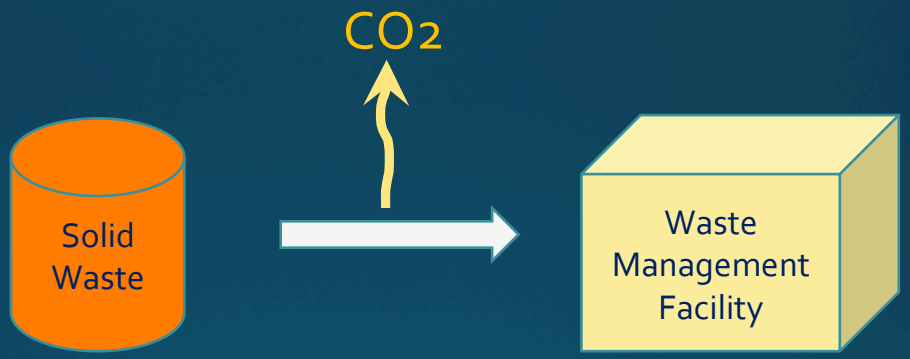
Environmental and Energy Benefits

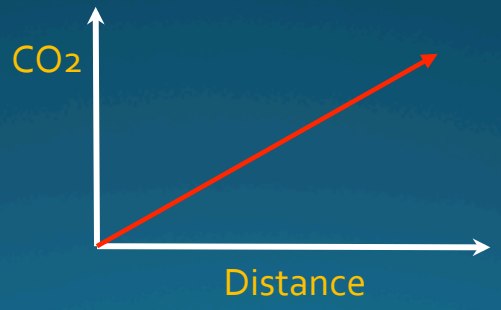
- Highly cited environmental issues with landfills
  - Ecosystem degradation
  - Leachate contamination of water resources
  - Landfill gas issues (hydrogen sulfide)

- Direct benefits from recycling
  - Energy savings by using recycled materials versus virgin materials
  - Less energy use results in less emissions to the environment (e.g., greenhouse gases)

