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1. Overview

1.1 Organization of User Manual

This User Manual accompanies Version 3.1 of the OrganEcs Tool, which has two separate editions: an Anaerobic Digestion Edition and a Compost Edition. OrganEcs was developed by the U.S. Environmental Protection Agency under the auspices of the Global Methane Initiative and in support of the Climate and Clean Air Coalition.

OrganEcs is a tool for estimating the costs associated with organic waste management projects. It provides planning-level assistance to local governments, waste professionals, policymakers, facility operators, and project developers to help them make financial decisions about their potential organic projects. Specifically, the tool assists users in determining the expected Internal Rate of Return (IRR) given user inputs for a composting project or an anaerobic digestion project. Model outputs should be viewed as preliminary results that can be used for planning purposes. These estimates should be verified through detailed feasibility studies prior to project development, or through the solicitation of bids from qualified firms.

This manual contains:

* An overview of the tool, its design, and important terminology (Section 1),
* Detailed documentation on how to use the Anaerobic Digestion edition and interpret results (Section 2),
* Detailed documentation on how to use the Compost edition and interpret results (Section 3),
* Explanation of the tool’s assumptions, methodology, and limitations (Section 4), and
* A list of sources uses to develop this user manual (Section 5)

1.2 Organization of Spreadsheet Tools

OrganEcs tabs are categorized in six sections (outline below). The four browntabs provide instructions. Users are required to enter data in all three blue tabs. The yellow tab contains default values, which users may choose to use or alter. The black tab summarizes and visualizes the tool's outputs. The two gray tabs show the hypothetical project’s estimated annual Income Statement and Balance Sheet, which is used to determine the IRR. Finally, the two green tabs contain assumptions and references.

|  |  |
| --- | --- |
| **Anaerobic Digestion Edition** | **Compost Edition** |
| **Basic Tool Information**  1. Title  2. Contents  3. Background  4. Instructions | **Basic Tool Information**  1. Title  2. Contents  3. Background  4. Instructions |
| **Data Inputs**  5. Facility Inputs  6. Waste Inputs  7. Economic Inputs | **Data Inputs**  5. Facility Inputs  6. Waste Inputs  7. Economic Inputs |
| **Default Values**  8. Default Values | **Default Values**  8. Default Values |
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| **Organic Waste Treatment Technologies**  10. Wet AD  11. Dry AD | **Organic Waste Treatment Technologies**  10. Compost W.O. FA  11. Compost With FA |
| **Additional Information**  12. Tool Assumptions  13. Sources | **Additional Information**  12. Tool Assumptions  13. Sources |

1.3 Entering Data

When you open the tool, you will be prompted to enable the tool’s macros. You must enable macros for the tool to function correctly. You will either be prompted with a popup upon opening the tool, or a yellow warning bar will appear at the top of the program asking you to “Enable Content.” If you did not choose to enable macros, close the tool and reopen it, and you will have the option again to enable macros.

Enter data for your hypothetical project into all **blue** (█) input cells. Cell color will change to a lighter shade of blue once you enter data.

**Yellow** (█) cells are default values that are automatically provided. You can change these values if you have local data available. You can reset any user-entered data to original default values by clicking on the “Reset Default Values” buttons provided on each data input page.

The light **gray** (█) cells, except for those in columns labeled “source” or “notes,” contain calculated values that cannot be edited.

Some cells have an automatic validity check. If you enter an incorrect value or make an invalid selection, the cell will turn **red**, and an error message will appear. Please correct the error before continuing.

Specific instructions for entering data into each tab can be found in the sections below.

1.4 Definitions

The following defined terminology appears in the OrganEcs tool. The first section contains a list of concepts related to organic waste management. The second section includes definitions for financial terms.

1.1.1 Organics Waste Management Terms

**Bulking Agent**: A carbon-based material (e.g., yard trimmings, wood chips, paper goods) added to a compost system to provide structural support and prevent the settlement and compaction of the waste.

**Combined Heat and Power (CHP)**: The concurrent production of electricity or mechanical power and useful thermal energy from a single source of energy.

**Compost With Forced Aeration (Compost with FA)**: A method of composting where organic waste is mixed in a large pile and layers of loosely piled bulking agents (e.g., wood chips, shredded newspaper) are added so that air can pass from the bottom to the top of the pile. The piles may also be placed over a network of pipes that force air into or draw air out of the pile.

