

European Technology Overview: Anaerobic Digestion (AD) of the Organic Fraction of the MSW

Ljupka Arsova
Senior Consultant
Gershman, Brickner & Bratton, Inc.

April 28, 2016

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- GBB Introduction
- Waste Management in EU
- Anaerobic Digestion Plants in EU
- Anaerobic Digestion Technologies in EU
- Why AD has been successful in EU?



GBB's Waste Consulting Services

- Economic, technical and environmental reviews
- Procurements
- Due diligence third-party reviews
- Waste characterization and sourcing
- Process planning and conceptual designs
- Independent feasibility consultant



WASTE MANAGEMENT IN EU

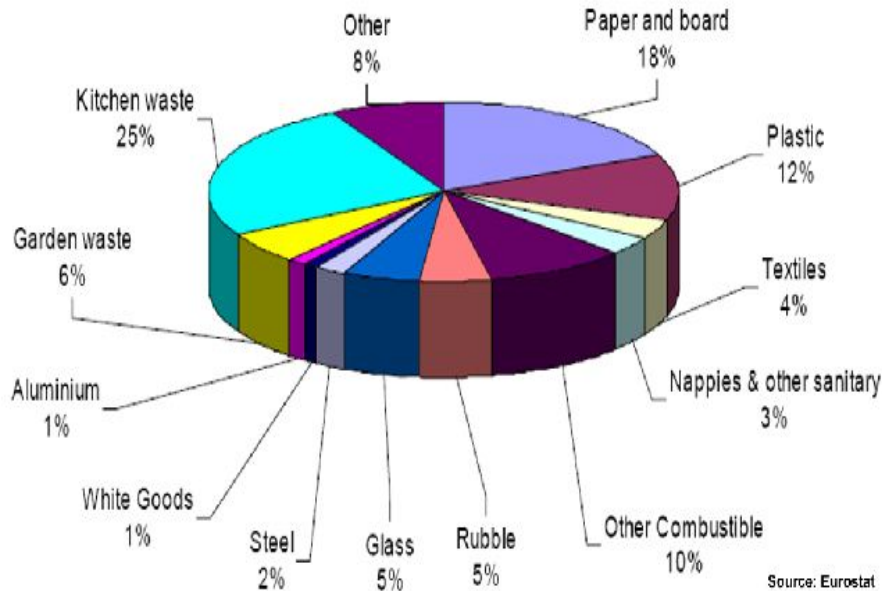
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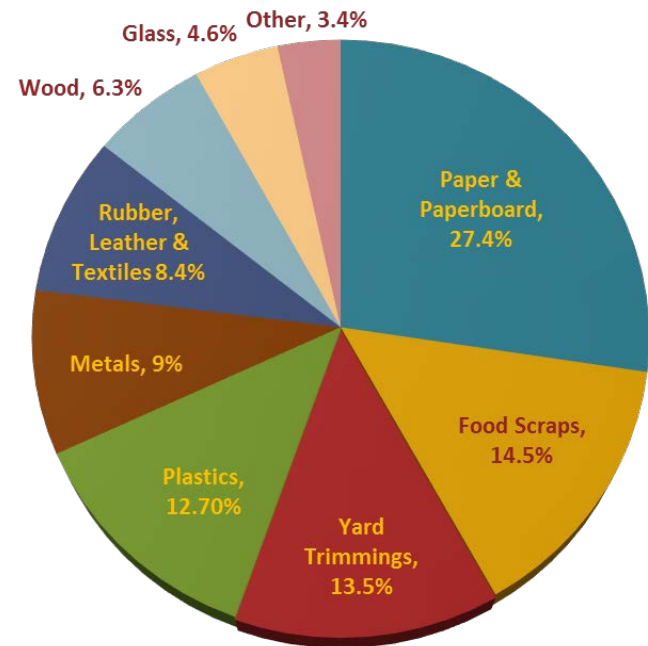
EU 27 Municipal Waste Composition

Municipal Solid Waste composition EU 27



Source: Zero Waste Europe, 2012

Composition of the MSW as generated, before recycling in the U.S.



