2018 State of the Markets Report
Highlights

- Natural gas markets experienced record high demand and supply.
- Natural gas storage fell to a multi-year low.
- Pipeline additions helped to reduce Marcellus bottlenecks.
- Higher average prices were seen nationally for both gas and electric markets.
- Capacity additions were led by natural gas-fired and wind-powered generation.
Natural Gas Prices Increased in 2018

Source: S&P Global Platts

2018 Average Spot Natural Gas Prices

<=1.95 >=5.15

$/MMBtu (Percent change since '17)

Sumas: $3.53 (35%)
PG&E CG: $3.35 (4%)
SoCal CG: $5.14 (51%)
Emerson: $2.94 (10%)
ClG: $2.53 (-4%)
NGPL Mideont: $2.55 (-5%)
Waha: $1.95 (-27%)
Chicago CG: $3.02 (4%)
Dom South: $2.64 (25%)
Henry Hub: $3.12 (5%)
Transco Z5: $4.37 (36%)
Transco Z6 NNY: $4.21 (46%)
Transco Z6 NY: $4.42 (47%)
Algonquin CG: $4.84 (31%)

Source: S&P Global Platts
Natural Gas Storage Hit Multi-Year Low

Source: EIA

Top Value: November 1 end of injection season
Bottom Value: April 1 start of injection

Source: EIA
Natural Gas Production Reached Record Highs in 2018

Source: EIA Natural Gas Monthly and Drilling Productivity Report; denotes average daily dry production
13 Bcf/d of Interstate Pipeline Capacity Added in 2018

Total 2018 Gas Pipeline Infrastructure Additions
Capacity: 13.1 Bcf/d
Miles: 689 mi.

1.8 Bcf/d
302 mi.

6.6 Bcf/d
109 mi.

4.7 Bcf/d
270 mi.

0 Bcf/d
0 mi.

Source: Office of Energy Projects
Power Burn Drove Natural Gas Demand Increase

Source: EIA, Bentek Energy; bars denote average daily demand by sector
U.S. Position As Net Exporter of Natural Gas Grew in 2018

Source: U.S. Energy Information Administration; denotes average daily imports and exports
Reported Index Volumes Nearly Doubled

Source: S&P Global Platts
Natural Gas Pipeline Outages Had Electric Market Impacts

Source: Ventyx Velocity Suite
Day-Ahead Power Prices Generally Increased

Capacity Market Prices Held Steady

Source: ISO/RTO webpages
Most Generation Capacity Additions Were Natural Gas & Solar

Source: EIA- Form 860M. Data do not cover additions or retirements in Alaska or Hawaii.
Electricity Demand Remained Steady

Electric Consumption by Sector

Source: EIA Forms 826 & 861
The Western Energy Imbalance Market Continued to Evolve

Source: Derived from ABB Velocity Suite.
Northwest Led Daily and Hourly Transactions in Bilateral Markets

Source: Derived from Electric Quarterly Reports (EQR)
Summer 2019 Reliability and Energy Market Assessment
Highlights

• Higher than average temperatures are expected in the West, South and East.
• Reserve margins are expected to be adequate in all regions except ERCOT.
• Aliso Canyon natural gas storage inventories remain an item of interest for electric reliability within the Western Interconnection.
• Natural gas futures price movements are mixed when compared to 2018 summer levels.
• Battery storage and wind and solar capacity will exceed previous summer levels.
• New LNG export capacity will drive natural gas demand growth.
• High natural gas injections are predicted to return storage to average levels.
• High hydroelectric power production is expected in California but below-average levels are expected in the Pacific Northwest.
Summer Temperatures Expected to be Above Normal

Source: National Oceanic and Atmospheric Administration
Modest Growth of Forecast Generation Capacity

Source: North American Electric Reliability Corporation
Reserve Margins Adequate in All Regions Except ERCOT

Source: North American Electric Reliability Corporation
Summer 2019 Natural Gas Futures Price Changes Mixed

Source: InterContinental Exchange
Note: Summer futures prices are the average July and August futures contract hub price added to the Henry Hub for April 1, 2019.
LNG In-Services Drive Demand Growth

Source: S&P Global, Inc. forecasts as of March 20, 2019
Natural Gas Storage to Return to Average Levels

Source: U.S. Energy Information Administration
Natural Gas Has the Highest Share of Generation Capacity

![Capacity Mix Diagram]
Power Burn Expected to Increase

Source: U.S. Energy Information Administration
Narrow Coal-Natural Gas Spread Promotes Diverse Generation

