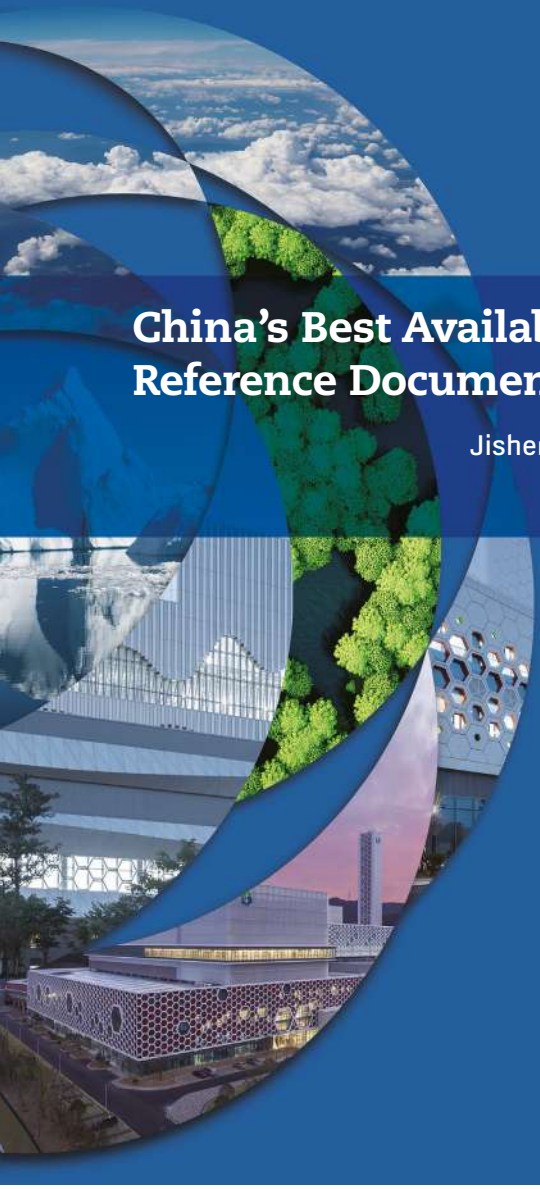
ENERGY & WASTE MANAGEMENT



China's Best Available Techniques (CBAT) – Reference Document for Waste Incineration

Jisheng LONG, Xuejun JIAO, Li BAI, Jianping LI, Hailiang DU and Yiru HUANG

SCIENCE PRESS

edp sciences

ENERGY & WASTE MANAGEMENT



China's Best Available Techniques (CBAT) – Reference Document for Waste Incineration

Jisheng LONG, Xuejun JIAO, Li BAI, Jianping LI, Hailiang DU and Yiru HUANG

As China's urbanization rate surpasses 65%, municipal solid waste in Chinese cities exceeds 250 million tons annually. Safe and sustainable waste management has become an unavoidable challenge. Municipal solid waste incineration for power generation, offering reduction, resource recovery, and harmless treatment, has evolved from early exploratory technology into the mainstream method for urban waste management. After more than 30 years of development, China has built the world's largest municipal waste incineration system, with a processing capacity exceeding 1.12 million tons per day in 2024, supported by leading-edge technology.

This book presents a comprehensive overview of the waste incineration industry in China, covering policies and standards, technological innovation, and future trends. It highlights best practices and lessons learned, offering practical guidance for developing countries facing similar waste management challenges, while contributing "Chinese wisdom" and "Chinese solutions" to global environmental governance and low-carbon development.

ISBN : 978-2-7598-3973-5

9 782759 839735

edp sciences
www.edpsciences.org

SCIENCE PRESS

Jisheng LONG, Xuejun JIAO,
Li BAI, Jianping LI,
Hailiang DU and Yiru HUANG

China's Best Available Techniques (CBAT) – Reference Document for Waste Incineration

SCIENCE PRESS
edp sciences

The original edition of this book was published in Chinese by Science Press (Beijing) in 2026. ISBN 978-7-03-084655-6.

Printed in France

EDP Sciences – ISBN(print): 978-2-7598-3973-5 – ISBN(ebook): 978-2-7598-3974-2
DOI: 10.1051/978-2-7598-3973-5

All rights relative to translation, adaptation and reproduction by any means whatsoever are reserved, worldwide. In accordance with the terms of paragraphs 2 and 3 of Article 41 of the French Act dated March 11, 1957, "copies or reproductions reserved strictly for private use and not intended for collective use" and, on the other hand, analyses and short quotations for example or illustrative purposes, are allowed. Otherwise, "any representation or reproduction – whether in full or in part – without the consent of the author or of his successors or assigns, is unlawful" (Article 40, paragraph 1). Any representation or reproduction, by any means whatsoever, will therefore be deemed an infringement of copyright punishable under Articles 425 and following of the French Penal Code.

This book cannot be reproduced or used for training artificial intelligence systems. Text and data mining is prohibited in accordance with Article 4(3) of Directive (EU) 2019/790.

The printed edition is not for sale in Chinese mainland.

© Science Press, EDP Sciences, 2026

Foreword

This volume provides a systematic exposition of China's WtE policy landscape, technological advancements, and future trajectories. It distills the sector's most impactful practical achievements and, through the exemplary practices of industry leaders like SUS ENVIRONMENT, presents valuable "Chinese wisdom" and "Chinese solutions" for advancing global sustainable waste management and low-carbon development.

China's experience offers a compelling case study of how coherent public policy, industrial capability, and technological innovation can converge to address the complex challenges of rapid urban growth. Over the past decades, the country has moved from fragmented disposal practices to an increasingly integrated system in which waste-to-energy plays a central and strategic role. As China's urbanization rate surpasses 65%, its cities now generate over 250 million tonnes of municipal solid waste (MSW) annually, presenting a pressing environmental imperative. Waste-to-energy (WtE) has emerged as the predominant approach, leveraging its distinct advantages in volume reduction, energy recovery, and environmentally sound treatment to become the bedrock of China's modern waste management framework.

Through more than three decades of dedicated development, China has established the world's most extensive WtE infrastructure, with daily processing capacity exceeding 1.12 million tonnes. This extraordinary expansion is underpinned by a robust triad of policy frameworks, technological innovation, and operational expertise and efficiency.

A comprehensive scheme of regulations and standards governs the entire project lifecycle—from site selection and engineering design to operational oversight and emissions control. Continuously refined and supported by targeted incentives, this framework has been instrumental in guiding the industry's high-quality development on a scale.

DOI: 10.1051/978-2-7598-3973-5.c901
© Science Press, EDP Sciences, 2026

Technologically, China has achieved remarkable breakthroughs with the independent development of large-scale mechanical grate incinerators capable of processing 1200 tonnes per day, specifically engineered for high-moisture, low-calorific waste. The establishment of an integrated technological chain-featuring high-efficiency power generation, ultra-low flue gas emissions, near-zero leachate discharge and comprehensive by-product utilization-demonstrates the sector's advanced capabilities. Particularly noteworthy, China's sophisticated leachate treatment system has yielded valuable insights applicable to waste management challenges across Southeast Asia and other regions.

With over 1000 WtE facilities commissioned nationwide, China has accumulated substantial engineering expertise in managing complex operational conditions, optimizing construction efficiency, and pioneering eco-industrial park models for synergistic treatment of municipal solid waste streams.

Dr. Long Jisheng, the chief editor (of this publication), has been pivotal in this sector's evolution. Following extensive international practice, he founded SUS ENVIRONMENT Co., Ltd. in 2008. Under his visionary leadership, the team has pioneered next-generation mechanical grate incinerator technology, advanced combustion control technologies, and cutting-edge emission purification processes, achieving complete technological independence and ending reliance on imported solutions. Through its groundbreaking design paradigms centered on "energy-efficiency" and "emission control", SUS ENVIRONMENT has been instrumental in transforming public perception from "Not In My Backyard (NIMBY)" to "Please In My Backyard (PIMBY)".