Source: US EPA, 2014



MSW Trends in the EU (1995-2014)

Landfilling decreased 54%

Recycling rate increased 166%

Composting has increased 170%

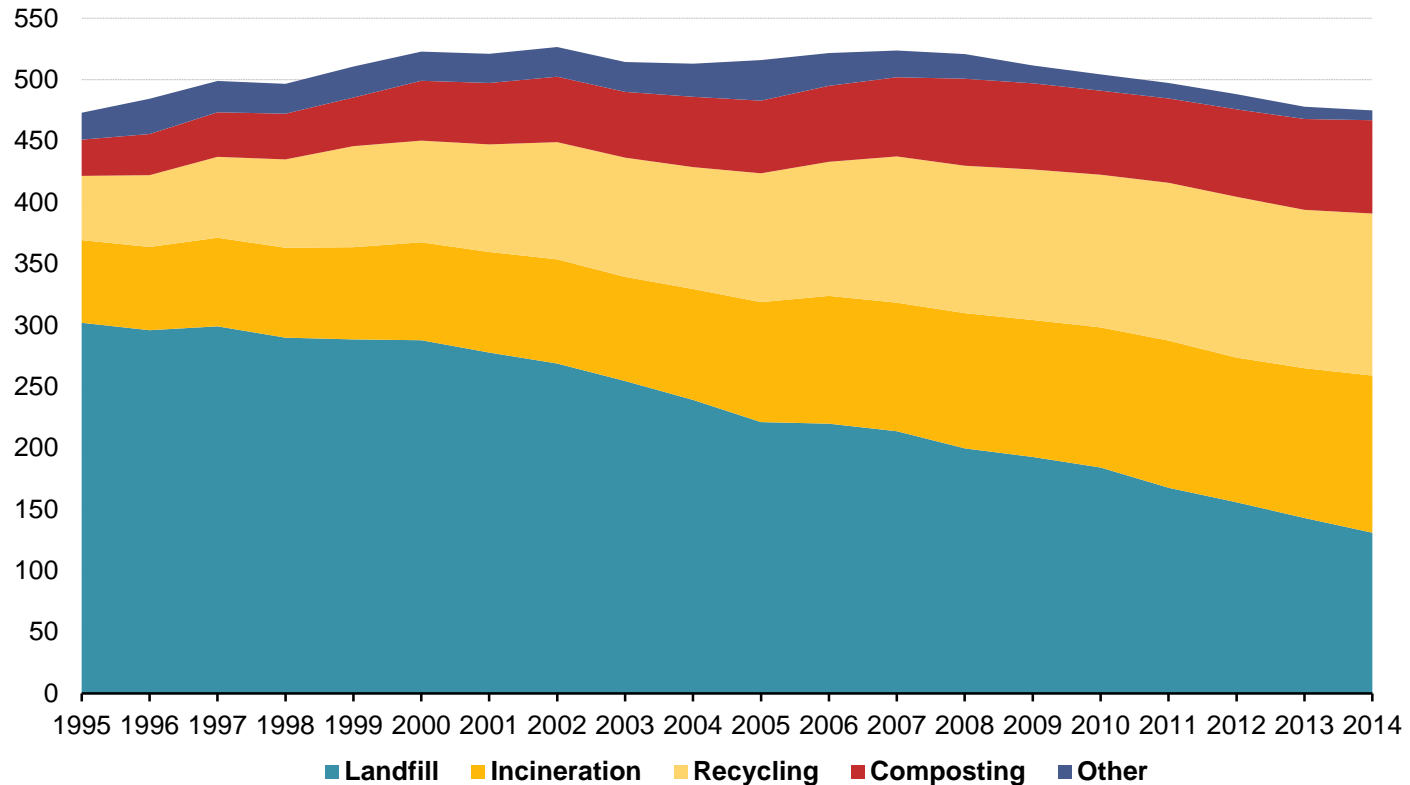
Waste-to-Energy Has increased 100%

Source: EUROSTAT, 2016

http://ec.europa.eu/eurostat/statistics-explained/index.php/Municipal_waste_statistics



EU-27 Municipal Waste Treatment, (2016, kg/Capita)



