



MECHANICAL-BIOLOGICAL TREATMENT OF WASTE WITH ALTERNATIVE FUEL (SRF) PRODUCTION FOR CEMENT INDUSTRY

TECHNOLOGY DESCRIPTION

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Mechanical-biological treatment of waste (MBT) is a common approach for all technology versions that involves the treatment of waste with a combination of mechanical and biological methods. The main difference between different approaches is the order of the process stages involved in MBT and the purpose of the biological treatment including fuel substitution and material use in cement industry. The technological chain is oriented either by the concept of splitting or by the idea of stabilization.

When "stabilization" is the main goal, the waste is biologically processed without separation. It is done by convective or diffusion biological drying and maximum hygienisation of waste before the next mechanical separation of non-combustible components. The remaining material can be used as alternative fuel or Solid Recovered Fuel (SRF) with energy production at appropriate facility. Thus, the production of fuel from solid waste is the basic possibility of MBT application. In the simplest case, it may consist of preliminary sorting, the removal of certain components from mixed waste and shredding the residue for:

- the transfer/sale of SRF to the nearest cement plant for energy and material recovery and fossil fuel substitution;
- the use of SRF in specialized incinerators for electric and/or thermal energy production.

The use of SRF in the cement industry allows the utilization of not only the fuel energy, but also its mineral part in the process of clinker production.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

In Ukraine, there is an interest in implementing demonstration projects for the SRF's utilization in cement industry as a part of the of the waste management strategy implementation. However, this possibility requires an additional discussion and development. In most cases, for the use of alternative fuels, cement plants need to be modernized. In addition, the feasibility for using SRF is determined by logistics, mainly the distance between SRF producer and cement plant. It should be mentioned that Ukrainian cement plants are located mainly in the west and south-east regions of the country.

Thus, technology readiness level for MBT in Ukraine is considered as technology concept formulated, commercial readiness as hypothetical commercial proposition.

CLIMATE RATIONALE OF THE TECHNOLOGY

Greenhouse Gas (GHG) emissions in the Waste Sector in Ukraine amount to approximately 12 Mt CO₂-eq. It's the only sector where there has been an upwards trend in GHG emissions observed since 1990 and therefore reducing emissions is especially important in terms of climate change mitigation. More than 65 % of GHG emissions in the Waste Sector are caused by MSW landfilling due to underdeveloped waste treatment technologies. It is expected that this share will continue to increase in future, if significant changes do not take place in MSW management practices in Ukraine.



The mechanical-biological treatment of waste with SRF production for the cement industry reduces the amount of waste to be disposed at landfills. This directly prevents the emissions of methane that would have occurred from waste disposal on land. The use of SRF produces less CO₂ emissions than the substituted conventional fossil fuel combustion (usually natural gas).

It means that combustion of alternative fuel from MSW for the substitution of fossil fuel contributes to the reduction of GHG emissions in two ways (i) MBT with SRF production prevents the release of methane into the atmosphere by landfilling minimization and (ii) alternative fuel produces less CO₂ emission than conventional fossil fuel combustion. According to the Updated Nationally Determined Contribution of Ukraine (published in 2021, available at: <https://bit.ly/3ik1wMQ>) to the Paris Agreement (NDC2), alternative fuel production is one of the key measures to be introduced in the national MSW management system to achieve the target on GHG emission reduction in the Waste sector by 2030.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The proposed level of MSW biological treatment's diffusion including mechanical-biological treatment of waste with alternative fuel production should ensure 5% by 2030, 16% by 2040 and up to 20 by 2050. Such a level of ambition corresponds to the implementation of Waste Sector Target scenario S3G to achieve the sectoral goal stated in the NDC2 as well as to the implementation of National Waste Management Strategy of Ukraine with ten-year postponement.

Ukraine is in the process of regional waste management plans (RWMP) development. As part of the RWMP development, each region is divided into 3-5 regional clusters. The modern regional sanitary landfill and waste processing plant should be constructed in each cluster as a core part of waste management system with annual processing capacity of 75,000-100,000 tons of solid waste will be constructed in the country by 2040. The prospects of SRF use in cement industry depends on number of cement plants in the country. Potentially all Ukrainian cement plants could use SRF for natural gas substitution.

