Manufacturing Energy and Carbon Footprint
Sector: All Manufacturing (NAICS 31-33)

Primary Energy Use: 19,663 TBtu
Total GHG Emissions: 1,165 MMT CO₂e

Primary Energy, 2018

<table>
<thead>
<tr>
<th>Energy</th>
<th>Onsite Energy</th>
<th>Offsite Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>344.1</td>
<td>11,589</td>
</tr>
<tr>
<td>Steam</td>
<td>40.5</td>
<td>7,312</td>
</tr>
<tr>
<td>Fuel</td>
<td>11,589</td>
<td>2,591</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy</th>
<th>Process Energy</th>
<th>Nonprocess Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation (excludes 4.2 TBtu renewable, non-combustion electricity output)</td>
<td>238.4</td>
<td>99.5</td>
</tr>
<tr>
<td>Steam Distribution Losses</td>
<td>853</td>
<td>30.2</td>
</tr>
<tr>
<td>Nonprocess Losses</td>
<td>552</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam Generation</td>
<td>198</td>
</tr>
<tr>
<td>Steam Distribution Losses</td>
<td>13</td>
</tr>
<tr>
<td>Electricity Export*</td>
<td>93</td>
</tr>
<tr>
<td>Excess Steam^</td>
<td>13</td>
</tr>
</tbody>
</table>

**Greenhouse Gas (GHG) Emissions**

<table>
<thead>
<tr>
<th>Energy (TBtu = Trillion British Thermal Units)</th>
<th>Greenhouse Gas (GHG) Emissions (MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td></td>
</tr>
<tr>
<td>Losses</td>
<td></td>
</tr>
</tbody>
</table>

**Energy use data source:** 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this [webpage](#).

**Last Revised:** December 2021

**Notes:**
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, onsite, and offsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

**Energy for All Purposes estimated at 24,355 TBtu**
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Energy and Carbon Footprint
Sector: All Manufacturing (NAICS 31-33)

Onsite Energy, 2018

Onsite Energy Use: 14,744 TBtu
Onsite Emissions: 780 MMT CO₂e

Fuel Types
- Natural Gas: 55%
- Byproduct Fuels: 36%
- Coal: 4%
- Distillate and Residual Fuel Oils: < 1%
- HGL (excl. natural gasoline): < 1%
- Other Fuels: 4%

Energy (TBtu = Trillion British Thermal Units)
- Fuel
- Electricity
- Steam
- Combined

Greenhouse Gas (GHG) Emissions
(MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)
- Total
- Onsite
- Process

Energy values and fuel type percentages rounded to nearest whole number

Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output

* Refers to sales and transfers of electricity to utilities and other entities
* Refers to sales and transfers of surplus steam

Feedstock energy excluded

Offsite Combustion Emissions +
Onsite Combustion Emissions +
Process Emissions

Notes:
- Sector-wide aggregate data for year 2018:
- Energy use data source: 2018 EIA MECS (with adjustments); See webpage for details
- Last Revised: December 2021

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
### Fuel and GHG Emissions, 2018

#### Primary Energy Use:
- **19,663 TBtu**
- **Total GHG Emissions:** **1,165 MMT CO$_2$e**

#### Energy Use Data Source:
- 2018 EIA MECS (with adjustments)

#### Process Emissions Data Source:

#### Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

#### Last Revised:
December 2021

---

**Manufacturing Carbon Footprint**

**Sector:** All Manufacturing (NAICS 31-33)

---

**Fuel**
- TBtu = Trillion British Thermal Units

**Greenhouse Gas (GHG) Emissions**
- MMT CO$_2$e - Million Metric Tons Carbon Dioxide Equivalent

---

**Process**
- Combustion
Primary Energy, 2018

Manufacturing Energy and Carbon Footprint
Sector: Alumina and Aluminum (NAICS 3313)

Primary Energy Use: 372 TBtu
Total GHG Emissions: 21 MMT CO₂e

Energy (TBtu = Trillion British Thermal Units)
- Fuel
- Electricity
- Steam
- Combined

Losses

Greenhouse Gas (GHG) Emissions (MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)
- Offsite
- Total
- Onsite

Total Emissions = Offsite Emissions + Onsite (Combustion + Process) Emissions

Table:

| Energy Use | 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage |
| Last Revised: | December 2021 |

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy for All Purposes estimated at 381 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Carbon Footprint
Sector: Alumina and Aluminum (NAICS 3313)

Fuel and GHG Emissions, 2018

Primary Energy Use: 372 TBtu
Total GHG Emissions: 21 MMT CO₂e

Fuel use data source:
2018 EIA MECS (with adjustments)
Process emissions data source:
See webpage for details
Last Revised: December 2021

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Energy and Carbon Footprint
Sector: Cement (NAICS 327310)

**Primary Energy Use:** 367 TBtu
**Total GHG Emissions:** 66 MMT CO₂e

### Primary Energy, 2018

- **Total Energy Use:** 367 TBtu
- **Nonprocess Energy:** 65.8
- **Process Energy:** 60.7
- **Electricity Export:** 0
- **Excess Steam:** 0

