



**Anaerobic Digestion of  
Source Separated Organics (SSO)  
Lessons Learned from Europe**

Presented at the  
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**Outline**

- GBB Overview
- Introduction
- European experience:
  - United Kingdom
  - Barcelona, Spain
- Summary lessons learned



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## Intro - GBB Overview

Established in 1980

Solid Waste and Technology Consultants

Helping Clients Turn Problems into Opportunities






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## GBB Waste Waste-to-fuel Technology Services

- Economic, technical and environmental issues reviews
  - Procurements
  - Due diligence
- Waste characterization and sourcing
- Process planning and design
  - Independent feasibility consultant





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# Introduction

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## Organic Waste Amount Developed Vs Developing Nations

**Annual generation per capita**

Country Type	Annual generation per capita (kg)
Low Income Countries	~10
Middle and High Income Countries	~120

**MSW composition in Low income countries**

Category	Percentage
Organic	64%
Other	17%
Plastic	8%
Paper	5%
Glass	3%
Metal	3%

**MSW composition in High income countries**

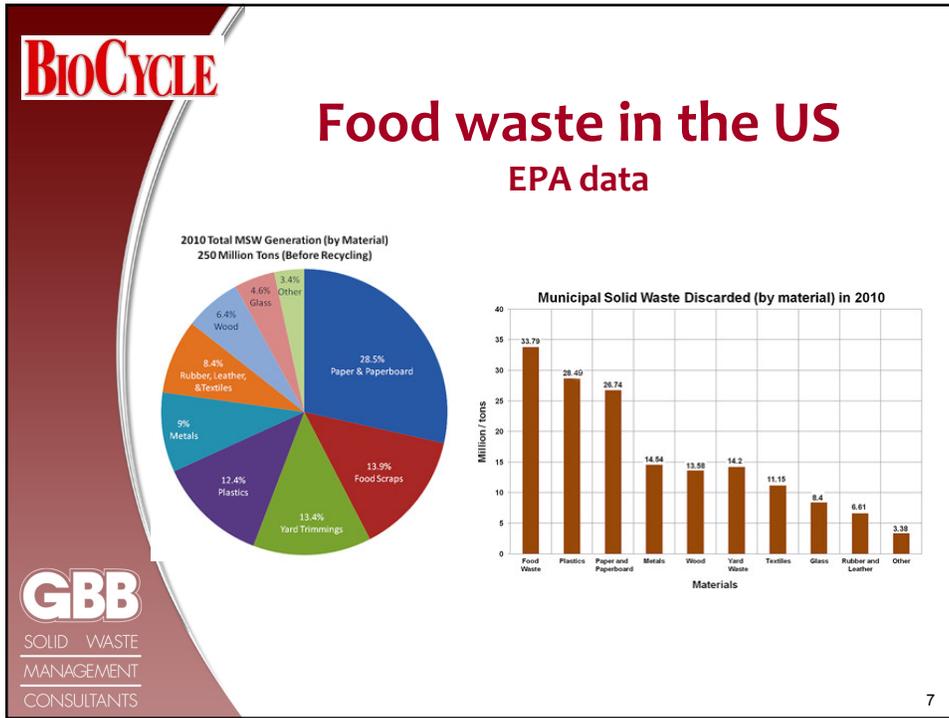
Category	Percentage
Organic	28%
Paper	31%
Plastic	11%
Other	17%
Glass	7%
Metal	6%

**Total amount of organic waste is still highest in the high-income countries**

Sources: UN and World Bank

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## HOW FAR ARE WE READY TO GO?



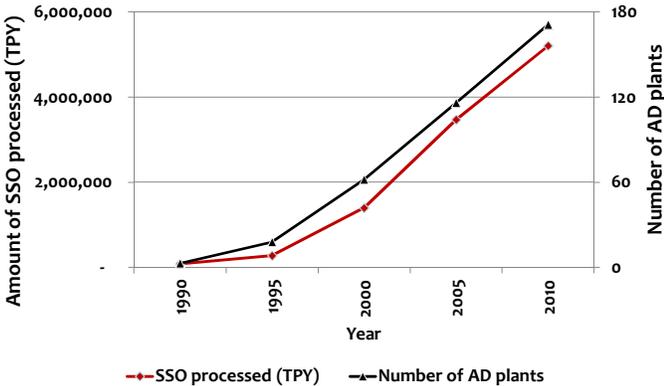
**A motorcycle, by Japanese toilet manufacturer TOTO, runs on biogas derived from human waste**

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## Or Maybe Learn From The Europeans....



