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TERMIČKO ISKORIŠĆENJE KOMUNALNOG I INDUSTRIJSKOG OTPADA - PRIMERI DOBRE PRAKSE I MOGUĆNOSTI NJIHOVE PRIMENE U SRBIJI

THERMAL TREATMENT OF WASTE – GOOD PRAXIS EXAMPLE AND POSSIBILITIES OF USE IN SERBIA

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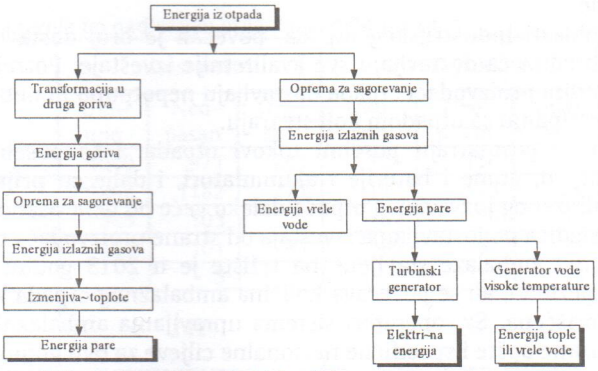
PROŠIRENI IZVOD – Iako se vrlo često o tome ne razmišlja, 98,5 % ukupnog otpada potiče iz: rudarstva, prerade nafte i gasa, poljoprivrede, tretmana muljeva (kanalizacionog uglavnom), industrije, dok samo oko 1,5 % predstavlja čvrsti komunalni otpad (MSW).

Usaglašavanje nacionalnih i EU propisa, ali i njihovo stvarno sprovodjenje, u oblasti gradjenja i održavanja uredjenih deponija, kao i teškoće pri proširenju postojećih i izboru novih lokacija, nameću korišćenje različitih vrsta tretmana, a time i termičkih procesa u sklopu kompleksnog lanca postupaka u sistemu upravljanja otpadom. Energija otpada se može koristiti na više načina (slika 1).



Slika 1. Mogući načini iskorišćavanja energije otpada

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Osnovne karakteristike termičkih tretmana otpada su: pogodni su za organske otpade, obuhvataju različite procese i tehnička rešenja, ali sva zahtevaju visoka ulaganja, procesi su u svim fazama regulisani vrlo strogim propisima, za rad im je neophodan obrazovan kadar, imaju srednje do visoke troškovi održavanja, generišu iskoristljivu energiju, ali i nusprodukte sa kojima se mora rukovati pod posebnim uslovima, i kao veoma važno vrlo su loše prihvaćeni od strane javnosti zbog grešaka u prošlosti. Ipak, po svojim tehničkim karakteristikama veoma slična termoelektranama i toplanama. Ložišta za sagorevanje otpada mogu biti rotacione peći, ložišta sa rešetkama, ložišta sa fluidizovanim slojem i dr., pri čemu se za održavanje temperature iznad 850 ^{0}C, koristi dodatno tečno ili gasovito gorivo ili tehnički kiseonik. Osnovne karakteristike najvećeg broja postrojenja za sagorevanje čvrstog komunalnog otpada sa iskorišćenjem količine toplote su:

- Kapacitet 10÷500 t/dan,
- Karakteristike ložišta:
  - snaga 10÷200 MW,
  - površina 10÷100 m^2,
  - zapremina 50÷2900 m^3,
  - temperatura u ložištu 800÷1250 ^{0}C,
- Karakteristike kotla:
  - pritisak >11 bar,
  - temperatura 190÷550 ^{0}C,
  - proizvodnja pare 8÷150 t/h,
  - snaga turbine 0.1÷70 MW.

U zemljama EU danas se termički iskorišćava oko 1-3 komunalnog otpada, pri čemu kapaciteti rastu, s obzirom da je termički tretman i zvanično prepoznat kao jedan od efikasnijih načina u borbi protiv klimatskih promena. Naravno, samo moderna, visoko energetski efikasna postrojenja imaju potencijal smanjenja uticaja CO_2.
Medjutim, danas se otpad veoma retko sagoreva bez prethodnog tretmana, a posebno se ističe proizvodnja SRF (Solid Recovered Fuels), koji predstavlja suvu frakciju komunalnog i industrijskog otpada, i uvek sa sadržajem veštačkih materijala bez prisustva hlora. Proizvodnja SRF i njegov kvalitet potpuno su definisani tehničkim standardima. Korišćenje SRF je veoma značajno u cementnoj industriji i energetskom sektoru, kao dodatno gorivo, o čemu svedoče i sledeći primeri:

