Compatibility Between Recycling and Waste-to-Energy

By "be Waste Wise"

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Editor' Note: This paper targets a broad audience. Unless specifically stated otherwise, the opinions expressed in this publication reflect the author's personal observations. The following article is the result of a *be Waste Wise* panel."

"In many respects, municipal solid waste (MSW) can be thought of as a "gateway" environmental problem – because all of us deal with waste every single day of our lives, there is greater awareness of issues around MSW than for many other environmental concerns" ~ Scott Kaufman

Introduction

Other *be Waste Wise* panels have discussed solid waste management as means for mitigating climate change as well as the role of recycling in an integrated waste management system. Moving down the sustainable waste management hierarchy, waste-to-energy (WTE) is being used to dispose of mixed Municipal Solid Waste (MSW) in plants that produce district heating and electricity. This panel addressed the role of waste-to-energy (if any) in the waste management hierarchy of North America and Europe, provided international experience on the degree of compatibility between recycling and waste-to-energy, analyses the arguments for the juxtaposition of waste-to-energy and recycling, and discusses the policies adopted in some communities to build successful sustainable waste management systems, with the general aim of moving away from landfills.

Recycling and/or waste-to-energy is probably one of the most controversial topics in the solid waste management sector. According to a World Bank report, this issue often becomes the center of emotional public debate. There are two main schools of thought when it comes to the topic of compatibility between recycling and waste-to-energy (or energy from waste as known in Europe). One of them says that the presence of a waste-to-energy combustion plant is an obstacle to a community's recycling efforts, whereas the other school of thought advocates that recycling and waste-to-energy are compatible and that the presence of a waste-to-energy plant correlates with recycling rates in communities.

Each community, however, has its own characteristics and different approaches should be applied for the implementation of sustainable waste management systems.

Waste-to-Energy and the Waste Management Hierarchy

Waste management experts in the U.S. and E.U. are uniformly of the opinion that landfilling is a last resort from an environmental standpoint. Landfill methane emissions, a large contributor to Climate Change, amounted to 17.5% of total anthropogenic methane emissions in the U.S. in 2011. The US EPA puts landfills at the bottom of its waste management hierarchy and source reduction at the top. Recycling and composting both of which require some external energy inputs take second place after source reduction. WTE, the contested technology, takes higher preference over sanitary

landfills because it allows for energy and material recovery from the input stream, while simultaneously reducing its volume.

Research Associate with the Earth Engineering Center, Dr. Eileen Berenyi reiterates that WTE can occupy a definite role in a city's waste management plan. It has been adopted in U.S. as well as European cities that are densely populated, have a problem with landfilling, and wish to avoid transporting waste long distances. Waste-to-energy is an evolving technology with many new developments to allow its use for smaller waste streams. These adaptations would mitigate some of the footprint of waste-to-energy by doing away with the need to transport waste long distances. The technology is also being adapted to suit more variations in waste stream composition. This would increase the overall efficiency of the plant. Doubts regarding the claims of efficiency and potential revenue streams of these smaller plants are likely to persist in the development stages. WTE is not only an important current strategy but one that will have greater importance in the years to come.

Austrian waste management services consultant, Franz Neubacher holds a more nuanced view and states that our thinking on waste management should not be reduced to a plain hierarchy. Waste Management is also an issue of culture (and therefore the best alternatives may vary from one culture to another). WTE and recycling are complementary and this can be asserted based on observed results and fundamental thermodynamics. However, the answer is not always an absolute one, it is case specific. In light of the ever greater pollution of the oceans with plastic we are witnessing landfilling is not an inevitable choice, WTE offers a viable alternative, Austria for example has come out with an absolute ban on landfilling of materials with Organic Carbon greater than 5%. The country instead recycles or composts 70% of its waste and treats the remaining 30% via combustion.

Much debate has ensued over whether WTE in fact contributes to or mitigates climate change and therefore over its desirability as a waste treatment alternative. As explained by Shawn Lawrence Otto, Co-founder of U.S. Presidential Science Debates, the majority of the waste in Europe and the U.S., more than 50% of it already is a part of the short carbon cycle (i.e. consisting of waste with an organic derivative) and does not add to climate change. The long carbon cycle, consisting of among other materials plastic, derived from petroleum resources does add to climate change, however it is a resource that has already been used once and WTE is merely recapturing that stored energy after its physical use as plastic. This helps offset more carbon emissions from the use of coal, oil or gas for electricity generation. The net effect is thus a reduction in carbon emissions. The official numbers show that the Emission Factors for MSW combustion (1,671 kgs of CO_2/MWh) are greater than coal (1,020 kgs of CO_2/MWh). It should be understood however that less than 50% of the CO_2 emissions from MSW combustions are part of the 'long cycle' and therefore contribute to climate change. This gives us a number of 835.5 kgs of CO_2/MWh which is less than the CO_2 emissions from coal. The balance 835.5 kgs of CO_2 emitted correspond to emissions from biogenic sources.

