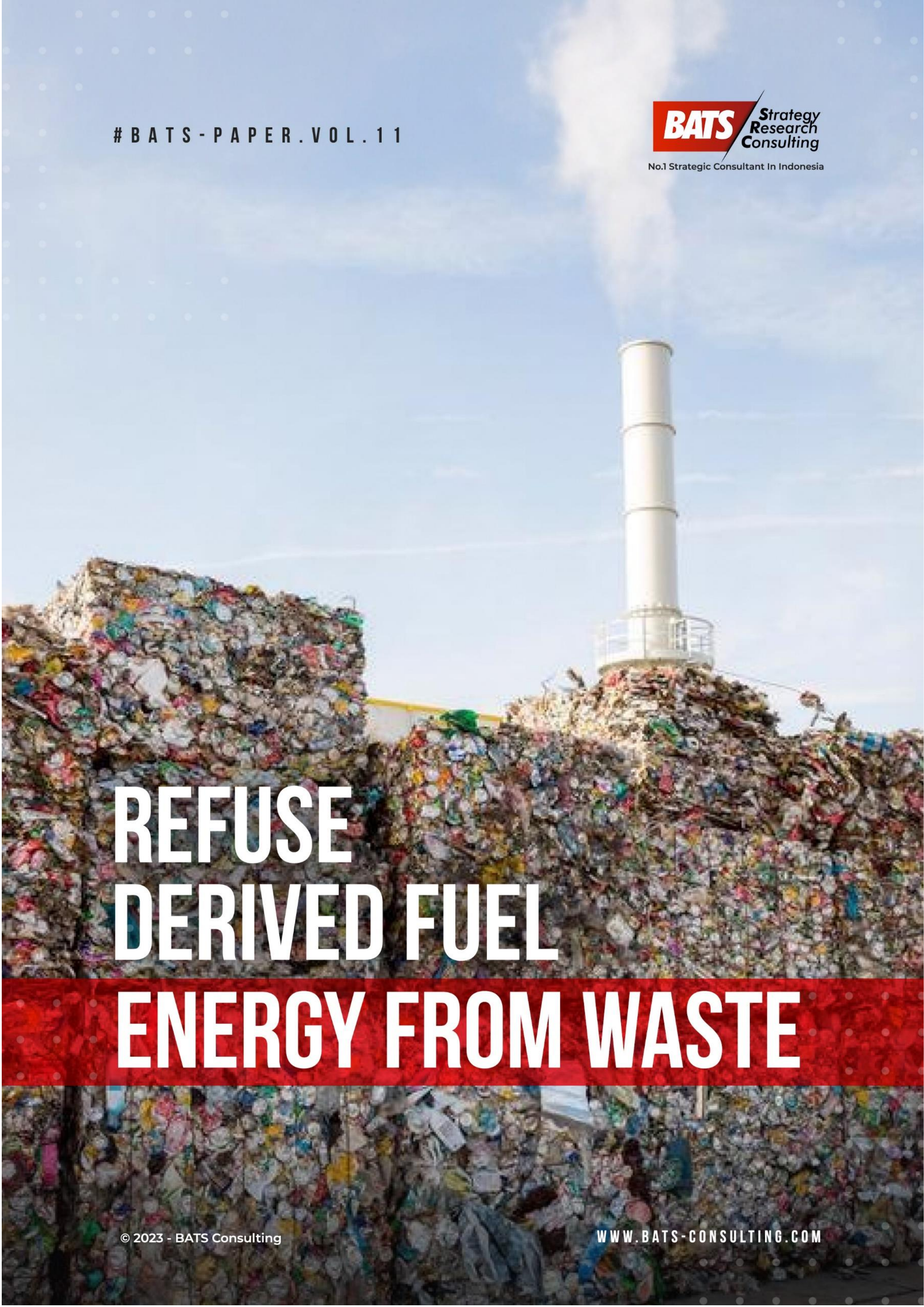
#BATS-PAPER.VOL.11

BATS Strategy Research Consulting

No.1 Strategic Consultant In Indonesia



REFUSE DERIVED FUEL ENERGY FROM WASTE

WWW.BATS-CONSULTING.COM


BATS Strategy Research Consulting
NO.1 STRATEGIC CONSULTANT IN INDONESIA
A CUP OF COFFEE WITH A GOOD BATS PAPER IS A PERFECT COMBINATION TO ACCOMPANY YOUR WEEKEND
WWW.BATS-CONSULTING.COM

