

Burning waste for energy

A proposal to dry processed sewage from Attica's treatment plant on the island of Psyttaleia to produce energy recently outraged locals. With landfill space at a premium throughout Greece, Professor Nicholas Themelis, director of the Earth Engineering Centre at Columbia University, tells the Athens News that waste-to-energy plants could be the answer to Greece's problems

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WHAT exactly does a waste-to-energy plant do?

In a waste-to-energy (WTE) plant, solid waste that cannot be recycled is combusted at high temperatures. The heat of combustion is used to produce steam that drives a generator of electricity. The net electrical energy provided to utilities for each tonne of solid waste corresponds to a savings of 170 litres of fuel oil. WTE plants can reduce the quantities of waste for landfilling by up to 90 percent.



This WTE plant provides heating for over half of Brescia, Italy

Doesn't the process produce harmful emissions?

Each modern WTE plant is equipped with a complex air pollution control system that captures gas and solid contaminants in the form of "fly ash" before the processed gas is released into the atmosphere. In the US there are eighty-nine WTE plants that during the last 15 years have implemented the Environment Protection Agency's (EPA) regulation of maximum achievable control technology (MACT). Our studies have shown that, as a result, emissions of mercury and other volatile metals have been reduced to a small fraction of emissions from US coal-fired power plants.

The same is true for the toxic organic compounds called dioxins. For example, the total amount of dioxins released from all US WTE plants is only 1 percent of the total US emissions of dioxins. The major source of dioxins in the US now is what the EPA calls "backyard burning". That's uncontrolled burning of waste and other materials. In Greece this is practised much more widely than in the US.

How do the emissions produced compare with pollution from landfills?

In Greece there are illegal landfills where waste is burned in an uncontrolled way. This way 250 grams of dioxins are produced each year, whereas in the US we burn 26 million tonnes of waste in WTE facilities and produce 12 grams. It has been estimated that for each tonne of solid waste that goes to a WTE plant rather than to a modern, regulated landfill such as the landfill at Ano Liosia, there is a savings of approximately 1.3 tonnes of carbon dioxide emissions.

This is due to the fact that the methane emitted from landfills has a "greenhouse gas" (GHG) effect that is 23 times greater than carbon dioxide. Methane emissions are much higher at the traditional landfills used all over Greece. They emit continuously and uncontrollably. A regulated landfill (or HYTA), on the other hand, emits methane while it's open to receive more waste and continues to emit some quantities, albeit smaller, after it has been sealed. It is estimated that a regulated landfill collects around 60 percent of its methane emissions. This means that a nationwide solution could generate well over 5 million tonnes of CO₂ credits and help Greece meet its Kyoto obligations.

By 2011 Greece must recycle between 55 and 80 percent of its packaging waste. That's plastic, paper, aluminium etc. These are EU targets and, if they are achieved, will there be enough material left for a WTE plant?

Recycling is the first priority in solid waste management. Anything that can be recycled should be recycled. Experience in the US and also in Greece at the Ano Liosia recycling operation has shown that the best way to separate recyclables is at the source, that is by the citizens, and not after mixing it with wet and dirty materials. A lot of the paper and most of the cardboard in Greece can be recycled by collecting them as a separate stream as is done in New York City, for example.

However, as the experience in Japan, Denmark and elsewhere has shown, even after all the possible recycling is done, there remains a very large fraction that can either be combusted in WTE facilities or landfilled. The EU has directed that combustible or compostable materials must not be landfilled in the near future and has helped finance WTE plants.

How many WTE plants would have to be built in Greece?

The economies of scale indicate four to five plants. However, when the low-temperature steam of WTEs can be used for district heating or industrial applications, the energy revenues can justify smaller-sized plants. For example, there are 31 small WTE plants in Denmark because they locate them in cities and towns where their heat can be used to for residential and commercial buildings. There may be such applications in Macedonia and other parts of Greece.



A WTE plant in Aalborg, Denmark

WTE plants are an expensive investment - in Greece, they may cost about \$300 per tonne of annual capacity. So they need to be in an area that generates enough waste for them to make financial sense, like Athens. Or where waste from several islands can be transported by sea to a single location. In the US these plants are self-financing and their construction is funded through bond issues. In Greece, of course, part of the cost could be provided by European Union funds.

A proposed new landfill in Fili, next to Ano Liosia, will be able to receive around 800,000 tonnes of waste a year. How much would a WTE plant able to process this amount of waste cost?

Around \$240 million if the same factory was built in the US. But the factory would save the money spent on landfilling. Also, the Fili WTE would generate about \$34 million of electricity. We must also take account of land cost savings. Landfills use up forever a lot of space and are simply not sustainable development. In New York City, they filled up the Freshkills landfill of 1,400 hectares in 50 years. They now transfer the waste for landfilling to other states over long distances. A Columbia University researcher recently showed that the diesel trucks that do the transfers produce 5 times more particulate matter than a WTE plant would in New York City. An important thing to mention is that modern WTEs, in contrast to landfills, are good neighbours that bring substantial economic and other benefits to the host community. The infusion of such a large capital investment in a community is an engine of development and should be accompanied by the creation of a communal park, a year-round swimming pool etc.

What is the life expectancy of the WTE plants and what would it cost to provide Greece with a comprehensive waste management solution?

In the short-term, regulated landfills are much preferable to traditional landfills. Every possible effort should be made to control landfill operations, especially in avoiding open landfill fires such as the one I saw this week while attending an international symposium on the environment at Kos.

Building of these WTEs, and of the necessary truck and marine transfer stations, may cost close to \$1.6 billion. However, as I mentioned earlier, there would be substantial revenues and capital from abroad to finance such a massive operation. With proper maintenance they can continue for a long time, same as other infrastructure. For example, this year the Saugus WTE in Massachusetts reached its 30th year and is now going for another 30.