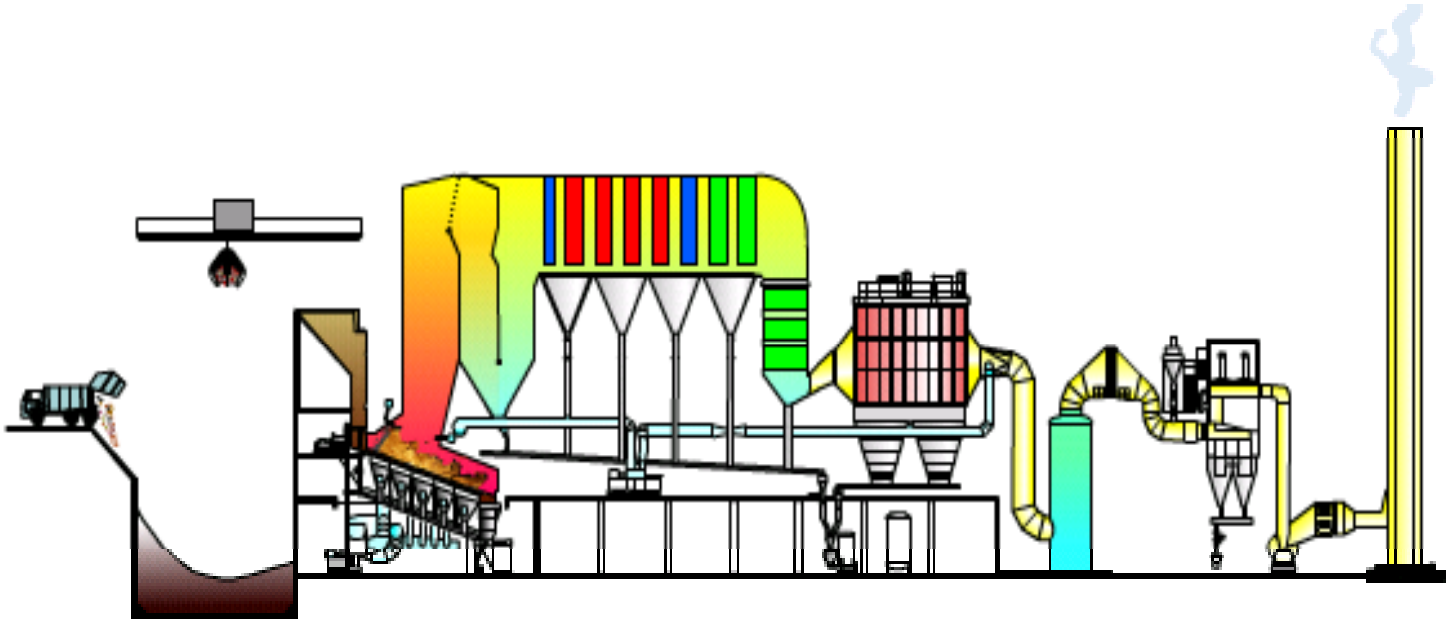
INTRAKAT

Waste to Energy

WTERT, N.Y., 16-17 October 2008

MUNICIPAL SOLID WASTE INCINERATION WITH SIMULTANEOUS ENERGY PRODUCTION (WASTE TO ENERGY)



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MUNICIPAL SOLID WASTE TREATMENT IN THE SURROUNDINGS ATHENS REGION

- One of the most important political and social problems in the world today, is the increasing quantity of municipal solid wastes (**MSW**), especially in major cities.

- The daily production of MSW in the Attica region, is estimated at **6.500 tones**). This means **around 2,4 million tones per year**, from which 90% is deposited in the Ano Liosia Sanitary Landfill**, which is already full.**

LEGAL FRAMEWORK

- The European Union Legislation for Sanitary Landfills (1999/31/EC), imposes the decrease of biodegradable waste which are deposit to sanitary landfills, **so the thermal treatment methods of municipal solid waste (mass-burning of «as received MSW»)** is the only solution to such problems, supplying an optimum solution in the serious social problem (for the government and all the local authorities).

- The Greek legislation for the Incineration of wastes is the Ministry Decision KYA 22912/1117/2005 (in harmonization with the European Union directive for **Incineration of Waste 2000/76/EC**).