WTE and Recycling Rates: A Correlation?

It has been shown that communities in the U.S. with WTE plants recycle 5% more of their waste than cities that don't. This correlation indicates that the assumption that waste-to-energy and recycling are incompatible requires further examination. Dr. Berenyi explains that for one, large amounts of ferrous metals are removed from waste streams at WTE facilities contributing in part to an increase in recycling percentages. The two technologies it appears can coexist. National data from the United

States Environmental Protection Agency (USEPA) show that the percentage of waste disposed of via recycling and WTE versus the waste disposed via landfilling has not changed significantly over the past 15 years. WTE as a percentage of waste generated has come down to 12% from over 15% in 1995. Recycling has gone up from 26% to 34% in the same 15 years, not a large increase. The two percentages added together have seen little change in the last 15 years, this translates to about 55% of the waste still being landfilled.

Neubacher likewise reports that in Europe recycling efficiencies have been increasing. Unlike the U.S., WTE's share in waste management in Europe has increased. Total residual (i.e. post-recycled) waste in Austria, after deducting recyclable materials was initially on an upward trend, until source separation, recycling and WTE reduced this percentage further. The country has succeeded in completely banning landfilling of waste since 2008 and is satisfied with its experience with WTE in waste management. Pre-cycling – making plastic polymer products and then after their use, their conversion from waste to energy – in Europe, is seen as complementary to WTE.

Dr. Berenyi, also Founder of Governmental Advisory Associates, a research and consulting firm in environmental sciences attributes this correlation in part to the state and local policy environment. It is likely that in a municipality where a WTE plant exists, there has been a lot of studies into what the waste streams consists of and how its components can best be maximized. This thinking engages the whole gamut of the waste sector. Often municipalities thinking about WTE are also engaged in various other integrated waste management initiatives. Florida is one example, where some of the facilities have the most advanced recycling programs, WTE facilities, and additional renewable energy generation (through solar panels) from landfills. Minnesota is another interesting example. The state has access to low cost landfills, however the local geology makes the sites unsuitable for landfilling. WTE has become a major strategy here, and smaller mid-sized plants are being built in conjunction with a very strong state-wide recycling policy. Thus it can be seen that policies are strong causal factors behind the correlation.

The Opposition to Waste-to-Energy and Rebuttals

A lot of the opposition to WTE stems from the thinking brought about by Rachel Carson's book Silent Spring in the 1960s, whereby people realized that hidden chemicals in the environment posed definite threats. This caused a political split with the environmentalists moving to the left and the chemical and petroleum industries moving to the right. When there is talk of burning anything, it is termed as 'sky dumping', which is deemed to pose a threat to health and the environment. While this was the case formerly, the burning of MSW with advanced technology today, is on par with Maximum Achievable Control Technology (MACT) and is a far safer than burning of the waste in backyard barrels (a common practice for decades). The implementation of the Clean Air Act (CAA) has ensured that the emission of those harmful chemicals has reduced by well over 90%, in some cases by 99.9%. This is also much better than the performance of 'clean coal' which is still trying to catch up. Mr. Otto recounts that there is also a lot of health evidence from the Minnesota pollution control agency and British health protection agency which have shown that there is no measurable increase in health effects between people that live close to a WTE site and those that don't. The concerns therefore are a leftover from the 1960s- 1970s era of thinking. Education should lead the way in showing that the same concerns are no longer valid.

In Vienna, where WTE is combined with district heating and electricity production, it reduces 1.4 tonnes CO2 eq. emissions per tonne of residual waste compared to landfilling with recovery of some landfill gas for electricity generation. These are net reductions that hold significant potential in the fight against Climate Change and cannot be ignored. Even hardened opponents of WTE will agree that continued landfilling poses grave threats to the climate and something must be done about it.