**Greenhouse Gas (GHG) Emissions**
- **Total Emissions:** 66 MMT CO₂e
- **Onsite Emissions:** 60.7
- **Offsite Emissions:** 5.2

**Notes:**
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

**Energy use data source:** 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this [webpage](#).

**Last Revised:** December 2021

**Energy for All Purposes estimated at 367 TBtu**
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Onsite Energy Use: 296 TBtu
Onsite Emissions: 61 MMT CO₂e

Manufacturing Energy and Carbon Footprint
Sector: Cement (NAICS 327310)

Onsite Energy, 2018

Process Energy
- Process Heating
  - 19.4 \(\pm\) 18.9
- Process Cooling and Refrigeration
  - 0.7 \(\pm\) 0.5
- Other Process Uses
  - 0.1 \(\pm\) 0.0
- Electro-Chemical
  - 0.1 \(\pm\) 0.0

Nonprocess Energy
- Facility HVAC
  - 0.1 \(\pm\) 0.0
- Other Facility Support
  - 0.0 \(\pm\) 0.0
- Onsite Transportation
  - 0.1 \(\pm\) 0.1
- Other Nonprocess
  - 0.0 \(\pm\) 0.0

Fuel Type
- Coal: 41%
- Petroleum Coke (byproduct f @)
  - 24%
- Natural Gas: 23%
- Waste Oils/Tars and Waste Materials (byproduct fuel)
  - 3%
- Coke and Breeze: <1%
- Distillate Fuel Oil: <1%
- Other Fuels: 8%

Energy
(TBtu = Trillion British Thermal Units)
- Fuel
- Electricity
- Steam
- Combined

Greenhouse Gas (GHG)
Emissions
(MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)

Total Onsite Process

Total Emissions =
- Offsite Combustion Emissions +
- Onsite Combustion Emissions +
- Process Emissions

Onsite Emissions = Onsite Combustion Emissions +
- Process Emissions

Electricity Export* Excess Steam*

Energy use data source:
2018 EIA MECS (with adjustments); See webpage for details
Last Revised: December 2021
Notes:
Sector-wide aggregate data for year 2018; energy values and fuel type percentages rounded to nearest whole number
Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
* Refers to sales and transfers offsite of electricity to utilities and other entities
* Refers to sales and transfers offsite or purging of surplus steam
Feedstock energy excluded

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Primary Energy Use: 4,842 TBtu
Total GHG Emissions: 332 MMT CO₂e

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage

Last Revised: December 2021

Notes: Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
* Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
^ Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy for All Purposes estimated at 8,169 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use
Manufacturing Carbon Footprint
Sector: Chemicals (NAICS 325)

Primary Energy Use: 4,842 TBtu
Total GHG Emissions: 332 MMT CO₂e

Fuel and GHG Emissions, 2018

Offsite Generation
- Electricity Generation
- Steam Generation

Onsite Generation
- Conventional Boilers
- CHP/Cogeneration
- Other Electricity Generation

Process Energy
- Process Heating
- Process Cooling and Refrigeration
- Other Process Uses
- Electro-Chemical
- Machine Drive

Nonprocess Energy
- Facility HVAC
- Facility Lighting
- Other Facility Support
- Onsite Transportation
- Other Nonprocess

Total Greenhouse Gas Emissions: 331.6

Energy use data source: 2018 EIA MECS (with adjustments)
See webpage for details
Last Revised: December 2021

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Energy and Carbon Footprint
Sector: Petrochemicals (NAICS 325110)

Primary Energy Use: 629 TBtu
Total GHG Emissions: 65 MMT CO₂e

Primary Energy, 2018

Offsite Energy

Onsite Energy

Process Energy

Nonprocess Energy

Energy (TBtu = Trillion British Thermal Units)

Greenhouse Gas (GHG) Emissions (MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage.

Last Revised: December 2021

Notes: Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number. Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output. *Electricity export refers to sales and transfers offsite of electricity to utilities and other entities. Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes. ^Excess steam refers to the sales and transfer offsite or purging of surplus steam.

Energy for All Purposes estimated at 1,520 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use.

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Carbon Footprint
Sector: Petrochemicals (NAICS 325110)

Fuel and GHG
Emissions, 2018

Fuel and GHG Emissions, 2018

Primary Energy Use: 629 TBrts
Total GHG Emissions: 65 MMT CO₂e

Energy use data source: 2018 EIA MECS (with adjustments)
Last Revised: December 2021
Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Fuel
(TBrts = Trillion British Thermal Units)

Greenhouse Gas (GHG) Emissions
(MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent)

Combustion

Process
Manufacturing Energy and Carbon Footprint
Sector: Plastics Material and Resins (NAICS 325211)

Primary Energy Use: 809 TBtu
Total GHG Emissions: 43 MMT CO₂e

Primary Energy, 2018

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage.