China's journey reflects the importance of long-term policy consistency, continuous technological upgrading, and transparent environmental standards in achieving both climate mitigation and resource efficiency objectives. As the global waste and resource management sectors seek pathways consistent with climate goals and circular economy ambitions, constructive international dialogue and knowledge exchange remain essential. It is my hope that this publication will contribute meaningfully to that dialogue and foster further collaboration between China and the global waste management community in advancing sustainable, low-carbon solutions for the future.

James Law
President
International Solid Waste Association (ISWA)
January 2026

Preface

As a core pillar of urban solid waste management, municipal solid waste incineration achieves waste reduction, resource utilization, and harmless disposal while enabling efficient energy recovery. It serves as a critical pathway for advancing the circular economy and achieving China's carbon peak and neutrality targets. Though China's waste-to-energy (WtE) industry emerged relatively late, three decades of vigorous development have propelled the sector from early technology introduction and assimilation to a new era of independent innovation and global leadership, establishing a distinctive high-quality development paradigm for the industry.

The evolution of China's WtE technology can be divided into four distinct developmental stages. The exploratory stage (late 1980s–2000) began with the commissioning of Shenzhen's first modern WtE plant and key national research and development (R&D) projects under China's Eighth Five-Year Plan. This period initiated domestic technological and equipment R&D, achieving a pivotal breakthrough from full import dependence to partial localization of core equipment. The growth stage (2001–2005) marked the gradual improvement of policy and standard frameworks alongside increasingly stringent environmental requirements. Domestically manufactured grate incinerators were widely promoted and applied, while the integrated flue gas purification process consisting of semi-dry deacidification, activated carbon injection and bag filter became the mainstream technical solution. Synchronous progress was also made in leachate and fly ash treatment technologies, with a large number of modern WtE plants completed and commissioned. Driven by the national ecological civilization strategy, the industry entered a rapid development stage from 2006 to 2020, marking its golden development period. Large-scale mechanical grate incinerators with independent intellectual property rights, featuring a single-unit capacity of up to 850 tonnes per day, dominated the domestic market. Cutting-edge technologies including ultra-low flue gas emission control, medium- and high-parameter power generation, and intelligent system control achieved continuous iterative upgrading. China has since ranked first globally in

DOI: 10.1051/978-2-7598-3973-5.c902
© Science Press, EDP Sciences, 2026

total municipal solid waste treatment capacity, delivering a host of world-class benchmark engineering projects. Since 2021, the industry has entered a steady and innovation-driven development stage. Against a backdrop of slowing market expansion, the industry focus has shifted toward lean operation, cost reduction and efficiency enhancement. Current technological research prioritizes large-scale unit design, high-efficiency operation, intelligent management, and low-carbon transformation, while domestic enterprises are actively expanding overseas business under the Belt and Road Initiative.

Throughout this development trajectory, China's indigenous technological innovation has attained globally recognized achievements. In core equipment research and application, leading enterprises including SUS ENVIRONMENT, SANFENG ENVIRONMENT and EVERBRIGHT ENVIRONMENT have independently developed and widely applied super-large mechanical grate incinerators. These units are specially optimized to suit the characteristics of China's municipal solid waste: high moisture content, low calorific value and complex composition. These incinerators reach a maximum single-unit processing capacity of 1200 tonne/day, meeting internationally advanced standards in waste adaptability, combustion efficiency and core component service life.

In terms of high-efficiency energy utilization, the domestic WtE industry has overcome the technical bottleneck of high-temperature corrosion in high-parameter waste heat boilers. Mainstream steam operating parameters have been progressively upgraded from medium-temperature and medium-pressure (4.0 MPa/400 °C), to medium-temperature and sub-high-pressure (6.5 MPa/450 °C), and further to medium-temperature and super-high-pressure (13.5 MPa/450 °C/485 °C). Combined with advanced technologies such as external dehumidification coupled with main steam reheating (MSR), these upgrades have raised the power generation efficiency of WtE plants from the traditional 20%–25% to over 30%, representing a landmark leap in industrial energy conversion performance.

In advanced pollution control, China has established the world's most stringent flue gas emission standards for WtE plants and pioneered a comprehensive ultra-low emission process system: selective non-catalytic reduction + semi-dry scrubber + dry sorbent injection + activated carbon injection + bag filter + selective catalytic reduction + wet scrubber. This integrated technical system ensures that emissions of particulate matter, sulfur dioxide, nitrogen oxides and other key pollutants are consistently maintained below regulatory limits.

Regarding by-product utilization and co-processing, China's WtE industry has formed a complete set of mature resource recovery technologies. These include fly ash treatment technologies such as water washing desalination coupled with cement kiln co-processing, low-temperature thermal decomposition coupled with water washing treatment, and high-temperature melting, as well as high-efficiency slag sorting technologies that realize metal recovery and the reuse of remaining tailings as construction raw materials. Beyond by-product recycling, innovative multi-source solid waste co-disposal modes have been developed, covering dried sludge, kitchen waste, and clinical waste co-processing. These practices have effectively improved facility utilization efficiency and strengthened the overall capacity of urban solid waste integrated management.

In the field of digitalization and intelligent operation, China's WtE industry has taken the lead in applying artificial intelligence (AI), machine vision, digital twins and other emerging technologies to incineration process control. Independently developed AI-based intelligent combustion optimization systems have enabled a fundamental shift from empirical manual regulation to data-driven smart combustion, greatly improving the operational stability, economic efficiency and environmental performance of WtE plants.

This book systematically establishes the complete knowledge framework and technical roadmap for municipal solid waste incineration power generation in China, covering policy and standard systems, technical principles, equipment systems, innovative engineering practices, operational management, and intelligent low-carbon development. It elaborates on full-process core technologies including waste receiving and storage, grate incineration, waste heat recovery, flue gas purification, leachate treatment, and ash-slag disposal. Meanwhile, the book highlights China's independent technological innovations and representative engineering practices in frontier fields, including large-scale grate equipment, high-parameter power generation, ultra-low emission control, intelligent operation, multi-waste collaborative treatment, and carbon capture, utilization and storage.

This book was authored by Jisheng Long, Xuejun Jiao, Li Bai, Jianping Li, Hailiang Du, and Yiru Huang, with valuable contributions from Yacheng Liu, Yang Cao, Zhaohui An, Yantao Wang, Yue Gong, Qianqian Yao, Honglei Hu, Chaojun Wen, Jingying Huang, Dekun Yang, Lu Chen, Jianguo Han, Jian Liu, Shujia Liu, Meilin Zhu, Di Wang, Haowen Yan, Qibin Yuan, Chongzhen Fu, Yilian Wu, Zhangfeng Hao, Yang Yang, Po Zhang, Dawei Qian, Liangliang Yang, Yunfeng Lao, Yuling Wen, Rui Gong, Haocheng Zhu, Fali Hu, Yong Dai, Bin Li, Yiyang Zhang, Jiachen Hu, Jidong Liu, Bei Li, Zhiwei Hu, Xiaoming Wang, Yifeng Chen, Youdong Wang, Yue Wang, Fei An, Shudong He, Zhiwei Liu, Chengxu Feng, Wangxiang Chen, Ting Yao, and Danian Ruan. The authors sincerely thank all contributors for their dedication and rigorous efforts in the compilation of this book. We hope this work can serve as a valuable reference for advancing global municipal solid waste incineration power generation technologies and promoting the green, low-carbon and intelligent development of the industry. Due to the limitations of the authors' knowledge and experience, inadvertent omissions and deficiencies may remain in the text. All valuable comments and corrections from readers are warmly welcomed.