Source: U.S. Energy Information Administration, S&P Global Market Intelligence, CME Group
Strong Hydro Expected in California but Moderate in Other Western States

Source: Natural Resources Conservation Service, US Department of Agriculture
Import Restrictions to Affect Pacific Northwest

Source: ABB Velocity Suite
Battery Storage Capacity Continuing to Grow through the Summer

Current and Planned Battery Storage by Year

Source: US Energy Information Administration Form 860M
Wind & Solar Capacity Continue Increasing

Cumulative Net Capacity of Wind and Solar Photovoltaic

- 2014
- 2015
- 2016
- 2017
- 2018
- 2019 (through August)

Source: US Energy Information Administration Form 860M
National Slides
NOAA June 2019 Through August 2019 Outlook

THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID JJA 2019
MADE 16 MAY 2019

EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

Probability of Below
Probability of Near-Normal
Probability of Above
Cumulative HDDs by City
April 2019

Source: Bloomberg Weather (daily data summed)
Cumulative CDDs by City
April 2019

Source: Bloomberg Weather (daily data summed)
Spot Natural Gas Prices Average ($/MMBtu) April 2019

Source: Platts
2019 Spot Power Prices ($/MWh)

- **Mid-Columbia**: $46.34 (122%)
- **Indiana Hub**: $33.03 (-9%)
- **Palo Verde**: $38.17 (46%)
- **NP 15**: $45.94 (46%)
- **SPP**: $28.32 (8%)
- **ERCOT North**: $28.23 (-10%)
- **Mass Hub**: $42.93 (-31%)
- **NYISO ZJ**: $42.24 (-25%)
- **PJM West**: $32.72 (-28%)
- **Into Southern**: $30.53 (0%)
- **SPP Price**: Average Monthly On-Peak Day-Ahead from January to April
- **Source**: S&P Global Intelligence and ISO/RTO Data

$ = Average 2019 Spot Price*
% Decrease/Increase from 2018

*Average Monthly On-Peak Day-Ahead from January to April
SPP Price is an average of the North and South Hubs
National Natural Gas Market Overview: U.S. Supply and Consumption

U.S. NG Supply and Demand

November 2017 – March 2018 vs November 2018 – March 2019

US Natural Gas Supply
Total Change in Supply: 8.9%

- Canadian Imports: -16.5%
- LNG Imports: -26.3%
- Net Dry Gas Production: 10.8%

Total Change in Demand: 4.3%

- Mexican Exports: 11.7%
- LNG Exports: 49.1%
- Power Generation: 7.0%
- Industrial: 1.1%
- Residential/Commercial: 4.6%

Note: Balance includes all amounts not attributable to other categories.
Source: Derived from Bentek Energy data

Updated Apr-2019
National Natural Gas Market Overview: Canadian Imports

Regional Imports from Canada

Source: Derived from Bentek Energy data

Updated Apr-2019
National Natural Gas Market Overview: Total US Gas Demand

Total U.S. Natural Gas Demand All Sectors

Source: Derived from Bentek Energy data, derived from interstate pipeline flow and modeled data.

Updated Apr-2019
U.S. Natural Gas Consumption for Power Generation

Source: Derived from Bentek Energy data
EIA National Storage Inventories

- 5 Year Range
- 2019-2020
- 2018-2019

Source: Derived from Bloomberg Data
Updated: Apr-2019
National Natural Gas Market Overview: Natural Gas Storage Inventory

EIA Regional Storage Inventories

Notes:
Source: Derived from Bloomberg Data
Updated: Apr-2019
Monthly U.S. Dry Gas Production – Lower 48 States

- **Dry Production**

Note: Prior to July 2010, chart was derived from a combination of EIA and Bentek Energy data.

Source: Derived from Bentek Energy data.
National Natural Gas Market Overview: Rig Count by Type

Rigs by Type

- **Oil Rigs**
- **Gas Rigs**

Source: Derived from Bloomberg data
Competing Fuels

- Nymex Henry Hub
- Big Sandy Barge (Low Sulfur Coal)
- WTI Crude Oil

Source: Derived from Bloomberg data

Updated Apr-2019
Daily Gas Sendout from Existing U.S. LNG Facilities

Notes: Everett data includes flows onto the AGT and TGP interstate lines, plus estimates of flows to the Mystic 7 power plant, Keyspan Boston Gas, and LNG trucked out of the terminal. Excludes flows to the Freeport LNG which flows via intrastate pipelines and flows to the Mystic 8 and 9 power plants.

