

Transforming Municipal Solid Waste (MSW) to Economically Viable Energy: An International Assessment

Hamed Zamenian¹, Matt Ray², Bugra Aslan³, Jake Rardin⁴, Dr. Tom Iseley⁵

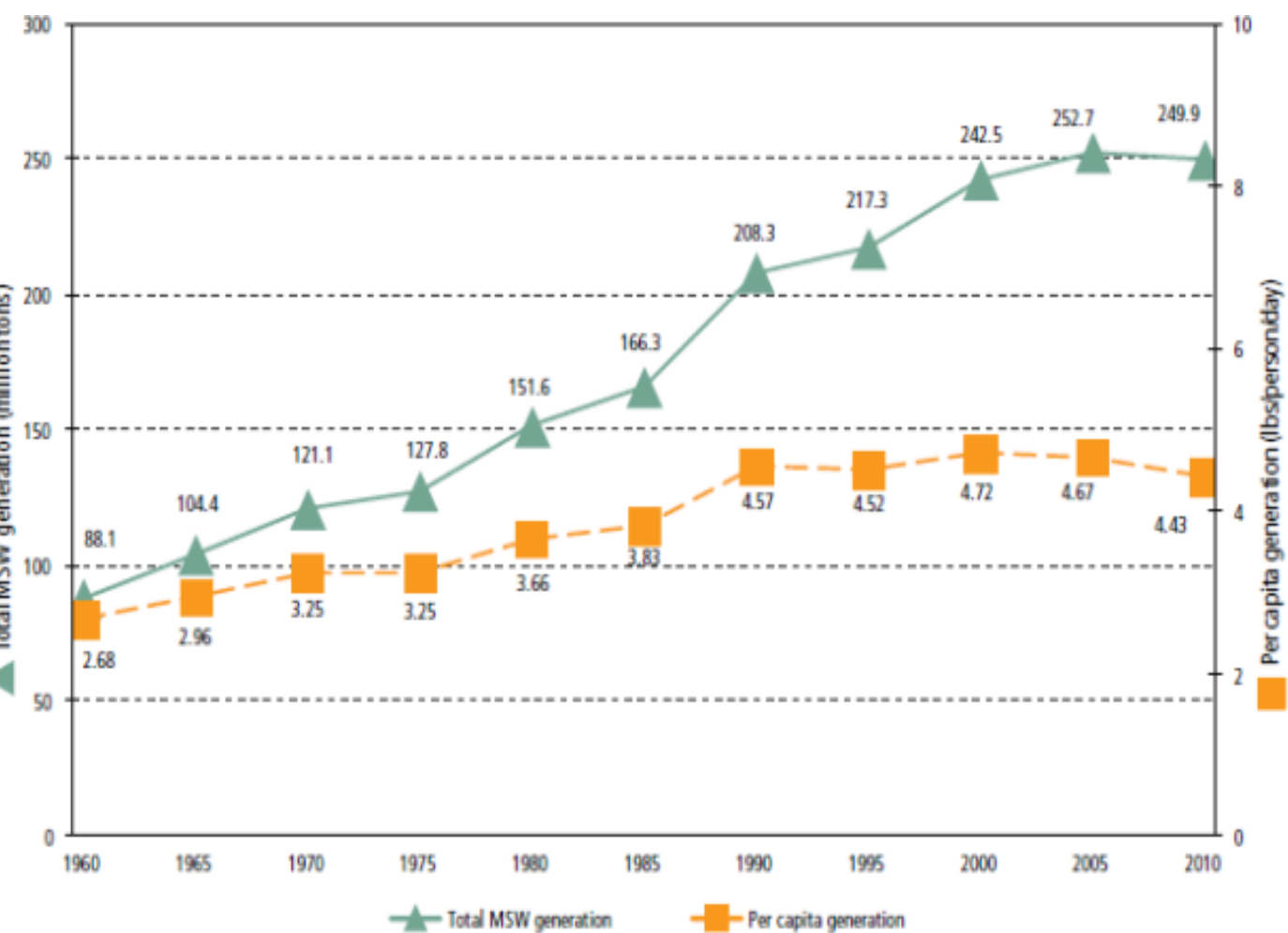
1-Graduate Assist. 2-Academic Lab Supervisor 3-Graduate Student 4-Undergraduate Student 5-Prof./ Director of CEMT