Contents

Foreword III
Preface V

CHAPTER 1
Policy and Standard System for Waste-to-Energy of China 1

1.1 Key Policy Framework for Solid Waste Treatment Industry of China . 1
1.1.1 Management System for MSW Treatment Industry of China . . 2
1.1.2 Legal and Policy Framework for WtE in China 3
1.2 Standard System Related to MSW Incineration and Solid Waste Industry in China 8
1.2.1 Standards Related to WtE Industry 8
1.2.2 Key Standards 9

CHAPTER 2
Development and Innovative Practice of WtE Technology in China 23

2.1 Overview of WtE Technology Development 23
2.1.1 Exploration Period of China's WtE Technology 24
2.1.2 Preliminary Development Period of China's WtE Technology . . 27
2.1.3 Rapid Development Period of China's WtE Technology 27
2.1.4 Stable Development Period of China's WtE Technology 28
2.2 Composition of WtE System 30
2.2.1 Waste Receiving and Storage System 30
2.2.2 Incineration System 30
2.2.3 Waste Heat Recovery and Utilization System 30
2.2.4 Flue Gas Treatment System 30
2.2.5 Residue Treatment System 31
2.2.6 Incineration Control System 31
2.2.7 Leachate Treatment System 31
2.3 Innovation and Practice in China's WtE Technology 32
2.3.1 Large-Scale Mechanical Grates 32
2.3.2 High-Efficiency Power Generation Technology 34
2.3.3 Ultra-Low Emission Technology for Flue Gas Pollutants 37

2.3.4 Efficient Leachate Treatment 40
2.3.5 Residue Resource Utilization 43
2.3.6 Smart Incineration Control Technology 46
2.3.7 Carbon Capture and Online Carbon Emission Monitoring Technology 48

CHAPTER 3
Waste Composition and Receiving 53

3.1 Trends in Waste Composition and Calorific Value 53
3.1.1 Trends in Waste Composition and Calorific Value 53
3.2 Waste Receiving, Storage, and Charging 55
3.2.1 Waste Receiving System 55
3.2.2 Waste Storage System 63
3.2.3 Waste Charging System 68
3.2.4 Waste Bunker Insulation and Heating 71

CHAPTER 4
Waste Incinerators and Waste Heat Boilers 73

4.1 Waste Incineration Grate, Charging & Slag Extractor System 73
4.1.1 Overview of Waste Incinerators 73
4.1.2 Composition of Waste Incinerator 74
4.2 Furnace Main Control Temperature 78
4.2.1 Furnace Temperature Control 79
4.2.2 Calculation Methods for Furnace Main Control Temperature . . 80
4.2.3 Current Regulatory Methods in China 83
4.2.4 Furnace Main Control Temperature Safeguard Measures 84
4.3 Refractory Materials 84
4.3.1 Refractory Materials 84
4.3.2 Hanging Brick 86
4.4 High-Parameter Waste Heat Boilers 93
4.4.1 WtE Boiler 93
4.4.2 Key Performance Indicators of Waste Heat Boilers 96
4.4.3 Structural Types of Waste Heat Boilers 100
4.4.4 High-Parameter Waste Heat Boilers 102
4.5 Boiler Corrosion Protection 109
4.5.1 Anti-Corrosion Technologies 109
4.5.2 Application of Anti-Corrosion Technologies 109
4.6 Boiler Sootblowing Technology 116
4.6.1 Soot Cleaning Methods 116
4.6.2 Analysis of Soot Cleaning Effectiveness 121

CHAPTER 5
Heat Recovery for Power Generation and Heating 129

5.1 Evaluation of Energy Utilization Efficiency 129

5.1.1 Calculation of Energy Utilization Efficiency . . . 129
5.1.2 Energy Efficiency Evaluation Indicators . . . 130
5.2 Overall Power Generation Efficiency . . . 131
5.2.1 Calculation of the Overall Power Generation Efficiency . . . 131
5.2.2 Main Factors Influencing Overall Power Generation Efficiency . . . 132
5.3 Turbine & Generator . . . 134
5.3.1 Turbine . . . 134
5.3.2 Generator . . . 136
5.4 High Back Pressure Turbine Heating . . . 136
5.4.1 Technical Principle . . . 137
5.4.2 Project Examples . . . 137
5.5 Deep Utilization of Flue Gas Waste Heat . . . 140
5.5.1 Technical Classification . . . 140
5.5.2 Technical Principles . . . 140
5.5.3 Technical Comparison . . . 142
5.6 Mobile Heat Supply . . . 143
5.6.1 Mobile Heat Supply Technology . . . 144
5.6.2 Application Cases . . . 145

CHAPTER 6
Flue Gas Cleaning Process . . . 147

6.1 Overview of Flue Gas Pollutants . . . 147
6.2 Particulate Matter Removal . . . 149
6.2.1 Primary Dust Removal Technologies . . . 149
6.2.2 Case Analysis . . . 151
6.3 Semi-Dry and Dry Deacidification Processes . . . 152
6.3.1 Semi-Dry Deacidification Process . . . 152
6.3.2 Dry Deacidification Process . . . 155
6.3.3 Circulating Dry Deacidification Process . . . 155
6.3.4 In-Furnace Calcium Injection Deacidification Process . . . 159
6.4 Wet Scrubbing Deacidification . . . 159
6.4.1 Process Description . . . 160
6.4.2 Case Analysis . . . 161
6.5 NOx Control Technologies . . . 161
6.5.1 SNCR Denitration Process . . . 162
6.5.2 SCR Denitration Process . . . 162
6.5.3 PNCR Denitration Process . . . 163
6.5.4 FGR Process . . . 164
6.5.5 Selection of Denitrification Processes . . . 165
6.5.6 Case Analysis . . . 165
6.6 Dioxins and Heavy Metals Removal . . . 167
6.6.1 Dioxins Removal Technologies . . . 167
6.6.2 Heavy Metal Removal Technologies . . . 170
6.7 Ultra-Low Emission Technologies for Flue Gas . . . 171
6.7.1 Overview of Ultra-Low Emissions . . . 171

6.7.2 Ultra-Low Emission Combined Processes . . . 172
6.8 Online Continuous Emission Monitoring . . . 173
6.8.1 Basic Components and Functions of CEMS . . . 173
6.8.2 Requirements for "Installation, Display, and Networking" . . . 174
6.8.3 Standard CEMS Configuration in China's Waste Incineration Sector . . . 175

CHAPTER 7
Treatment of Fly Ash . . . 179

7.1 Characteristics of Fly Ash . . . 179
7.1.1 Physical Characteristics of Fly Ash . . . 179
7.1.2 Chemical Composition and Mineral Phase Analysis of Fly Ash . . . 180
7.1.3 Pollutant Occurrence Characteristics of Fly Ash . . . 181
7.2 Fly Ash Stabilization Treatment . . . 181
7.2.1 Fly Ash Solidification/Stabilization Technology . . . 181
7.2.2 Landfill Operation . . . 184
7.2.3 Fly Ash Stabilization Project Case . . . 184
7.3 Fly Ash Resource Utilization . . . 185
7.3.1 Co-Processing in Cement Kilns with Water Washing and Desalination . . . 186
7.3.2 High Temperature Melting Technology . . . 188
7.3.3 Low Temperature Thermal Decomposition-Washing Technology . . . 190
7.3.4 Fly Ash Return to Furnace Technology . . . 192
7.3.5 Foamed Ceramics Technology . . . 193
7.3.6 Technology Comparison . . . 194

CHAPTER 8
Slag Resource Utilization . . . 199

8.1 Slag Characteristics . . . 199
8.1.1 Slag Physical Characteristics . . . 199
8.1.2 Slag Chemical Characteristics . . . 200
8.1.3 Slag Management Requirements . . . 200
8.2 Slag Resource Utilization . . . 201
8.2.1 Policies on Slag Resource Utilization . . . 201
8.2.2 Pathways for Slag Resource Utilization . . . 201
8.2.3 Introduction to Slag Resource Utilization Processes . . . 202
8.2.4 Typical Slag Resource Utilization Case . . . 204

CHAPTER 9
Leachate Treatment . . . 207

9.1 Leachate Production and Water Quality . . . 207
9.1.1 Leachate Production . . . 207
9.1.2 Leachate Quality . . . 209

9.2 Treatment Standards and Processes 209
9.2.1 Treatment Standards 209
9.2.2 Treatment Process 210
9.3 Operation of Leachate Treatment System 214
9.3.1 Anaerobic System 214
9.3.2 MBR-Biochemical System 215
9.3.3 MBR-Ultrafiltration System 216
9.3.4 Nanofiltration System 217
9.3.5 Reverse Osmosis System 218
9.3.6 DTRO Concentrate Reduction System 219
9.4 Case Project 219
9.4.1 Design Influent Water Quality 220
9.4.2 Designed Effluent Water Quality 220
9.4.3 Actual Operating Water Quality 221