Last Revised: December 2021

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- ^ Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy for All Purposes estimated at 1,816 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Carbon Footprint
Sector: Plastics Material and Resins (NAICS 325211)

Primary Energy Use: 809 TBoo
Total GHG Emissions: 43 MMT CO₂e

Fuel and GHG Emissions, 2018

- Offsite Generation
  - Electricity Generation
  - Steam Generation

- Onsite Generation
  - Conventional Boilers
  - CHP/ Cogeneration
  - Other Electricity Generation

- Process Energy
  - Process Heating
  - Process Cooling and Refrigeration
  - Other Process Uses
  - Electro-Chemical
  - Machine Drive
    - Pumps, Fans, Compressed Air, Materials Handling, Materials Processing, Other Systems

- Nonprocess Energy
  - Facility HVAC
  - Facility Lighting
  - Other Facility Support
  - Onsite Transportation
  - Other Nonprocess

Energy use data source: 2018 EIA MECS (with adjustments)
See webpage for details
Last Revised: December 2021

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
**Primary Energy, 2018**

- **Offsite Energy**
  - Fuel: 393 TBtu
  - Offsite Generation: 322 TBtu
  - Steam Generation: 15.2 TBtu
  - Generation and Transmission Losses: 208 TBtu

- **Onsite Energy**
  - Onsite Generation (excludes 0.1 TBtu renewable, non-combustion electricity output): 15.1 TBtu
  - Onsite Losses: 19 TBtu
  - Process Energy: 16.0 TBtu
  - Nonprocess Energy: 7.2 TBtu

- **Losses**
  - Combined: 9.1 TBtu

**Energy for All Purposes** estimated at 403 TBtu

Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use.

**Notes**: Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number.

- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output.
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities.
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes.
- Excess steam refers to the sales and transfer of surplus steam or purging of surplus steam.

**Energy use data source**: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this [webpage](#).

**Last Revised**: December 2021
Manufacturing Carbon Footprint
Sector: Computers, Electronics and Electrical Equipment (NAICS 334, 335)

Fuel and GHG Emissions, 2018

Primary Energy Use: 393 TBarrels
Total GHG Emissions: 24 MMT CO₂e

Fuel use data source: 2018 EIA MECS (with adjustments)
See webpage for details
Last Revised: December 2021

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Primary Energy Use:

- **Primary Energy Use:** 127 TBtu
- **Total GHG Emissions:** 6 MMT CO₂e

### Energy for All Purposes

**Energy use data source:** 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit [this webpage](#).

**Last Revised:** December 2021

**Notes:**
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

**Energy for All Purposes estimated at 127 TBtu**

Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

---

**Greenhouse Gas (GHG) Emissions**

*MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent*

- **Total Energy Use:** 127 TBtu
- **Onsite Energy Use:** 5.3 TBtu
- **Process Energy Use:** 3.6 TBtu
- **Nonprocess Energy Use:** 2.0 TBtu
- **Steam Generation:** 0.0 TBtu
- **Electricity Generation:** 5.3 TBtu
- **Steam Distribution Losses:** 1 TBtu
- **Electricity and Steam Generation Losses:** 0.4 TBtu
- **Generation and Transmission Losses:** 73 TBtu

---

**Energy use and losses diagram**

- **Fuel:** 14 TBtu
- **Electricity:** 40 TBtu
- **Steam:** 0 TBtu
- **Combined Losses:** 73 TBtu

- **Process Losses:** 10 TBtu
- **Nonprocess Losses:** 7 TBtu

**Electricity Export**: 0 TBtu

**Excess Steam**: 0 TBtu

---

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Fuel and GHG Emissions, 2018

Manufacturing Carbon Footprint
Sector: Semiconductor and Related Devices (NAICS 334413)

Primary Energy Use: 127 TBtu
Total GHG Emissions: 6 MMT CO₂e

Total Greenhouse Gas Emissions: 6.1

Energy use data source: 2018 EIA MECS (with adjustments)
See webpage for details

Last Revised: December 2021

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Prim 479 479 479 479arty Energy, 2018

<table>
<thead>
<tr>
<th>Energy (TBtu = Trillion British Thermal Units)</th>
<th>Greenhouse Gas (GHG) Emissions (MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td></td>
</tr>
<tr>
<td>Offsite</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Onsite</td>
<td></td>
</tr>
</tbody>
</table>

Total Emissions = Offsite Emissions + Onsite (Combustion + Process) Emissions

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this [webpage](https://www.eia.gov).

Last Revised: December 2021

Notes: Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number

- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, onsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy for All Purposes estimated at 482 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Primary Energy Use: 1,935 TBtu
Total GHG Emissions: 96 MMT CO₂e

**Manufacturing Energy and Carbon Footprint**

**Sector:** Food and Beverage (NAICS 311, 312)

**Primary Energy, 2018**

<table>
<thead>
<tr>
<th>Energy Use</th>
<th>2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this <a href="#">webpage</a>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last Revised</td>
<td>December 2021</td>
</tr>
</tbody>
</table>
| Notes      | Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number

- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

**Greenhouse Gas (GHG) Emissions**

- (MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)

**Energy for All Purposes estimated at 1,952 TBtu**

Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use.
Fuel and GHG Emissions, 2018