Purdue School of Engineering and Technology, Indianapolis

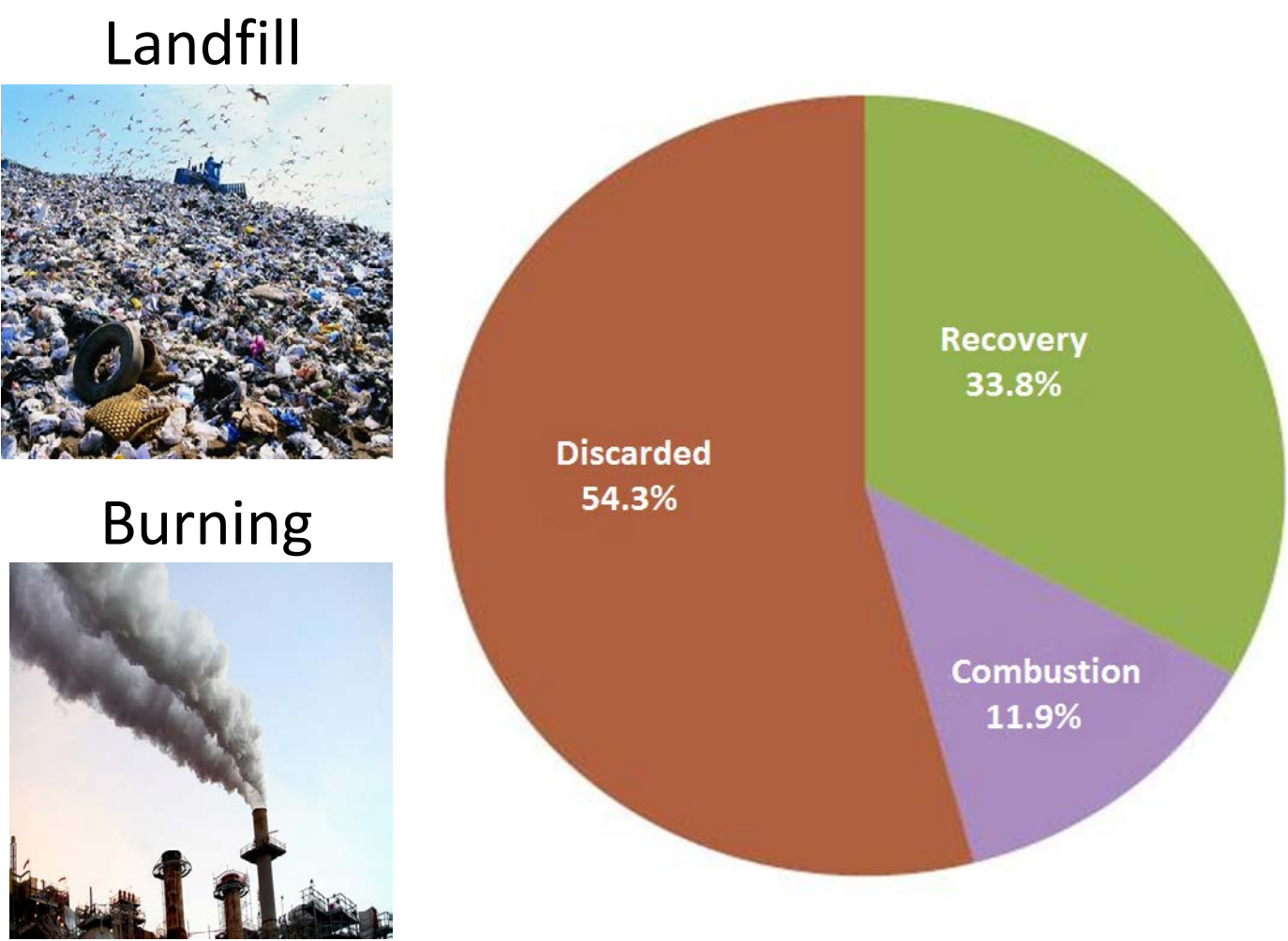
Crossroad

MSW Generation in U.S. ¹