Year	Amount of SSO processed (TPY)	Number of AD plants
1990	~0	~0
1995	~500,000	~10
2000	~1,500,000	~30
2005	~3,500,000	~70
2010	~5,000,000	~130

**Leaders with biggest capacity installed: Germany, Spain and France**

Source: Eurostat, 2011

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**Anaerobic Digestion as Integral  
Part of the Sustainable Waste  
Management Systems  
Case studies:  
Barcelona & United Kingdom**

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**Barcelona, Spain**



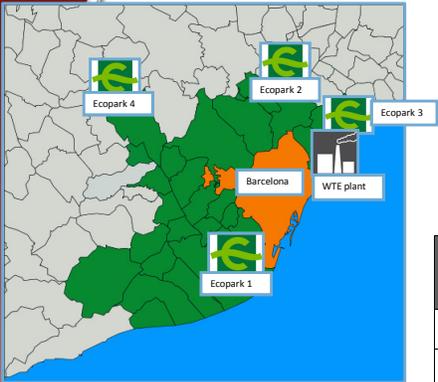
- Well developed and mature SSO management system
- The EU Landfill directive was translated into Spanish legislation in 2001
- First AD plant started operating in 2001

*Source: Earth Engineering Center,  
Columbia University*

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Map of the Metropolitan Area of Barcelona with locations of the Ecoparks

- Serving 3.12 mil people in the Metropolitan area of Barcelona
- 155,000 tons SSO/year separately collected for processing in AD plants
- Produce electricity and compost
- Public Private Partnership

**AD plants in Barcelona**

Facility	Technology	AD Capacity (TPY)
Ecopark 1	BTA	50,000
Ecopark 2	Valorga	120,000
Ecopark 3	Ros Roca	90,000

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**BIOCYCLE** **AD plants in Barcelona, Spain**



Ecopark 3- RosRoca Technology



Ecopark 2- Valorga Technology

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## United Kingdom

- SSO management system under development
- EU Landfill directive translated into the UK legislation in 2009
- 47% of local authorities in the UK provide SSO collection services to households and an increasing number are looking to collect food waste from small businesses and schools (May 2011)



Locations of the AD plants in the UK  
 Source: Official Information portal on AD in UK,  
<http://biogas-info.co.uk/maps/index2.htm#>



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## Plants Processing Organic Waste In UK

Type of technology	Number of operating commercial plants	Expected additional number of plants	
		2017	2022
Aerobic composting*	177	N/A	7
Anaerobic digestion**	44	78	80

\*GBB Inc. 02/2012 internal data  
 \*\*WRAP NNFFCC UK AD infrastructure report



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What should we have in mind  
as we proceed towards better  
management of organic waste  
in the US?

**LESSONS LEARNED**

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**LESSON 1:  
WASTE REDUCTION AND  
PUBLIC EDUCATION**

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## Waste and Resources Action Program (WRAP) initiative

- Aims to raise awareness of the need to reduce food waste
- Different tools:
  - Explore the kitchen
  - Portions and planning
  - The story of food



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## LESSON 2: NATIONAL WASTE MANAGEMENT POLICY

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## UK Waste Management Policy

- EU Landfill Directive of 1999
  - Requires to reduce landfilling of biodegradable waste relative to 1995 levels
    - 25% reduction by 2010
    - 50% reduction by 2013
    - 65% reduction by 2020
- Waste Framework Directive
- Integrated Pollution Prevention and Control Directive
- Environmental Permitting Regulations
- AD and Composting Quality Protocols
- Food waste processed at composting and anaerobic digestion plant counts towards the national recycling rate

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## UK Renewable Energy Policies

- Policies derived from international and EU level climate change agreements
- EU targets to be met by 2020 (*the '20-20-20' targets*):
  - Reduction in EU greenhouse gas emissions of at least 20 percent below 1990 levels
  - 20 percent of EU energy consumption to come from renewable resources
  - 20 percent reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency

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**LESSON 3:  
FUNDING AND INCENTIVES**



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**UK Funding and Incentives**