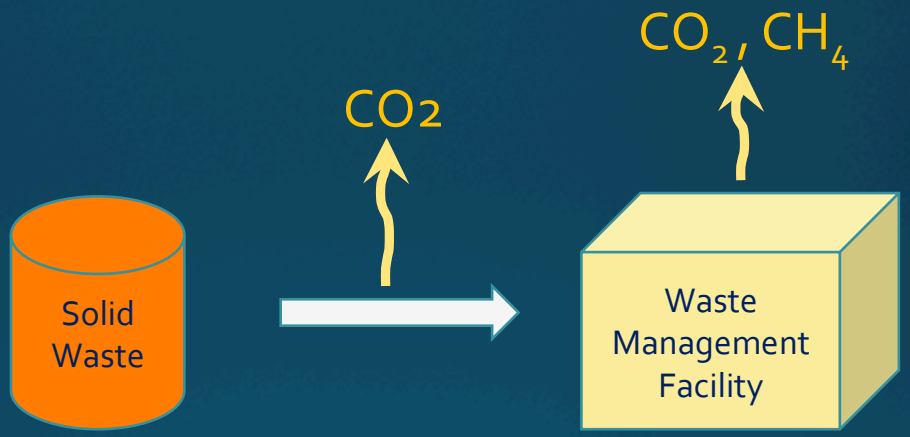
Carbon Footprint

Collection and Transportation

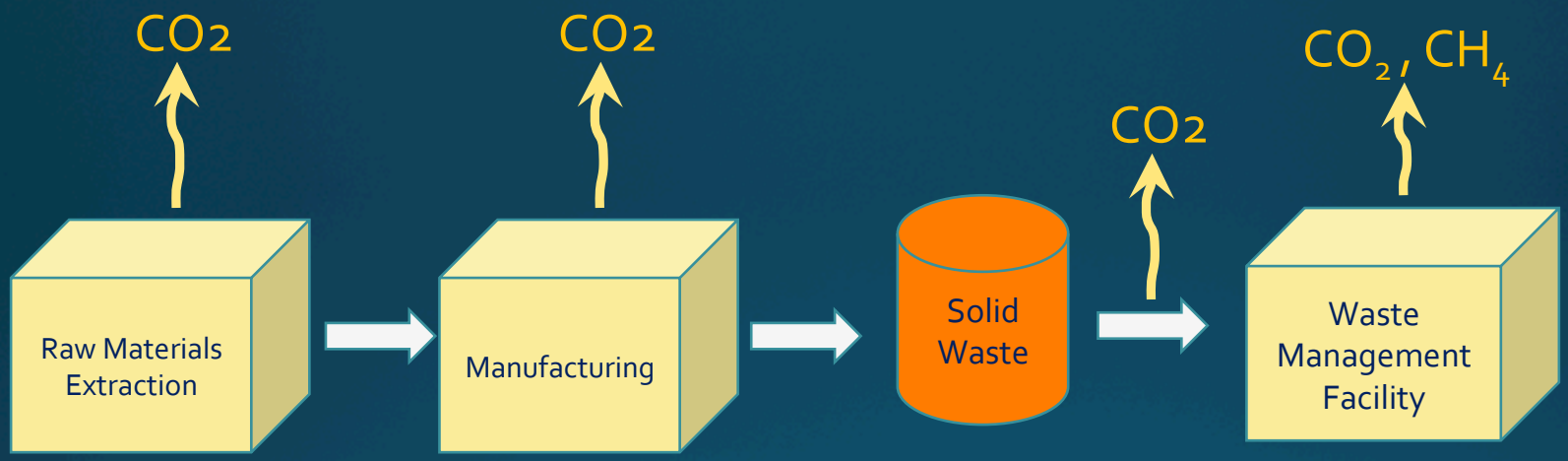




Final Disposition



Recycling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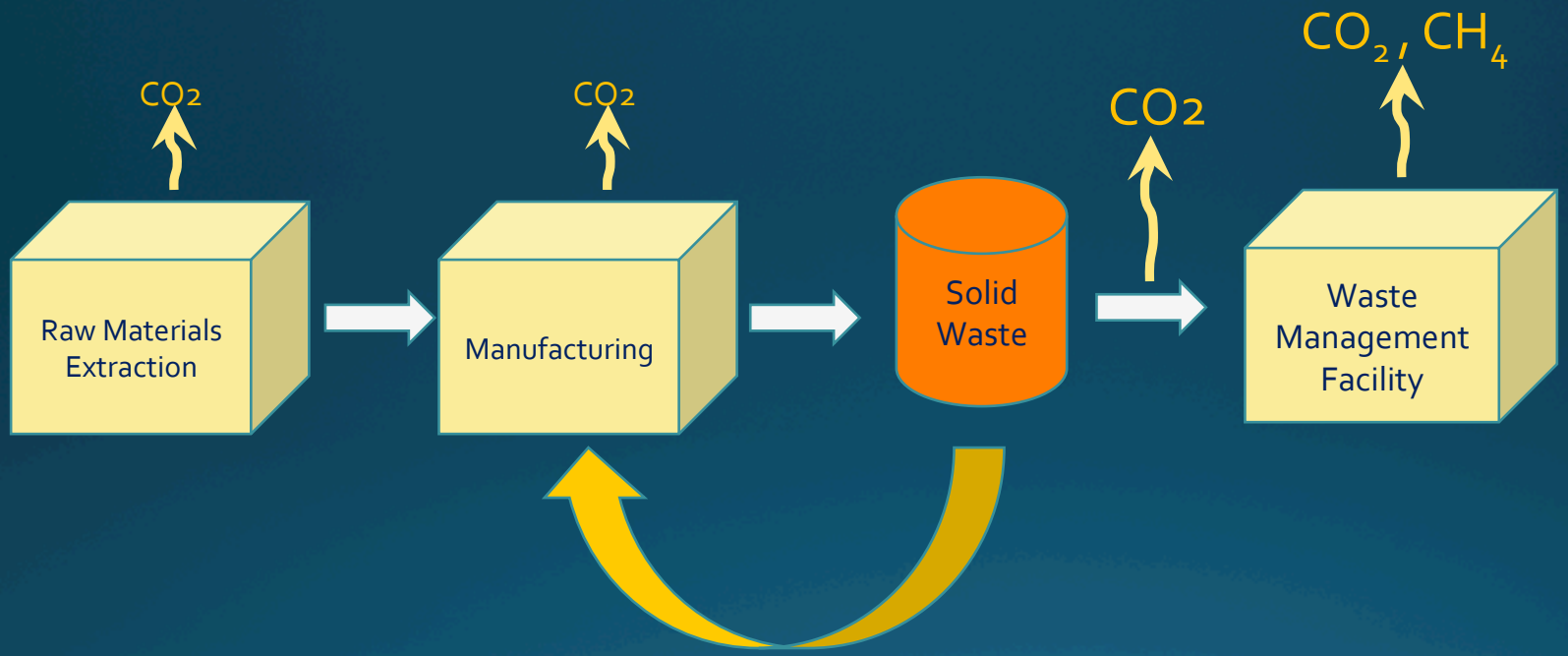
CO2
CO2
CO2 , CH4
Raw Materials Extraction
Manufacturing
Solid Waste
Waste Management Facility