EXPECTED IMPACTS OF THE TECHNOLOGY

The process of MBT projects development creates jobs associated with the design, construction and operation of waste treatment and biogas energy recovery systems. MBT projects involve engineers, construction firms, equipment vendors, and cement industry. Many of these costs are spent locally for materials, construction and operational personnel, helping communities to realize economic benefits from the increased employment and local sales. By linking communities with innovative ways to deal with their MSW, it helps them to enjoy the increased environmental protection, better waste management and responsible community planning.

The use of SRF as an alternative to fossil fuels for cement manufacture would result in the following environmental benefits:

- Fossil fuel substitution;
- Less GHG emissions;
- The elimination of health problems associated with open dumping of MSW.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION



EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

The combustion of fuels from MSW in cement plants or in specialized boiler houses requires the fuel's classification. Ukraine already has a standard for solid recovered fuel (DSTU, 2018). This document was accepted by confirmation method and submitted in English language only.

The introduction of face-out stimulating tariffs for waste disposal and high enough tariffs for waste treatment may support to raise the level of waste treatment to minimise the amount of landfilling.

PROPOSED POLICIES/MEASURES TO ENHANCE TECHNOLOGY IMPLEMENTATION

In order to achieve the GHG emission target in the Waste sector, which was set up in the NDC2, the following main policies and measures are proposed to be implemented for dissemination of technologies for MBT of waste with alternative fuel (SRF) production for cement industry:

1. The creation of necessary infrastructure:

- 1.1. The development of regional waste management plans based on cluster structure (2021-2028)
- 1.2. The establishment of coordination council for research on waste reuse and processing (2022-2023)
- 1.3. The creation of waste management registers and adoption of the decree of their maintenance (2022-2023)
- 1.4 The support of the development of inter-municipal cooperation (2021-2028)

2. The creation of economic and financial conditions for MBT with alternative fuel production:

- 2.1 The introduction of high gate fee/tax for waste disposal and CO2 emission (2022-2024)
- 2.2 The creation of other technical and economic condition for MBT with alternative fuel production (2022-2024)

3. The provision of long-term and low-interest loans or grants through state funds, private sources and international funds:

- 3.1 Explore sources of funding (national and international agencies (2021-2022)
- 3.2 Training in development of proposal for funding (2022-2024)
- 3.3 Preparation of funding proposals to be submitted (2024-2030)

4. The creation of the stakeholder and technical expert networks for technology development and transfer:

- 4.1 The creation of the platform for national technical experts and stakeholders on the basis of government or non-government organizations (2022-2024)
- 4.2 Exchange information and lessons learned (info campaigns for population, workshops and conferences for experts and other interested parties) (2024-2030)

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

There is considerable discrepancy in the cost of various MBT plants, because there is no "universal" way for mixed MSW processing. Various solutions can be considered to be the most beneficial for different areas/clusters. Capital expenditures for the implementation of MBT technologies depend on many factors including:

1. Initial MSW content (solid waste after separate collection or mixed solid waste);
2. The availability and type of sorting process before MBT (manual, automatic);
3. Treatment capacity (scale effect).

The cost of MBT projects with a capacity of 85-200 kt/yr, which were implemented in Germany and the UK from 2001 to 2012, was in the range of 20 to 75 M€ with average CAREX around 250 €/t of MSW processed during the year. Typical



specific costs for the projects in capacity range of 100-200 kt/yr are from 150 to 400 €/t in countries such as France, Spain, USA, and Australia.

In Ukraine, the project's planned cost could be in the range of 120 to 250 €/t. Operational costs (OPEX) for MBT technology are primarily related to electricity consumption, repairs and maintenance costs, staff remuneration, and cost of residuals disposal. They are typically in the range from 8 to 12% of capital expenditures.

The final cost of MSW processing is determined by CAPEX and OPEX as well as the terms of project financing. If the project's specific capital cost amounts 150 €/t, the final cost of MSW treatment is 30-40 €/t depending on the conditions and share of involved bank capital.

Financial and economic barriers for technology implementation include low feasibility (low IRR, NPV, long payback period) of MBT projects for mechanical-biological treatment of waste with biogas and energy production because of low tariffs for waste treatment, low tariffs for waste landfilling, low population income, inadequate access to financial resources, and high cost of capital and finance.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

Reports prepared within the TNA Project:

- Technology Needs Assessment
- Barriers Analysis and Enabling Frameworks
- Technology Action Plan

Full texts of the TNA reports are available at: <https://tech-action.unepdtu.org/country/ukraine/>

TNA Project page at the web-site of the Ministry of Environment and Natural Resources of Ukraine:
<https://menr.gov.ua/news/33450.html>