Manufacturing Carbon Footprint
Sector: Food and Beverage (NAICS 311, 312)

Primary Energy Use: 1,935 TBtu
Total GHG Emissions: 96 MMT CO₂e

Offsite Generation
- Electricity Generation: 1,024
- Steam Generation: 45

Onsite Generation
- Conventional Boilers: 48.2
- CHP/Cogeneration: 236
- Other Electricity Generation: 2

Process Energy
- Process Heating: 9.6
- Process Cooling and Refrigeration: 17.6
- Other Process Uses: 0.1

Nonprocess Energy
- Facility HVAC: 61
- Facility Lighting: 0
- Other Facility Support: 24
- Onsite Transportation: 3
- Other Nonprocess: 1

Fuel
(TBtu = Trillion British Thermal Units)

Greenhouse Gas (GHG) Emissions
(MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent)

Combustion
Process

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Energy use data source:
2018 EIA MECS (with adjustments)

Process emissions data source:
See webpage for details

Last Revised: December 2021

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Primary Energy, 2018

Onsite Energy
- Onsite Generation (excludes 1.4 TBtu renewable, non-combustion electricity output)
  - Total Emissions = Offsite Emissions + Onsite (Combustion + Process) Emissions
- Onsite Generation Losses: 448
- Process Energy Losses: 863
- Steam Distribution Losses: 260

Offsite Energy
- Fuel: 2,140
- Electricity Generation: 245
- Steam Generation: 40
- Total Emissions = Offsite Emissions + Onsite (Combustion + Process) Emissions

Energy for All Purposes estimated at 2,887 TBtu
Includes primary energy plus net energy consumed for non-fuel purposes, including feedstock use

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy use
- 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage
- Last Revised: December 2021

Manufacturing Energy and Carbon Footprint
Sector: Forest Products (NAICS 321, 322)
Primary Energy Use: 2,883 TBtu
Total GHG Emissions: 80 MMT CO₂e

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Carbon Footprint
Sector: Forest Products (NAICS 321, 322)

Primary Energy Use: 2,883 TBTu
Total GHG Emissions: 80 MMT CO₂e

Fuel and GHG Emissions, 2018

Offsite Generation
- Electricity Generation: 689 MBTu (32.5%)
- Steam Generation: 53 MBTu (2.8%)

Onsite Generation
- Conventional Boilers: 2,855 MBTu (26.1%)
- CHP/Cogeneration: 1,585 MBTu (14.3%)
- Other Electricity Generation: 6 MBTu (0.3%)

Process Energy
- Process Heating: 196 MBTu (9.7%)
- Process Cooling and Refrigeration: 0 MBTu (0.0%)
- Other Process Uses: 15 MBTu (0.9%)
- Electro-Chemical: 0 MBTu (0.0%)
- Machine Drive: 42 MBTu (2.1%)

Nonprocess Energy
- Facility HVAC: 24 MBTu (1.3%)
- Facility Lighting: 0 MBTu (0.0%)
- Other Facility Support: 2 MBTu (0.1%)
- Onsite Transportation: 15 MBTu (1.0%)
- Other Nonprocess: 1 MBTu (0.1%)

Fuel
- Total Primary Energy Use: 2,883 TBTu

Greenhouse Gas (GHG) Emissions
- Total GHG Emissions: 80 MMT CO₂e

Notes:
- Energy use data source: 2018 EIA MECS (with adjustments)
- See webpage for details
- Last Revised: December 2021

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Primary Energy, 2018

**Onsite Generation** (excludes <0.1 TBtu renewable, non-combustion electricity output)

- Total Energy: 7.3 TBtu
- Onsite Energy: 2.4 TBtu
- Offsite Energy: 0.0 TBtu
- Process Energy: 6.0 TBtu
- Nonprocess Energy: 1.3 TBtu

**Energy Use**
- 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this [webpage](#).
- Last Revised: December 2021
- Notes: Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number. Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output. Electricity export refers to sales and transfers offsite of electricity to utilities and other entities. Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes. Excess steam refers to the sales and transfer offsite or purging of surplus steam.

**Greenhouse Gas (GHG) Emissions**
- Total Emissions: 7 MMT CO₂e
- Offsite Emissions: 0.0 MMT CO₂e
- Onsite Emissions: 7.3 MMT CO₂e

**Energy for All Purposes** estimated at 161 TBtu
- Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use.

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Fuel and GHG Emissions, 2018

Emissions, 2
Fuel a
160
Fuel (TBtu = Trillion British Thermal Units)

Greenhouse Gas (GHG) Emissions (MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent)

Combustion
Process

Manufacturing Carbon Footprint
Sector: Foundries (NAICS 3315)

Primary Energy Use: 160 TBtu
Total GHG Emissions: 7 MMT CO₂e

Fuel

Nonprocess Energy

Process Energy

Onsite Generation

Offsite Generation

Conventional Boilers

Process Heating

Electricity Generation

Process Cooling and Refrigeration

CHP/ Cogeneration

Other Process Uses

Other Electricity Generation

Electro-Chemical

Other Nonprocess

Other Facility Support

Onsite Transportation

Facility Lighting

Facility HVAC

Energy use data source:
2018 EIA MECS (with adjustments)