ADVANTAGES – DISADVANTAGES of WTE

ADVANTAGES

- The weight of MSW is reduced up to 70-80% while the volume is reduced up to 90%
- Absence of pathogenic substances in the products, due to high temperatures.
- Requirement of very small land areas for the WTE Plant.
- steam (teleheating) and/or electricity production .

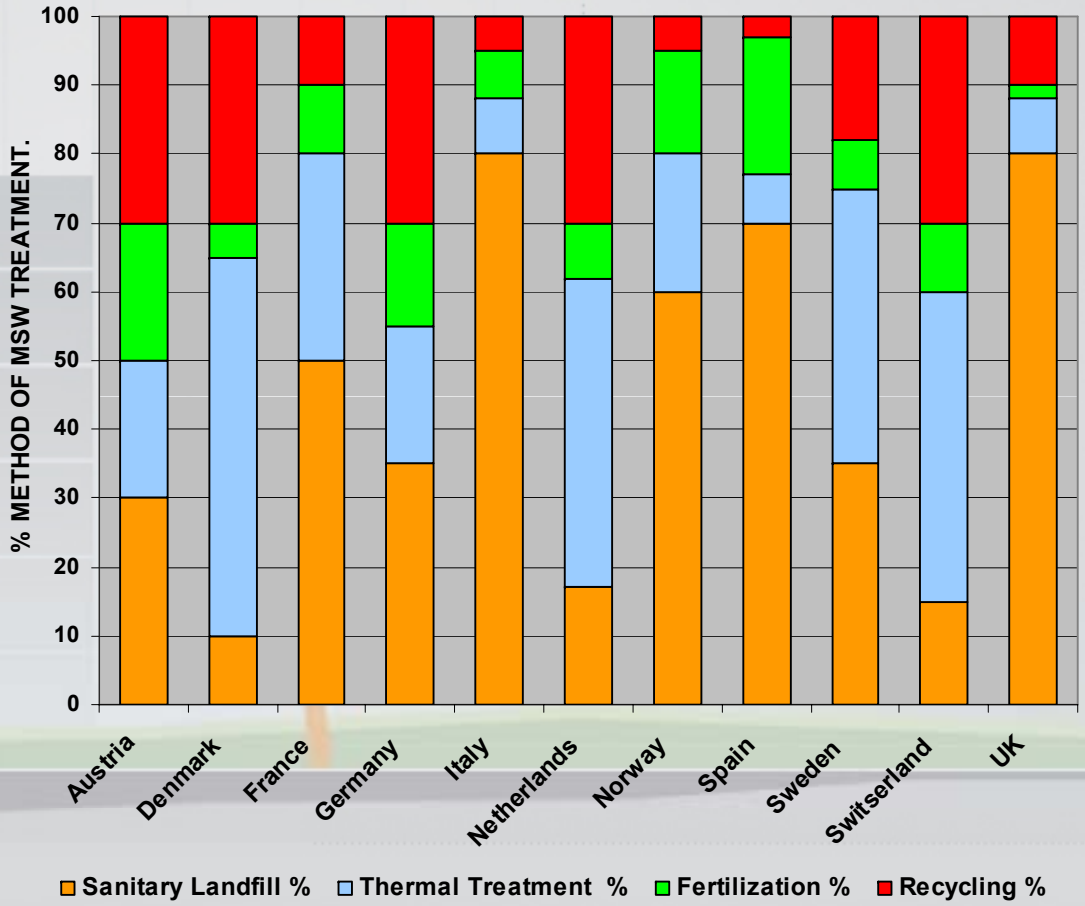
DISADVANTAGES

- A little higher construction and operational cost (flue-gas cleaning system and ash treatment) comparing with sanitary lanfill
- Requirement of relative big capacities

  (application in cities with an average population of more than 200,000 for feasibility).

MSW TREATMENT METHODS IN EU

- In the major cities of Europe, the incineration of MSW is applied with great success (even mass-fired without any pre-selection and recycle in the source of MSW).
- In 2006, in Europe the total WTE capacity of CEWEP members was around 52 million ton.
- **WTE is an energy recovery operation** , after 17th June 2008 (voted by EU Parliament)



- Pioneer countries in the application of waste to energy are **Switzerland, Sweden, Netherlands, Denmark, Germany, France and Belgium.** Almost the only method for municipal solid waste treatment today **in Greece**, is the disposal to **sanitary landfills**.