WWW.BATS-CONSULTING.COM

+

=

IT'S A PERFECT COMBINATION

ENJOY YOUR WEEKEND :)

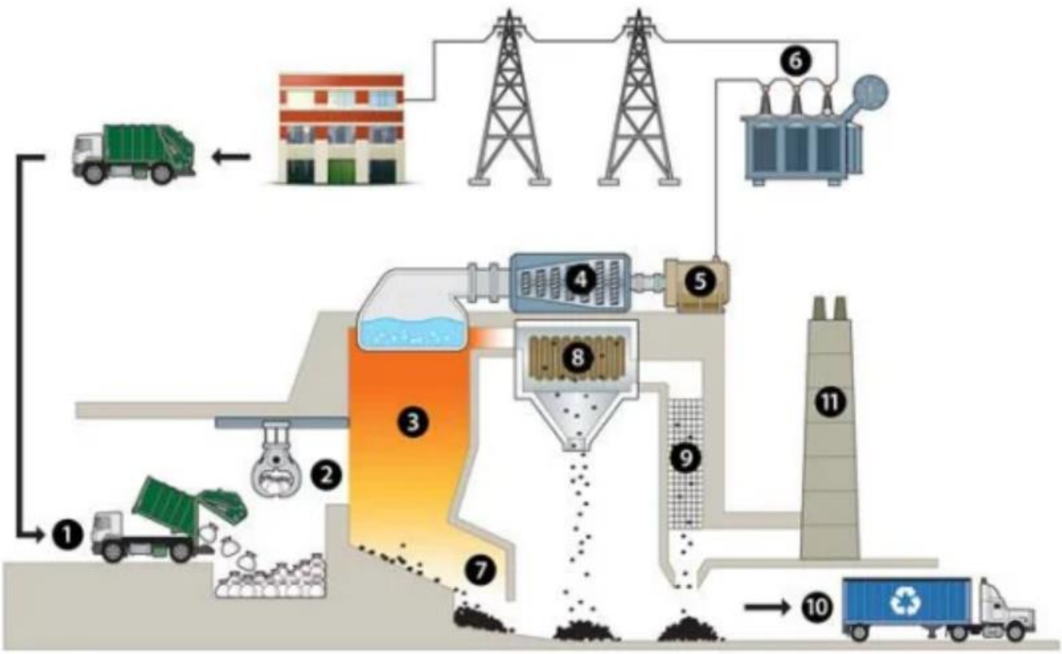
TABLE OF CONTENT

Refuse Derived Fuel: Energy from Waste

A. Introduction

In the traditional sense, renewable sources of energy are those that can be replenished by nature, such as hydropower, wind power, solar power, and biomass. Municipal solid waste (MSW) refers to the materials discarded in urban areas, including predominantly household waste with sometimes the addition of commercial wastes, collected and disposed by the municipalities.

As well as traditional recycling methods, commercial waste can be used to create a renewable energy source known as refuse-derived fuel (RDF). This allows waste produced by your business to be used to generate electricity, heat and other forms of energy and is often known as the energy from waste (EFW) process.



The different types of waste that can be used in waste to energy are municipal solid waste, agricultural waste, and industrial waste. Municipal solid waste is the most common type of waste that is used in this process. It includes everyday items like paper, plastic, and metal. Agricultural waste includes things like manure, straw, and wood chips. Industrial waste includes things like slag, ash, and boiler dust. Municipal solid waste is the most common type of waste that is used in waste to energy.