Recycling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CO_2, CH_4
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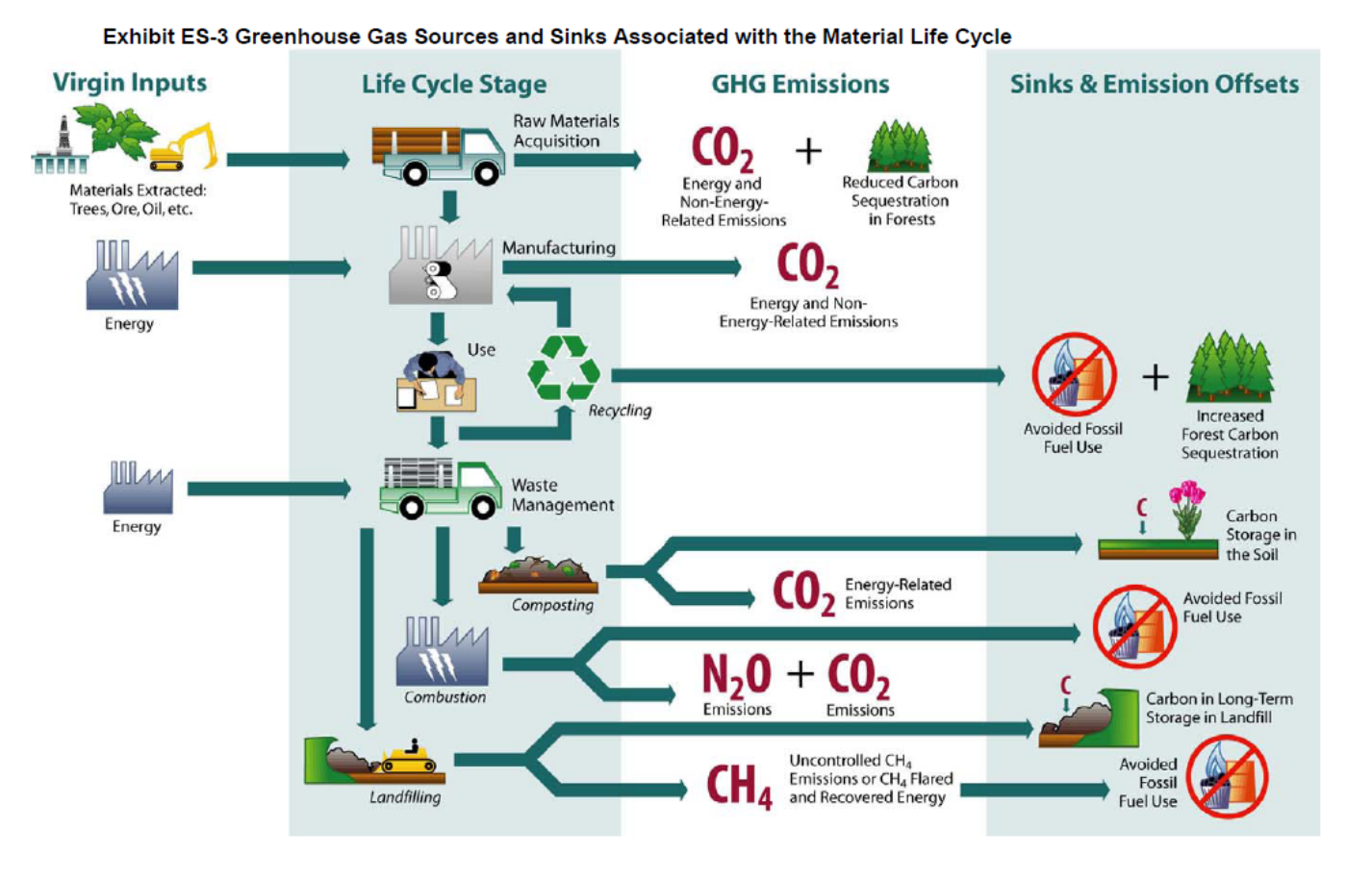