Source: Derived from Bentek Energy data
Source: Derived from Bentek Energy data
World LNG Estimated Landed Prices: Apr-19

Landed prices are the monthly average of weekly trades from the prior month.

Note: Includes information and Data supplied by IHS Global Inc. and its affiliates ("IHS"); Copyright (publication year) all rights reserved.
Landed prices are the monthly average of weekly trades from the prior month.
National Natural Gas Market Overview: LNG Competitive Price Hubs

Historical and World Gas Futures Prices

- Henry Hub
- TZ6 NY
- Algonquin Citygates
- UKNBP
- Japanese LNG Spot Price
- Futures Prices

$/MMBtu

Notes:
Source: Derived from Bloomberg data

Updated Apr-2019
WTI vs Brent Crude Oil Price

Source: Derived from Bloomberg data
## National Natural Gas Market Overview: Nymex Futures Curve

### Nymex Futures Curves

<table>
<thead>
<tr>
<th>Date</th>
<th>Jun-19</th>
<th>Dec-19</th>
<th>Jun-20</th>
<th>Dec-20</th>
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<tbody>
<tr>
<td>$/MMBtu</td>
<td>$2.45</td>
<td>$3.15</td>
<td>$2.95</td>
<td>$3.35</td>
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</table>

Source: Derived from Bloomberg data

Updated: Apr-2019
Infrastructure Report

Office of Energy Projects Energy Infrastructure Update
http://www.ferc.gov/legal/staff-reports.asp

(see “Energy Infrastructure” tab)
## Natural Gas Highlights

### Natural Gas Activities in March 2019

<table>
<thead>
<tr>
<th>Status</th>
<th>No. of Projects</th>
<th>Storage Capacity (Bcf)</th>
<th>Deliverability (MMcf/d)</th>
<th>Capacity (MMcf/d)</th>
<th>Miles of Pipeline</th>
<th>Compression (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
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<tr>
<td>Placed in Service</td>
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<td></td>
<td>484</td>
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<td>12,500</td>
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<tr>
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<td>205</td>
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<td>53,068</td>
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<tr>
<td>Proposed</td>
<td>3</td>
<td></td>
<td>523</td>
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<td>Storage</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Placed in Service</td>
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<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Certificated</td>
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<td>0.0</td>
<td>0.0</td>
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<td></td>
<td>0</td>
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<tr>
<td>Proposed</td>
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<td>1.0</td>
<td>0.0</td>
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<td></td>
<td>0</td>
</tr>
<tr>
<td>LNG (Import &amp; Export)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Placed in Service</td>
<td>2</td>
<td>10.1</td>
<td>2,840.0</td>
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<td>0.0</td>
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<td>0</td>
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<tr>
<td>Proposed</td>
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<td>0.0</td>
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</table>

### Natural Gas Activities through March 31, 2019

#### January through March 31, 2018

<table>
<thead>
<tr>
<th>Status</th>
<th>No. of Projects</th>
<th>Storage Capacity (BCF)</th>
<th>Deliverability (MMcf/d)</th>
<th>Capacity (MMcf/d)</th>
<th>Miles of Pipeline</th>
<th>Compression (HP)</th>
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<tbody>
<tr>
<td>Pipeline</td>
<td></td>
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<tr>
<td>Placed in Service</td>
<td>4</td>
<td></td>
<td></td>
<td>3943.5</td>
<td>1.4</td>
<td>282,400</td>
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<tr>
<td>through March 31, 2018</td>
<td>2</td>
<td></td>
<td></td>
<td>980.0</td>
<td>34.1</td>
<td>62,760</td>
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<td>Certificated</td>
<td>7</td>
<td></td>
<td></td>
<td>1129.2</td>
<td>61.3</td>
<td>107,081</td>
</tr>
<tr>
<td>through March 31, 2018</td>
<td>16</td>
<td></td>
<td></td>
<td>3251.5</td>
<td>242.4</td>
<td>121,015</td>
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<td>Storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placed in Service</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>through March 31, 2018</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Certificated</td>
<td>1</td>
<td>0.0</td>
<td>79.0</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>through March 31, 2018</td>
<td>1</td>
<td>0.3</td>
<td>125.0</td>
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<td>0</td>
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<td>LNG (Import &amp; Export)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placed in Service</td>
<td>2</td>
<td>10.1</td>
<td>2840.0</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>through March 31, 2018</td>
<td>1</td>
<td>0.0</td>
<td>825.0</td>
<td></td>
<td></td>
<td>0</td>
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<tr>
<td>Certificated</td>
<td>1</td>
<td>8.2</td>
<td>1414.0</td>
<td></td>
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</tr>
<tr>
<td>through March 31, 2018</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
# Electric Generation Highlights