The U.S. Environmental Protection Agency considers MSW a renewable energy resource because the waste would otherwise be sent to landfills (U.S. Environmental Protection Agency, 2006a). The U.S. Department of Energy includes MSW in renewable energy only to the extent that the energy content of the MSW source stream is biogenic (Energy Information Administration, 2007). The non-renewable portion of MSW has to be either separated or accepted as part of the fuel (Themelis and Millrath, 2004), and practically all the wastes in MSW after material recovery and recycling are treated as renewable.

Waste-to-energy (WTE) processes recover the energy from the waste through either direct combustion (e.g., incineration, pyrolysis, and gasification) or production of combustible fuels in the forms of methane, hydrogen, and other synthetic fuels (e.g., anaerobic digestion, mechanical biological treatment, and refuse-derived fuel).

Incineration and gasification are the two primary WTE technologies that have been used successfully throughout the world. It is estimated that about 130 million tonnes of MSW are combusted annually in over 600 WTE facilities worldwide, producing electricity and steam for district heating and recovered metals for recycling (Themelis, 2003). WTE incineration has long been accepted as a solid waste management option, complementing landfilling and composting.

Incineration of MSW in WTE facilities prevents the possible aqueous and gaseous pollution associated with landfilling and provides a source of reliable, renewable energy. As a proven, environmentally sound technology, WTE has been used extensively in Europe and developed countries in Asia such as Japan and Singapore (American Society of Mechanical Engineers, 2008).

B. Comparison of the Major MSW Management Technology Options: Landfilling, Composting, and Incineration.

Technology	Advantages	Disadvantages
Landfilling	• An universal solution that provides ultimate waste disposal; • Relatively low cost and easy to implement; • Complements with other technology options for handling the residual waste; • Can derive landfill gas as a byproduct for household and industrial uses; and • Costs incurred incrementally as landfill expands.	• Cost increases significantly with liner, leachate collection and removal system, and stricter regulations; • Requires large area of land; • Does not achieve the objectives of reducing volume of MSW and converting MSW into reusable resources; and • May result in secondary pollution problems, including groundwater pollution, air pollution, and soil contamination.
Composting	• Converts decomposable organic materials into an organic fertilizer; dan	• Takes up more space than some other waste management technologies;

	• Reduces the amount of waste to be landfilled and integrates well with landfilling and materials recovery/recycling.	• Can be costly to implement and maintain, and has no environmental or economic advantages compared to incineration; • Requires waste size reduction and some degree of waste separation/processing; and • Quality of the fertilizer produced is low and volume is disproportionately large, resulting in poor market demand.
Incineration	• Provides substantial reduction (by 90%) in the total volume of waste requiring disposal in landfill; • Requires minimal pre-processing of waste; • The bottom ash from incineration is biologically clean and stable, and can be used in road building and the construction industry; • A very stable process, and virtually all wastes can be burned and the burning process can be adequately controlled; • Heat from combustion can be used as energy source for generation of steam and/or electricity; and • Air emissions can be well controlled.	• High capital and operational and maintenance costs, compared to other, nonincineration options; • Significant operator expertise is required; • Air pollution control equipment is required to treat the flue gas, and the fly ash needs to be disposed in hazardous waste landfills; • More raw material have to be used to replace those that have been incinerated, and it does not save energy in the long run as resources are not recycled; • May some time discourage recycling and waste reduction; and • Public perception is sometimes negative, primarily with dioxins emission.

C. Indonesia's Urban Expansion and MSW Management Challenge

Indonesia is the world's most populous country and is developing rapidly. Increasing population, rapidly developing economic and social systems, accelerated urbanization, and need for improvements in both the standards of living and the surrounding ecosystems pose multiple environmental challenges in Indonesia, including air pollution, water and soil pollution, waste disposal, water shortage, and massive energy demand.

Meanwhile in Jakarta, the daily amount of waste for Jakarta residents has increased by 1,573 tons per day in the last five years. Along with this increase, the Provincial Government of DKI Jakarta will add two waste processing into alternative fuels until 2024.