CHAPTER 10
Biogas Utilization 223

10.1 Biogas Co-Combustion 223
10.1.1 Introduction to Components of Biogas 223
10.1.2 Emergency Combustion Torch of Biogas 223
10.1.3 Biogas Co-Combustion in Furnaces 224
10.2 Power Generation from Biogas Internal Combustion Engines 226
10.3 Biomethane 227
10.3.1 Introduction to Biogas Purification Process 227
10.3.2 Biogas Dehydration 227
10.3.3 Biogas Desulfurization 229
10.3.4 Carbon Dioxide Removal 230
10.3.5 Application Cases 232

CHAPTER 11
Odor, Noise, and White Plume Control 235

11.1 Odor Control 235
11.1.1 Types and Sources of Odors in WtE Plants 235
11.1.2 Odor Control Standards for MSW Incineration Plants 235
11.1.3 Primary Odor Control Measures 238
11.2 Noise Control 243
11.2.1 Noise Emission Standards 243
11.2.2 Noise Control Measures 244
11.3 White Plume Control 247
11.3.1 White Plume Elimination Technology in the Turbine Room 247
11.3.2 Stack Flue Gas White Plume Elimination Technology 249

CHAPTER 12
Waste Incineration Control and Intelligent Optimization Operation 257

12.1 Automatic Combustion Control 257
12.1.1 National Regulations and Industry Standards for Combustion Automation: Requirements and Recommendations 257
12.1.2 Introduction to General Technical Solutions for ACC System 261
12.1.3 Technical Characteristics of Multi-Source Solid Waste Co-Processing Combustion Control 265
12.1.4 Application Cases of Combustion Automation Technology . . 268
12.2 Intelligent Optimization Control for Waste Incineration 269
12.2.1 AI-Powered Intelligent Optimization Control System 270
12.2.2 Furnace Flame Image Recognition Technology and Flue Gas Cleaning Optimization 273
12.2.3 Field Implementation of Intelligent Control Optimization System for Waste Incineration 275
12.3 Industrial TV Monitoring System 276
12.3.1 Large Screen in Central Control Room 276
12.3.2 Equipment Monitors 277
12.3.3 Environmental Monitoring Display Screen in Plant Area . . . 278

CHAPTER 13
Digital Operation Management of WtE Plants 281

13.1 Waste Crane Automation 281
13.1.1 Overview of Waste Crane Automation 281
13.1.2 System Functions and Automatic Operation Principles 282
13.1.3 Application Value of Waste Crane Automation 285
13.2 Plant-Wide Digital Operation Management and Control System 285
13.2.1 Introduction to Digital Operation Management and Control System 286
13.2.2 Application Benefits 297

CHAPTER 14
Application of Simulation Systems in WtE Plants 299

14.1 Overview of Simulation Systems 299
14.1.1 Composition of Simulation Systems 299
14.1.2 Basic Functions and Performance Requirements of Simulation Systems 302
14.2 Application of Simulation Systems in Training 304

CHAPTER 15
Co-Processing of Multi-Source Solid Waste in WtE Plants 307

15.1 Co-Processing of Sewage Sludge 307

15.1.1 Process Flow of Sludge Drying Co-Processing in WtE Plants . . . 308
15.1.2 Wet Sludge Reception, Storage, and Conveyance . . . 309
15.1.3 Sludge Drying System . . . 309
15.1.4 Co-Incineration of Dried Sludge in Furnace . . . 310
15.1.5 Odorous Gas and Wastewater Treatment . . . 312
15.1.6 Application Cases of Sludge Drying Co-Incineration . . . 313
15.1.7 Other Co-Processing Technologies for Municipal Sludge . . . 315
15.2 Co-Processing of Kitchen Waste . . . 317
15.2.1 Overview of Kitchen Waste . . . 317
15.2.2 Co-Processing of Kitchen Waste through Incineration . . . 317
15.3 Co-Processing of Industrial Organic Solid Waste . . . 322
15.3.1 Reception and Storage of Industrial Organic Solid Waste . . . 322
15.3.2 Modification and Adjustment of the Incineration System . . . 323
15.3.3 Modification and Adjustment of Flue Gas Treatment System . . . 325
15.4 Co-Processing of Clinical Waste . . . 326
15.4.1 Types and Characteristics of Clinical Waste . . . 326
15.4.2 Co-Processing Technologies for Clinical Waste . . . 326
15.4.3 Case Studies of Co-Processing Clinical Waste . . . 332

CHAPTER 16
Trends in Intelligent and Low-Carbon Development . . . 335

16.1 Smart Power Plants . . . 335
16.1.1 Definitions and Characteristics of Smart Power Plants . . . 335
16.1.2 Application Prospects of Smart Power Plants in WtE Facilities . . . 336
16.1.3 Summary . . . 340
16.2 Zero-Carbon Park . . . 340
16.2.1 Zero-Carbon/Negative-Carbon Eco-Industrial Park Model . . . 341
16.2.2 Construction of High-Efficiency Low-Carbon Incineration Plants . . . 343
16.2.3 Summary . . . 344

References . . . 347

Chapter 1

Policy and Standard System for Waste-to-Energy of China

The waste-to-energy (WtE) industry of China began in the late 1980s, gradually progressing through exploration, initial development, rapid development, and stable development phases. Over the past three decades of WtE development, policy support, demand drivers, and technological advantages have emerged as the three most critical driving factors. The introduction of a series of policies has mobilized local governments and enterprises, effectively driving the development of the full industry chain for waste incineration. Concurrently, China has actively advanced standardization efforts to regulate technical standards, enhance technical exchange and collaboration, and improve industrial technological capabilities and innovation capacity by integrating it into industrial policies. It is precisely this series of promulgated laws, regulations, policies, and standards that has effectively driven the rapid and high-quality development of the WtE industry.

1.1 Key Policy Framework for Solid Waste Treatment Industry of China

The municipal solid waste (MSW) treatment industry of China has established a systematic and well-developed management system and policy framework, forming a governance pattern characterized by central coordination, local implementation, and multi-department collaboration. The policy system covers multiple dimensions, including comprehensive planning, fiscal and tax support, and technical standards, comprehensively utilizing economic incentives and market mechanisms to promote the construction of treatment facilities and technological innovation. This has effectively advanced waste treatment towards reduction, resource recovery, and harmlessness, creating a favorable development environment for modern treatment methods such as WtE.

DOI: 10.1051/978-2-7598-3973-5.c001
© Science Press, EDP Sciences, 2026

1.1.1 Management System for MSW Treatment Industry of China

China implements a five-tier government management system comprising the State Council—province and municipality directly under the Central Government—prefecture-level city—county, city—township, and town. In waste management administration, the State Council, provincial, and county and city governments play crucial roles. Specifically, ministries under the State Council are primarily responsible for formulating regulations, policies, and standards. Provincial governments mainly oversee policy implementation (some provinces also establish provincial-level policy standards). County and city governments serve as executive entities and are responsible for planning and constructing waste collection and disposal facilities, as well as fee collection and payment.

The administrative departments of the waste management industry primarily involve the Ministry of Housing and Urban–Rural Development (MOHURD), the Ministry of Ecology and Environment (MEE), the National Development and Reform Commission (NDRC), and the Ministry of Finance (MOF) at both national and local levels. The main responsibilities of each department are shown in figure 1.1. MOHURD primarily guides the technical direction of industry, and issues industry standards, construction standards, and technical specifications. MEE focuses on formulating pollutant emission policies and supervising pollutant emissions. NDRC is responsible for releasing industrial policies (such as concession operations and electricity pricing), formulating plans and policies, and managing investment approvals and supervision. MOF mainly develops fiscal policies, funding arrangements, fiscal subsidies, and incentives. Additionally, multiple national and industry departments form the National Patriotic Health Campaign Committee, an advisory and coordinating organization within the State Council, tasked with unified leadership and coordination of patriotic health-related work, and directing nationwide concerted actions on waste management issues. This committee has issued a series of early waste management policies, such as Notice on the report of handling municipal waste to improve environmental sanitation (State Council General Office Document [1986] No. 57) and Notice on several suggestions regarding solving domestic waste problems of China (State Council Document [1992] No. 39), which have propelled the development of WtE. Furthermore, the advancement of WtE has also relied on joint efforts by industry associations such as the China Association of Urban Environmental Sanitation, the China Association of Environmental Protection Industry, and the China Association of Circular Economy. These associations assist government departments in conducting industry research and information collection, facilitating communication among industry stakeholders, standardizing industry operations, establishing standards, building industry exchange platforms, and uniting various industry players to promote the high-quality development of the environmental sanitation sector of China.