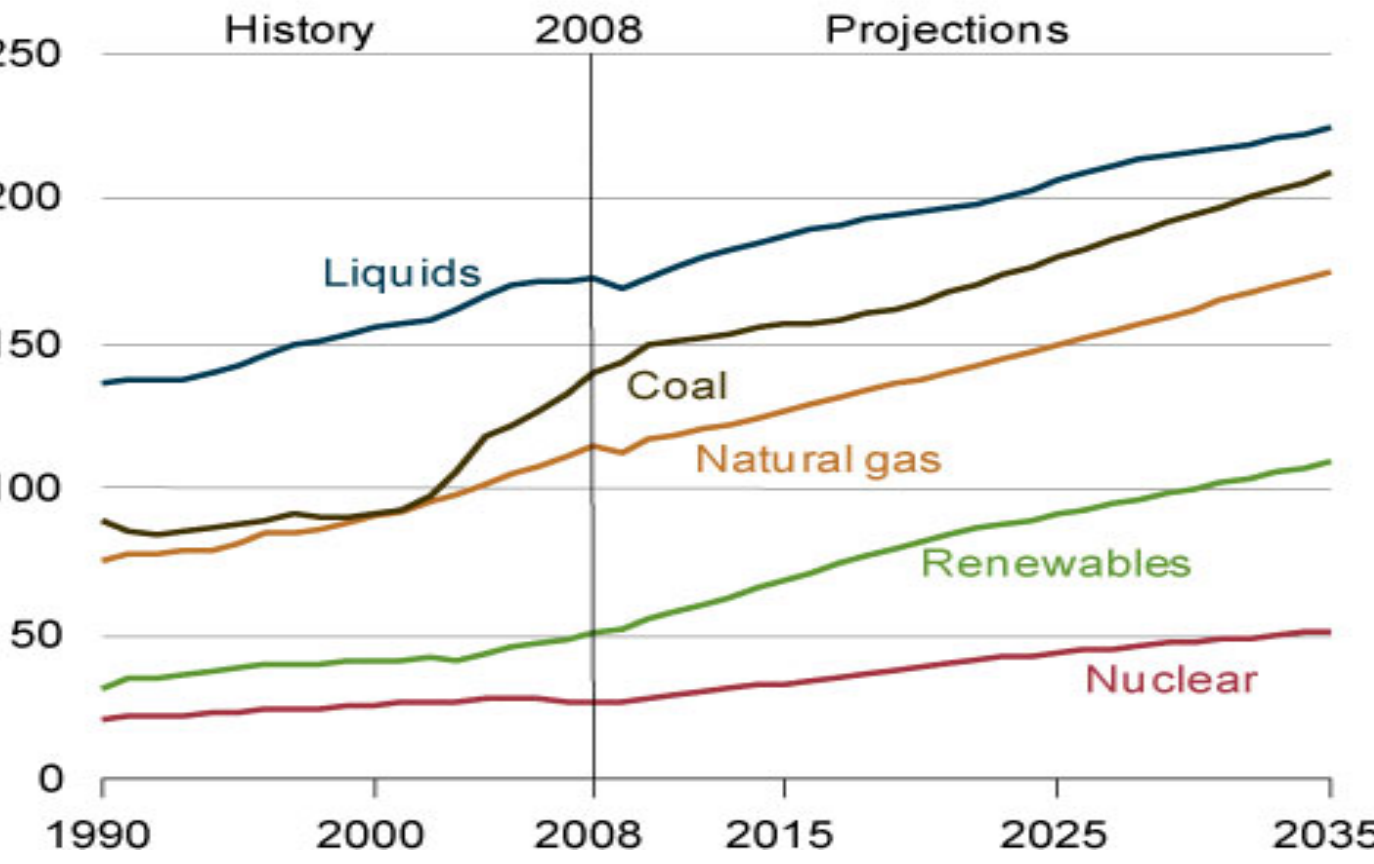
- The world population is increasing daily, and waste generating is rising proportionally.