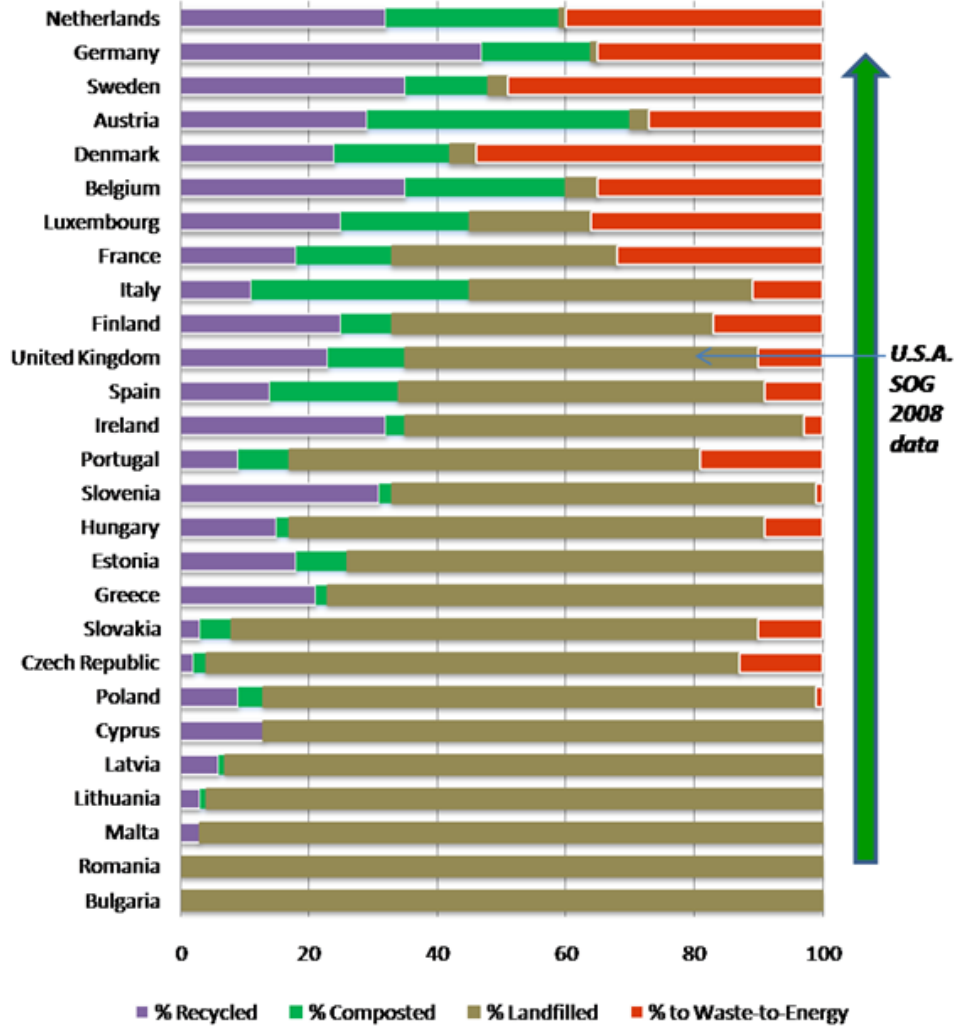
Source: EUROSTAT, 2016





The Sustainable Waste Management Ladder

Earth Engineering Center, Columbia University (based on Eurostat 2008 data)