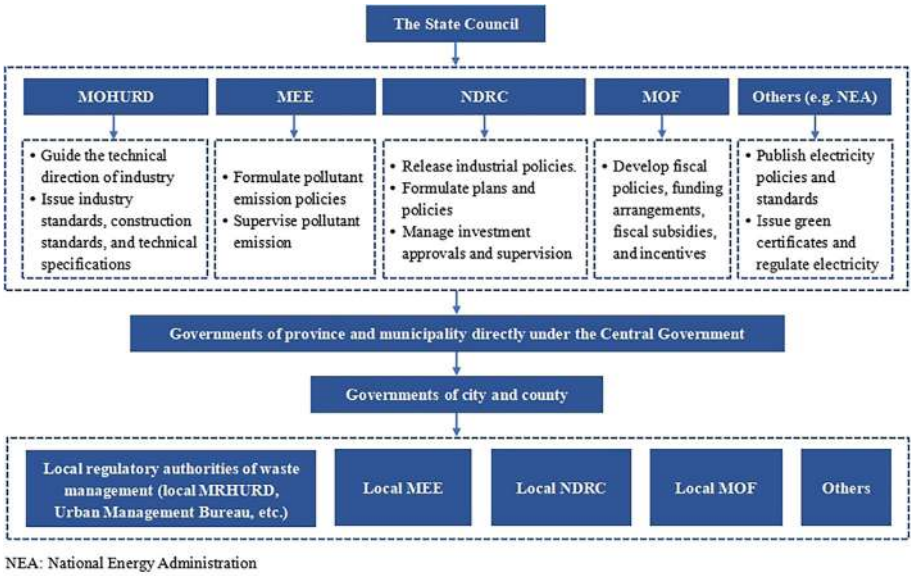


FIG. 1.1 – Administrative management system of WtE industry in China.

1.1.2 Legal and Policy Framework for WtE in China

Since 2020, governments of China at all levels have issued over 150 policies and regulations related to WtE, as shown in figure 1.2, which have significantly advanced the development of WtE.

WtE possesses dual attributes of environmental protection and energy generation. First, regarding its environmental attributes, as environmental issues became increasingly severe, the state introduced a series of environmental policies, which encourage waste treatment methods like incineration and power generation to reduce pollution. These policies provide strong support for the growth of the WtE industry. Second, in terms of energy attributes, WtE, as a form of renewable energy, aligns with the energy policy direction in China. National energy policies encourage enterprises to increase the utilization of renewable energy, so as to promote the transformation and upgrading of the energy structure. Simultaneously, authorities have implemented preferential policies such as tax reductions, investment subsidies, feed-in tariffs, and full electricity purchase guarantees to incentivize active participation in WtE project construction and operation. Additionally, urban planning has gradually incorporated WtE facilities to facilitate the site selection and construction for WtE plants. A combination of environmental policies, industrial policies, energy policies, and urban planning measures has greatly accelerated the rapid development of the WtE industry. Meanwhile, the continuous improvement and optimization of these policies will continue to provide broader market opportunities and development prospects for the sustainable growth of the WtE industry.

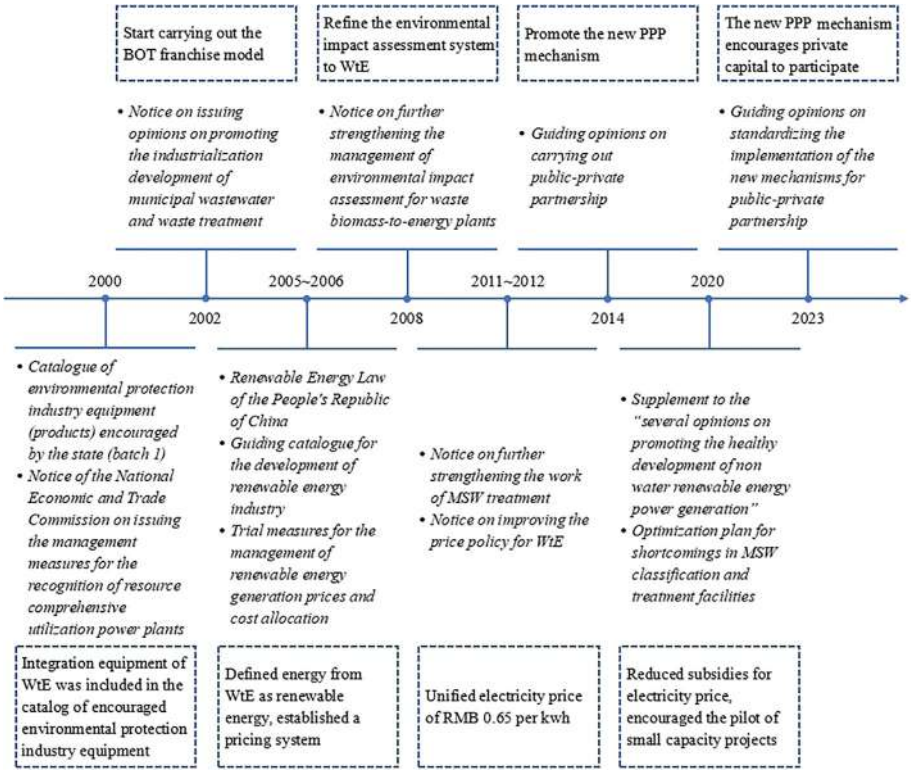


Fig. 1.2 – Policies and regulations of WtE industry in China.

1.1.2.1 Laws Related to WtE

Laws possess high levels of authority, enforceability, binding force, and stability. China has established a relevant legal framework for environmental protection and pollutant control. The two pivotal pieces of legislation among them are the *Environmental Protection Law of the People's Republic of China* and the *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes*, which have propelled the development of WtE in China.

The concept of environmental protection was introduced to China in the mid-20th century. The promulgation of the *Environmental Protection Law of the People's Republic of China (Trial)* in 1979 marked the formal entry of environmental protection efforts into the legal framework in China. Building on this foundation, the *Environmental Protection Law of the People's Republic of China* was first adopted in 1989 and comprehensively revised in 2014. This law defines the status of environmental protection in national economic and social development, specifying the competent authorities, scope of management, penalties, and other relevant provisions. This law encompasses protection across various environmental domains, including the atmosphere, water, and soil, and establishes the fundamental

principles, systems, and policy measures for environmental protection to comprehensively promote the conservation and improvement of the ecological environment.

In 1995, the *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes* was first promulgated, which was subsequently revised or amended in 2004, 2013, 2015, 2016, and 2020. Compared to the *Environmental Protection Law of the People's Republic of China*, this law focuses more on the prevention and management of solid waste pollution. The law has undergone multiple revisions and addressed aspects such as MSW treatment facilities, supervision of solid waste pollution prevention and control, and penalties, which made it adapt to meet the new demands of socioeconomic development and environmental protection. The law emphasizes that the solid waste pollution prevention and control should adhere to the principles of reduction, resource utilization, and harmlessness. It stipulates that entities and individuals involved in the generation, collection, storage, transportation, utilization, or disposal of solid waste shall bear legal responsibility for any environmental pollution caused.

1.1.2.2 Policy Framework of WtE

Based on the issuing authorities, policies and regulations can be broadly categorized into comprehensive, fiscal/taxation, and technical types. This section will provide an overview by policy category.