- There have been three particular ways to discard MSW.



World Energy Consumption²



- Could we change the projections?
- What would happen if we could increase the growth of **Renewables**?

A Bridge Between Two Industries

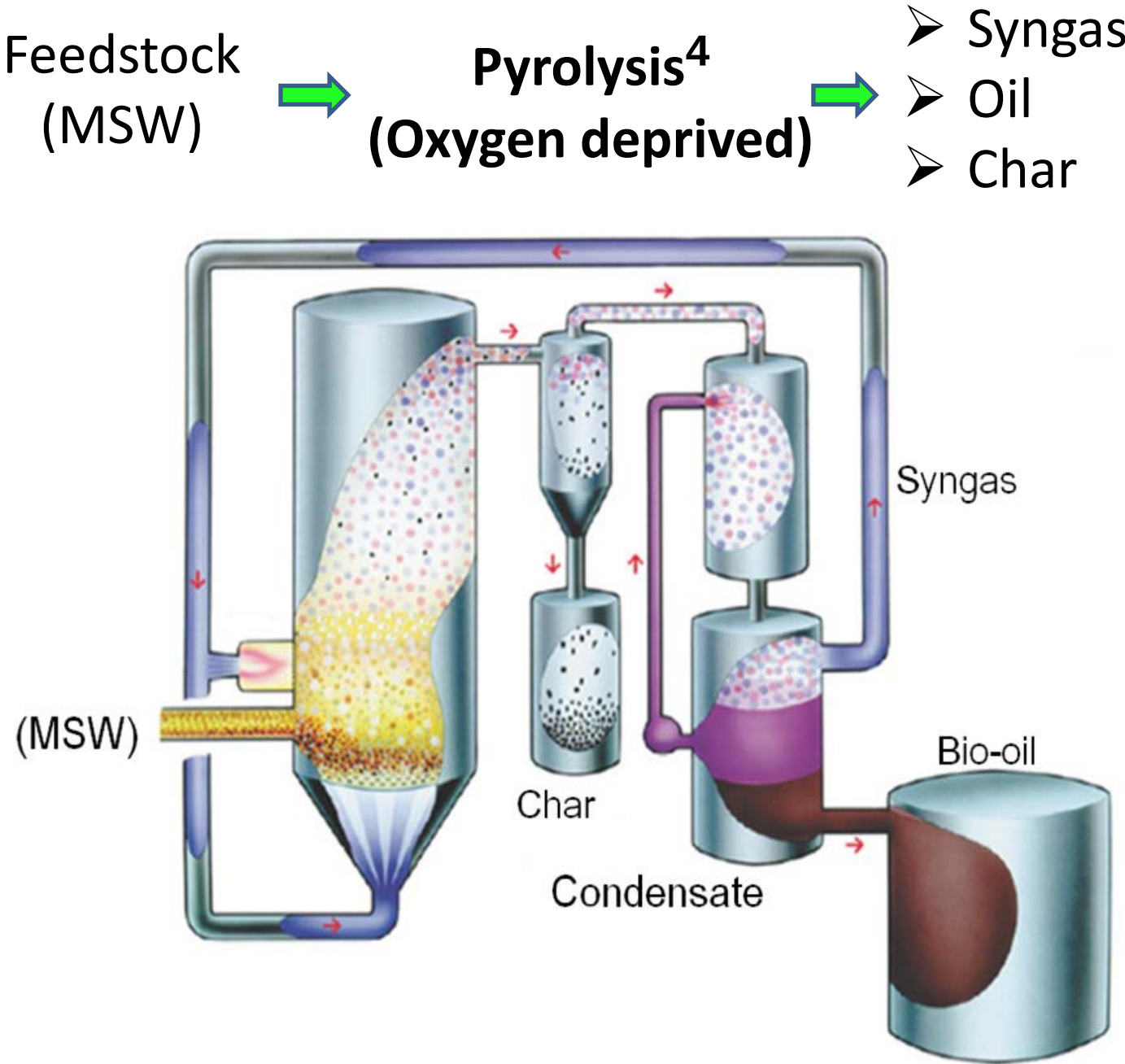
Waste to Energy (WTE) technology is a green opportunity to continue the path of human ingenuity and technological advancement.