Solid Waste Management and Greenhouse Gases:
A Life-Cycle Assessment of Emissions and Sinks
US EPA (http://epa.gov/climatechange/wycd/waste/SWMGHGreport.html)

Life Cycle Assessment Tools

- A number of tools are now available that allow the quantification of energy and environmental differences between alternative management strategies → over a materials lifecycle.
- Examples specific to waste:
  - EASETECH (Denmark) – Environmental Assessment System for Environmental Technologies
  - MSW-DST (US) – Municipal Solid Waste Decision Support Tool
  - WARM (US) – Waste Reduction Model
  - WRATE (UK) – Waste and Resources Assessment Tool for the Environment

WARM

- Developed for planners to track GHG emissions for an alternative scenario based on some baseline scenario
- Emissions calculations are made using life-cycle approaches that consider upstream and downstream impacts

WARM

- Web-based calculator (basic)
- Excel-based calculator (more advanced)
- Documentation (2012) and calculation transparency

Steps 1 and 2. Baseline and Alternative Scenarios

	Baseline Scenario					Alternative Scenario				
Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Generated	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted
Aluminum Cans				N/A	0					N/A
Aluminum Ingot				N/A	0					N/A
Steel Cans				N/A	0					N/A
Copper Wire				N/A	0					N/A
Glass				N/A	0					N/A
HDPE				N/A	0					N/A
LDPE	N/A			N/A	0		N/A			N/A
PET				N/A	0					N/A
LLDPE	N/A			N/A	0		N/A			N/A
PP	N/A			N/A	0		N/A			N/A
PS	N/A			N/A	0		N/A			N/A
PVC	N/A			N/A	0		N/A			N/A
PLA	N/A				0		N/A			
Corrugated Containers				N/A	0					N/A
Magazines / Third-class mail				N/A	0					N/A
Newspaper				N/A	0					N/A

WARM

- Well-documented
- Very accessible – even for decision-makers
- Output (emissions and energy) consistent with most decision-makers at a community level who care about now (*maybe more than they care about*)

Waste Reduction Model (WARM) -- Results

Total GHG Emissions from Baseline MSW Generation and Management (MTCE):	-
Total GHG Emissions from Alternative MSW Generation and Management (MTCE):	-
Incremental GHG Emissions (MTCE):	-

MTCE = metric tons of carbon equivalent

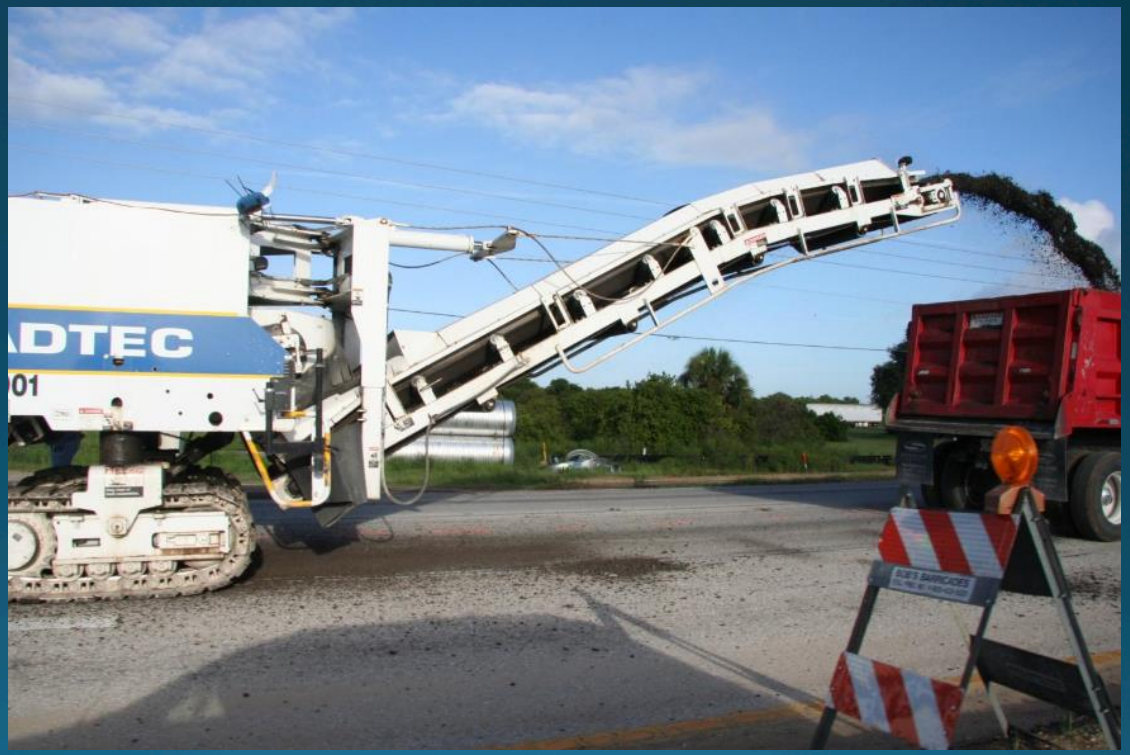
Per Ton Estimates of GHG Emissions for Alternative Management Scenarios