ANAEROBIC DIGESTION PLANTS IN THE EU

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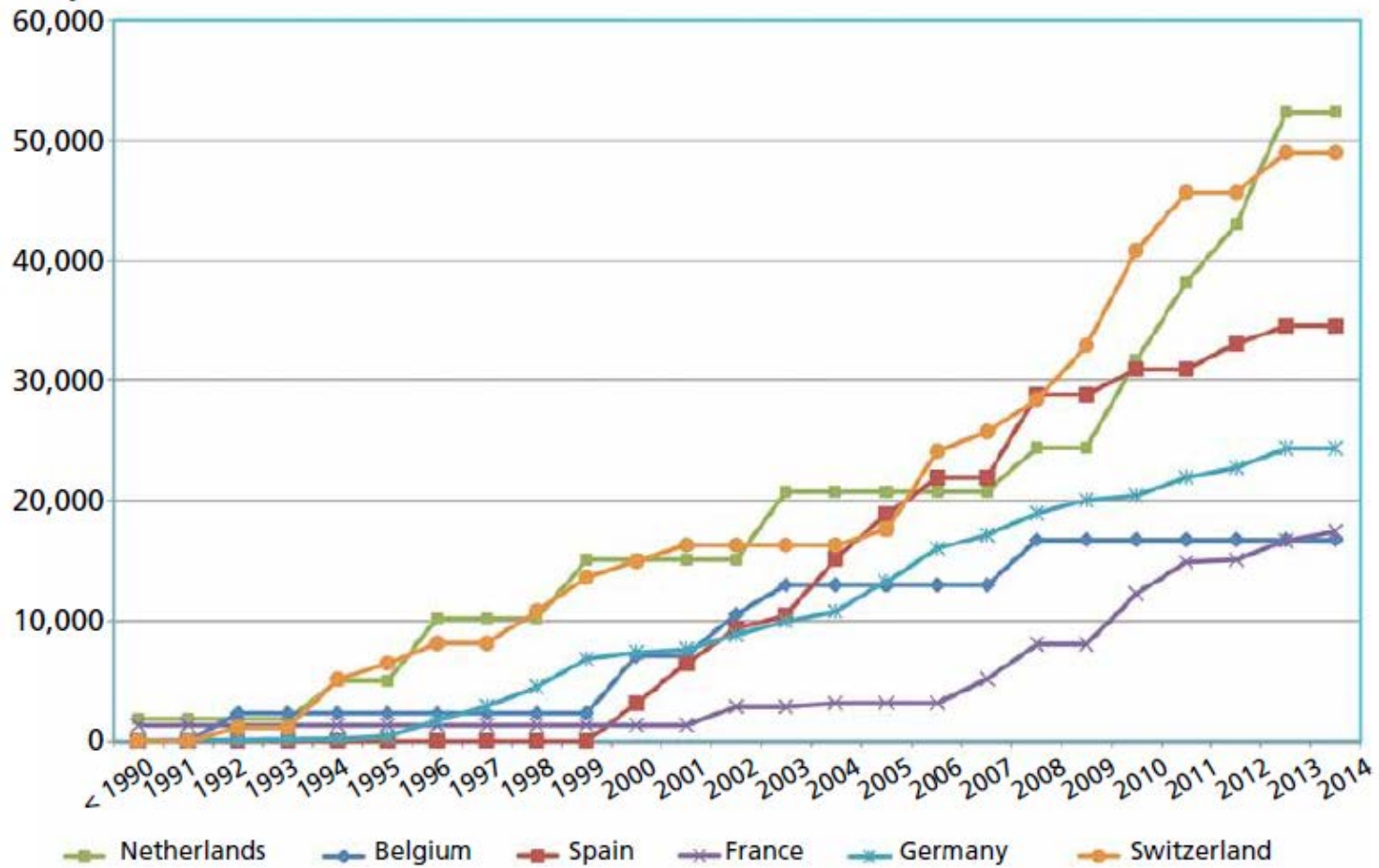
Evolution of the AD

- Organic Fraction from the Municipal Solid Waste
- Initially constructed for processing the mixed MSW
- Source separation of organics started in the '90s following the Landfilling Directive
- Used to be considered exclusive to the composting now working together
- Higher quality of processing for a bigger price