The DKI Jakarta Environment Agency recorded an increase in the daily amount of waste based on data from the Bantargebang Integrated Waste Processing Site (TPST) scales, Bekasi, West Java. The average amount of incoming waste is 7,228 tons per day in 2021, or a 27 percent increase from the average incoming waste in 2015 of 5,655 tons per day.

One of the efforts to deal with the increase in waste is by using landfill mining facilities and processing waste into refused- derived fuel (RDF) in Bantargebang. The RDF factory is considered more affordable than the intermediate treatment facility (ITF).

Acting Governor of DKI Jakarta Heru Budi Hartono plans to add RDF factories in Rorotan, North Jakarta, and Pegadungan, West Jakarta, in 2024. Reflecting on the RDF factory in Bantargebang, the local government will no longer issue tipping fees or pay fees to pay for waste processing . The tipping fee budget will instead be focused on developing RDF factory facilities.

For the initial stage, waste that has been processed into RDF will be used as fuel for two cement factories, namely PT Indocement Tunggal Prakarsa Tbk in Citeureup, West Java, and PT Solusi Bangun Indonesia Tbk in Narogong, West Java.

The RDF factory processes 2,000 tons of waste per day. As much as 1,000 tons of waste came from piles of old waste that were more than six years old obtained through the landfill mining method . This old trash comes from the Bantargebang inactive zone.

The waste is then chopped and crushed so that it becomes a certain size to be used as raw material for RDF. Meanwhile, the remaining old waste that does not comply with RDF standards will be used as humus soil which can be used as a place to plant plants.

The composition of the processing results is also different. For 1,000 tons of new waste will produce 40 percent RDF, 15 percent residue, and the rest is liquid waste, while 1,000 tons of old waste will be processed into 35 percent RDF, 40 percent humus soil, and the rest into liquid waste which will evaporate later.

D. Air Pollution Control and GHG Reduction in WTE Incineration

Disposal and treatment of MSW can produce significant amount of GHG emissions: carbon dioxide and nitrous oxide are produced by incineration, while methane (which is 21 times more potent than carbon dioxide over 100 years) is produced as a byproduct of the anaerobic decomposition of MSW in landfills.

Methane produced at solid waste disposal sites contributes approximately 3–4% of the global anthropogenic GHG emissions (Intergovernmental Panel on Climate Change, 2006). Compared to the option of landfilling, WTE can curb the contribution of MSW on GHG emissions through avoiding the release of methane from landfills and offsetting emissions from fossil fuel power plants.

Comparative studies of WTE and landfilling have shown that WTE can reduce up to 1.3 tonnes of carbon equivalent per ton of MSW through avoiding the release of methane from landfills and offsetting emissions from fossil fuel power plants (American Society of Mechanical Engineers, 2008). U.S. data indicate a net emission reduction of 0.15 ton of carbon equivalent was achieved for every ton of MSW managed by WTE instead of being landfilled (with the national average methane recovery) in 2003. WTE can be a small step towards reducing Indonesia's total GHG emissions. In addition, WTE can reduce the transport of MSW to distant landfills and the associated emissions and fuel consumption.

E. Problems and Prospects of WTE Incineration in Indonesia

Along with the rapid economic growth, Indonesia faces pressing needs for environmentally sound waste management technology and clean energy. WTE is playing, and will continue to play, an increasingly important role in MSW management in the near future. Nonetheless, development of WTE incineration industry in Indonesia faces several major challenges.

1. **Capital and operating costs**

   Compared to other MSW treatment technologies and power generation from other renewable resources, WTE requires high capital investments and operational costs. Imported incineration equipments are expensive and have high operating and maintenance costs. Equipments based on domestic technologies cost much less but are generally limited to relatively low capacities. However, for WTE facilities to become truly self-sufficient, the tipping fee and the government subsidy need to be significantly raised to make up for the higher cost of electricity generation. Indonesia should invest in the research and development of domestic technologies and incineration equipment, especially the large capacity incinerators, to help make WTE incineration more affordable by municipalities across the country.