Process emissions data source:
See webpage for details

Last Revised: December 2021

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

See webpage for details

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics

Page 3 of 3
Primary Energy Use: 272 TBtu
Total GHG Emissions: 15 MMT CO₂eq

**Primary Energy, 2018**

**Onsite Energy**
- **Electricity Generation**: 137 TBtu (6.4 MMT CO₂eq)
- **Steam Generation**: 0 TBtu
- **Generation and Transmission Losses**: 87 TBtu

**Offsite Energy**
- **Fuel**: 272 TBtu (135 MMT CO₂eq)
- **Generation and Transmission Losses**: 0 TBtu

**Process Energy**
- **Onsite and Steam Generation Losses**: 2 TBtu
- **Steam Distribution Losses**: 0 TBtu
- **Energy and Steam Generation Losses**: 0 TBtu
- **Energy Export**: 13.5 TBtu (8.1 MMT CO₂eq)
- **Nonprocess Energy**: 1.3 TBtu (0.3 MMT CO₂eq)

**Nonprocess Energy**
- **Electricity Export**: 0 TBtu
- **Excess Steam**: 0 TBtu

**Greenhouse Gas (GHG) Emissions** (MMT CO₂eq = Million Metric Tons Carbon Dioxide Equivalent)
- **Total**: 15.0 MMT CO₂eq
- **Onsite**: 8.6 MMT CO₂eq
- **Offsite**: 6.4 MMT CO₂eq

**Energy Use**
- **Data Source**: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this [webpage](#).
- **Last Revised**: December 2021

**Notes**
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers of electricity to utilities and other entities
- Feedstock energy excluded from primary, onsite, and offsite energy values and included in Energy for All Purposes
- *Excess steam refers to the sales and transfer of excess steam or purging of surplus steam

**Energy for All Purposes**
- Estimated at 274 TBtu
- Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

*Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by [Energetics](#)*
Onsite Energy, 2018

**Onsite Energy Use:** 185 TBtu
**Onsite Emissions:** 9 MMT CO₂e

### Process Energy
- **Process Heating**
  - Total: 126 Btu
  - Onsite: 9.2 Btu
  - Process: 6.7 Btu

- **Process Cooling and Refrigeration**
  - Total: 19 Btu
  - Onsite: 0.6 Btu
  - Process: 0.0 Btu

- **Other Process Uses**
  - Total: 4 Btu
  - Onsite: 0.1 Btu
  - Process: 0.0 Btu

### Machine Drive
- **Pumps**
  - Total: 3 Btu
  - Onsite: 1.7 Btu
  - Process: 0.0 Btu

- **Fans**
  - Total: 6 Btu
  - Onsite: 1.3 Btu
  - Process: 0.0 Btu

- **Compressed Air**
  - Total: 6 Btu
  - Onsite: 0.6 Btu
  - Process: 0.0 Btu

- **Materials Handling**
  - Total: 2 Btu
  - Onsite: 0.0 Btu
  - Process: 0.0 Btu

- **Materials Processing**
  - Total: 3 Btu
  - Onsite: 1.3 Btu
  - Process: 0.0 Btu

### Nonprocess Energy
- **Facility HVAC**
  - Total: 3 Btu
  - Onsite: 0.9 Btu
  - Process: 0.3 Btu

- **Facility Lighting**
  - Total: 4 Btu
  - Onsite: 0.4 Btu
  - Process: 0.0 Btu

- **Other Facility Support**
  - Total: 3 Btu
  - Onsite: 0.0 Btu
  - Process: 0.0 Btu

- **Onsite Transportation**
  - Total: 0 Btu
  - Onsite: 0.0 Btu
  - Process: 0.0 Btu

### Energy Use Data Source:
- 2018 EIA MECS (with adjustments); See webpage for details
- Last Revised: December 2021

### Notes:
- Sector-wide aggregate data for year 2018
- Energy values and fuel type percentages rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- * Refers to sales and transfers of offsite electricity to utilities and other entities
- ** Refers to sales and transfers of offsite or purging of surplus steam
- Feedstock energy excluded
Fuel and GHG Emissions, 2018

Manufacturing Carbon Footprint
Sector: Glass and Glass Products (NAICS 3272, 327993)

Primary Energy Use: 272 TWh
Total GHG Emissions: 15 MMT CO₂e

Nonprocess Energy
- Facility HVAC: 0.3
- Facility Lighting: 0.0
- Other Facility Support: 0.0
- Onsite Transportation: 0.0
- Other Nonprocess: 0.0

Process Energy
- Process Heating: 6.7
- Process Cooling and Refrigeration: 0.0
- Other Process Uses: 0.0
- Electro-Chemical: 0.0
- Machine Drive: 0.2

Onsite Generation
- Conventional Boilers: 0.1
- CHP/ Cogeneration: 0.0
- Other Electricity Generation: 0.0