(1) Comprehensive policies

Since the Sixth Five-Year Plan, the significance of treating wastewater, exhaust gas, and solid waste has been fully recognized by the competent authorities. Through the development during the Seventh Five-Year Plan, environmental protection indicators were first incorporated into the national economic and social development plans at all levels during the Eighth Five-Year Plan, marking the formal inclusion of environmental planning into national development decision-making. During the Ninth Five-Year Plan period, environmental protection investments were significantly increased, leading to rapid development of the environmental protection industry. Since the 10th Five-Year Plan, waste incineration has entered a period of rapid development. Notably, the Eleventh Five-Year Plan introduced specific quantitative requirements for waste incineration for the first time, serving as a crucial milestone in the development of the WtE industry of China. Over the subsequent two decades, the target for the harmless treatment rate of MSW is to reach 95% by the Thirteenth Five-Year Plan, with a target of 80% for county-level areas, highlighting China's determination in waste management. The *14th Five-Year Plan for the development of MSW classification and treatment facilities* pointed out that by the end of the 13th Five-Year Plan, the harmless treatment rate of MSW had reached 99.2%, exceeding the target, which means the harmless treatment of MSW in cities and counties across the country has been basically achieved. Correspondingly, the requirements for new harmless treatment capacity for MSW have also increased.

(2) Fiscal and taxation policies

WtE holds a dual identity. On one hand, it serves as a method of waste disposal; on the other hand, it falls within the realm of circular economy and renewable energy utilization. This dual status enables one to fully benefit from economic incentive policies in both areas. Based on comprehensive policy documents, current economic support policies for WtE primarily include as follows.

1) Project operation policies
After an initial exploratory phase and upon mastering the scope of technological applications, the investment mechanisms for WtE in China have also undergone innovation. The introduction of relevant operational policies has further provided a favorable market environment for the development of the waste incineration industry. (Relevant policies: State Planning Commission Document No. 1591 [2002], State Council Document No. 60 [2014], and policies related to the public–private partnership (PPP) mechanism. The Key clause guidelines are shown in table 1.1).

Tab. 1.1 – Key policies and core clause guidelines for MSW incineration project operations in China.

Document number	Policy name	Core clause guidance
State Planning Commission Document No. 1591 [2002]	*Opinions on promoting the industrialized development of municipal sewage and waste treatment*	Specify requirements for project investment and construction, concession operation, and waste disposal fees
State Council Document No. 60 [2014]	*Guiding opinions on innovating key investment and financing mechanisms to encourage social investment*	Encourage private capital participation in municipal infrastructure investment, construction, and operation. Establish and improve the PPP mechanism. Promote the PPP model. Encourage private capital investment in waste treatment projects
State Finance Ministry Document No. 455 [2017]	*Notice on the comprehensive implementation of PPP mode for government-participated sewage and waste treatment projects*	Government-involved waste treatment projects shall fully implement the PPP model. The transition of existing projects to the PPP model shall be carried out in an orderly manner. Efforts shall be made to establish a unified, standardized, and efficient PPP market dominated by social capital in this field as soon as possible, thereby

Tab. 1.1 – (continued).

Document number	Policy name	Core clause guidance
		significantly optimizing the supply structure of relevant environmental public goods and services
State Council General Office Document No. 101 [2018]	*Guidelines on maintaining efforts to strengthen weak links in infrastructure development*	Construction of MSW treatment facilities, promotion of PPP system, and advancement of rural waste disposal
State Finance Ministry Document No. 10 [2019]	*Implementation opinions on promoting the standardized development of PPP*	Reduce risks of government implicit debt and quantify requirements for new PPP projects
State Finance Ministry Document No. 119 [2022]	*Notice on further promoting the standardized development and transparent operation of PPP*	Promote standardized development of PPP projects
State Council General Office Document No. 115 [2023]	*Guiding opinions on regulating the implementation of the new PPP mechanism*	Emphasize user-pay principle. Deepen infrastructure investment and financing system reform. Stimulate private investment vitality

2) Price support policies

Power grid enterprises are required to fully purchase the on-grid electricity generated by WtE plants within their coverage area, with the grid obligated to accept all power output from these projects. The electricity price shall adopt a unified subsidy electricity price. The difference between the subsidized tariff and the benchmark coal-fired power tariff is shared between the national fund and provincial power grids. (Relevant policies: State Electricity Regulatory Commission Decree No. 25, and NDRC Document No. 801 [2012]).

It is stipulated that waste generators shall bear the disposal fees, with local governments serving as the unified collection entity. The fee standards are determined by local authorities. The collected fees shall be allocated for the collection, transportation, and treatment of MSW. (Relevant policy: State Planning Commission Document No. 872 [2002]).

3) Tax preference policies

On one hand, WtE enterprises sell self-generated electricity and provide waste treatment services. The enterprise that meets the requirements can enjoy the value-added tax (VAT) immediate refund policy. The VAT on electricity is eligible

for a 100% immediate refund, while the VAT on waste treatment fees qualifies for a 70% immediate refund. On the other hand, clear tax incentives have been established for WtE plants, including three exemptions and three reductions in corporate income tax, a 100% immediate VAT refund for electricity, and a 70% immediate VAT refund for waste treatment fees. (Relevant policies: State Finance Ministry Document No. 198 [2001], State Finance Ministry Document No. 25 [2004], NDRC Document No. 1864 [2006], State Finance Ministry Document [2008] No. 156, and State Council Decree No. 512).

(3) Technical policies

Based on the principles of MSW reduction, resource recovery, and harmless treatment, through continuous comparison and exploration, it was concluded that the WtE technology should be gradually developed, marking the beginning of national encouragement for adopting WtE. Such policies recommend that cities with adequate economic conditions, waste heat value (≥5000 kJ/kg), and a lack of sanitary landfill resources can develop WtE technology, with grate furnace technology being recommended. Detailed regulations on the applicability of WtE technology were also established. The technical policies have progressively clarified that WtE should be the primary method for waste treatment in China. (Relevant policies: MOHURD Document No. 120 [2000], MOHURD Document No. 61 [2001], MOHURD Document No. 227 [2016]).

1.2 Standard System Related to MSW Incineration and Solid Waste Industry in China

In the field of MSW incineration standard development, China has gone through distinct phases of "near absence before 2000, rapid development during 2001–2010, significant advancement in 2011–2020, and refinement/optimization post-2011". Prior to 2000, only a few national and industry standards existed. Between 2001 and 2010, over a dozen fundamental and critical national/industry standards were established. After 2011, WtE industry standards entered a phase of specialization and optimization—while revising previous standards, the scope expanded to cover three-waste treatment, individual equipment, operations, and supervision in WtE plants. The MSW incineration standard system in China provides operational guidelines for the industry, ensuring process safety and environmental compliance through standardized regulations.

1.2.1 Standards Related to WtE Industry

The standard system in China comprises five levels: national standards, industry standards, local standards, association standards, and enterprise standards. Between 2000 and 2010, the WtE-related standards of China entered a crucial development phase, during which foundational standards were established. Most of them are national standards and municipal construction industry standards issued

by MOHURD, such as "Standard for pollution control on the municipal solid waste incineration" (GB 18485—2001), "Municipal solid waste incineration boilers" (GB/T 18750—2002), "Technical code for projects of municipal solid waste incineration" (CJJ 90—2002), "Technical specification for operation maintenance and safety of municipal solid waste incineration plant" (CJJ 128—2009), and "Standard for assessment on municipal solid waste incineration plant" (CJJ/T 137—2010). From 2011 to the present, the WtE-related standards have entered a refinement and optimization phase, focusing not only on revising existing standards but also on detailing standards. The standards transformed from foundational types to those emphasizing products and technologies, project operation and maintenance, evaluation, and supervision. For example, "Standard for pollution control on the municipal solid waste incineration" (GB 18485-2001) underwent a full-text revision in 2014; the updated version GB 18485-2014 was issued and implemented to supersede the old edition. A standard amendment sheet for GB 18485-2014 was released in 2019 and came into force in 2020. In 2024, GB 18485-2014 was included in the review catalogue of mandatory national standards.