- Termoelektrana (mrki i kameni ugalj) RWE Gerstein, 220 kt/god
- Termoelektrana Vattenfall Jänschwalde (lignitni ugalj), 400 kt/god
- Termoelektrana RWE Berrenrath (lignitni ugalj), 70 kt/god
- Veliki broj cementnih peći u Nemačkoj, 900 - 1200 kt/god po peći
- CHP postrojenje, Neumünster, 150 kt/a

U razvijenim zemljama čest je slučaj i korišćenja peći za proizvodnju kreča ili cementa koje se mogu koristiti za ko-sagorevanje otpada ili se mogu adaptirati za tretman opasnog otpada. Time izbegava potreba za novim postrojenjem, a u slučaju ko-sagorevanja značajno se smanjuje cena goriva za proizvodnju cementa. Ovakve peći su pogodne za tečne organske otpade, ali ne i za otpade sa visokim udelom vlage/vode, sumpora, hlora, teških metala, uz stalnu kontrolu osnovnog proizvoda i otpadnih gasova.
Veliki broj do sada izgradjenih postrojenja u svetu i planiranje novih, kao i pozitivna iskustva sa korišćenjem pojedinih otpada u domaćim cementarama, ukazuju da je ovaj način uklanjanja otpada, prihvatljiv sa ekonomskog stanovišta i stanovišta zaštite životne sredine, te bi se mogao značajnije uzeti u razmatranje i u pojedinim gradskim sredinama u Republici Srbiji. Pri tome bi trebalo imati na umu sledeće:

- neophodno je omogućiti razvoj i uređenje tržišta otpadom na način koji će omogućiti legalne tokove otpada i sprečavanje ilegalne trgovine i prometa otpadom
- s obzirom na urušen sistem finansiranja reciklažne industrije neophodno je hitno kreiranje finansijskog instrumenta za sistemsku podršku
- potrebno je obratiti posebnu pažnju na neiskorišćenost pojedinih vrsta industrijskog otpada u gradjevinarstvu, industriji, i sl.
- s obzirom na nedostatak jasnih procedura koje definišu korišćenje otpada, prerade otpada i pojma end-of-waste, ubrzano raditi na daljem razvoju nacionalnih propisa
- unaprediti obaveštenost i uključenost stanovništva u sve faze donošenja odluka u oblasti upravljanja otpadom, većim uključivanjem profesionalnih udruženja (npr. SeSWA, PKZS i sl.), akademije, nevladinog sektora i sl.

Sve ovo međutim nije moguće bez jasne političke volje koja u oblasti zaštite životne sredine i upravljanja otpadom, danas, na žalost, u Republici Srbiji, ne postoji.

Ključne reči: komunalni otpad, industrijski otpad, termički tretman, SRF.

***EXTENDED ABSTRACT** – Although not commonly addressed, 98.5% of overall waste quantities originate from mining, oil and gas treatment, agriculture, sludge treatment (mainly municipal sewage sludge) and industry, while only the remaining 1.5% represents municipal solid waste (MSW).*

Harmonization of national and EU regulations and their proper implementation during construction of new and maintenance of existing waste dumps, coupled with difficulties associated with expansion of existing disposal sites and selection of new disposal locations, impose the need for different waste treatment technologies, including those denoted as thermal treatments, to be used and applied as one of the measures in complex waste management chain. Energy from waste may be utilized in many different ways (Figure 1).

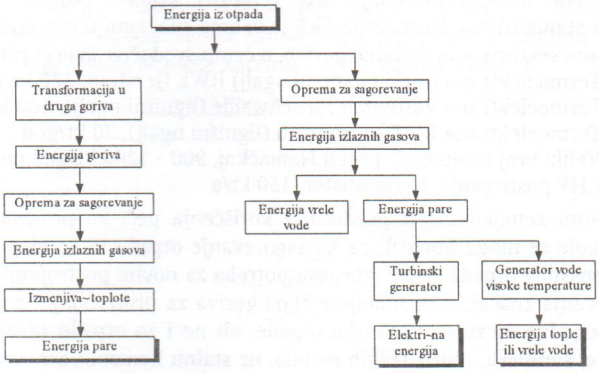

***Figure 1.** Possible waste-to-energy utilization manners*

Thermal treatment processes are characterised by the following: they are convenient for organic waste, they include different processes and technical solutions which are unfortunately all associated with high investment costs, their implementation is regulated by quite stringent regulatory rules, they require educated and trained personnel, they are