Offsite Generation
- Electricity Generation: 6.4
- Steam Generation: 0.0

Fuel (TWh = Trillion British Thermal Units)
Greenhouse Gas (GHG) Emissions (MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent)
Combustion
Process

Energy use data source: 2018 EIA MECS (with adjustments)
See webpage for details

Last Revised: December 2021
Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Energy and Carbon Footprint
Sector: Iron and Steel (NAICS 331110, 3312)

Primary Energy, 2018

Primary Energy Use: 1,469 TBtu
Total GHG Emissions: 100 MMT CO₂e
Fuel and GHG Emissions, 2018

Primary Energy Use: 1,469 TBoT
Total GHG Emissions: 100 MMT CO₂e

Fuel (TBoT = Trillion British Thermal Units)
Greenhouse Gas (GHG) Emissions (MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent)

- Offsite Generation
  - Electricity Generation: 28.4
  - Steam Generation: 9
- Onsite Generation
  - Conventional Boilers: 1.0
  - CHP/Cogeneration: 1.7
  - Other Electricity Generation: 0.0
- Process Energy
  - Process Heating: 18.6
  - Process Cooling and Refrigeration: 0.2
  - Other Process Uses: 3.5
  - Electro-Chemical: 0.0
  - Machine Drive: 0.1
- Nonprocess Energy
  - Facility HVAC: 1.0
  - Facility Lighting: 0.0
  - Other Facility Support: 0.1
  - Onsite Transportation: 0.3
  - Other Nonprocess: 0.4

Emission Use Data Source: 2018 EIA MECS (with adjustments)
See webpage for details
Last Revised: December 2021

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Primary Energy, 2018

Offsite Energy

- Fuel 65
- Electricity 80
- Steam 0

Generation and Transmission Losses 154

Electricity Generation 10.6

Onsite Energy

- Onsite Generation (excludes 0.2 TBtu renewable, non-combustion electricity output) 0.7 0.5
- Electric and Steam Generation Losses 3
- Steam Distribution Losses 1

Onsite Energy Total 135

Process Energy

- Process Losses 43
- 8.3 1.5

Nonprocess Energy

- Nonprocess Losses 23
- 5.2 1.6

Energy for All Purposes estimated at 302 TBtu

Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

Greenhouse Gas (GHG) Emissions (MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)

- Offsite
- Total
- Onsite

Total Emissions = Offsite Emissions + Onsite (Combustion + Process) Emissions

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage

Last Revised: December 2021

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Fuel and GHG Emissions, 2018

Primary Energy Use: 299 TBtu
Total GHG Emissions: 14 MMT CO₂e

Energy use data source: 2018 EIA MECS (with adjustments)
See webpage for details

Last Revised: December 2021

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

Manufacturing Carbon Footprint
Sector: Machinery (NAICS 333)

Fuel (TBtu = Trillion British Thermal Units)

Greenhouse Gas (GHG) Emissions (MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent)

Combustion
Process

Prepare for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Energy and Carbon Footprint
Sector: Petroleum Refining (NAICS 324110)

Primary Energy Use: 3,728 TBtu
Total GHG Emissions: 244 MMT CO₂e

Primary Energy, 2018

Onsite Energy

Onsite Generation
(excludes 0.1 TBtu renewable, non-combustion electricity output)

Fuel 3,059

Generation and Transmission Losses 301

Electrical Generation 21.9

Total 3,374

Steam Generation 10.8

Total 243.8

Process Energy

Electricity and Steam Generation Losses 223

Process Losses 686

Nonprocess Energy

Steam Distribution Losses 158

Nonprocess Losses 23

Energy for All Purposes estimated at 3,728 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage
Last Revised: December 2021

Greenhouse Gas (GHG) Emissions
(MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)

Energy (TBtu = Trillion British Thermal Units)
- Fuel
- Electricity
- Steam
- Combined

Losses

Total Emissions = Offsite Emissions + Onsite (Combustion + Process) Emissions

Electricity Export*

Excess Steam^
Primary Energy, 2018

**Manufacturing Energy and Carbon Footprint**

**Sector:** Plastics and Rubber Products (NAICS 326)

**Primary Energy Use:** 562 TBtu

**Total GHG Emissions:** 27 MMT CO₂e

---

**Energy Use**

- **Fuel**
- **Electricity**
- **Steam**
- **Combined**
- **Losses**

**Greenhouse Gas (GHG) Emissions**

- **Total Emissions**
  - Offsite Emissions
  - Onsite Emissions

---

**Energy use data source:** 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this [webpage](https://www.eia.gov/energyexplained/article/2018-eia-mecs-energy-footprint).