**Compost Without Forced Aeration (Compost W.O. FA)**: A method of composting where organic waste is fed into a drum, silo, or trench, and then mechanically turned or mixed to ensure the material is aerated.

**Dewatering**: The part of the wastewater treatment process to remove unwanted moisture whereby sludges are reduced in volume and converted from a liquid to a solid product.

**Dry Anaerobic Digestion (Dry AD)**: Dry anaerobic digester systems are designed to process feedstock with greater than 15 percent total solid content. Feedstocks for a dry digester are often described as stackable.

**Wet Anaerobic Digestion (Wet AD)**: Wet anaerobic digester systems are designed to process feedstock with less than 15 percent total solid content. Feedstocks for a wet digester are typically in slurry form.

1.1.2 Financial Terms

**Ancillary Costs**: Any cost or expense involved in a transaction but not directly related to it.

**Capital Cost Contingency**: The amount that is included in a project budget to represent uncertainty.

**Capital Expenditure (Capex)**: The funds used by a company to acquire, upgrade, and maintain physical assets such as property, plants, buildings, technology, or equipment.

**Depreciation**: An accounting method of allocating the cost of a tangible or physical asset over its useful life or life expectancy. Depreciation represents how much of an asset’s value has been used up.

**Earnings Before Interest and Taxes (EBIT)**: A company’s net income before income tax expense and interest expenses are deducted. Also referred to as operating income or operating profit, EBIT is used to analyze the performance of a company’s core operations without the costs of the capital structure and tax expenses impacting profit.

EBIT = Revenue – Cost of Goods Sold – Operating Expenses

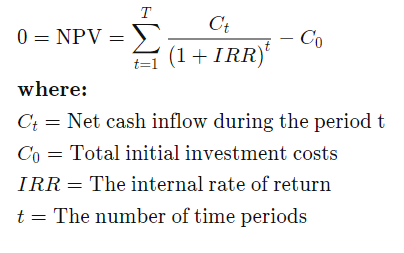
**Earnings Before Interest, Taxes, and Depreciation, and Amortization (EBITDA)**: A metric of corporate profitability which excludes the expenses associated with debt by adding back interest expense and taxes to earnings. EBITDA shows earnings before the influence of accounting and financial deductions.

EBITDA = Operating Profit + Depreciation Expense + Amortization Expense

**Earnings Before Interest After Taxes (EBIAT)**: A way to measure a company’s ability to generate income from its operations for the period being examined while considering taxes. By eliminating elements that can potentially boost or reduce financial strength (i.e., tax benefits), EBIAT provides an accurate picture of a company’s finances. EBIAT reveals how much cash a company has available to pay its debt obligations.

EBIAT = EBIT x (1 – Tax Rate)

**Equity Payback**: The amount of time it takes to recover the cost of an equity investment.

**Gate Fee**: Also known as a tipping fee, a gate fee is the charge levied upon a given quantity of waste received at a waste processing facility.

**Internal Rate of Return (IRR)**: The annual rate of growth that an investment is expected to generate. IRR is used to estimate the profitability of potential investments. IRR can be calculated by setting the net present value (NPV) equal to zero.

**Equity Internal Rate of Return (Equity IRR)**: Also known as levered IRR, equity IRR accounts for debt financing when calculating the return on investments. If the financing structure or interest rate changes, equity IRR will change as well.

**Project Internal Rate of Return (Project IRR)**: Also known as unlevered IRR, project IRR does not take account for the financing structure when calculating the return on investments. This calculation does not take debt capital into account and instead assumes 100 percent equity financing.

**Principal Payment**: A payment toward the original amount of a loan balance.

**Operations and Maintenance (O&M)**: The functions, duties, and labor associated with the daily operations and normal repairs, replacement of parts and structural components, and other activities needed for a facility to continue providing acceptable services.

**Tenor**: The length of time remaining before a financial contract expires.

**Total Debt Service**: The debt obligations due in the coming year. On a balance sheet, total debt service will include short-term debt and the current portion of long-term debt.

**Value-Added Tax (VAT)**: A consumption tax that is placed on a product whenever value is added at each stage of the supply chain. Also known as a goods and services tax.