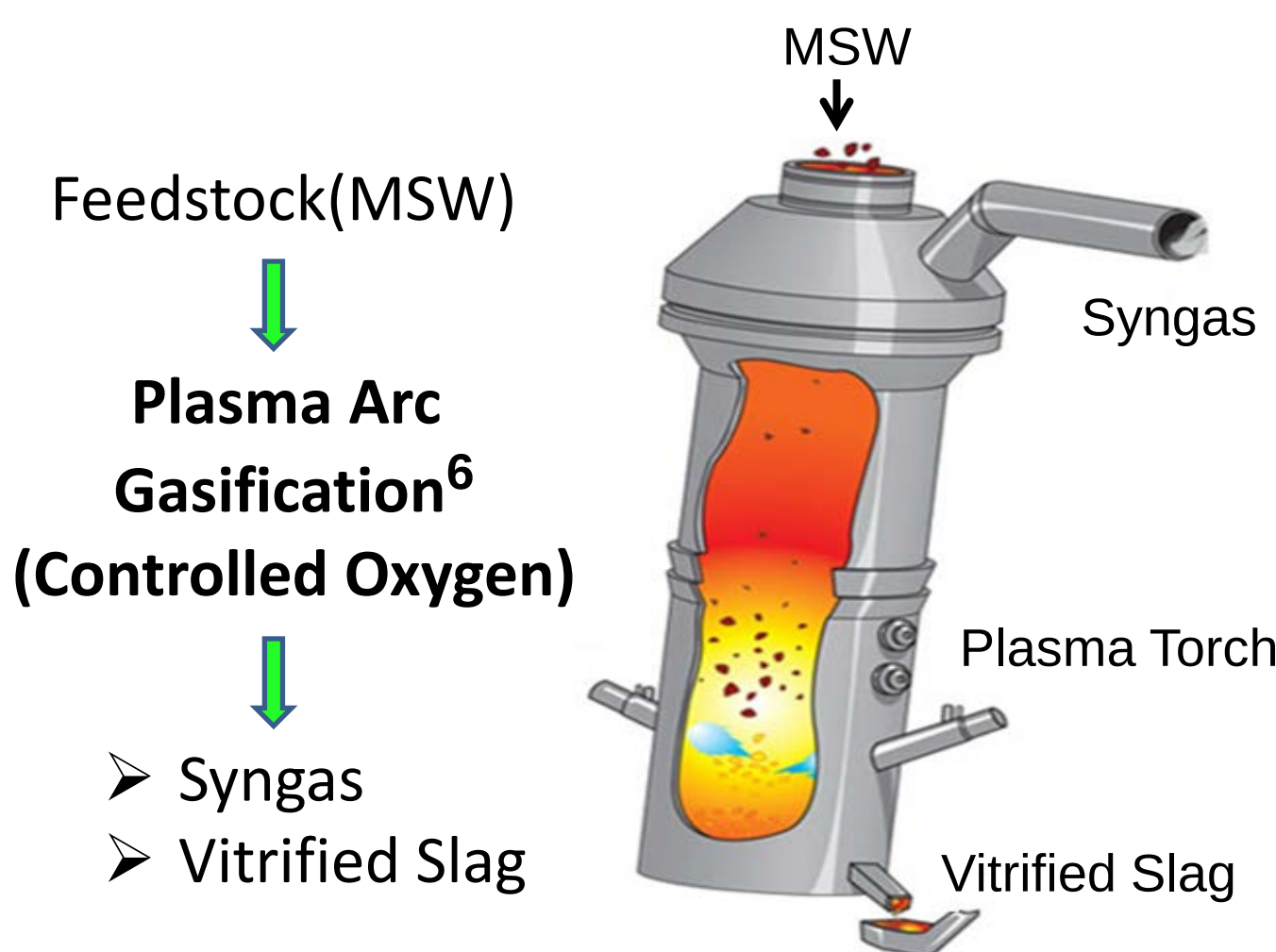
