AEO2021 Macro-Industrial Working Group: Updates and preliminary results

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By
Office of Energy Markets & Financial Analysis
Office of Energy Consumption & Efficiency Analysis
AEO2021 Macro-Industrial Working Group: Overview

• Review of AEO2020
• AEO2021 macro updates and preliminary results
• AEO2021 industrial updates and preliminary results
• Longer-term plans for industrial modeling
• Discussion & questions
Review of Industrial AEO2020 results
Industrial sector energy consumption increases fastest for natural gas and hydrocarbon gas liquids in the AEO2020 Reference case, and bulk chemicals and nonmanufacturing are the fastest-growing industries in the sector.

**Industrial energy consumption by energy source and subsector (AEO2020 Reference case)**

Source: U.S. Energy Information Administration, Annual Energy Outlook 2020
In the AEO2020 Reference case, energy intensities decline in most heavy industries, reflecting industrial capital stock turnover and adoption of new, more energy-efficient technologies.

Source: U.S. Energy Information Administration, Annual Energy Outlook 2020
Self-generation from combined heat and power (CHP), especially for bulk chemicals, accounts for most AEO2020 Reference case growth in industrial sector electricity consumption as quantities of purchased electricity remain fairly flat.

Source: U.S. Energy Information Administration, Annual Energy Outlook 2020
AEO2021 updates and preliminary results
AEO2021 and COVID-19

- AEO2021 will reflect updated macroeconomic projections (GDP and industrial shipments) that underlie industrial energy consumption

- STEO forecast incorporates short-term impacts of COVID-19 on broad industrial energy consumption for coal, natural gas, and purchased electricity.

- EIA released a *Trends and Expectations Report* which describes the impact of the pandemic on the energy sector and identifies key issues that are being considered in the development of AEO2021: https://www.eia.gov/outlooks/aeo/trends_expectations.php

- EIA will host a series of workshops on the near- and long-term impacts on energy markets, with the macro and demand workshop on September 25 at 1:00 PM EST. See: https://www.eia.gov/outlooks/aeo/workshop/energy_markets/
Key preliminary macro results

• Preliminary AEO2021 real GDP grows an average of 2.1% per year from 2020 to 2050, up two tenths of a percent from AEO2020.

• Average growth of consumption is 2.4% over the projection period in AEO 2021 as compared to 2.0% in AEO2020.

• Business investment is projected to grow 3.0% per year from 2020 to 2050 in the AEO2021, up five tenths from AEO2020.

• Growth of nonfarm business productivity averages 1.6% over the projection period as compared to 1.5% in the AEO2020.

Source: AEO2021 Preliminary run and AEO2020 Reference run
Summary of the Macroeconomic Activity Module (MAM) in the National Energy Modeling System (NEMS)

- Macroeconomic submodule runs the New Scenario using new Energy Inputs from NEMS
- Industrial submodule runs the New Scenario of values of shipments by industry sectors
- Employment submodule runs the New Scenario of employment by sector
- Regional submodule
- Commercial floorspace submodule

MAM applies the ratios of the New Scenario values more than the Baseline values onto the Macro Baseline variables to obtain solution

NEMS

- NEMS macro baseline variables
- NEMS energy variables
- Other NEMS modules

MAM variables used as inputs in NEMS
Worst ever real GDP in US history with the economy contracting 32.9% in the 2nd quarter of 2020
Growth in GDP and most of its components is slower in the preliminary AEO2021 projection than history.

Average annual percent growth:

- Real GDP: 2.1% (2.5% in 2020 to 2050), 2.7% (2.4% in 1989 to 2019)
- Consumption: 2.4% (2.7% in 2020 to 2050), 3.0% (3.0% in 1989 to 2019)
- Fixed Nonresidential Investment: 1.0% (3.0% in 2020 to 2050), 0.9% (1.0% in 1989 to 2019)
- Fixed Residential Investment: 4.3% (4.7% in 2020 to 2050)
- Exports: 3.5% (4.7% in 2020 to 2050)
- Imports: 3.8% (5.2% in 2020 to 2050)

Source: AEO2021 Preliminary run

Previous 30 Year Growth (1989 to 2019)
Projected 30 Year Growth (2020 to 2050)
The preliminary AEO2021 projection for GDP and most of its components is quicker than recent projections

average annual percent growth

Source: AEO2021 Preliminary run
Inflation remains moderate throughout the projection and bond yields gradually rise from historic lows

Source: AEO2021 Preliminary run
Consumption, nonresidential investment and imports increase in share of demand mix while government fades

change in GDP share over projection period

percentage points

<table>
<thead>
<tr>
<th>Category</th>
<th>AEO2021 (2020-50)</th>
<th>AEO2020 (2019-50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>2.1%</td>
<td>-5.1%</td>
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<tr>
<td>Government</td>
<td>-3.7%</td>
<td>-5.1%</td>
</tr>
<tr>
<td>Nonresidential Investment</td>
<td>2.4%</td>
<td>2.4%</td>
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<tr>
<td>Residential Investment</td>
<td>-0.7%</td>
<td>1.0%</td>
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<tr>
<td>Inventories</td>
<td>-0.3%</td>
<td>1.1%</td>
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<tr>
<td>Import</td>
<td>0.5%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Export</td>
<td>2.3%</td>
<td>2.3%</td>
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</tbody>
</table>

Source: AEO2021 Preliminary run
Preliminary AEO2021 real GDP growth is similar to other projections

<table>
<thead>
<tr>
<th>Projection</th>
<th>2020-50</th>
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<tbody>
<tr>
<td>AEO 2021</td>
<td>1.9</td>
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<tr>
<td>AEO 2020</td>
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<tr>
<td>IHSM (Aug 2020)</td>
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<td>CBO (Jan 2020)</td>
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<td>OASDI (2020)</td>
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<tr>
<td>Oxford (Sept 2020)</td>
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</tbody>
</table>

Sources: as listed
AEO2021 major updates for industrial

- Implementation of MECS benchmarking to process flow industries
- Update in Relative Energy Intensities for equipment in food, metal-based durables, and chemicals industries
- Implementation of Technology Possibility Curves for process flow industry technologies
- Better alignment of petroleum coke consumption with refinery industry
Value of shipments

Energy-intensive industries

Non-energy-intensive industries

Sources: AEO2020, AEO20201 preliminary run

WORKING GROUP PRESENTATION FOR DISCUSSION PURPOSES. DO NOT QUOTE OR CITE AS RESULTS ARE SUBJECT TO CHANGE
Total industrial delivered energy

quadrillion British thermal units

Sources: AEO2020, AEO20201 preliminary run

History  Projection

AEO2020

AEO2021 preliminary
Combined heat and power electricity generation

Sources: AEO2020, AEO20201 preliminary run
Longer-term modeling and data enhancements

• Integrate more effective fuel price sensitivity in process flow models

• Enhance sensitivity of industrial energy intensity to changes in capacity utilization

• MECS 2018 to be published early next year and will be incorporated into AEO2022

• Benchmark non-manufacturing industries to 2017 Economic Census

• Investigate the source of the “extra” natural gas left for the non-manufacturing sectors

• Proposal for 3-year MECS cycle later this year
Questions/Comments?
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