Evolution of the AD Capacity by Country

Installed capacity per million inhabitants
ton/y

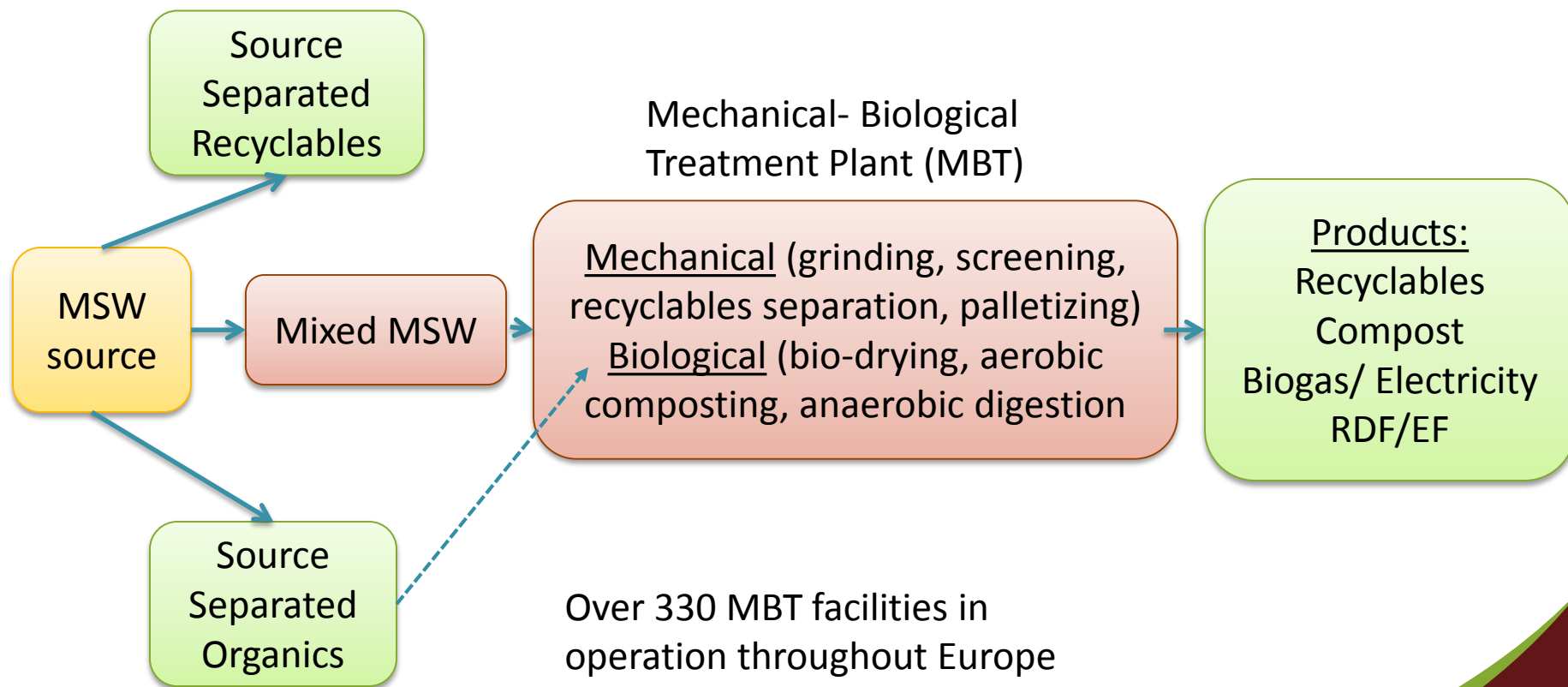




Current Status of AD in Europe

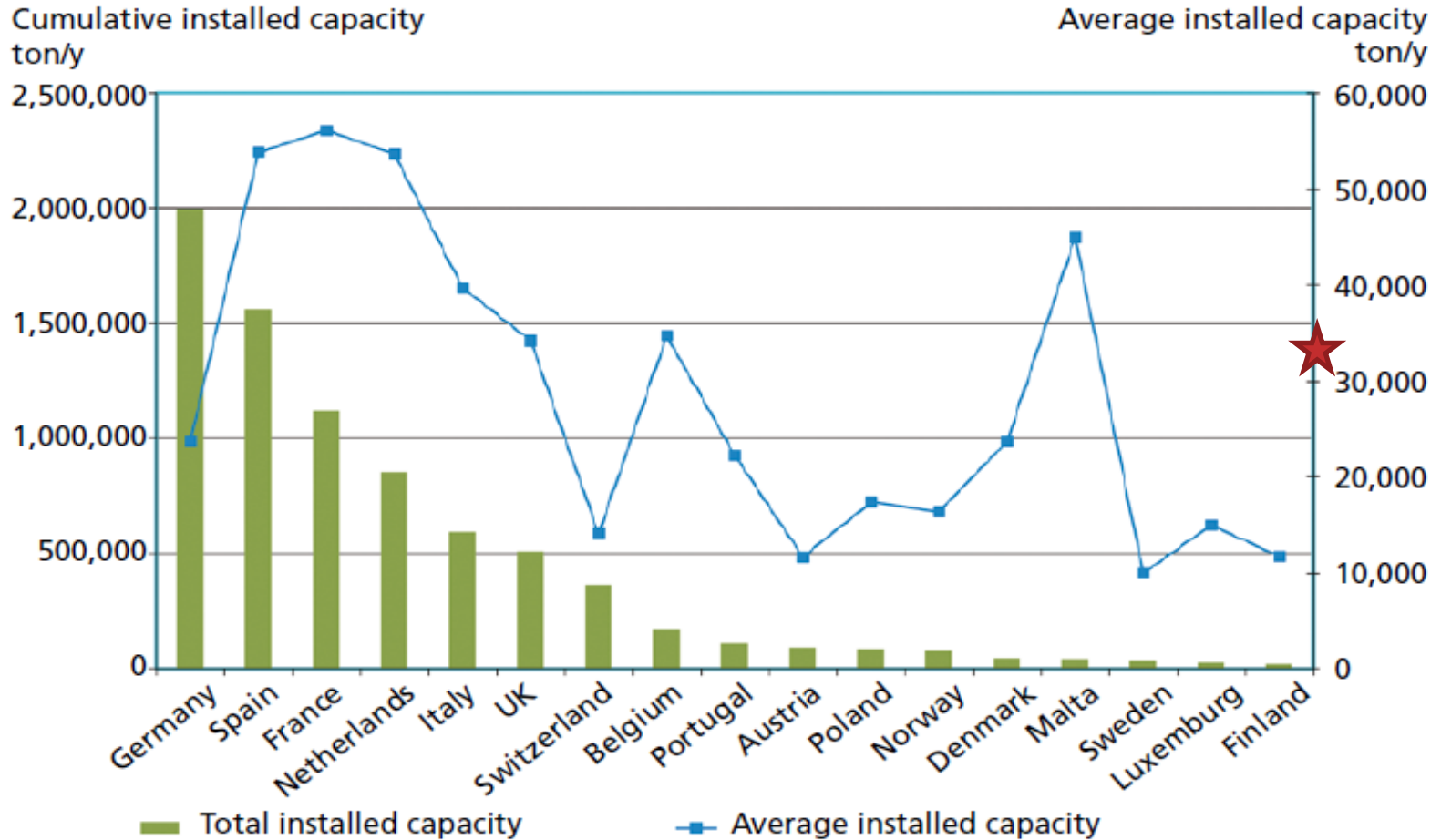
- Total of 244 facilities
- Cumulative capacity of 7,750,000 Tonnes/year (enough to process 5% of the biodegradable fraction generated in the EU)
- Stand alone, combined with composting facilities, or part of Mechanical Biological Treatment Facilities (MBT)
- Germany and Spain are leaders in the total AD capacity installed
- Netherlands and Switzerland have the largest capacity installed per capita

Mechanical Biological Treatment (MBT)