2. OrganEcs Anaerobic Digestion: Tab-by-Tab Guide

2.1 Basic Tool Information (Brown Tabs)

2.1.1 Cover

The Cover tab includes attribution and contact information.

2.1.2 Title

The Title tab includes the full title, acknowledgements, and disclaimer, as well as a recommended citation for the tool.

2.1.3 Contents

The Contents tab has the names of all tabs in the OrganEcs tool color-coded and listed as hyperlinks to easily navigate to any tabs.

2.1.4 Background

The Background tab briefly describes the purpose of the OrganEcs tool.

2.1.5 Instructions

The Instructions tab provides an overview of the model organization and describes what a user must do to complete a OrganEcs run. You can also find a list of tool limitations and assumptions.

2.2 Data Inputs (Blue Tabs)

2.2.1 Facility Inputs

This tab collects information about the design, construction, and operation parameters for your proposed facility.

#### Technology Selection

Select “Yes” in the dropdown list for the waste treatment technologies you are interested in developing or comparing. If you do not want to include the technology, select “No.”

#### Facility Operations

Enter the year construction will begin on the facility and the estimated time period for construction in the “Investment Year” and “Construction Period” fields (cells E14 and E15, respectively). The gray cell will auto-populate the “Operations Start Year” based on the information entered into the blue cells. Fill in the average round-trip distances in kilometers from the proposed facility to surrounding waste generators and landfills in rows 21 to 23.

#### Facility Design

Enter the percentage of capital expenditures invested into waste treatment equipment that are subject to VAT. In the “Ancillary Costs” field in row 28, enter the total costs and expenses incurred from operating the equipment.

If your facility will use wet anaerobic digestion treatment technology, indicate whether you intend to use wastewater treatment infrastructure on site using the dropdown menu in row 29. Selecting “Yes” will include the costs for wastewater treatment infrastructure and exclude operating costs associated with offsite wastewater management.

2.2.2 Waste Inputs

This tab collects information about the availability and characteristics of the waste feedstock you intend to send to the facility.

#### Feedstock Availability Bulking Agent

Enter the amount of waste in tonnes that will be sent to the facility per year for each waste type in the blue cells in row 20 (“Yard Waste” through “Purchased Bulking Agent”). The total feedstock availability, which excludes the purchased bulking agent, will be calculated based on the inputted values (cell L20).

The yellow cells in this table contain default feedstock characteristics, derived from the literature. You may choose to replace these values with facility-specific data, if available.

Based on the values entered for each waste category, the tool will calculate the carbon to nitrogen (C:N) ratio for the waste, as well as the moisture percentage and the percent of volatile solids.

#### Total Incoming Feedback

The feedstock availability value in cell E38 will automatically auto-populate and does not need to be modified. In cell E39, enter the absolute maximum capacity of waste that the facility can process as a percentage of the feedstock availability.

The yellow cells in the table labeled “Energy & Gas Yields” can also be altered using data specific to the facility. The gray cells in this table will automatically auto-populate and should not be modified.

2.2.3 Economic Inputs

This tab collects information about the project costs and revenues. Prices should be entered in the current year and in United States Dollars (USD).

#### Project Costs

Fill in project-specific costs for labor, facility operations, energy purchases, land purchases or leases, site development and equipment costs, and end-product application and transport costs.

For the labor cost per person (cells E18 and E19), enter the cost of employing one manager or one operator and number of employees in cells E20 and E21. The model will calculate the total labor costs required in tabs 10 and 11. The labor cost should include the base pay and any benefits provided.

In the section of the table labeled “Facility Operations,” you only need to fill in the “Process Water Purchase Price” field in cell E23 if you plan to pursue a wet anaerobic digestion project. Similarly, the “Wastewater Treatment Cost” field in cell E24 is only required for wet anaerobic digestion projects that will not treat wastewater on site.

#### Project Revenues

Fill in the revenues that result from your facility operations and sellable end products, site-specific values for inflation and taxes, and information about your project’s financing.

In the Facility Operations section of the table, the gate fees represent the per tonne fee that your facility will charge for each component of the organic waste stream. The “Avoided Landfill Disposal Fee” in cell K23 should only be filled in if you would like to include the savings from avoided landfill disposal in your business plan. To compare the costs of technologies, leave this value as 0.