**Last Revised:** December 2021

**Notes:**
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

---

**Energy for All Purposes estimated at 563 TBtu**

Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

---

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by [Energetics](https://www.energetics.com)
Fuel and GHG Emissions, 2018

- **Primary Energy Use:** 562 T佰tu
- **Total GHG Emissions:** 27 MMT CO2e

**Greenhouse Gas (GHG) Emissions**
(MMT CO2e - Million Metric Tons Carbon Dioxide Equivalent)

**Process Use**
- Other Process Uses: 0.1 T佰tu
- Electro-Chemical: 0.0 T佰tu
- Machine Drive: 0.0 T佰tu

**Process Heating**
- 1.7 T佰tu

**Process Cooling and Refrigeration**
- 0.0 T佰tu

**Nonprocess Energy**
- Facility HVAC: 1.1 T佰tu
- Facility Lighting: 0.0 T佰tu
- Other Facility Support: 0.1 T佰tu
- Onsite Transportation: 0.1 T佰tu
- Other Nonprocess: 0.0 T佰tu

**Process Emission Data Source:**
- 2018 EIA MECS (with adjustments)

**Last Revised:** December 2021

**Notes:**
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth

**Fuel Use Data Source:**
- 2018 EIA MECS (with adjustments)
Primary Energy, 2018

Manufacturing Energy and Carbon Footprint
Sector: Textiles (NAICS 313-316)

Primary Energy Use: 183 TBtu
Total GHG Emissions: 9 MMT CO₂e

- Offsite Energy
  - Electricity Generation
    - Fuel
    - Generation and Transmission Losses 91
  - Steam Generation
    - 0.1
  - Generation and Transmission Losses 0

- Onsite Energy
  - Onsite Generation (excludes 0.1 TBtu renewable, non combustion electricity output)
    - 1.3
    - 1.2
  - Electric and Steam Generation Losses 4
  - Steam Distribution Losses 4

- Process Energy
  - 5.8
  - 0.9

- Nonprocess Energy
  - 1.9
  - 0.2

- Process Losses 36
- Nonprocess Losses 7

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage

Last Revised: December 2021

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy for All Purposes estimated at 183 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Fuel and GHG Emissions, 2018

Manufacturing Carbon Footprint
Sector: Textiles (NAICS 313-316)

Primary Energy Use: 183 TBr
Total GHG Emissions: 9 MMT CO₂e

Emissio
Fuel and GHG

Energy use data source:
2018 EIA MECS (with adjustments)
Process emissions data source:
See webpage for details

Last Revised: December 2021

Notes:
Sector-wide aggregate data for year 2018; energy values rounded to
nearest whole number; emissions values rounded to nearest tenth

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Energy and Carbon Footprint
Sector: Transportation Equipment (NAICS 336)

Primary Energy Use:
- 659 TBtu
- 32 MMT CO₂e

Primary Energy, 2018

Onsite Energy
- Fuel: 172
- Electricity Generation: 22.8
- Steam Generation: 0.1
- Electric Generation Assumptions:
  - Onsite Electric Generation (excludes 0.3 TBtu renewable, non-combustion electricity output)
  - Steam Distribution Losses: 5
  - Process Energy Losses: 95
  - Nonprocess Energy Losses: 51

Offsite Energy
- Fuel: 485
- Electricity Generation: 313
- Steam Generation: 0

Total Energy Use:
- Primary Energy Use: 659 TBtu
- Total GHG Emissions: 32 MMT CO₂e

Greenhouse Gas (GHG) Emissions (MMT CO₂e)

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage.

Last Revised: December 2021

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- *Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- **Feedstock energy excluded from primary, onsite, and offsite energy values and included in Energy for All Purposes
- ^Excess steam refers to the sales and transfer of surplus steam or purging of surplus steam

Energy for All Purposes estimated at 662 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Fuel and GHG Emissions, 2018

Manufacturing Carbon Footprint
Sector: Transportation Equipment (NAICS 336)

Primary Energy Use: 659 TBU
Total GHG Emissions: 32 MMT CO₂e

Fuel and GHG Emissions, 2018

Offsite Generation
- Electricity Generation
- Steam Generation

Onsite Generation
- Conventional Boilers
- CHP/ Cogeneration
- Other Electricity Generation

Process Energy
- Process Heating
- Process Cooling and Refrigeration
- Other Process Uses
- Electro-Chemical
- Machine Drive
  - Pumps, Fans, Compressed Air, Materials Handling, Materials Processing, Other Systems

Nonprocess Energy
- Facility HVAC
- Facility Lighting
- Other Facility Support
- Onsite Transportation
- Other Nonprocess

Fuel
- Btu = Trillion British Thermal Units

Greenhouse Gas (GHG) Emissions
- MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent

Energy use data source: 2018 EIA MECS (with adjustments)
See webpage for details

Last Revised: December 2021

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth
Primary Energy, 2018

<table>
<thead>
<tr>
<th>Energy (TBtu = Trillion British Thermal Units)</th>
<th>Greenhouse Gas (GHG) Emissions (MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td></td>
</tr>
<tr>
<td>Losses</td>
<td></td>
</tr>
</tbody>
</table>

| Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage |
| Last Revised: December 2021 |
| Notes: Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number. Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non- combustion renewable output. *Electricity export refers to sales and transfers of electricity to utilities and other entities. Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes. ^Excess steam refers to the sales and transfer of offsite or purging of surplus steam. |

Energy for All Purposes estimated at 126 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use.
Fuel and GHG Emissions, 2018