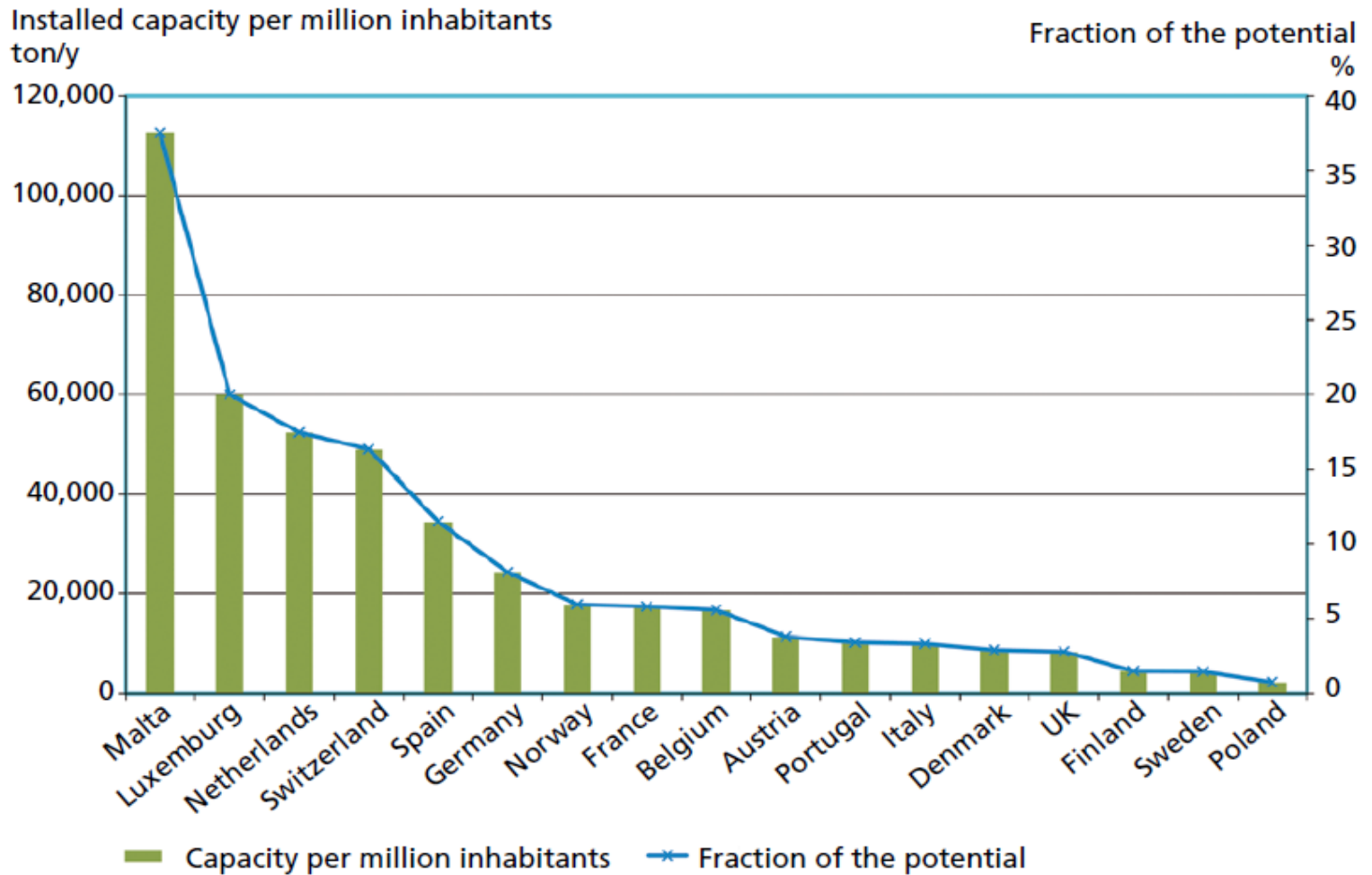


Total Installed Capacity





Installed Capacity per capita



AD TECHNOLOGIES IN EU

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Types of AD technologies in operations

Parameter	Cumulative Installed Percentage, 2014	
Temperature	Mesophilic	Thermophilic
	67%	33%
Feedstock	Solid Waste	Co-digestion
	89%	11%
Complexity of the system	One Phase	Two Phases
	93%	7%
Moisture Content	Wet	Dry
	38%	62%
MSW Feedstock	Source separated	Mixed Waste
	55%	45%

Most Commonly Installed Technologies

AD technology	Number of plants	Total capacity, tons/year
Kompogas	26	533,500
Valorga	19	2,197,000
Ros Roca	17	541,000
BTA	17	300,500
DRANCO	15	627,000
Citec	13	469,500
Linde	11	459,000
Total	118	5,127,500

Source: IEA, 2008

Experience

- Plants are in operation 10-20 years
- Not all plants and technologies has been equally successful
- Feedstock has to match the technology installed
- Both mixed waste and source separated organics can be contaminated
- Source separated organics in different parts of Europe lead different biogas yield

Trends

- Steady increase of the capacity
- Upgrading of existing composting plants to include AD capacity
- Both composting and WTE industry has accepted the AD as beneficial solution for all
- Batch tunnel dry AD facilities
- More AD plants coming in Eastern Europe



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WHY AD HAS BEEN SUCCESSFUL IN EU?

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AD Drivers in the EU

- Landfill Directive, 1999 - Limited the amount of biodegradable municipal waste going to landfills
- Feed in tariffs
- On average 80 €/t landfilling tax
- 18 EU Countries with landfilling material bans



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PLEASE JOIN US AT THE 2016 RENEWABLE ENERGY FROM WASTE CONFERENCE DESIGNED TO PROVIDE INSIGHT INTO DEVELOPING TRENDS, SUCCESSFUL PROJECTS, AND THE FUTURE OF THE INDUSTRY: NOVEMBER 14-16, 2016, IN LONG BEACH, CA (WWW.REWCONFERENCE.COM).

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Thank you!

Questions?

Ljupka Arsova

larsova@gbbinc.com

Tel: 703.663.2433

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