Map of Waste To Energy Plants in Germany

MSW Waste to Energy Plants in Germany

- In Operation
- Design
- Waste Water Sludge Combustion

PROPOSED INVESTMENT

- **Design, Construction and Operation, of MSW waste to energy (mass-burning) plants in all major cities (annual capacity 150.000 – 450.000 ton.**), with the simultaneous production of electricity for sale to the Public Power Corporation (exploitation of the MSW lower heating value).

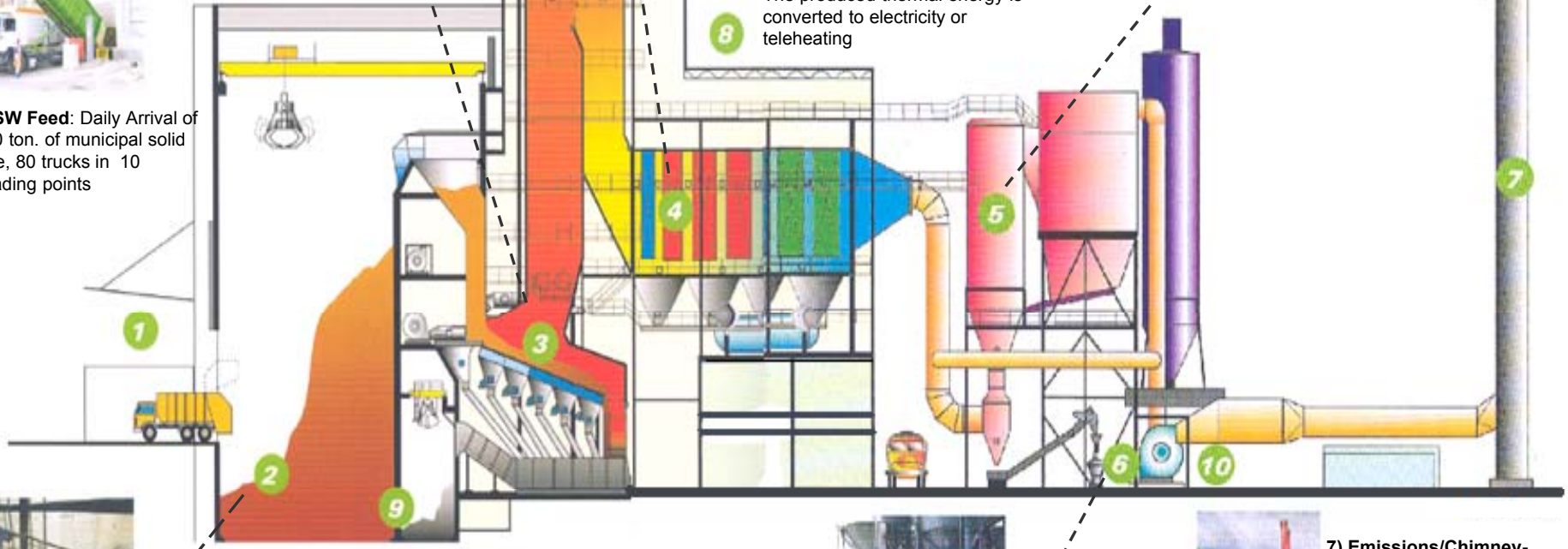
3) Combustion grates : The thermal treatment is taking place in water-cooled combustion grates (or air-cooled), with a capacity of 20 ton/hr/line)

4) Boiler : The hot exhaust gases produce the steam

5) Flue-Gas Cleaning System: The major systems are scrubbers, electrostatic filters, bag filters and cyclones, activated carbon filters, chemicals (like NH_3, CaO, $Ca(OH)_2$,..)

1) MSW Feed: Daily Arrival of 1.200 ton. of municipal solid waste, 80 trucks in 10 unloading points

8) SteamTurbine & Generator : The produced thermal energy is converted to electricity or teleheating



2) MSW warehouse : The MWS storage has a capacity of 15.000 m3 for around 8.000 ton.
In that point the mixing of the MSW from the crane handler and the feed in the the hopper of the combustion chamber, are taking place.

9) Bottom ash: The solid waste after incineration (bottom ash) is disposed to sanitary landfill or reused as additive in construction activities and in roads.