Manufacturing Carbon Footprint
Sector: Automobile and Light Duty Motor Vehicle (NAICS 33611)

Primary Energy Use: 125 TBoo
Total GHG Emissions: 6 MMT CO₂e

- Offsite Generation
  - Electricity Generation: 79 TBoo
  - Steam Generation: 1 TBoo

- Onsite Generation
  - Conventional Boilers: 3.7 TBoo
  - CHP/Cogeneration: 35.6 TBoo
  - Other Electricity Generation: 0.0 TBoo

- Process Energy
  - Process Heating: 23.0 TBoo
  - Process Cooling and Refrigeration: 0.2 TBoo
  - Other Process Uses: 0.1 TBoo
  - Electro-Chemical: 0.0 TBoo
  - Machine Drive: 0.1 TBoo

- Nonprocess Energy
  - Facility HVAC: 0.5 TBoo
  - Facility Lighting: 0.0 TBoo
  - Other Facility Support: 0.0 TBoo
  - Onsite Transportation: 0.0 TBoo
  - Other Nonprocess: 0.0 TBoo

Total Greenhouse Gas Emissions: 6.2 TBoo

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number; emissions values rounded to nearest tenth
- Energy use data source: 2018 EIA MECS (with adjustments)
- See webpage for details
Manufacturing Energy and Carbon Footprint
Sector: Aerospace Product and Parts (NAICS 3364)

Primary Energy Use: 124 TBtu
Total GHG Emissions: 6 MMT CO₂e

Primary Energy, 2018

Offsite Energy
- Fuel
  - Electricity Generation
    - Generation and Transmission Losses
      - Total: 60
        - Offsite: 93
        - Onsite: 31
  - Steam Generation
    - Generation and Transmission Losses
      - Total: 0
        - Offsite: 0
        - Onsite: 0
  - 64

Onsite Energy
- Onsite Generation
  - (excludes 0.1 TBtu renewable, non-combustion electricity output)
    - 1.0
      - Offsite: 47
      - Onsite: 13
  - Offsite Generation
    - 17
  - Steam Distribution Losses
    - 2
    - Total: 27
  - Process Energy
    - 2.5
      - Process Losses: 12
    - 0.3
  - Nonprocess Energy
    - 2.7
      - Nonprocess Losses: 12
    - 0.5

Total Energy Use: 124 TBtu
Total GHG Emissions: 6 MMT CO₂e

Greenhouse Gas (GHG) Emissions
(MMT CO₂e = Million Metric Tons Carbon Dioxide Equivalent)

Energy use data source: 2018 EIA MECS (with adjustments). For full information on references, definitions, assumptions, and other sectors, visit this webpage

Last Revised: December 2021

Notes:
- Sector-wide aggregate data for year 2018; energy values rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- Electricity export refers to sales and transfers offsite of electricity to utilities and other entities
- Feedstock energy excluded from primary, offsite, and onsite energy values and included in Energy for All Purposes
- Excess steam refers to the sales and transfer offsite or purging of surplus steam

Energy for All Purposes estimated at 126 TBtu
Includes primary energy plus net energy consumed for nonfuel purposes, including feedstock use

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Onsite Energy, 2018

Onsite Generation

- Conventional Boilers: 0.7
- CHP/Cogeneration: 0.3
- Other Electricity Generation (excludes 0.1 TBTu renewable, non-combustion electricity output): 0.0

Process Energy

- Process Heating: 0.8
- Process Cooling and Refrigeration: 0.4
- Other Process Uses: 0.1
- Electro-Chemical: 0.0

Nonprocess Energy

- Facility HVAC: 1.7
- Facility Lighting: 0.7
- Other Facility Support: 0.2
- Onsite Transportation: 0.0
- Other Nonprocess: 0.1

Energy Use: 64 TBTu
Onsite Emissions: 2 MMT CO$_2$e

Notes:
- Sector-wide aggregate data for year 2018
- Energy values and fuel type percentages rounded to nearest whole number
- Offsite generation shown on net basis (purchases, sales, and transfers accounted for) and includes onsite non-combustion renewable output
- * Refers to sales and transfers offsite of electricity to utilities and other entities
- ^ Refers to sales and transfers offsite or purging of surplus steam
- Feedstock energy excluded

Greenhouse Gas (GHG) Emissions (MMT CO$_2$e = Million Metric Tons Carbon Dioxide Equivalent)

Total Onsite Process

- Onsite Emissions = Onsite Combustion Emissions + Process Emissions

Energy use data source: 2018 EIA MECS (with adjustments);
See webpage for details
Last Revised: December 2021

Prepared for the U.S. Department of Energy, Advanced Manufacturing Office by Energetics
Manufacturing Carbon Footprint
Sector: Aerospace Product and Parts (NAICS 3364)

Primary Energy Use: 124 TBTu
Total GHG Emissions: 6 MMT CO₂e

Fuel and GHG Emissions, 2018

Fuel (TBtu = Trillion British Thermal Units)

Greenhouse Gas (GHG) Emissions (MMT CO₂e - Million Metric Tons Carbon Dioxide Equivalent)

Combustion

Process