For the “Transportation Fee” in cell K25, input the cost of transporting one ton of waste one kilometer. The transportation fee should take into consideration the cost of fuel, the fuel efficiency of the collection vehicle, and the collection vehicles capacity in tons.

In the “Construction Cost Factor” and “Equipment Cost Factor” fields (cells K39 and K40), enter 1 if the equipment costs are equal to those in the United States and Europe. For example, if the equipment costs are 25 percent of those in the United States and Europe, enter 0.25. The “Inflation Rate – General” in cell K41 applies to labor, water, maintenance, land application, and lease cost. The “Inflation Rate – Disposal Fee, Gate Fee” in cell K42 applies to the avoided landfill disposal cost and facility processing fee.

The model automatically estimates the Equity IRR. If you would like to estimate the Project IRR, please set the “Percent Equity” in cell K55 to 100 percent and the “Percent Debt” in cell K54 equal to 0 percent.

For the dropdown menu in cell K64, choose “Yes” or “No” depending on whether your project will use debt/equity to finance the purchase of new equipment. If you select “Yes,” equipment is financed under the same debt/equity, tenor, and interest rate assumptions as the original short-term debt. Select “No” if equipment is purchased outright with available free cash flow.

2.3 Default Values (Yellow Tab)

The Default Values tab displays the data used for all the calculations in the OrganEcs tool. It also notes the sources for each data point. You may either use the default data or enter data from locally operating facilities or vendor proposals in the yellow tabs. If you enter your own data but wish to return to the default values, click the “Reset Default Values” button to the right of the table.

The Facility Operations section of the table includes information on the number of operating days per year, the land requirement, and electricity and fuel demand for a proposed facility. It also includes specific information about the anaerobic digestion process, including primary and final screening residues as a percentage of incoming feedstock and requirements for processing water and treating wastewater. For wet anaerobic digestion, there are rows breaking down the composition of the digestate produced.

Under the Digestion System Capex section, the only value that can be altered is the “Capital Cost Contingency” in row 36.

The All Systems O&M section of the table contains specific information about the operation and maintenance costs. The maintenance and insurance costs are represented as percentages of the total capital expenditure. There is a row for outside services or supplies and for cost contingency, which are represented as percentages of the operation and maintenance cost.

2.4 Outputs (Black Tab)

This tab presents basic information about your project based on the values inputted in earlier tabs.

The table on the left calculates outputs from the first year of operations for wet anaerobic digestion projects. The table on the right calculates outputs from the first year of operations for dry anaerobic digestion projects. All cells will auto-populate based on your inputs and do not need to be altered.

Beneath both tables are two graphs visualizing the projected revenues, expenses, and gross profit over time. The bar chart compares the total revenues and total expenses per year. The line graph represents the project’s gross profit over time.

2.5 Organic Waste Treatment Technologies (Gray Tabs)

There are two gray tabs: one for wet anaerobic digestion projects and another for dry anaerobic digestion projects. Both sheets show a hypothetical project’s estimated annual Income Statement and Balance Sheet, which is used to determine the IRR. The IRR is the rate that the modeled project’s cash flows break even with initial investment. IRR is determined by setting the net present value of all cash flows (both positive and negative) from the investment equal to zero. Note that this model estimates Equity IRR.

The sheet is organized by first listing important assumptions based on user inputs from tabs “5-Faculty Inputs,” “6-Waste Inputs,” “7-Economic Inputs,” and “8-Default Values.” Below this are estimated project costs and revenues, debt schedules, interest, depreciation, and other important information.

These tabs calculate various measures of cash flow, profit, debt payments, and expenses following generally accepted accounting methodologies and standards. The grey tabs show to the user estimated consolidated project profit and loss, depreciation, operating cash flow, and loan payments over the project’s lifespan.

2.6 Additional Information (Green Tabs)

2.6.1 Tool Assumptions

The Tool Assumptions tab displays all fixed parameter values for all calculations in the OrganEcs tool.

2.6.2 Sources

The Sources tab lists call data sources used to create the OrganEcs tool with one citation per row.

3. OrganEcs Compost Edition: Tab-by-Tab Guide

3.1 Basic Tool Information (Brown Tabs)

3.1.1 Cover

The Cover tab includes attribution and contact information.