associated with medium to high maintenance costs, they generate useful energy but also different by products that require special handling, and finally, they are usually poorly received by the public due to well publicized mistakes made in the pasts. Still, based on their technical features, these processes are very similar to those used in thermal power and heat plants. Waste incineration furnaces may be designed as rotating furnaces, grate fired furnaces, fluidized bed furnaces and similar, where combustion temperatures are maintained above 850 ^{0}C through the use of additional liquid or gas fuel or technical oxygen. Most municipal solid waste incineration facilities with utilization of waste energy are characterized by the following:

- *Capacity* *10-500 t/day*
- *Furnace features:*
  - *power generation capacity* *10-200 MW,*
  - *surface area* *10-100 m^2,*
  - *volume* *50-2900 m^3,*
  - *temperature in the furnace* *800-1250 °C,*
- *Boiler features:*
  - *pressure* *> 11 bar,*
  - *temperature* *190-550 °C,*
  - *steam production* *8-150 t/h,*
  - *turbine capacity* *0.1-70 MW.*

In the EU countries, approximately 1/3 of municipal waste is currently being thermally treated. However, number of thermal waste treatment facilities is growing having in mind that thermal treatment is officially recognized as one of the efficient climate change mitigation measures. It goes without saying that only modern, highly efficient facilities are qualified to be considered as proper global CO2 emission reduction technology.

However, waste is today rarely incinerated without appropriate pre-treatment, where particular attention is given to solid recovery fuels – SRF. These fuels represent dry fraction of municipal and industrial solid waste, with commonly added synthetic materials and removal of any form of chlorine. Production and quality of SRF are fully defined by related technical standards. Use of SRF is highly important in cement and energy generation industries, where SRFs are used as additional fuels. The following are some representative examples:

- *Thermal power plant RWE Gerstein (brown and bituminous coal fired plant), 220 kt/a*
- *Thermal power plant Vattenfall Jänschwalde (lignite fired plant), 400 kt/a*
- *Thermal power plant RWE Berrenrath (lignite fired plant) 70 kt/a*
- *Large number of cement kilns in Germany, 900 - 1200 kt/a per kiln*
- *CHP plant, Neumünster, 150 kt/a.*

In developed countries, furnaces used in cement or lime production processes are often utilized for co-combustion of waste or are fully reconstructed to be used for hazardous waste treatment. In that manner, the need for new waste treatment facilities is eliminated, while in case of co-incineration applied in the cement industry, additional benefit reflects through reduced price of primary fuel. With continuous control of the product quality and composition of flue gas emissions, the considered type of kilns is suitable for treatment of organic liquid wastes, but not for waste varieties with high moisture, sulphur and heavy metals content.

Large number of thermal treatment facilities built to date and quite considerable number of those planned to be constructed in the near future, as well as positive experiences related to the use of certain waste types in Serbian cement factories, indicate that considered waste removal technology is financially and environmentally acceptable. It is therefore concluded that thermal treatment facilities and their possible implementation in

urban areas in the Republic of Serbia should be given more attention. However, the following should be kept in mind:

- *It is necessary to facilitate development and proper regulation of national waste market in a manner that will encourage legal flows of waste and prevent illegal waste trade and traffic;*
- *Bearing in mind the undermined viability of recycling financing mechanisms, it is necessary to establish new financial instrument that will provide systematic support for the activities considered;*
- *It is necessary to pay special attention to the unused potential of certain types of industrial wastes generated in construction and other industries;*
- *Heaving in mind the absence of clearly defined procedures that would address and regulate waste utilization, treatment and end-of-waste issues, it is necessary to make the best efforts to further develop related national legislation;*
- *It is necessary to improve awareness and participation of broader population in all phases of waste management decision making processes, primarily through greater engagement of professional organizations (SeSWA, PKZS and similar), Serbian Academy of Sciences and Arts, non-governmental sector etc.*

However, all of this will not be possible without strong political support, particularly in waste management and environmental sectors. Unfortunately, this kind of support does not exist in today's political climate in Serbia.

Key words: *municipal waste, industrial waste, thermal treatment, SRF.*