CHAPTER 15. EMISSIONS ANALYSIS

TABLE OF CONTENTS

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15.1 INTRODUCTION

The U.S. Department of Energy (DOE) will conduct an emissions analysis as part of the notice of proposed rulemaking for electric motors. To assess the impacts of proposed energy conservation standards on certain environmental indicators, DOE will use a variant of the Energy Information Administration (EIA)'s National Energy Modeling System (NEMS).[a] EIA uses NEMS to produce the *Annual Energy Outlook (AEO)*.[1] DOE will use a variant known as NEMS-BT to provide key inputs to the analysis, based on the latest version of the *Annual Energy Outlook*.

In the emissions analysis, DOE uses NEMS-BT to estimate the reduction in power sector emissions of carbon dioxide (CO_2), nitrogen oxides (NO_X), and mercury (Hg) that may result from new energy conservation standards for electric motors. NEMS-BT is run similarly to the *AEO* NEMS, except that electric motors energy use is reduced by the amount of energy saved (by fuel type) due to each considered efficiency standard level. The inputs of national energy savings come from the NIA spreadsheet model, while the output is the forecasted physical emissions. The net benefit of each considered standard level is the difference between the forecasted emissions estimated by NEMS-BT at that level and the *AEO* Reference Case. DOE conducts the emissions analysis as a policy deviation from the most recent *AEO*, which is likely to be *AEO 2012*. The results of the emissions analysis include changes in NO_X, mercury, and CO_2 emissions in 5-year forecasted increments for each trial standard level.

In addition to estimating impacts of standards on power sector emissions, DOE will estimate emissions impacts in production activities that provide the energy inputs to power plants. (These are referred to as "upstream" emissions.) This full-fuel-cycle analysis includes impacts on emissions of methane and nitrous oxide, both of which are recognized as greenhouse gases.

15.2 AIR EMISSIONS DESCRIPTIONS AND REGULATION

Below are descriptions of the air emissions that DOE will consider in the emissions analysis, and the regulations that affect these emissions. Each version of NEMS-BT reflects the estimated impacts of all regulations that had been promulgated by a specific date.

[a] For more information on NEMS, refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2003*, DOE/EIA-0581(2003). March 2003. EIA approves use of the name NEMS only to describe an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications, and the model is run under policy scenarios that are variations on EIA assumptions, DOE refers to the model as NEMS-BT (BT is DOE's Building Technologies Program). NEMS-BT was previously called NEMS-BRS.

15.2.1 Carbon Dioxide

In the absence of any Federal emissions control regulation of power plant emissions of CO_2, a DOE standard is likely to result in reductions of these emissions. The CO_2 emission reductions likely to result from a standard will be estimated using NEMS-BT and national energy savings estimates drawn from the NIA spreadsheet model. The net benefit of the standard is the difference between emissions estimated by NEMS-BT at each standard level considered and the *AEO* Reference Case. NEMS-BT tracks CO_2 emissions using a detailed module that provides results with broad coverage of all sectors and inclusion of interactive effects.

15.2.2 Sulfur Dioxide

SO_2 emissions from affected electric generating units (EGUs) are subject to nationwide and regional emissions cap and trading programs, and DOE has preliminarily determined that these programs create uncertainty about the potential standards' impact on SO_2 emissions. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for affected EGUs in the 48 contiguous states and the District of Columbia (D.C.). SO_2 emissions from 28 eastern states and D.C. were also limited under the Clean Air Interstate Rule (CAIR), at 70 FR 25162 (May 12, 2005), which created an allowance-based trading program. Although CAIR has been remanded to EPA by the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit), see *North Carolina v. EPA*, 550 F.3d 1176 (D.C. Cir. 2008), it remains in effect temporarily, consistent with the D.C. Circuit's earlier opinion in *North Carolina v. EPA*, 531 F.3d 896 (D.C. Cir. 2008). On July 6, 2011, EPA promulgated a replacement for CAIR, entitled "Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals," but commonly referred to as the Cross-State Air Pollution Rule or the Transport Rule. 76 FR 48208 (August 8, 2011). On December 30, 2011, however, the D.C. Circuit stayed the new rules while a panel of judges reviews them, and told EPA to continue enforcing CAIR (see *EME Homer City Generation v. EPA*, No. 11-1302, Order at *2 (D.C. Cir. Dec. 30, 2011)).

The attainment of emissions caps is typically flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess SO_2 emissions allowances resulting from the lower electricity demand caused by the imposition of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. However, if the standard resulted in a permanent increase in the quantity of unused emissions allowances, there would be an overall reduction in SO_2 emissions from the standards. While there remains some uncertainty about the ultimate effects of efficiency standards on SO_2 emissions covered by the existing cap and trade system, the NEMS-BT modeling system that DOE uses to forecast emissions reductions currently indicates that no physical reductions in power sector emissions would occur for SO_2.

15.2.3 Nitrogen Oxides

Under CAIR, there is a cap on NO_X emissions in 28 eastern states and the District of Columbia. All these States and D.C. have elected to reduce their NO_X emissions by participating in cap-and-trade programs for EGUs. Therefore, energy conservation standards for electric

motors may have little or no physical effect on these emissions in the 28 eastern states and the D.C. for the same reasons that they may have little or no physical effect on NO_X emissions. DOE is using the NEMS-BT to estimate NO_X emissions reductions from possible standards in the States where emissions are not capped.

15.2.4 Mercury

In the absence of caps, a DOE energy conservation standard could reduce Hg emissions and DOE plans to use NEMS-BT to estimate these emission reductions. On December 21, 2011, EPA announced national emissions standards for hazardous air pollutants (NESHAPs) for mercury and certain other pollutants emitted from coal and oil-fired EGUs. 76 FR 24976. The NESHAPs do not include a trading program and, as such, DOE's energy conservation standards would likely reduce Hg emissions. For the emissions analysis for this rulemaking, DOE plans to estimate mercury emissions reductions using NEMS-BT based on *AEO2011*, which does not incorporate the NESHAPs. DOE expects that future versions of the NEMS-BT model will reflect the implementation of the NESHAPs.

15.2.5 Particulate Matter

DOE acknowledges that particulate matter (PM) exposure can impact human health. Power plant emissions can have either direct or indirect impacts on PM. A portion of the pollutants emitted by a power plant are in the form of particulates as they leave the smoke stack. These are direct, or primary, PM emissions. However, the great majority of PM emissions associated with power plants are in the form of secondary sulfates, which are produced at a significant distance from power plants by complex atmospheric chemical reactions that often involve the gaseous (non-particulate) emissions of power plants, mainly SO_2 and NO_X. The quantity of the secondary sulfates produced is determined by a very complex set of factors including the atmospheric quantities of SO_2 and NO_X, and other atmospheric constituents and conditions. Because these highly complex chemical reactions produce PM comprised of different constituents from different sources, EPA does not distinguish direct PM emissions from power plants from the secondary sulfate particulates in its ambient air quality requirements, PM monitoring of ambient air quality, or PM emissions inventories. For these reasons, it is not currently possible to determine how the amended standard impacts either direct or indirect PM emissions. Therefore, DOE is not planning to assess the impact of these standards on PM emissions. Further, as described previously, it is uncertain whether efficiency standards will result in a net decrease in power plant emissions of SO_2, which are now largely regulated by cap and trade systems.

REFERENCES

1 Energy Information Administration (April 2011), *Annual Energy Outlook 2011 with Projections to 2035*, Washington, DC. Report No. DOE/EIA-0383(2011). http://www.eia.gov/forecasts/aeo/