2. **Equipment corrosion**

   Due to the lack of waste sorting and material separation, MSW in Indonesia contains relatively high levels of chlorine and sulfur (Zhang et al., 2008), which form acid gases (HCl and SO2) during combustion and can cause serious corrosion of the steam boilers.

   Even though higher efficiencies can be achieved by operating WTE plant heat recovery boilers at higher temperatures, the rate of high temperature corrosion will also increase. Largely because of cost considerations, carbon steel and 310 stainless steel instead of highly resistant materials (e.g., Ni-base alloys) are typically used to make the boiler tubes in MSW incinerators, requiring frequent superheater repairs and replacements. To combat the corrosion problem and to improve the power generation efficiency of WTE plants, more efforts are to be spent on improving the process conditions in the boiler and on developing less expensive corrosion-resistant alloys.

3. **Air pollutant emissions**

A range of air pollutants, particularly dioxins, are produced in MSW incineration and can be released into the atmosphere in significant quantities if the incinerator and the flue gas cleaning system are not properly designed and operated. Nonetheless, it is necessary for WTE facilities to continue improve the incinerators and flue gas treatment systems to further reduce their air pollutant emissions.

For better protection of public health, Indonesia should impose tighter limits on emissions of dioxins and other air pollutants from incineration facilities (towards the European and U.S. standards), which is expected to lead to a wave of development and implementation of new air pollution control technologies.

4. **Fly ash management**

Management of fly ash from MSW incineration has not received adequate attention in Indonesia, while improper disposal can potentially cause secondary environmental pollution from the fly ash. Despite the significant waste volume reduction, considerable amount of solid residues (i.e., bottom ash, fly ash, and air pollution control residue) are generated at different points in the process of MSW incineration.

After appropriate stabilization treatment, the bottom ash is often used as a construction material. In contrast, fly ash is a hazardous waste due to the enrichment of dioxins and heavy metals, and must be disposed accordingly (Li et al., 2004; Yan et al., 2006). Although fly ash is required to be disposed of in hazardous waste landfills.

F. Conclusion

Waste To Energy (WTE) solves the problem of MSW disposal while recovering the energy from the waste materials, and the pollutant emissions can be controlled to low levels. With the significant benefits of environmental quality and reduction of GHG emissions, MSW is increasingly accepted as a clean source of energy around the world and mostly Europe.

Government polices and regulations, financial incentives, new technologies, and improved operations will strengthen the position of WTE in the renewable energy market in Indonesia. Research and technology development focusing on corrosion phenomena, flue gas control, fly ash management and beneficial reuse of residues will further drive the growth of WTE industry. WTE incineration is expected to make increasingly greater contribution to supplying renewable energy in China, while helping solving the country’s MSW management.

Reference

American Society of Mechanical Engineers, 2008. Waste-to-Energy: A Renewable Energy Source from Municipal Solid Waste; White Paper Submitted to Congress; New York, NY.

Brookins, C.L., 2007. Major forces and factors shaping global markets: the emerging agricultural world. J. Agribusiness 25, 1–16.

https://www.kompas.id/baca/metro/2023/06/28/jakarta-tambah-dua-rdf-plant- tahun-2024

Cheng, H., Hu, Y., 2009. Energy from municipal solid waste. An experience from China. Chim. Oggi. 27, 26–28.

Cheng, H., Hu, Y., in press. Planning for sustainability in China's urban development: status and challenges for Dongtan eco-city project. J. Environ. Monitor. 10.1039/B911473D.

Cheng, H., Zhang, Y., Meng, A., Li, Q., 2007. Municipal solid waste fueled power generation in China: a case study of waste-to-energy in Changchun city. Environ. Sci. Technol. 41, 7509–7515.

Cheng, H., Hu, Y., Zhao, J., 2009. Meeting China's water shortage crisis: current practices and challenges. Environ. Sci. Technol. 43, 240–244.