Material	GHG Emissions per Ton of Material Source Reduced (MTCE)	GHG Emissions per Ton of Material Recycled (MTCE)	GHG Emissions per Ton of Material Landfilled (MTCE)	GHG Emissions per Ton of Material Combusted (MTCE)	GHG Emissions per Ton of Material Composted (MTCE)
Aluminum Cans	(1.35)	(2.42)	0.01	0.01	NA
Aluminum Ingot	(1.98)	(1.90)	0.01	0.01	NA
Steel Cans	(0.87)	(0.49)	0.01	(0.42)	NA
Copper Wire	(1.98)	(1.33)	0.01	0.01	NA
Glass	(0.14)	(0.08)	0.01	0.01	NA
HDPE	(0.40)	(0.23)	0.01	0.35	NA
LDPE	(0.49)	NA	0.01	0.35	NA
PET	(0.61)	(0.30)	0.01	0.34	NA
LLDPE	(0.43)	NA	0.01	0.35	NA
PP	(0.42)	NA	0.01	0.35	NA
PS	(0.68)	NA	0.01	0.45	NA
PVC	(0.54)	NA	0.01	0.18	NA
PLA	(0.59)	NA	(0.44)	(0.17)	(0.05)
Corrugated Containers	(1.53)	(0.85)	(0.01)	(0.13)	NA
Magazines/third-class mail	(2.36)	(0.84)	(0.13)	(0.09)	NA

Energy Savings

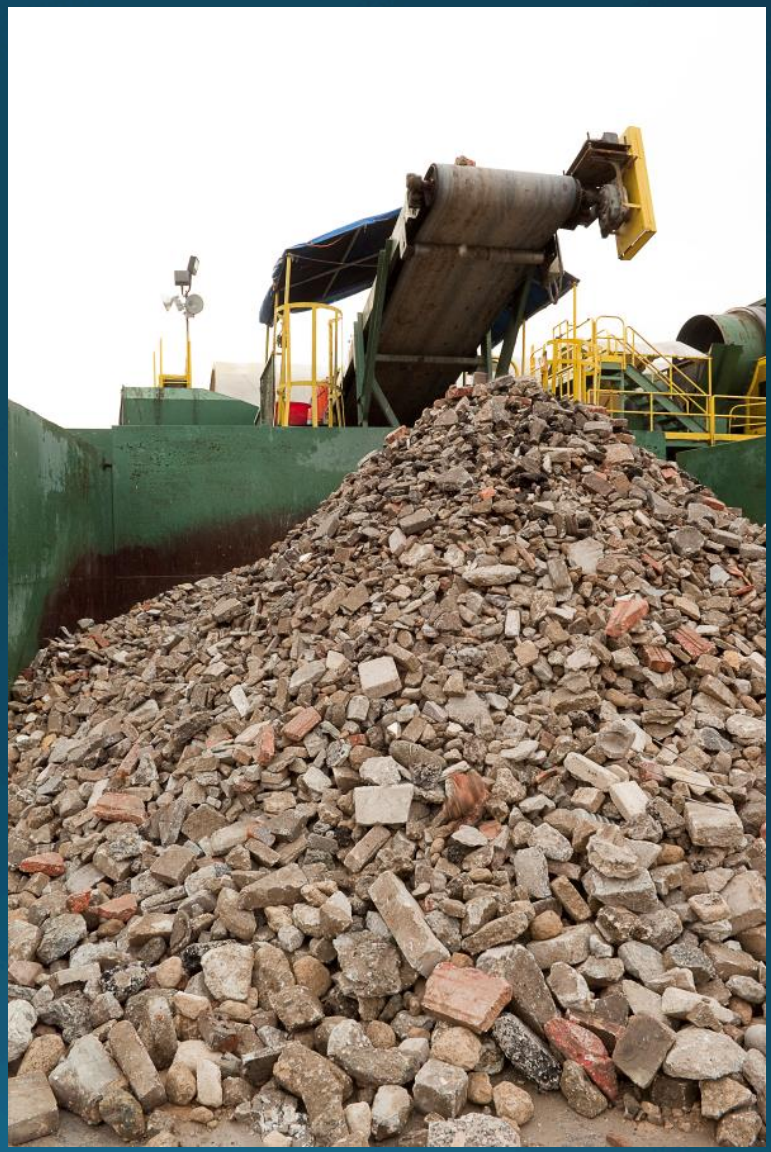
- Waste recycling estimates were used along with WARM energy factors to estimate energy savings from C&D recycling.