10) Fly ash : stabilization and deposit in underground mines (treatment as hazardous waste)

6) Mixing of CaO and activated carbon : This mixing is taking plave within the WtE Plant in the Flue-Gas Cleaning System

7) Emissions/Chimney-Stack : On Line emissions measurement with state of the art equipment for dioxins, fourans, PAHS, etc., in the exhaust gases and in the wastewaters of the process, according to the EU Directive 2000/76 for the protection of the Environment

Treatment of Byproducts of WTE Plants

- The most important process in such an incineration plant, is the **flue gas cleaning system**, for the chemical cleaning of the produced gaseous pollutants. The major systems are scrubbers, electrostatic filters, bag filters and cyclones, activated carbon filters, chemicals (like NH_3, CaO, $Ca(OH)_2$, etc.).

- The best available **antipollution techniques** during the whole thermal treatment process of the MSW, with the use of the very strict emission limits of the **2000/76/EC directive**, and similar in USA and other countries, leads to the environmental acceptance of the MSW incineration plants worldwide, and also settle these incineration methods more friendly for the environment, comparing with typical human activities, like the industrial pollution and the traffic pollution of cars.

BASIC INCOME/BUSINESS PLAN

- **Basic Income:** Gate fee.
  - ✓ Private: Gate Fee 28 €/τον. Recently increased in **40 €/ton.**
  - ✓ Municipalities: Gate Fee **30- 40€/ton**. (**in Germany** the relative gate fee amounts to **100-150 €/ton)**.

- **Second Income:** The **second income** is the selling of the produced electricity to the Public Power Corporation with **73 €/MWh**, according to the new Greek law for the renewable energy sources (N. 3468/2006).
  Furthermore there is a priority of access to the Public Power Corporation network and less time required for all the bureaucratic operation for the permits as well as some extra income from the recovered metals from the bottom ash (estimated at 100 €/ton).

INVESTMENT COST – OPERATION COST

- **Indicative Investment Cost <u>90 - 130 mil.€</u>**
  (depending on the capacity of the WTE plant and the BAT selected)**.** It includes the project & site development, the environmental studies, the technical equipment & installation, the civil works, the land area acquisition of around 4-6 hectares.

- **<u>Annual Operation Cost</u>**

  11-15 mil.€ (depending on the capacity of the WTE plant and the selected technology**)**

  - ✓ Personnel 40-50 total.
  - ✓ Flue - Gas cleaning system and fly & bottom ash treatment.
  - ✓ Equipment maintenance and Spare Parts, Insurances and contingencies .

- **<u>Locating the suitable site (land).</u>**

  - ✓ The optimum **selection of the land layout (site)** for the plant, is a decision of the municipal authorities in cooperation with the Ministry of Environment and other local governmental authorities in Greece. The required land area is around 40.000-60.000 sq.m (4-6 hectares).

FINANCIAL EVALUATION OF THE INVESTMENT

- **State subsidy** of the whole investment, according to the new Greek Development Law, rated at a 30-40% and depending on the selective site for the plant construction (25% equity and 45% loan).
- **Gate Fee 40 €/ton.**
- Energy Pricing **73€/MWh**

TECHNOLOGY	INVESTMENT (€)	ANNUAL CAPACITYof the WtE PLANT (TON.)	IRR after taxes
MASS-FIRED INCINERATION	125.000.000	450.000	19%
MASS-FIRED INCINERATION	90.000.000	300.000	16%