3.1.2 Title

The Title tab includes the full title, acknowledgements, and disclaimer, as well as a recommended citation for the tool.

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The Background tab briefly describes the purpose of the OrganEcs tool.

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The Instructions tab provides an overview of the model organization and describes what a user must do to complete a OrganEcs run. You can also find a list of tool limitations and assumptions.

3.2 Data Inputs (Blue Tabs)

3.2.1 Facility Inputs

This tab collects information about the design, construction, and operation parameters for your facility.

#### Technology Selection

Select “Yes” in the dropdown list for the waste treatment technologies you are interested in developing or comparing. If you do not want to include the technology, select “No.”

#### Facility Operations

Enter the year construction will begin on the facility and the estimated time period for construction in the “Investment Year” and “Construction Period” fields (rows 14 and 15). The gray cells will auto-populate based on the information entered into the blue cells. Fill in the average round-trip distances in kilometers from the proposed facility to surrounding waste generators and landfills in rows 21 to 23.

#### Facility Design

For the peak throughput operating year of the facility and the percentage of compost the facility intends to sell each year, OrganEcs provides default values that a user can either choose to use or alter based on available information.

Enter the percentage of capital expenditures invested into waste treatment equipment that are subject to value-added taxation (VAT). In the “Ancillary Costs” field in row 28, enter the total costs and expenses incurred from operating the equipment.

3.2.2 Waste Inputs

This tab collects information about the availability and characteristics of the waste feedstock you intend to send to the facility.

#### Feedstock Availability Bulking Agent

Enter the amount of waste that will be sent to the facility per year for each waste type in the blue cells in row 20 (“Yard Waste” through “Purchased Bulking Agent for Compost”). Note that composting without forced aeration requires either 100 percent yard waste or a mix of yard waste, food waste, manure, and sludge that is at least 60 percent yard waste. The total feedstock availability, which excludes the purchased bulking agent, will be calculated based on the inputted values (cell L20).

The yellow cells in this table contain default feedstock characteristics, derived from the literature. You may choose to replace these values with facility-specific data, if available.

Based on the values entered for each waste category, the tool will calculate the carbon to nitrogen (C:N) ratio for the waste, as well as the moisture percentage and the percent of volatile solids.

#### Total Incoming Feedback

Enter the growth rate of waste as a percentage in cell E40. The model assumes the facility will have the capacity to process the amount of waste generated by the site three years from now, which is determined by the inputted growth rate. If you do not want the facility to grow in capacity, change the “Peak Throughput Operating Year” field in the Facility Inputs tab.

3.2.3 Economic Inputs

This tab collects information about the project costs and revenues. Prices should be entered in the current year and in USD.

#### Project Costs

Fill in project-specific costs for labor, facility operations, energy purchases, land purchases or leases, and site development and equipment costs.

For the labor cost per person (cells E12 and E13), enter the cost of employing one manager or one operator and the number of each type of employee in E14 and E15. The model will calculate the total labor costs required in tabs 10 and 11. The labor cost should include the base pay and any benefits provided.

#### Project Revenues

Fill in the inputs to calculate the revenues that stem from your facility operations and sellable end products, site-specific values for inflation and taxes, and information about your project’s financing.

In the Facility Operations section of the table, the gate fees represent the per ton fee that your facility will charge for each component of the organic waste stream. The “Avoided Landfill Disposal Fee” in cell K17 should only be filled in if you would like to include the savings from avoided landfill disposal in your business plan. In order to compare the costs of technologies, leave this value as 0. For the “Transportation Fee” in cell K19, input the cost of transporting one ton of waste one kilometer. The transportation fee should take into consideration the cost of fuel, the fuel efficiency of the collection vehicle, and the collection vehicles capacity in tons.

The “Inflation Rate – General” in cell K24 applies to labor, water, maintenance, land application, and lease cost. The “Inflation Rate – Disposal Fee, Gate Fee” in cell K25 applies to the avoided landfill disposal cost and facility processing fee.

The Financing section of the table includes default values for the depreciation life of composting equipment and infrastructure (cell K33 and cell K34). If you choose to alter these cells, you must select a value that is between 5 and 20 years. Cell K35 represents the desired IRR on the equity portion of the investment. If you would like your project to break even, you must set the value to a minimum of 0.15 percent in order for the model to return values. Similarly, you must enter a minimum value of 1 for the “Equity Payback” in cell K36 for the model to return values.

