Developments and trends shaping the future for Waste-to-Energy technology suppliers

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1. About ESWET

• ESWET is the Association of European Suppliers of Waste-to-Energy technology

• Aims:
  • Developing & disseminating Waste Incineration technologies
  • Initiating & furthering a consciousness for the positive aspects of waste incineration for the environment, energy production, recovery of resources

• Focus of the activities: the law making process in Brussels
1. About ESWET

Members

- ALSTOM
- B&W
- CARMEUSE
- CNIM
- Doosan Lentjes
- Hitachi Zosen
- INOVA
- Keppel Seghers
- Lab
- Lhoist
- LUEHR FILTER
- MAGAUDI
- MARTIN GmbH
- OSCHATZ
- SICK
- JFE Engineering Group
- Steinmüller Babcock Environment
- TM.E. S.p.A.
- VINCI

European Suppliers of Waste to Energy Technology
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2. Introduction

- First waste incineration plants in Europe were built in the middle of the 19th century
- Simple, batch type technology - no heat recovery, no flue gas treatment
- Main reason was hygiene, plagues had often claimed many lives
2. Introduction

Hamburg 1896

Source: A. Nabasik and A. Nottrodt
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3. Modern Waste-to-Energy technology

- Large-scale application of waste incineration only in the beginning of the 1950s
  - Landfill space became more scarce
  - Environmental consciousness increased
  - Financial resources available
- Technology substantially improved, by majority grate-based
- Continuous waste feeding and residue removal
- Heat recovery introduced
- Flue gas treatment introduced in several steps
3. Modern Waste-to-Energy technology

Waste Delivery and storage

Incineration, steam generating

Flue Gas Cleaning

Energy Recovery
3. Modern Waste-to-Energy technology

1. Feed Hopper
2. Grate
3. Combustion Chamber
4. Boiler

Energy Recovery (steam, hot water or electricity)
Bottom Ash Collection for recovery (metals and construction material)
3. Modern Waste-to-Energy technology

Fabric Filter (for particles, dioxins, heavy metals)

Scrubber (for acid gases, such as HCl and SO$_2$)

Cleaned Gas (mostly water vapour and CO$_2$)

Fly ash storage (for disposal)
3. Modern Waste-to-Energy technology
3. Modern Waste-to-Energy technology

- Organic compounds are safely destroyed
- Bottom ash left after incineration can be recovered, e.g. for road construction
- Metals embedded in residual waste can be recovered
- More than 90% of the energy can be recovered and used in industry, for heating/cooling or converted to electricity
- Emission requirements for WtE plants are the most stringent of any industry
- Emissions from WtE plants are thus negligible, especially compared to other sources
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4. Challenges - legal / technical

Waste hierarchy

Prevention

Reuse

Recycle

Recovery

Disposal


Waste combustion = Recovery, when R1 > 0.65

Waste combustion = Disposal, when R1 < 0.65
4. Challenges - legal / technical
Waste treatment

2013 MSW Treatment in EU28 [Eurostat]
4. Challenges - legal / technical

Circular economy

- Circular Economy pushes for re-use and recycling of materials
- Closing materials loops to maximise recycling
- But
  - Recycling should be acc. EU standards
  - There has to be a market for the secondary products
  - It needs to be financially viable
  - Materials loops are not infinite; eventually materials will reach their ‘end of life’
- Landfilling is no alternative, should in any way be minimised
- Thermal treatment is then the solution
4. Challenges - legal / technical
Circular economy

- Bottom ash from WtE plants contains minerals and metals
- Mineral fraction can, after proper ageing, be used for e.g. road construction, landfill cover
- There is long experience of removing metals from bottom ash for recycling

- In recent years, many efforts have been undertaken successfully to recover more metals (especially non-ferrous) and in a better quality
- Dry discharge of bottom ash promises an even higher potential for metal recovery, even precious (Ag, Au) and potentially also rare earth metals
4. Challenges - legal / technical

Energy union

- Energy Union proposed in 2015 aims at secure, sustainable and affordable energy for the EU
- WtE is recognised as helpful for security of supply and reducing greenhouse gas emissions
- Need a technology that will treat all waste, not leave combustible waste aside. Needs to work 24/7, providing dispatchable electricity and heat for district heating networks. Technology needs to produce affordable, locally-sourced energy, without any fuels added that would undermine the security of supply
4. Challenges - legal / technical

Energy union

- The R1 Formula from the Waste Framework Directive mandates a high energy recovery efficiency, which is easier to achieve when applying CHP
- As the use (and acceptance) of CHP depends on the climate, a Climate Correction Factor was agreed on and published in 2015, incentivising the increase in energy use from existing or newly built WtE plants
- Plants in the yellow area will not benefit from correction, in the green to a certain degree, in the blue area the most
More than 80% of the energy contained in the waste is recovered for further use in a steam (hot water) boiler.

Mostly in Scandinavia, WtE plants are base-load for district-heating networks, replacing fossil fuels.

With flue gas condensation, they reach more than 90% thermal efficiency.

When only electricity can be exported, efficiencies of 22-25% are achieved.

With special efforts/designs or in combination with power plants, efficiencies > 30% can be reached.
4. Challenges - legal / technical

Energy union

Example: SYSAV Malmö, SE - > 90% thermal efficiency through integration in DH network and flue gas condensation
4. Challenges - legal / technical

Energy union

Example: Mainz, DE - > 40% electrical efficiency through integration in gas-fired combined cycle power plant
4. Challenges - legal / technical
BREF compliance

• Best Available Techniques (BATs) or proven equivalent are mandated by EU legislation (IED)
• The BAT reference document for Waste Incineration (WI BREF) is currently under revision
• BATAELs (ranges) will be elaborated from data provided by existing BREF-compliant plants, by majority grate-based, who have very low emissions
• Permits will have to be reviewed and adapted (if necessary), within 4 years of the publication of new BAT Conclusions
4. Challenges - legal / technical

BREF compliance

- Many different types of flue gas cleaning systems have been developed and successfully introduced
- They all meet the emission limits of the IED, with the emissions in operation far below the limits
- The focus in the last years has been on less consumption of energy and chemicals
- Also technologies have been introduced that aim at lowering the primary emission of combustion related emissions, like NOx
- More pollutants can be sampled or measured continuously, enabling a faster reaction to excursions
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5. The future for Waste-to-Energy technology suppliers

In Europe, ESWET is confident that smart regulation will come on:

- Ambitious but workable WI BREF, enabling existing plants to continue their good work, keeping newly-built ones affordable
- Circular Economy must favour WtE over landfilling, due to its potential to recover metals / minerals
- Landfilling will progressively be phased-out by more recycling AND more WtE

- The energy landscape in Europe will change dramatically; to renewable, but also more ‘local’ energy sources
- Waste-to-Energy will have an increasing role to play in this supply
Beyond Europe...

- Some countries are extensively relying on WtE (e.g. Japan, China), others will look for proven, reliable and high-quality Waste-to-Energy technology
- The key technologies have been developed in Europe, suppliers are still strongly Europe-based, with partners in many countries/regions of the world
- Europe exports not only technology, but also regulation / legislation
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- WtE is well-proven, reliable technology with high availability
- WtE is aimed at residual waste, doesn’t interfere with recycling, is a better alternative to landfilling
- Energy can be recovered, as well as minerals/metals reused
- Emissions from WtE plants are very low and don’t significantly contribute to overall emissions

- WtE is an essential part of sustainable waste management
Thank you for your attention!

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ESWET President

www.eswet.eu