CONTRIBUTION OF MSW INCINERATION IN THE GLOBAL WARMING

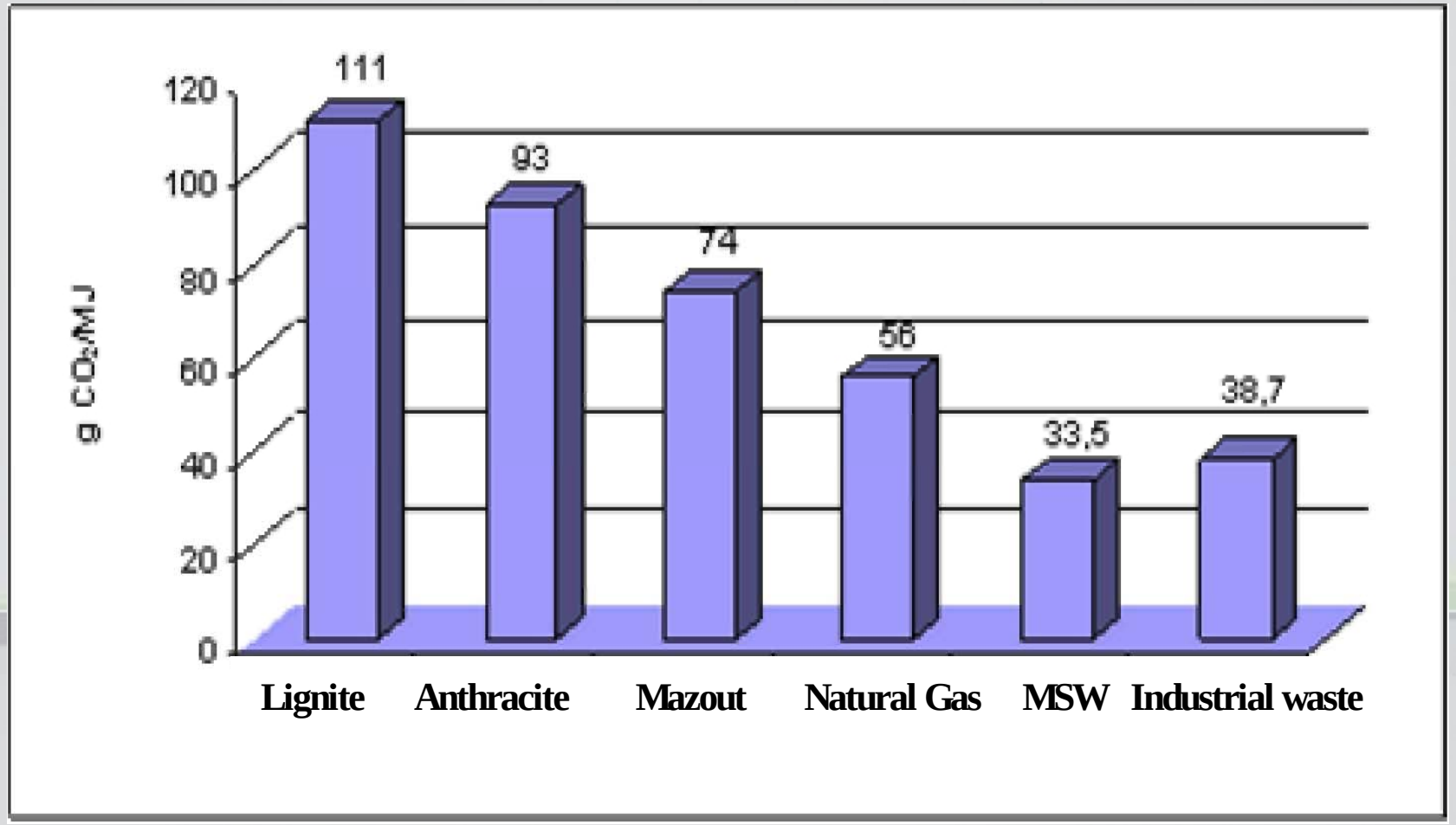
- It is well known that **the methane** which is produced in significant quantities in Sanitary Landfills, (the estimated production of CH_4 in Greek sanitary landfills, ranges between 30 - 250m^3/ton dry MSW), **is the most harmful gas of the Global Warming gases (Greenhouse phenomenon).** The production of methane is avoided with the application of the MSW thermal treatment methods.

- The **MSW Waste to Energy Plants** have a significant contribution in the reduction of the atmospheric CO_2. The recovered energy which is produced from the MSW thermal treatment, **reduces the emissions of gases which contribute to the Greenhouse phenomenon in two ways**:

  a) avoids the methane production and other greenhouse gases produced in Sanitary Landfills, and,

  b) produces less CO_2 emissions compared to traditional fuels .

CO_2 emissions during energy production from the combustion of different fuels *(Bilitewski, 2006).*



SYNERGIA (WTERT – GREECE)

- The Council for Energy Recovery from Wastes **SYNERGIA,** was founded in July 2008 by the company **INTRAKAT** of Greece and the **Earth Engineering Center** of Columbia University of the U.S.A. The main objective of the Council is to bring together professionals from universities and the industries who are interested in helping Greece to implement technologies for the recovery of energy from solid wastes (WTE) and preserve valuable Greek land for future generations.

- The **mission of Synergia** is the development of sustainable waste management in Greece via the recovery of energy and materials, on the basis of scientific knowledge of the effects of various waste treatment technologies in the country and worldwide.

- For more information : **www.wtert.gr**

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