Concurrently, with the rapid development of WtE industry, an increasing number of social organizations have begun to issue relevant association standards in recent years, with the content of standards becoming more detailed, covering areas such as byproduct treatment (*e.g.*, fly ash and slag), monitoring and control technologies for specific pollutants like dioxins, incineration plant energy efficiency evaluations, enterprise management and social services, and carbon emission reduction which is increasingly prominent recently.

China has issued national standards related to the WtE industry, along with industry standards covering municipal construction (CJ, CJJ), power (DL), environmental protection (HJ), machinery (JB), and other sectors. Additionally, local standards have been released by more than ten provinces and municipalities, including Beijing, Shanghai, Jiangsu, Zhejiang, and Guangdong. Furthermore, dozens of group standards have been published by various social organizations. Tables 1.2–1.4 list some of the published standards in the WtE industry as of May 2026.

1.2.2 Key Standards

The national and industry standards in the field of MSW incineration have stipulated the control of pollutants, technical specifications, evaluation, and supervision of waste incineration. This section mainly selects several important standards for analysis and introduction.

1.2.2.1 National Standards

Important national standards in the field of municipal solid waste incineration include the "Standard for pollution control on the municipal solid waste incineration" (GB 18485—2014), "Municipal solid waste incinerator and heat recovery boiler" (GB/T 18750—2022), and "Standard for engineering technology of municipal solid waste incineration and energy utilization" (GB/T 51452—2024).

Tab. 1.2 – List of national standards related to WtE.

Standard no.	Name
GB 16889—2024	Standard for pollution control on the landfill site of municipal solid waste
GB 18484—2020	Standard for pollution control on hazardous waste incineration
GB 18485—2014	Standard for pollution control on the municipal solid waste incineration
GB/T 18750—2022	Municipal solid waste incinerator and heat recovery boiler
GB/T 18773—2008	Environmental sanitation standard for incineration of medical treatment wastes
GB/T 25032—2010	Municipal solid waste incineration bottom ash aggregate
GB/T 29152—2025	Flue gas cleaning system for municipal solid waste incineration
GB/T 34552—2017	Municipal solid waste fluidized bed incineration boiler
GB/T 44565—2024	Technical requirements for high efficiency grate furnace for assessment
GB/T 45149—2025	Technical specifications at the project level for assessment of greenhouse gas emission reduction — Biomass power generation and cogeneration projects
GB/T 51452—2024	Standard for engineering technology of municipal solid waste incineration and energy utilization

Tab. 1.3 – List of industry standards related to WtE.

Issuing department	Standard no.	Name
Ministry of housing and urban–rural development	Construction 142–2010	Construction standard for municipal solid waste incineration projects
	RISN—TG009—2010	Technical guidelines for municipal solid waste incineration
	RISN—TG010—2010	Technical guidelines for safety assessment of municipal solid waste incineration plant
	RISN—TG016—2014	Technical guideline on municipal solid waste fluidized bed incineration engineering
	RISN—TG018—2015	Technical guideline for assessment of municipal solid waste fluidized bed incineration plant

Tab. 1.3 – (continued).

Issuing department	Standard no.	Name
	RISN—TG022—2016	Guideline for Clean Incineration of Municipal Solid Waste
	CJJ 128—2017	Technical standard for operation maintenance, and safety of municipal solid waste incineration plants
	CJJ/T 137—2019	Standard for assessment on municipal solid waste incineration plants
	CJJ/T 212—2015	Standard for supervision on operation of municipal solid waste incineration plants
	CJJ 231—2015	Specification for Maintenance of Municipal Solid Waste Incineration Plant
	CJJ/T 270—2017	Standard for marking signs of Municipal Solid Waste Incineration Plant
	CJJ/T 316—2023	Technical standard for solidification/stabilization treatment of municipal solid waste incineration fly ash
	CJ/T 432—2013	Technical requirements of waste grab cranes in municipal solid waste incineration plant
	CJ/T 531—2018	Testing, sampling and sample preparation of slag and ash from waste incinerator
	CJ/T 538—2019	Technical requirements for MSW incineration fly ash stabilization treatment facilities
	CJ/T 546—2023	Powdered activated carbon for MSW incineration flue gas purification
	CJ/T 3036—1995	Environmental sanitation standard for incineration of medical treatment wastes
National energy administration	DL/T 1842—2018	Evaluation specification for waste-to-energy plant operation
	DL/T 1843—2018	Specification for identification and evaluation of hazard sources for waste-to-energy plant

Tab. 1.3 – (continued).

Issuing department	Standard no.	Name
National energy administration	DL/T 1938—2018	Technical specification for slag treatment of waste-to-energy plant
	DL/T 1967—2019	Technical specification for flue gas cleaning system of waste-to-energy plant
	DL/T 2013—2019	Code for waste-to-energy plant from the unit commissioning to completed acceptance
	DL/T 2423—2021	Engineering technical specifications of flue gas cleaning for biomass power plant
	DL/T 2427—2021	Technical specification for waste pool of waste-to-energy plant
	DL/T 2428—2021	Technical specification for flue gas cleaning system of hazardous waste plant
	DL/T 2429—2021	Performance Test Code for Incinerator and Heat recovery steam generator
	DL/T 2430—2021	Guide for work safety assessment of waste-to-energy plants
	DL/T 2591—2023	Specification of operation of waste store-transport system for waste power plant
	DL/T 2817—2024	Technical code for overhaul and maintenance of leachate treatment system in waste-to-energy plant
	DL/T 2818—2024	Technical code for flue gas sodium alkali wet desulfurization system of waste-to-energy plant
	DL/T 2819—2024	Guideline for performance acceptance testing of waste-to-energy plants
	DL/T 2820—2024	Guide for technology supervision of waste-to-energy plants
	DL/T 5475—2025	Guidelines for item segregation of construction budget for garbage power generation project
	NB/T 47050—2016	Technical specification for reciprocating grate

Tab. 1.3 – (continued).

Issuing department	Standard no.	Name
Ministry of ecology and environment	HJ 75—2017	Specifications for continuous emission monitoring of SO_2, NO_x, and particulate matter in the flue gas emitted from stationary sources
	HJ 76—2017	Specifications and test procedures for continuous emission monitoring of system for SO_2, NO_x, and particulate matter in flue gas emitted from stationary sources
	HJ/T 176—2005	Technical specifications for centralized incineration facility construction on hazardous waste
	HJ 177—2023	Technical specifications for centralized incineration engineering on medical waste
	HJ 1134—2020	Technical specification for pollution control of fly-ash from municipal solid waste incineration
	HJ 1205—2021	Self-monitoring technology guidelines for pollution sources —Solid waste incineration
	HJ 1307—2023	Technical guideline for field supervision and inspection of municipal solid waste incineration plants with power generation
	HJ 2012—2012	Technical specification for bag filters of municipal solid waste incineration
Ministry of industry and information technology	JB/T 10249—2001	Specification of MSW incineration boilers
	JB/T 11310—2012	Filter for bag filter of exhaust gas treatment in solid waste incinerator
	JB/T 12121—2015	Technical requirements for grate of huge type MSW incinerator
	JC/T 2822—2024	Alternative raw materials for cement—Treated fly-ash from municipal solid waste incineration

Tab. 1.4 – List of local standards related to WtE.

Region	Standard no.	Name
Beijing	DB11/503—2026	Emission standard of air pollutants for hazardous waste incineration
	DB11/T 1234—2022	The norm of Energy consumption for the incineration treatment of municipal solid waste
	DB11/T 1416—2017	Guidelines for accounting of greenhouse gas emissions from municipal solid waste incineration enterprise
	DB11/T 2109—2023	Assessment code for municipal solid waste incineration plants operation
	DB11/T 2164—2023	Assessment indicator system of cleaner production for municipal solid waste incineration
Tianjin	DB12/T 779—2018	Technical specification for producing ceramsite from municipal solid waste incineration fly ash by high temperature sintering
	DB12/1101—2021	Emission standard of air pollutants for municipal solid waste incineration
Hebei province	DB13/5325—2021	Standard for air pollution control on the municipal solid waste incineration
Shanxi province	DBJ04/T 371—2018	Technical standard for installation of grate type domestic waste incineration boiler system
Shanghai	DB31/767—2013	Emission standard of air pollutants for hazardous waste incineration
	DB31/768—2025	Emission standard of air pollutants for municipal solid waste incineration
Jiangsu province	DB32/T 3558—2019	Technical specification for melting treatment of municipal solid waste incineration fly ash
	DB32/T 3641—2019	Construction specification for the application of municipal solid waste incineration bottom ash aggregate in highway engineering
	DB32/T 4076—2021	Technical standard for landfill disposal of stabilized fly-ash from municipal solid waste incinerator
	DB32/T 4244—2022	Technical code of co-processing for restaurant food waste with municipal solid waste incineration

Tab. 1.4 – (continued).