## New Generation In-Service (New Build and Expansion)

<table>
<thead>
<tr>
<th>Primary Fuel Type</th>
<th>March 2019</th>
<th>January – March 2019 Cumulative</th>
<th>January – March 2018 Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Units</td>
<td>Installed Capacity (MW)</td>
<td>No. of Units</td>
</tr>
<tr>
<td>Coal</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>11</td>
<td>943</td>
<td>16</td>
</tr>
<tr>
<td>Nuclear</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Oil</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Water</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Wind</td>
<td>3</td>
<td>239</td>
<td>15</td>
</tr>
<tr>
<td>Biomass</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Geothermal Steam</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Solar</td>
<td>6</td>
<td>11</td>
<td>59</td>
</tr>
<tr>
<td>Waste Heat</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other *</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21</strong></td>
<td><strong>1,193</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

*Sources: Data derived from Velocity Suite, ABB Inc. and The C Three Group LLC. The data may be subject to update.

* “Other” includes purchased steam, tires, and miscellaneous technology such as batteries, fuel cells, energy storage, and fly wheel.
# Electric Transmission Highlights

## Transmission Projects Completed

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High Probability of Completion</td>
</tr>
<tr>
<td>≤230</td>
<td>0.0</td>
<td>28.0</td>
<td>20.0</td>
<td>392.3</td>
<td>532.1</td>
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<tr>
<td>345</td>
<td>165.0</td>
<td>169.8</td>
<td>165.0</td>
<td>819.3</td>
<td>960.0</td>
</tr>
<tr>
<td>500</td>
<td>0.0</td>
<td>0.0</td>
<td>7.4</td>
<td>69.4</td>
<td>738.0</td>
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<tr>
<td>Total U.S.</td>
<td>165.0</td>
<td>197.8</td>
<td>192.4</td>
<td>1,281.0</td>
<td>2,230.1</td>
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</tbody>
</table>

## Sources

Data derived from Staff Database and U.S. Electric Transmission Projects ©The C Three Group, LLC.
## Installed Generating Capacity and Proposed Additions

### Total Available Installed Generating Capacity

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Installed Capacity (GW)</th>
<th>% of Total Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>259.05</td>
<td>21.68%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>529.22</td>
<td>44.29%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>107.98</td>
<td>9.04%</td>
</tr>
<tr>
<td>Oil</td>
<td>39.75</td>
<td>3.33%</td>
</tr>
<tr>
<td>Water</td>
<td>100.44</td>
<td>8.41%</td>
</tr>
<tr>
<td>Wind</td>
<td>98.17</td>
<td>8.22%</td>
</tr>
<tr>
<td>Biomass</td>
<td>16.11</td>
<td>1.35%</td>
</tr>
<tr>
<td>Geothermal Steam</td>
<td>3.84</td>
<td>0.32%</td>
</tr>
<tr>
<td>Solar</td>
<td>38.10</td>
<td>3.19%</td>
</tr>
<tr>
<td>Waste Heat</td>
<td>1.36</td>
<td>0.11%</td>
</tr>
<tr>
<td>Other*</td>
<td>0.78</td>
<td>0.07%</td>
</tr>
<tr>
<td>Total</td>
<td>1,194.78</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

### Proposed Generation Additions and Retirements by April 2022

<table>
<thead>
<tr>
<th>Primary Fuel Type</th>
<th>All Additions</th>
<th>High Probability Additions</th>
<th>Retirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Units</td>
<td>Installed Capacity (MW)</td>
<td>No. of Units</td>
</tr>
<tr>
<td>Coal</td>
<td>1</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>236</td>
<td>62,895</td>
<td>115</td>
</tr>
<tr>
<td>Nuclear</td>
<td>12</td>
<td>11,481</td>
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<tr>
<td>Oil</td>
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<tr>
<td>Water</td>
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<tr>
<td>Wind</td>
<td>534</td>
<td>100,129</td>
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<tr>
<td>Biomass</td>
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<td>617</td>
<td>24</td>
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<tr>
<td>Geothermal Steam</td>
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<td>913</td>
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<tr>
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<tr>
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<tr>
<td>Total</td>
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<td>273,860</td>
<td>937</td>
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</tbody>
</table>

Sources: Data derived from Velocity Suite, ABB Inc. and The C Three Group LLC. The data subject to update.

* "Other" includes purchased steam, tires, and miscellaneous technology such as batteries, fuel cells, energy storage, and fly wheel.