Neubacher, a key player in Austria's move away from landfills, recalls that it is also not true that WTE serves as a disincentive to recycling initiatives. Austria has companies that rely very strongly on landfill dumping, and receive support from the landfill lobby which in turn receives government subsidies. In these countries the cost of dumping is much lower than having a proper operational WTE facility. The third largest town in Austria, Linz once had a big air quality problem. An idea was put forth that suggested the building of a WTE plant in Linz. The state governor and the Mayor both green party members issued a permit without opposition. Public discussions also did not see one person objecting and the people are now very satisfied with the plant. The argument that environmentalists oppose WTE is thus not true everywhere. There are often economic issues, a lack of understanding/ inappropriate technologies which hinder the acceptance of WTE.

Shawn Lawrence Otto questions the assumption sometimes made that waste-to energy is more expensive than landfills. This claim is predicated on the belief that environmental costs of decomposition of waste in landfills can be externalized. No responsibility is taken for these green house gas (GHG) emissions other than covering it up and eventually harvesting the methane. Harvesting methane from landfills post closure is possible, but is not the best alternative since majority of the methane emissions during the landfill's life are released while it is still open.

Barriers to Adoption of Waste-to-Energy

The biggest obstacle to the implementation of WTE lies not in the technology itself but in the acceptance of citizens. Citizens who are environmentally minded but lack awareness of the current status of WTE bring up concerns of environmental justice and organize around this. They view WTE as 'dumping' of pollutants on lower strata of society and their emotional critique rooted in the hope for environmental justice tends to move democracy. An advocate of public understanding of science, Shawn Lawrence Otto regrets that the facts are not able to hold the same sway. Some US liberal groups such as the Center for American Progress are beginning to realize that the times and science have changed. It will take more consensus on the science and the go ahead from environmental groups before the conversation moves forward, seemingly improbable but not without precedent.

The Spittelau waste-to-energy plant is an example of opposition coming together in consensus over WTE. It was built in Vienna in 1971 with the purpose of addressing district heating and waste management issues. Much later awareness of the risks of dioxins emitted by such plants grew and the people's faith in the technology was called into question. It also became a political issue whereby opposition parties challenged the mayor on the suitability of the plant. The economic interests of landfill owners also lay in the shutting down of the WTE facility. The alternative was to retrofit the same plant with advanced technology that would remove the dioxins through Selective Catalytic Reduction (SCR). Through public discussions it appeared that the majority of the people were against the plant altogether though thorough studies by informed researchers showed that the science backs WTE. The mayor, Helmut Zilk eventually consulted Green Party members on how to make this technology better perceived in the eyes of the people, and asked the famous Austrian

artist Freidensreich Hundertwasser, who was a green party member to design the look of the plant. Freidensreich Hundertwasser after carefully studying the subject wrote a letter of support, stating his belief as to why WTE was needed and accepted Mayor Helmut Zilk's request. Later public opinion polls showed that there were a majority of people who were either in favor of or not opinionated about the plant, with only 3% in outright opposition of the plant.

Polarized discussion on the optimal choice: Waste-to-Energy or recycling has kept public discourse from questioning whether there may not be intermediate or case specific solutions. This polarization serves to move the conversation nowhere. For now it can be agreed that landfills are devastating in their contribution to Climate Change and must be done away with. The choice then, of treatment processes for municipal solid waste are plentiful. If after recovery of recyclable materials there remains a sizeable waste stream the option of waste-to-energy can be explored.

In this venture some of the primary considerations should be,

1. Environmental implications (i.e. CO2 emissions vis-à-vis the next best fuel source) given the composition of the local waste stream. If the waste stream consists of a high percentage of recyclables the more sustainable waste strategy would be to ramp up recycling efforts rather than to adopt WTE,

2. Likely composition and variation of the waste stream and the feasibility of the technology to handle such a waste stream,

3. Financial considerations with regards to the revenue stream from the WTE facility and its long term viability,

4. Efforts at making citizens aware of the high standards achieved by this technology in order to secure their approval.

Resources

1. U.S. Green House Gas Inventory. 2013. US EPA.
2. The Future of WTE: The new Waste-to-Energy developments that will change the industry. Felicia Jackson, Associate, Carbon International.
3. Municipal Solid Waste: Clean Energy. US EPA.
4. Coal: Clean Energy. US EPA.
5. Why burning waste for energy fights Climate Change. 2013. Shawn Lawrence Otto.
6. Recycling and WTE: Are they compatible?: 2009 Update. Eileen Berenyi.
7. Municipal Solid Waste: Wastes. US EPA.
8. Waste-to-Energy in Austria: White Book. Franz Neubacher.
9. The Spittelau Thermal Waste Treatment Plant. Waste-to-Energy Research and Technology Council.

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