Example: All of the asphalt recycled in 2012 resulted in an energy savings equivalent to 23,000,000 barrels of oil



Greenhouse Gas Emissions

- Waste recycling estimates were used along with WARM GHG emission factors to estimate GHG offsets resulting from C&D recycling.



Example: All of the concrete recycled in 2012 resulted in a GHG savings equivalent to removing over 2.5 million passenger from the road during that year.

Job Creation

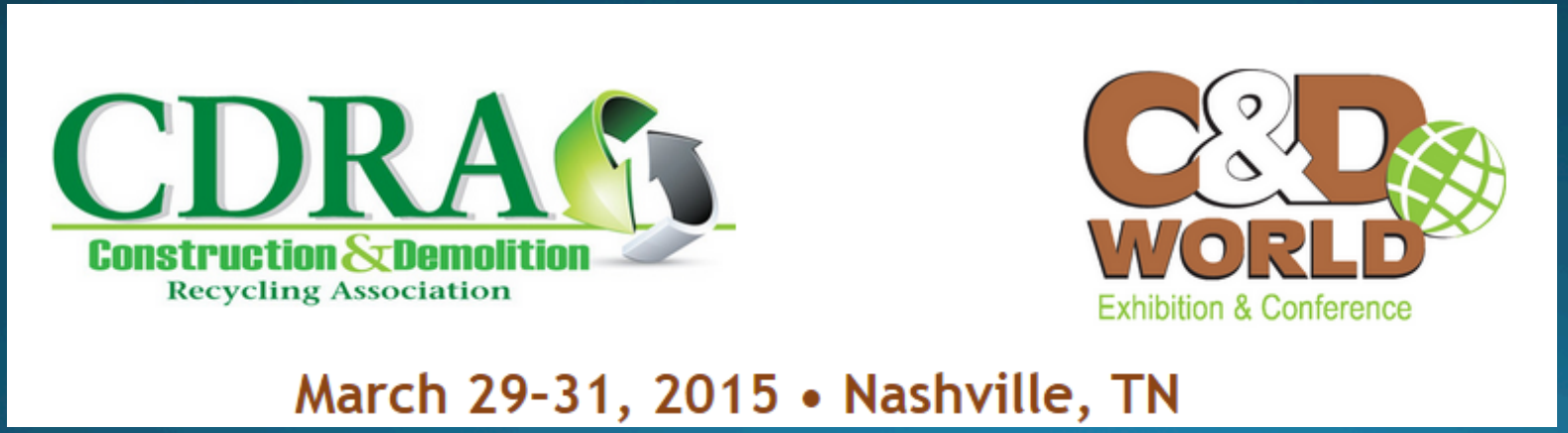
- Job statistics from both bulk aggregate and mixed C&D processing facilities have been collected.

Direct and Indirect Economic Benefit

- Economics statistics from both bulk aggregate and mixed C&D processing facilities have been collected.

Summary and Conclusions

- C&D is one of the larger components of our waste stream.
- C&D recycling is critical achieving targeted recycling rates.
- Tools are now available to quantify benefits associated with C&D recycling.
- Estimates clearly demonstrate the benefits of C&D recycling - economic, job creation, and environmental.



Contact Information

Timothy G. Townsend, PhD, PE

Professor

Department of Environmental Engineering Sciences

Engineering School for Sustainable Infrastructure and Environment

University of Florida

Gainesville, Florida 32608

352-392-0846

ttown@ufl.edu

http://pages.ees.ufl.edu/townsend/

QUESTIONS?

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