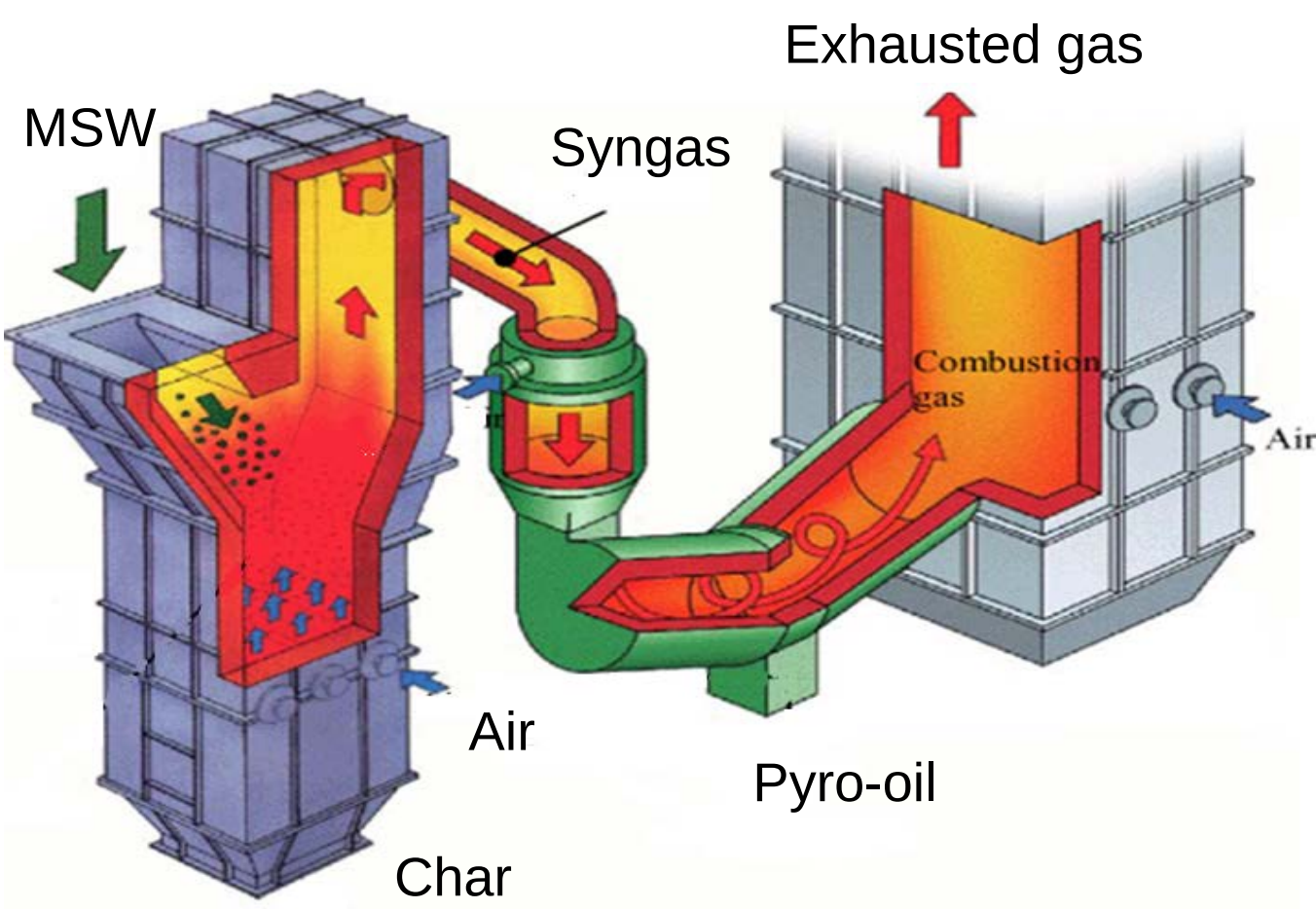
WTE Technologies