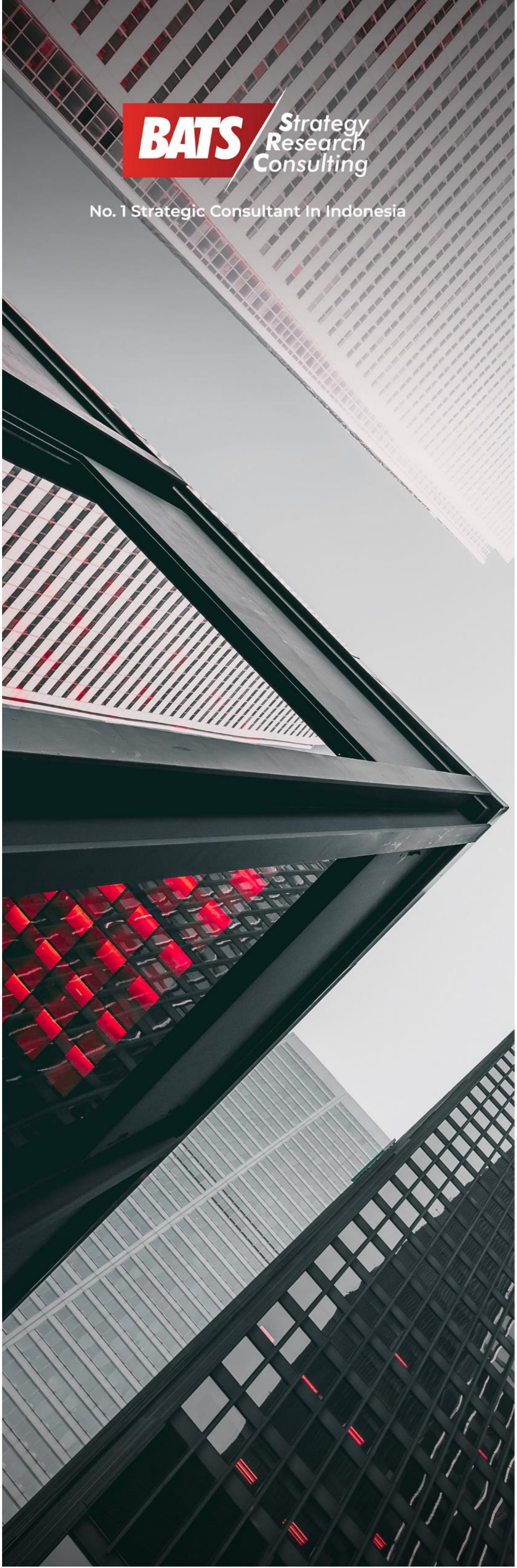
Denison, R.A., 1996. Environmental life-cycle comparison of recycling, landfilling, and incineration: a review of recent studies. Annu. Rev. Energ. Environ. 21, 191–237.

Energy Information Administration, 2007. Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy; Office of Coal, Nuclear, Electric and Alternate Fuels, U.S. Department of Energy: Washington, DC.

Energy Information Administration, 2009. Country Analysis Brief: China. U.S. Department of Energy, Washington, DC.

European Union, 2000. Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the Incineration of Waste Brussels, Belgium.

Feiner, J., Mi, S., Schmid, W.A., 2001. Meeting the challenge of future urbanization: risks and opportunities for future urban planning in the People's Republic of China. Disp. 145, 10–18.



BRIAN PRAMUDITA S.E., Ak., M.Ak., CA, CPA., BKP., CIB., CCA

Managing Partner - BATS Consulting

- Chartered Accountant
- Certified Public Accountant
- Register Tax Consultant
- Certified Investment Banker
- Certified Carbon Auditor

+62 816-1105-174

brianpramudita@bats-consulting.com

CONTACT US

FIND US!

Office : +6221 2212 9136
Mobile : +62882 9022 2512
(Giordano)
Email
info@bats-consulting.com

Join Our Forum Group Discussion Taxation!

And Free Consultation