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# Benefits of Adopting California's Advanced Clean Cars II (ACC II) Standards in Maryland

This fact sheet outlines the benefits of adopting the California Advanced Clean Cars II (ACC II) standards in the state of Maryland. The California Air Resources Board (CARB) adopted these standards on August 25, 2022.[1] These standards would require increasing sales of zero emission vehicles (ZEVs) in the light-duty vehicle (LDV) fleet, reaching 100% of new sales by 2035. For the remaining new LDV sales prior to that date, CARB is imposing more stringent pollutant emission standards.[2]

An analysis of program benefits was conducted by Sonoma Technology, Inc., with technical input on data and methods from the International Council on Clean Transportation and Northeast States for Coordinated Air Use Management (NESCAUM). The overall analytical approach is summarized below:

1. Baseline emissions modeling using the U.S. Environmental Protection Agency (EPA) MOVES3 model was conducted. MOVES was run at the County scale for the representative counties in Maryland used in EPA's National Emissions Inventory (NEI). MOVES input data and growth rates relevant to the analysis were provided by Maryland and were used along with NEI input data. Emissions modeling was conducted for a 2017 base year, 2030, and 2040. Results for the representative counties were scaled to the statewide level using apportionment factors developed for the NEI.
2. The baseline MOVES output was adjusted in post-processing to account for the benefits of ACC II. The adjustment factors for $NO_x$, $PM_{2.5}$, VOCs and $CO_2$ were developed using baseline and ACC II rule emissions inventories provided by CARB. Adjustment factors for $SO_2$ and $NH_3$ were calculated from the in-use ZEV fractions resulting from the rule. The adjustments used in the health benefits analysis assume that the program starts with model year 2027, but an emissions scenario representing a model year 2026 start was also developed.
3. The in-use ZEV fractions were used to calculate ZEV electricity consumption, and emissions factors from the U.S. Department of Energy's GREET 2021 model

1 California Air Resources Board, "Proposed Advanced Clean Cars II (ACC II) Regulations," (2022), https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii

2 These standards also apply to some medium-duty vehicles.

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and EPA's eGRID database were used to calculate grid emission increases associated with ZEVs. In turn, the reductions in energy consumption from conventional LDVs and GREET emission factors for petroleum production and distribution were used to calculate emission decreases in the petroleum sector. Net well-to-wheel (WTW) emissions were calculated from the reductions in vehicle and petroleum-related emissions and the increase in grid emissions.

4. Projections of the light-duty ZEV population over time were generated using Maryland's current in-use ZEV population, and CARB estimates of in-use ZEV increases due to the rule.
5. EPA's COBRA model was used to estimate the health benefits associated with implementation of the ACC II program in Maryland.

The original MOVES output and all subsequent calculations are documented in a summary spreadsheet. Table 1 summarizes the emission benefits of adopting ACC II starting with model year 2027 compared to a business-as-usual scenario based on EPA projections of ZEV impacts under current LDV greenhouse gas rules. Cumulative reductions are provided for 2030, 2035, and 2040.

**Table 1:** Cumulative ACC II emission benefits compared to a business-as-usual scenario

| By 2030 | | | By 2035 | | | By 2040 | | |
|---|---|---|---|---|---|---|---|---|
| $NO_x$ | $PM_{2.5}$ | WTW $CO_{2e}$ | $NO_x$ | $PM_{2.5}$ | WTW $CO_{2e}$ | $NO_x$ | $PM_{2.5}$ | WTW $CO_{2e}$ |
| 668 | 52 | 7.1 | 2,656 | 251 | 33.2 | 5,978 | 585 | 76.7 |

*Notes:* Assumes ACC II implementation in model year 2027. $NO_x$ and $PM_{2.5}$ are expressed in U.S. tons, $CO_{2e}$ is expressed in million metric tons.

Current Maryland tailpipe emissions of $CO_{2e}$ from light-duty on-road vehicles are projected to decrease in future years due to current regulations in the business-as-usual scenario and would decrease by increasing amounts if ACC II is adopted. Table 2 provides $CO_{2e}$ emission reductions for selected years that were estimated for the BAU scenario and the additional $CO_{2e}$ emission reductions if ACC II is adopted (model year 2027 implementation scenario).

**Table 2:** Projected annual on-road LDV $CO_{2e}$ emission reductions under business-as-usual and ACC II adoption scenarios, in million metric tons

| Year | Business-as usual $CO_{2e}$ reductions | | Additional $CO_{2e}$ reductions if ACC II sales goals are achieved | |
|---|---|---|---|---|
| | Tailpipe | Well-to-wheel | Tailpipe | Well-to-wheel |
| **2030** | 2.3 | 3.2 | 2.3 | 3.5 |
| **2035** | 4.2 | 5.9 | 6.1 | 8.6 |
| **2040** | 5.0 | 7.0 | 9.0 | 12.1 |

*Notes:* Assumes ACC II implementation in model year 2027.

The annual health benefits of Maryland's adoption of ACC II beginning with model year 2027 were estimated with COBRA. COBRA estimates the change in number of cases and their economic values for $PM_{2.5}$-associated health effects. The aggregated economic values combining all health effects are summarized in Table 3. In general, adopting ACC II reduces on-road mobile source emissions but would increase electric generation emissions. The net benefit of these emission changes in Maryland is $603.5 million dollars.

**Table 3:** COBRA-estimated economic values of Maryland adopting ACC II, in millions of U.S. dollars

| Analysis year | Total $NO_x$ reduction[a] | Total $PM_{2.5}$ reduction[a] | In-state benefit[b] | Out-of-state benefit[b] | In-state burden[c] | Out-of-state burden[c] | Net benefit[d] |
|---|---|---|---|---|---|---|---|
| **2040** | 769 | 74 | 489.2 | 200.3 | -32.6 | -53.5 | 603.5 |

[a] Emissions reduction in tons per year
[b] Benefit of reduced on-road emissions
[c] Burden of increased electric generation emissions
[d] Sum of in-state and out-of-state benefits and burdens

Table 4 lists the five other states most impacted by Maryland's adoption of ACC II, as modeled in COBRA. These are a function of the pollutant dispersion algorithms in COBRA (electric grid emissions can be transported farther than vehicle emissions because they are emitted at higher elevations), as well as the population of nearby states (a higher impacted population results in a larger monetary impact).

**Table 4:** Top five states most impacted by Maryland's adoption of ACC II

| State adopting ACC II | Emission sectors | Top 5 impacted other states |
|---|---|---|
| **Maryland** | On-road, petroleum production | Pennsylvania, Virginia, New Jersey, New York, Delaware |
| **Maryland** | Electric generation | Pennsylvania, New Jersey, New York, Virginia, Massachusetts |

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