Thermal Decomposition Technologies

- A thermal decomposition of carbon-based materials at elevated temperatures in a controlled oxygen environment. ³



- Feedstock (MSW) → **Gasification⁵** (Controlled Oxygen) → Syngas, Oil, Char

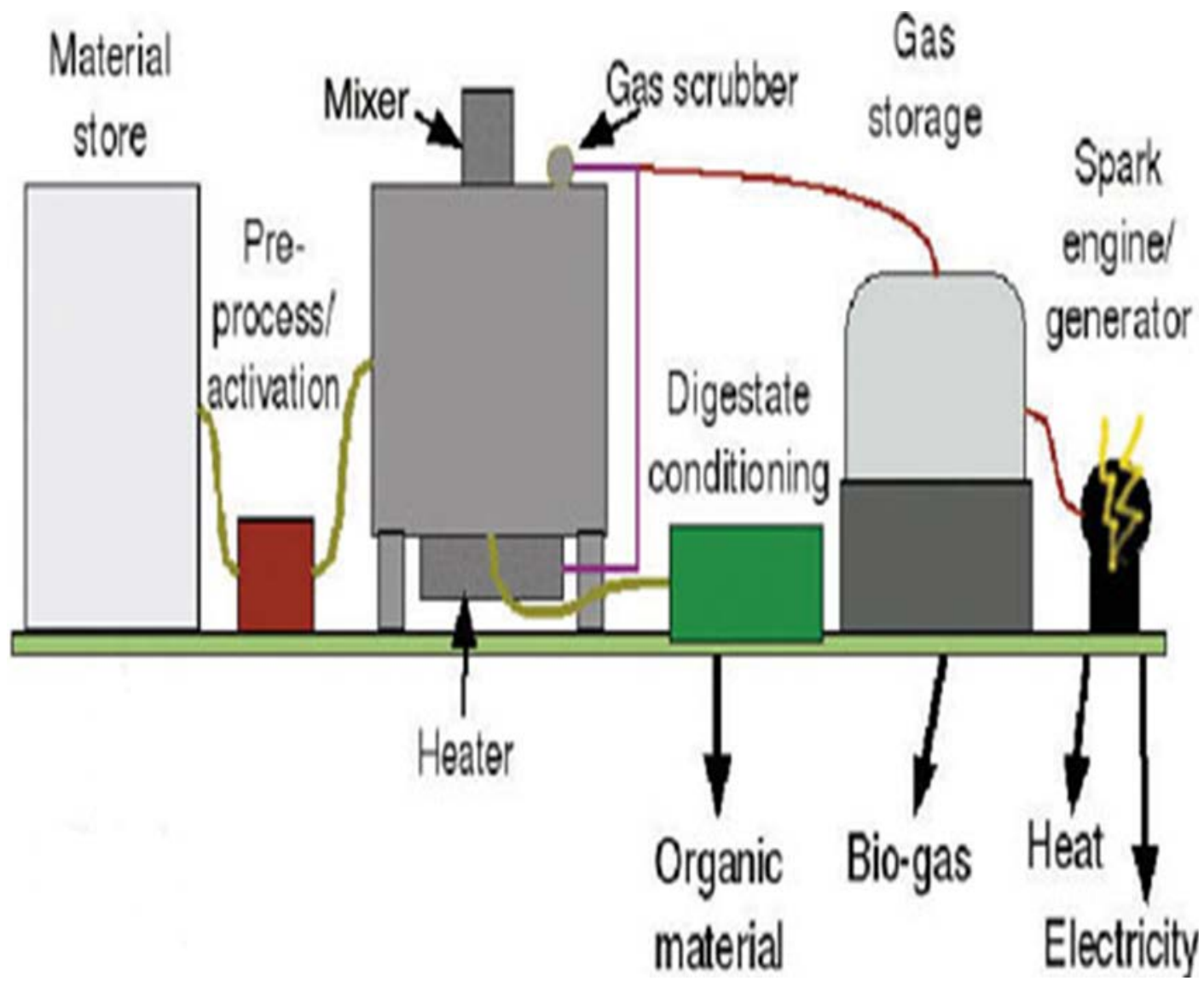


Summary of Thermochemical Decomposition Processes				
	Technology	Feedstock	Temperatures	By Products
1	Pyrolysis	Pre-sorted MSW	800 -1,800 °F	syngas, Oil, Carbon Char
2	Gasification	Pre-sorted MSW	1,450 -3,000 °F	syngas, Oil, Tar
3	Plasma Arc Gasification	MSW	7,200-12,600°F	syngas, Vitrified slag

Biological Decomposition Technology

Anaerobic Digestion (AD) is a natural process which breaks down **organic** waste into simple chemical components in the absence of oxygen.

Feedstock (OFMSW) → **Anaerobic Digestion (AD)⁷** → Biofuel, Fertilizer



Industry Assessment

This research study evaluated 36 national and international WTE technology providers while considering MSW as the feedstock and energy as the co-product. (See the handout for more details.)

Anaerobic Digestion Technology

Plasma Arc Gasification Technology

Gasification Technology

Evaluation of New and Emerging Pyrolysis Technology

Company	Tech.	Benefits	Challenges
