

Proposed Orange County Sanitation District

Energy Independence Policy

Summary Policy Statement

The Orange County Sanitation District (Sanitation District) will strive to be a net energy exporter. Electrical, thermal, and methane gas generation will be maximized. Energy utilization will be minimized using sound engineering and financial principles.

Background

The Orange County Sanitation District (Sanitation District) is a regional governmental agency principally chartered to protect the public health through collection and treatment of wastewater. The governing Board of Directors has defined this role to include the recovery and utilization of resources from wastewater for the public good as a part of that mission. The environmental impact mitigation of the human activity of 2.6 million people and the natural drainage of the 471 square miles the Sanitation District serves is our principal concern.

Environmental impacts can be broadly separated into impacts to land, air, and water. The Sanitation District owns and operates facilities that are capable of shifting the impacts of this human activity between land, air, and water through the use of natural processes and energy. For example, as a water focused utility, the Sanitation District seeks to produce the cleanest water possible to minimize the impacts of human activity on waterways and the ocean, as well as to renew freshwater resources for further domestic and commercial use. A natural result of cleaning this water is the separation and concentration of constituent solid and gaseous materials. These solid and gaseous products will impact land and air. The balance of impact on land, air, and water are shifted by application or creation of energy through chemical, biological, or thermal conversion technics.

The Sanitation District is also committed to be a good neighbor. As such, significant amounts of energy are spent capturing and converting odorous air and vapor streams. The Sanitation District has pursued a comprehensive program to cover and seal its liquid and solid processes. Air streams are ducted to large fans which move thousands of cubic feet of foul air per minute through chemical, biological, and activated carbon beds to scrub the air of odorants that are regulated or may be perceived as a nuisance by the community.

The Sanitation District has utilized an anaerobic digestion process that relies on biological conversion of solid organic material to methane and carbon dioxide gas. The methane is converted to electrical and heat energy in power plants for internal use. The Sanitation District's secondary treatment system is another example of using energy to convert water impacts to air emissions. Approximately 23% of the Sanitation District's energy usage within the treatment process is devoted to aerating water so biological agents can convert soluble organic material to nitrogen and carbon dioxide. The generation of energy itself creates an impact on the environment in air and thermal emissions.

Current Situation

The potential exists to further shift environmental impacts between land, air, and water through the utilization of energy. The Sanitation District is an environmental steward that seeks to balance and minimize overall impact by efficiently utilizing the energy inputs to its processes and maximizing the harvesting of energy available in the incoming wastewater.

On the energy use side of the ledger, the Sanitation District invests prudently in lifecycle energy efficiency to minimize the use of energy to achieve its mission. Pumping systems to lift water and move material are premium efficiency. Thermal energy is harvested from power production for use in the process and to heat and cool occupied buildings. Aeration compressors and diffusers are selected by overall efficiency. Lighting systems are upgraded over time to more efficient technologies and lighting levels are balanced between safety and security needs versus energy utilization and light pollution concerns. Facility designers and operators make careful choices regarding the utilization of every watt of electricity, BTU of heat, and therm of gas consumed.

On the energy generation side of the ledger, the Sanitation District seeks to maximize the internal creation of energy. The primary source of energy creation is in digester gas, also called biogas, which is mostly methane. Organic solids collected and concentrated in the water treatment processes are converted biologically to biogas composed of 65% methane, 34% carbon dioxide, and other trace constituents. The Sanitation District has been using this technology since the 1950s. Research has been ongoing since that time to maximize the production of digester gas. Some of the areas of research include improved mixing and heating; improved feeding; chemical addition to limit trace pollutant production; introduction of food waste; injection of fats, oils, and grease; and cell lysing.

The Sanitation District cleans the biogas and converts this biogas into electricity, heat, and exhaust gas. The exhaust gas is regulated ever more tightly for nitrogen compounds, carbon monoxide, particulates, and volatile organic compounds which require costly and performance degrading engine control technologies. This is another example of an air impact/energy trade off. These internal systems of energy harvesting provide roughly 66% of the Sanitation District's electrical demand and 92% of the Sanitation District's thermal demand in the treatment plants. The Sanitation District can shift the digester gas between treatment plants via an interplant pipeline and has roughly 8 MW of additional generation capacity if more gas is produced.

In addition, the Sanitation District is installing electrical battery storage capacity. This system is primarily in place to lower operating cost by importing electricity for charging during low-cost nighttime hours and discharging that energy for process use during peak-cost hours. The slight energy loss due to system inefficiencies is outweighed by the cost savings and benefit to the region by lowering the peak demand of the Sanitation District by up to five megawatts.

Future Policy Statement

The Sanitation District seeks to be energy independent by self-generating all the electrical and thermal energy necessary to sustain its operations. This will be accomplished by economically minimizing its utilization requirements and maximizing energy harvested from the wastewater it receives. The Sanitation District will also study and use photovoltaic cells in non-process areas where it makes economic sense. Energy independence will improve the Sanitation District's environmental impact and improve its operational reliability and resiliency.

When the Sanitation District has achieved energy independence, it will seek to make excess biogenic or green energy available to external users via gas sales, the power grid exports, or transportation fuels. The State of California has set goals for renewable energy utilization for electrical production and hydrogen transportation fuels. The Sanitation District's biogas is viewed favorably in these industries to meet the State of California targets. The Sanitation District is working very diligently and creatively to maximize the production of gas and reduce its own energy needs, but energy independence is the first goal which has not yet been met.

Staff recommends that innovative research continue to maximize energy harvesting and to minimize energy inputs first to make the Sanitation District energy independent in the most basic mission of protecting the public health and the environment. Once this has been achieved, excess energy can be made available for meeting the State of California's goals for the electrical grid and transportation fuels.

Initiatives to Support Progress Toward the Policy Goal:

Initiative: Maximize the anaerobic digestion conversion of organics to methane through receipt of food waste and operational techniques.

Initiative: Investigate and install energy storage and photovoltaic systems where practical to achieve energy independence/resilience.

Initiative: Continue to support the conversion of biomethane into electricity and heat for process use. Improve systems as necessary to comply with air regulations.