MEMORANDUM FOR: Angelina LaRose
Assistant Administrator for Energy Analysis

FROM: Jim Diefenderfer
Director, Office of Long-Term Energy Modeling

SUBJECT: Summary of AEO2023 Macro-Industrial Working Group, held on
Tuesday, August 30, 2022

This memorandum summarizes the presentation and discussion at the *Annual Energy Outlook 2023*
(AEO2023) Macroeconomic-Industrial Working Group meeting. The macroeconomic and industrial
groups presented preliminary AEO2023 results and model updates. A question-and-answer discussion
followed the presentations.

The presentation slides are available in a separate document on our website. All slides, charts, and
discussions for AEO2023 are preliminary and, therefore, should not be quoted or cited. We will release
the final AEO2023 report in early 2023.

Macroeconomic Activity Module (MAM) updates

We discussed the key updates to the MAM this year, which included the following models:

- IHS Markit's U.S. Macroeconomic Model
- Commercial Floor Space Model and data

Industrial Demand Module (IDM) updates

We discussed the key updates for the IDM this year, including:

- Benchmarking manufacturing steam coal consumption by industry to EIA's *Quarterly Coal Report*
- Modifying cement fuel use, including by assuming no new kilns will be fueled by coal, petcoke, or distillate
- Making the iron and steel industry's furnace technology choice between basic oxygen furnaces or electric arc furnaces sensitive to fuel price
- Splitting the balance of manufacturing sector into four separate industries
- Adding electric boilers as a technology choice
- Publishing cement and lime process emissions
- Extending the combined-heat-and-power (CHP) investment tax credit through 2024

We also discussed longer-term plans for updates to the IDM, including:

- Considering other potential effects of the Inflation Reduction Act
- Updating technology parameters for process flow industries (iron and steel, cement and lime, pulp and paper, aluminum, and glass)
- Enhancing the bulk chemicals industry to specifically model non-fuel hydrogen production
- Adding process emissions for more industries, including bulk chemicals and iron and steel
- Benchmarking electricity by industry to data from the U.S. Census Bureau's Annual Survey of Manufactures
- Including more low-carbon functionality (hydrogen, electrification, carbon capture)
- Restructuring the IDM and data preprocessing in various ways, including by using Python

Discussion

For the changes to how we model the iron and steel industry, an attendee asked if the electric arc furnace capacity would be limited by the availability of scrap steel or the expansion of direct reduced iron. We said we had not yet implemented such restrictions, but we are considering them for AEO2024. We also said that although the IDM has a mechanism for direct reduced iron, we could develop it further and also take scrap supply into account.

An attendee asked to what extent we model the Inflation Reduction Act in the IDM. We replied that we added only the baseline investment tax credit for combined heat and power for AEO2023. We will consider the provisions related to hydrogen and carbon capture tax credits as well as funding for low-carbon technology in energy-intensive industries in future AEOs.

An attendee asked which industries would have electric boiler options. We said we were planning to implement electric boilers in the paper and food industries, as well as possibly other end-use industries, such as metal-based durables.

An attendee asked if our assumptions of no bonus credits for wages and apprenticeship, domestic content, or project siting were solely for CHP or for all of NEMS. We responded that it was only for industrial CHP and that other modules might make a different decision. (Post-meeting note: We are still evaluating the possibility of incorporating bonus credits across NEMS modules.)

An attendee commented that the $5.8 billion in funding to support lower-carbon technologies in energy-intensive industries might best be modeled as an acceleration of technical adoption rather than pricing changes. He mentioned we may also want to model industrial heat pumps as replacing steam.

An attendee asked if our assumption of no new coal-fired cement kilns was driven by regulation or by the cement industry itself. We responded that it was more of a simplifying assumption right now, but the industry does seem to be moving toward lower-carbon cement and away from coal. The assumption may require further investigation, including considering the possibility for increased coal use. Another attendee suggested we look at the Portland Cement Association's decarbonization road map document. (Post-meeting note: According to the *Manufacturing Energy Consumption Survey*, coal represented 63% of total fuel use in cement in 1998 but declined to 36% of total fuel use in 2018.)

An attendee asked if we model energy use from carbon capture and storage (CCS). We said we do not, but we will, once CCS is implemented in NEMS, because the CCS process will have its own intrinsic energy demand. We are currently unsure if all CCS energy demand would be accounted for in the industrial sector (as defined by the IDM); some could also be in refining and possibly other sectors. On a related note, an attendee noted CCS for process emissions would have to be modeled differently than CCS for combustion.

Attendees

Guests (WebEx/phone)

Neal Elliott	American Council for an Energy-Efficient Economy
Anna Johnson	American Council for an Energy-Efficient Economy
Pavitra Srinivasan	American Council for an Energy-Efficient Economy
Hideharu Takemoto	American Honda Motor
Brett Smith	American Iron and Steel Institute
Andrew Baxter	American Petroleum Institute
John Meyer	Leidos
Jefferson Riera	OnLocation, Inc.
Hao Deng	OnLocation, Inc.
Amogh Prabhu	OnLocation, Inc.
Michael Schaal	OnLocation, Inc.
Frances Wood	OnLocation, Inc.
Robert Hershey	Professional
Naveen Dasari	Rhodium Group
Michael Gaffney	Rhodium Group
Hannah Kolus	Rhodium Group
Anna van Brummen	Rhodium Group
Francesco Memoli	Tenova Inc.
Joe Cresko	U.S. Department of Energy
Jennifer Li	U.S. Department of Energy
Chikara Onda	U.S. Department of Energy
Nicole Ryan	U.S. Department of Energy
Walt Tunnessen	U.S. Environmental Protection Agency
Wyatt Thompson	University of Missouri
Jarrett Whistance	University of Missouri

EIA attendees (WebEx/phone)

Erin Boedecker
Michael Cole
Peter Colletti
Jim Diefenderfer
Michael Dwyer

Kathryn Dyl
Mindi Farber-DeAnda
Kevin Jarzomski
Angelina LaRose
Mary Lewis
Tom Lorenz
John Maples
Kevin Nakolan
James Preciado
Mark Schipper
Elizabeth Sendich
Estella Shi
Matthew Skelton
Courtney Sourmehi
Stephanie Tsao
Josh Whitlinger