1 Green Light Energy Solution Co.	Pyrolysis	1) Need 3-5 people to operate the equipment, 2) 1 year warranty, operating personnel training 3) feedstock : MSW, tire, wood waste, sewage sludge, oil sludge, food industry waste	1) Average payback period is 4-5 years 2) transform waste into 90-98% combustible syngas and 10% solid carbon char and without any liquid tar fraction 3) feedstock must be pelletize (2inch)

References

1- Environmental Protection Agency (EPA), (2010), Municipal Solid Waste Generation, Recycling, and disposal in United States: Facts and figures for 2010. Retrieved from http://www.epa.gov/wastes/nonhaz/municipal/pubs/msw_2010_factsheet.pdf

2- The Future of Energy, Retrieved from <http://energyfuture.wikidot.com/world-energy-use>

3- Young, G. C. (2010). Municipal Solid Waste to Energy Conversion Processes: Economic, Technical and Renewable Comparisons. Hoboken, NJ: John Wiley & Sons, Inc.

4- Energy from waste and wood, Retrieved from <http://energyfromwasteandwood.weebly.com/technologies.html>

5- Global Environmental Center foundation, Retrieved from http://www.gec.jp/waste/data/waste_C-1.html

6- How stuff work, Retrieved from http://www.gec.jp/waste/data/waste_C-1.html

7- Zero waste energy systems, Retrieved from http://www.zwes.ca/Section/Solutions/Anaerobic_Digestion