The model automatically estimates the Equity IRR. If you would like to estimate the Project IRR, please set the “Percent Equity” in cell K39 to 100 percent and the “Percent Debt” in cell K38 equal to 0 percent.

For the dropdown menu in cell K48, choose “Yes” or “No” depending on whether your project will use debt/equity to finance the purchase of new composing equipment. If you select “Yes,” equipment is financed under the same debt/equity, tenor, and interest rate assumptions as the original short-term debt. Select “No” if equipment is purchased outright with available free cash flow.

3.3 Default Values (Yellow Tab)

The Default Values tab displays the data used for all the calculations in the OrganEcs tool. It also notes the sources for each data point. You may either use the default data or enter data from locally operating facilities or vendor proposals in the yellow tabs.

The Facility Operations section of the table includes information on the number of operating days per year, the land requirement, and electricity and fuel demand for a proposed facility. It also includes specific information about the anaerobic digestion process, including primary and final screening residues and compost production as a percentage of incoming feedstock.

Under the Digestion System Capex section, the only value that can be altered is the “Capital Cost Contingency” in row 26.

The All Systems O&M section of the table contains specific information about the operation and maintenance costs. The maintenance and insurance costs are represented as percentages of the total capital expenditure. There is a row for outside services or supplies and for cost contingency, which are represented as percentages of the operation and maintenance cost.

3.4 Outputs (Black Tab)

This tab presents basic information about your project based on the values inputted in earlier tabs.

The table on the left calculates outputs from the first year of operations for projects that will use composting without forced aeration. The table on the right calculates outputs from the first year of operations for projects that will use composting with forced aeration. All cells will auto-populate based on your inputs and do not need to be altered.

Beneath both tables, there are two graphs visualizing the projected revenues, expenses, and gross profit over time. The bar chart compares the total revenues and total expenses per year. The line graph represents the project’s gross profit over time.

3.5 Organic Waste Treatment Technologies (Gray Tabs)

There are two gray tabs: one for projects that use composting without forced aeration and another for projects that use composting with forced aeration. Both sheets show a hypothetical project’s estimated annual Income Statement and Balance Sheet, which is used to determine the IRR. The IRR is the rate that the modeled project’s cash flows break even with initial investment. IRR is determined by setting the net present value of all cash flows (both positive and negative) from the investment equal to zero. Note that this model estimates Equity IRR. To estimate Project IRR, please set total debt on the “7-Economic Inputs” tab equal to zero.

The sheet is organized by first listing important assumptions based on user inputs from tabs “5-Faculty Inputs,” “6-Waste Inputs,” “7-Economic Inputs,” and “8-Default Values.” Below this are estimated project costs and revenues, debt schedules, interest, depreciation, and other important information.

These tabs calculate various measures of cash flow, profit, debt payments, and expenses following generally accepted accounting methodologies and standards. The grey tabs show to the user estimated consolidated project profit and loss, depreciation, operating cash flow, and loan payments over the project’s lifespan.

3.6 Additional Information (Green Tabs)

3.6.1 Tool Assumptions

The Tool Assumptions tab displays all fixed parameter values for all calculations in the OrganEcs tool. It also notes the sources for each assumption value.

3.6.2 Sources

The Sources tab lists call data sources used to create the OrganEcs tool with one citation per row.

4. Limitations

4.1 Anaerobic Digestion Edition: Limitations

First, cost estimates are for source-separated organic feedstocks and thus do not include pre-sorting costs or revenues associated with an upstream materials recovery facility. Additional costs associated with establishing source-separated collection are not considered.

Facility performance (e.g., electricity and compost production, water demand, wastewater generation, equipment lifespan, and operating days/year) is based on published data for typical facilities and will vary based on a number of factors, including but not limited to, O&M practices, feedstock characteristics, selected technology, and climate.

4.2 Compost Edition: Limitations

Facility performance (e.g., electricity and compost production, water demand, wastewater generation, equipment lifespan, operating days/year) is based on published data for typical facilities and will vary based on a number of factors, including, but not limited to, O&M practices, feedstock characteristics, selected technology, and climate.

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