Conversion of MSW Transfer Stations into Renewable Energy Centers

Municipal Solid Waste Transfer Stations (MSWTS) play an important role in a community's total waste management system, serving as the link between a community's solid waste collection program and a final waste disposal facility. W2E has developed an innovative system of converting municipal solid waste (MSW) into a slate of usable energy and energy-related products.

MSWTS currently provide the standard intermediate handling step in MSW disposal, preliminary to the disposal of non-recyclable wastes at a landfill or incinerator. MSWTS facilities can make MSW available in large quantities, on a continuous basis. W2E has targeted these sites to become Alternative Energy Centers, which will eliminate MSW disposal issues and make energy from one of the most available domestic sources of renewable power worldwide

In a landfill the biodegradable components of MSW (e.g. paper and food wastes) decompose and emit methane – a greenhouse gas 23 times more potent than carbon dioxide. Other components (e.g. leachate) can also cause significant pollution in air and ground water.

Incineration, another disposal option for this waste, is already restricted in the USA. A known source of air emissions pollutants, such as dioxins and furans, incineration is under close scrutiny and can face resistance in other parts of the world. These options waste a valuable resource by not making use of it.

ALTERNATIVE ENERGY CENTERS

The conversion of these transfer stations into Alternative Energy Centers (AECs), to use the MSW onsite to produce a variety of energy and energy-related products is a practical alternative to the standard disposal options for this material. These AECs could achieve a significant reduction in dependence on imported fossil fuels by making use of these domestic resources. They will also increase energy security by creating geographically dispersed distributed energy centers, and at the same time, provide a more realistic waste disposal option for a growing world population that is demanding and using more goods and services and as a result, producing more waste.

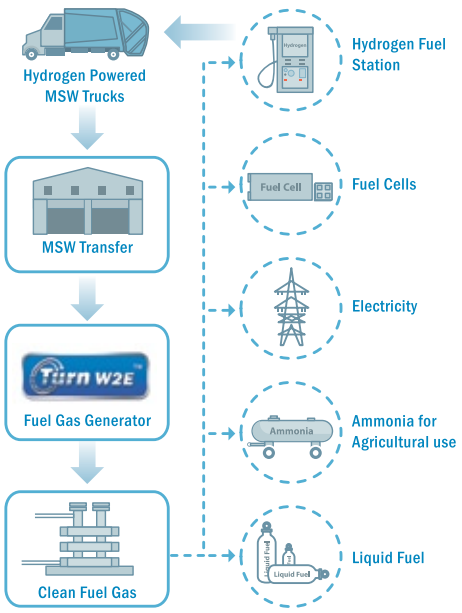
At an MSWTS, the material is received and the recyclables separated out, collected and sold to the appropriate recycler (scrap metal, plastics, etc). After the recyclables are removed, some MSWTS will take the remaining MSW and shred it to make a "fluff". The fluff has a heating value of 7000 BTU/lb to 9000 BTU/lb. The moisture content of the fluff is 30-35%, which is in the ideal range for processing it into alternative energy products using a W2E process.

Wastes Common to MSWTS

Waste Category	Generated by	Contains
Municipal solid waste (MSW)	households, businesses, institutions, and industry	food containers, packaging, food wastes, and paper products
Yard waste	biomass materials from general outdoor maintenance	leaves, grass clippings, tree trimmings and brush, often seasonal
Household hazardous waste (HHW)	hazardous materials generated by households	cleaning products, pesticides, herbicides; used automotive products (e.g. motor oil, brake fluid, antifreeze); paint
Recyclables	materials that can be reprocessed for manufacture into new products	paper, newsprint, ferrous metals, plastic, glass containers, aluminum cans, motor oil & tires
Construction and demolition (C&D)	debris from demolition or construction of buildings, roads, other structures	concrete, brick, wood, masonry, roofing materials, sheetrock, plaster, metals and tree stumps

This mixed stream of MSWTS fluff presents a challenge for most clean energy extraction processes. The W2E technologies were created to overcome this challenge. The energy is easily, efficiently extracted from the combination wastes via this environmentally sound methodology. It is then processed further to electricity, CHP, or steam as needed, to meet local energy demands. Options for the final selection of this energy source include the conversion to hydrogen, ammonia, and Fischer-Tropsch liquids, which is determined by the local energy demand.