Region		Standard no.	Name
Jiangsu province		DB32/T 4679—2024	Technical specification for automatic monitoring of flue gas emission process (operating status) in domestic municipal solid waste incineration power plant
Zhejiang province		DB33/T 1185—2019	Technical specification for municipal sdomestic waste disposal
		—	Technical guideline for ultra-low emission renovation of municipal solid waste incineration plants in Zhejiang province
Fujian province		DB35/T 1853—2019	Internal inspection regulation for waste incineration boiler of power plant
		DB35/1976—2021	Standards of nitrogen oxide emissions for municipal solid waste incineration
		DB35/T 2128—2023	Maintenance guidelines for metal parts of waste incineration boilers
Henan province	Henan province	DB41/T 2348—2022	Code for Safe Operation of Municipal Solid Waste Incineration Power Boilers
		DB41/2556—2023	Emission standard of air pollutants for municipal solid waste incineration
	Puyang	DB4109/T 043—2023	Technical specifications for energy conservation and environmental protection of municipal solid waste incineration power generation boilers
	Zhumadian	DB4117/T 403—2024	Energy efficiency requirements for municipal solid waste incineration power generation boilers
Hubei province	Wuhan	DB4201/T 616—2020	Technical specification for safety disposal and management of fly ash from MSW incinerator
Guangdong province	Guangdong province	DB44/T 1097—2012	Energy efficiency testing code for municipal waste incineration boiler
		DBJ/T 15—174—2019	Standard for operations management on solid waste incineration plant in Guangdong province
		DB44/T 2605—2025	Calculation and quota of energy consumption for municipal solid waste incineration power facilities

Tab. 1.4 – (continued).

Region		Standard no.	Name
Guangdong province	Guangzhou	DB4401/T 120—2021	Technical code for energy-saving and consumption-reducing of municipal solid waste incinerator for power generation
	Dongguan	DB4419/T 10—2024	Specification for lean operation of municipal solid waste incineration plants
	Shenzhen	SZDB/Z 233—2017	Code for operation of municipal solid waste treatment facilities
Hainan province		DB46/ 484—2019	Standard for pollution control on the municipal solid waste incineration
		DBJ 22—2012	Standard for operation supervision of municipal solid waste incineration plant
Gansu province		DB62/T 4913.3—2024	Guideline for greenhouse gas emission accounting and reporting—Part 3: solid waste incineration enterprises

(1) Standard for pollution control on the municipal solid waste incineration (GB 18485—2014)

The standard is mandatory and crucial environmental regulation issued by the Ministry of Ecology and Environment. The standard specifies detailed requirements for pollutant emission limits, monitoring and supervision mandates, as well as operational and management provisions for MSW incineration facilities. It further mandates WtE plants to implement the installation-establishment-networking system. Serving as the most critical reference standard for the design and construction of MSW incineration projects in China, the standard establishes the baseline for performance and pollution control requirements. The key provisions include as followed.

1) Application
The standard applies to pollutant emission control for MSW incineration facilities, including newly constructed, renovated, and expanded MSW incineration plants.

2) Incinerator technical performance
The furnace temperature shall be no less than 850 °C, with a flue gas retention time of at least 2 s. The slag heat reduction rate shall not exceed 5%.

The duration of pollutant emissions during each malfunction or accident of the incinerator shall not exceed 4 h, and the cumulative duration of pollutant emissions during annual startup/shutdown processes, as well as malfunctions or accidents, shall not exceed 60 h.

3) Emission limits of pollutants
The maximum allowable emission concentrations for major pollutants in flue gas from MSW incineration are specified in table 1.5. These limits are mandatory industry requirements that all waste incineration facilities must comply with.

Tab. 1.5 – Emission limits of pollutants in flue gas from MSW incinerators.

No.	Polluting substance	Concentration	Sampling period
1	Total dust (mg/m^3)	30	Hourly average value
		20	24 h average value
2	Nitrogen oxides (NO_x) (mg/m^3)	300	Hourly average value
		250	24 h average value
3	Sulfur dioxide (SO_2) (mg/m^3)	100	Hourly average value
		80	24 h average value
4	Hydrogen chloride (HCl) (mg/m^3)	60	Hourly average value
		50	24 h average value
5	Mercury (Hg) and its compounds, expressed as Hg (mg/m^3)	0.05	Average value
6	Cadmium (Cd), thallium (Tl) and their compounds, expressed as Cd + Tl (mg/m^3)	0.1	Average value
7	Antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper(Cu), manganese(Mn), nickel (Ni) and their compounds, expressed as Sb + As + Pb + Cr + Co + Cu + Mn + Ni (mg/m^3)	1.0	Average value
8	Dioxins (ng TEQ/m^3)	0.1	Average value
9	Carbon monoxide (CO) (mg/m^3)	100	Hourly average value
		80	24 h average value

Note: Reference conditions: 273.16 K, 101.325 kPa, and oxygen content 11% (V/V%, dry flue gas).

4) Monitoring requirements
MSW incineration plants shall install online monitoring devices for incinerator operating conditions. The monitoring results shall be publicly displayed *via* electronic display boards and connected to the monitoring centers of local environmental protection administrative departments and industry administrative departments. The online monitoring indicators for incinerator operating conditions shall at least include carbon monoxide concentration in flue gas and combustion temperature inside the furnace.

(2) Municipal solid waste incinerator and heat recovery boiler (GB/T 18750—2022)

The standard serves as a technical specification for MSW incinerators in China, providing unified technical requirements for the design, manufacturing, inspection, and acceptance of MSW incinerators. The main contents are as follows.

1) Classification and model
The standard specifies the classification of rated waste incineration capacity for individual incinerators ranging from 100 t/d to 1200 t/d, and categorizes waste heat boilers based on their structural types and pressure ratings. It also establishes distinct product model naming conventions for incinerators and waste heat boilers. The incinerator model nomenclature primarily reflects its rated waste processing capacity, while the waste heat boiler model designation mainly indicates its structural configuration, rated steam output, steam pressure, and steam temperature.

2) Technical requirements
(a) Requirements for waste to incinerator
Under the precondition of not affecting the normal operation of the incinerator and compliance with pollutant emission standards, MSW incinerators may co-process certain industrial solid waste, agricultural solid waste, disinfection-qualified infectious waste, injurious waste, and pathological waste (excluding human organs), as well as other types of non-hazardous waste such as municipal sludge.

(b) Design requirements
The product design of incinerators and waste heat boilers shall be conducted based on the lower heating value at the design point and the rated waste incineration capacity. It specifies the system composition of incinerators and waste heat boilers and provides fundamental design principles regarding product performance, control monitoring, and safety. In particular, it mandates that incinerators and waste heat boilers must be equipped with an ACC system.

(c) Performance indices
The lower heating value of waste fed into the incinerator shall be greater than 4500 kJ/kg.

The applicable range of thermal load and grate mechanical load for the incinerator and boiler should be 70% ~ 110% of the rated operating condition.

The overall design life of the incinerator and boiler should be greater than 25 years.

For incinerators with a rated waste treatment capacity of 300 t/d or above, the designed thermal efficiency of the incinerator and boiler shall not be less than 78%; for incinerators with a rated waste treatment capacity below 300 t/d, the designed thermal efficiency shall not be less than 75%.

2) Inspection, marking, and packaging
Specifies the items and material requirements for factory product inspection, defines the nameplate and painting/packaging requirements for incinerator and waste heat boiler products, as well as the random documents to be provided.