- WRAP :
  - Anaerobic Digestion Loan Fund
  - Fund to support development of collection of food waste
- Environmental Transformation Fund (ETF)
- Renewable Transport Fuel Obligation
- Various Funds for procurement of AD projects in England, Wales, Scotland
- Same public funding is available for foreigners as for local developers
- Renewable Obligations Certificates (ROCs)
- Feed-in-Tariffs (FIT)
- Renewable Heat Incentives (RHI)



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## Landfill Tax in the UK

- Resulted from the implementation of the EU directive on landfilling waste
- Applies to all untreated MSW and C&I waste
- Started at £7 (\$11)/tonne in 1996
- Increased to £24 (\$38)/tonne by 2007
- Will increase by £8 (\$13)/tonne/year until reaching £80 (\$128)/tonne in April of 2014
- £64 (\$102)/tonne as of April 2012



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## Gate Fees at Waste Processing Facilities in UK

SUMMARY INFORMATION ON GATE FEES IN UK IN 2011			
Treatment	Grade/Material/Type of Facility	Gate fees (£/tonne)	
		(\$/ton, conversion factor 1.6)	
		Median	Range
MRF	All	22	-52 to 122
	Contracts starting in 2010 or later	6	-44 to 91
Organics	Open-air windrow (OAW)	34	8.6 to 74
	In-vessel (IV), food & garden waste	62	42 to 119
	Anaerobic digestion (AD)	62	52 to 93
Landfill	Gate fee only	29	17 to 79
	Gate fee plus Landfill Tax	110	98 to 160
EfW	Pre 2000 facilities	78	51 to 114
	Post 2000 facilities	105	78 to 140
MBT		122	83 to 144



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Source: WRAP, Gate Fees Report 2011

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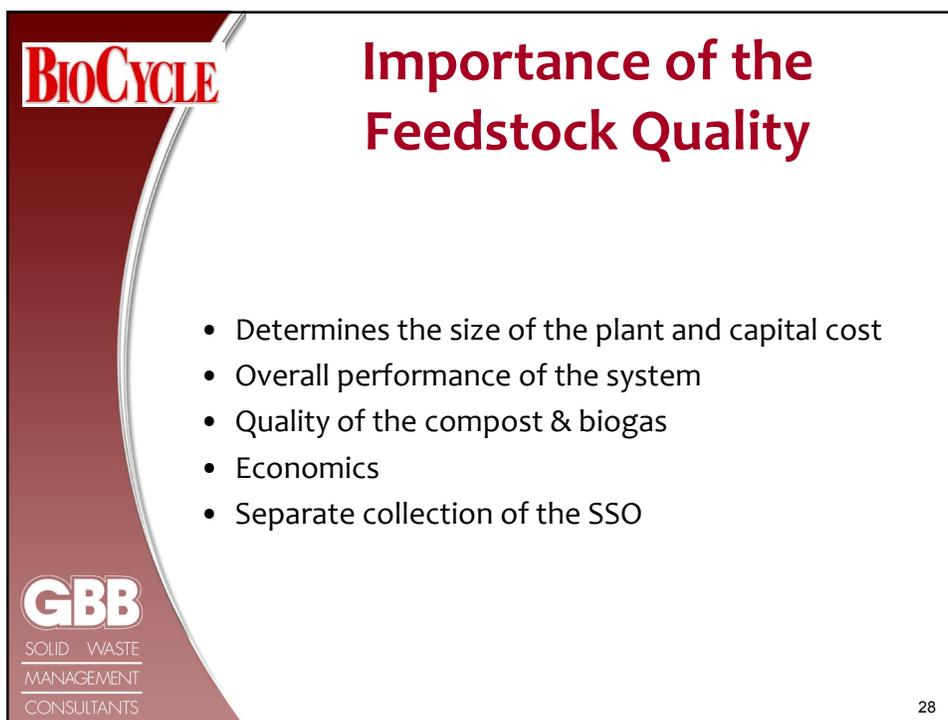


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**LESSON 4:  
FEEDSTOCK QUALITY**

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**Importance of the  
Feedstock Quality**

- Determines the size of the plant and capital cost
- Overall performance of the system
- Quality of the compost & biogas
- Economics
- Separate collection of the SSO

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## Lessons

- Waste Reduction
- National Waste Management Policy
- Funding and Incentives
- Feedstock Quality



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## Thank you!!

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