Because of the proximity of MSWTS to population centers, they offer ideal locations for distributed renewable and alternative energy generation, including hydrogen production and dispensing. As the use of hydrogen moves into the mainstream, hydrogen vehicles, including on-the-road and off-the-road vehicles will be able to procure the renewable fuel produced from the waste at the local AEC. W2E solutions for energy from MSW at the MSWTS include the production of steam or electricity, hydrogen, or ammonia for energy and/or fertilizer use, either individually or in almost any combination

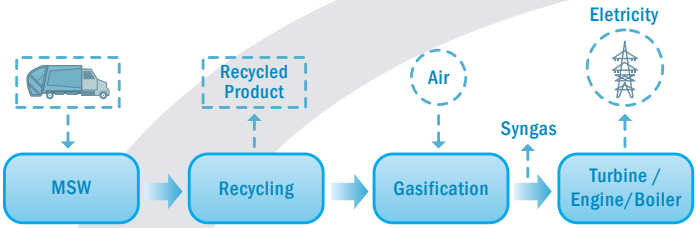


Potential of Energy Products generated from 100 Tons/day of MSW delivered at the Transfer Station

ENERGY FORM	MSW PROCESSED	ENERGY PRODUCT GENERATED
Steam	100 Tons/Day	23 Tons/Hr
Electricity	100 Tons/Day	5 MW (Gross)
Hydrogen	100 Tons/Day	6000 kg/day
Ammonia	100 Tons/Day	35 Tons/day

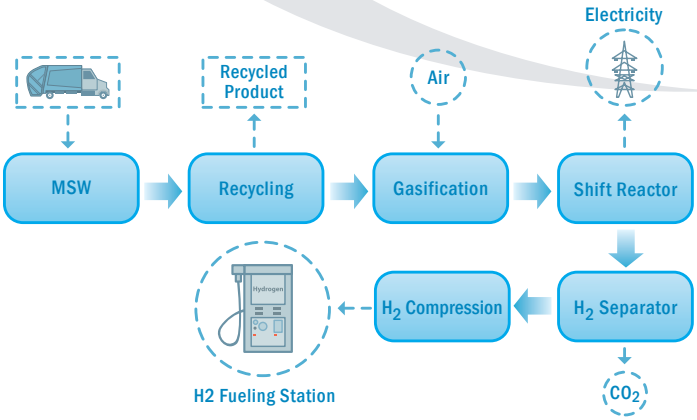
PRODUCTION OF ELECTRICITY

For the production of electricity, the solid MSW fluff is reacted with air under substoichiometric conditions to produce clean fuel gas – a process known as gasification. This clean fuel – often called syngas - is then utilized either in a gas engine, a gas turbine, or in a steam boiler to produce electricity and/or steam.



PRODUCTION OF HYDROGEN

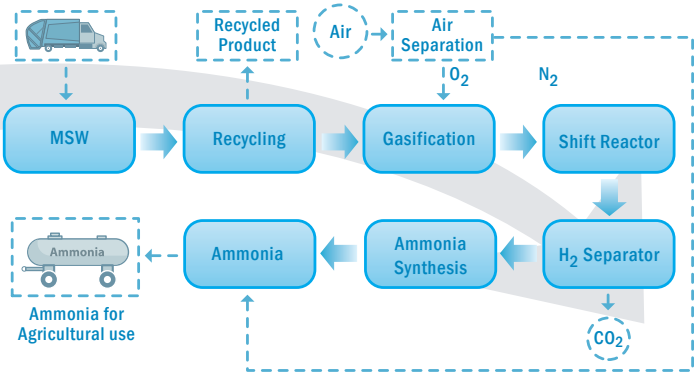
For the production of hydrogen, the solid MSW fluff is reacted with air under substoichiometric conditions to produce clean fuel gas – the gasification process. The clean fuel gas, or syngas, contains CO, H_2, CO_2, H_2O, and N_2. After adding more water to it, this gas is further reacted in a "shift reactor". In a shift reactor, CO is shifted to H_2 and CO_2. The hydrogen component is then separated from the gas mixture by using a pressure swing absorption (PSA) unit to yield pure hydrogen. This pure hydrogen can then be compressed for use in a hydrogen fueling station.



AMMONIA PRODUCTION

For the production of ammonia, the solid MSW fluff is reacted with oxygen under substoichiometric conditions to produce clean fuel gas – the gasification process as above, but using the oxygen instead of air, reserving the N_2 separately for the ammonia synthesis.

The process begins by separating the air into O_2 and N_2. The O_2 is used for the gasification process and the subsequent production of a pure stream of compressed hydrogen. Nitrogen and hydrogen are subsequently brought together for the production of ammonia in the ammonia synthesis reactor.



ECONOMICS

Case studies indicate that a MSWTS changing over to a W2E system to become an AEC realize a simple payback in less than 3 years. The MSWTS owner can also generate additional revenues by increasing the volume of material handled on the same site, by adding the system to the present operations.

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