Sacramento Area Council of Governments
Addendum to 8/10/2018
Technical Methodology for Greenhouse Gas Calculations for the 2020 MTP/SCS

Pursuant to Section 65080 of the Government Code, on August 10, 2018, SACOG submitted to ARB documentation of the technical methodology (TM) intended for use in developing and analyzing the 2020 Sustainable Community Strategy (SCS). At that time, ARB had not yet finalized its SCS evaluation guidelines document, nor had it published or distributed its auto operating cost (AOC) calculator. Subsequent to SACOG's submittal of its TM, ARB published draft evaluation guidelines (March 2019), posted a draft of its AOC calculator (August 28, 2018), and published an updated version of its AOC calculator (early in 2019). During this period, ARB requested additional information on SACOGs TM submittal, and requested changes to it. The requests for additional information and changes resulted in a significant dialog between ARB and SACOG staff. Appendix A includes emails documenting the dialog, and agendas and meeting notes for some of the conversations between ARB and SACOG staff. The purpose of this submittal is to finalize additions and clarifications to the SACOG TM submittal.

Additions and clarifications are provided for the following specific topics: version of EMFAC to be used; calculation of AOC; and approach to report an increment of progress analysis in SACOG's SCS.

I. Version of EMFAC

At the time of the TM submittal, ARB had provided no firm guidance on the version of EMFAC to be used for SB 375 related greenhouse gas (GHG) estimates. The TM submittal, instead of identifying a specific version to be used, identified significant differences in GHG rates and the share of VMT by passenger vehicles in versions of EMFAC that complicated the process of identifying a version of EMFAC to be used. On 9/11/2018, ARB directed SACOG to: 1) use either EMFAC2011 or EMFAC2014 for SCS forecast years; 2) use EMFAC2007 for year 2005 and prior SCS performance; and 3) use the ARB methodology for adjusting between EMFAC2007 and the more current version of EMFAC. Since that direction, SACOG has used EMFAC2014 for forecast years, adjusting appropriately to EMFAC2007 for prior years to develop the 2020 SCS.

The March 2019 ARB draft evaluation guidelines stated that for third round SCSs, MPOs should use the exact versions of EMFAC utilized for the second round SCSs. For SACOG, that would require using EMFAC2011 instead of EMFAC2014. Therefore, for purposes of the 2020 SCS submittal, SACOG proposes the following approach:

The submittal and GHG reduction calculation continue to be based on EMFAC2014 for future years, using EMFAC2007 for the prior years and adjustment process. SACOG will also submit a similar calculation for the 2020 SCS using the same approach, but with EMFAC2011 for the 2020 SCS forecasts, as additional information but not for the formal GHG emissions reduction forecast.

II.   *Calculation of Auto Operating Cost*

In its TM submittal, SACOG proposed using the same calculation method as used in the 2012 and 2016 SCSs (see memorandum in Appendix B showing the 2016 method and results). For its 2020 SCS, SACOG proposed two changes: 1) updating the fuel price forecasts using the 2017 Department of Energy/Energy Information Administration (DOE/EIA) "Energy Outlook" series; and 2) augmenting the calculation with a separate, VMT-weighted calculation for plug-in electric vehicles.

Appendix B provides the basic update of AOC using the method and sources used by the four large MPOs for the first and second round SCSs. The updates include: updates to DOE/EIA fuel price forecasts; updates to the non-fuel costs per mile based on AAA "Your Costs of Driving"; and updates to the passenger vehicle fleet MPG based on EMFAC2014. The updates convert all costs to year 2017 dollars. The basic comparison on AOC for SACOG, comparing the 2016 SCS to the 2020 SCS, is provided below Note that the application of the method used in SCS1 and SCS2 resulted in a 14 percent reduction in AOC.

2035 Forecasts of Auto Operating Costs--SACOG

Factor	2016 SCS	2020 SCS
Pass. Veh. Fleet MPG	28.3	39.4
Gasoline Price ($ / gallon)	$5.41	$5.09
Non-0Fuel Costs ($ / mile)	$0.10	$0.12
AOC ($ / mile)	$0.29	$0.25

Since the TM submittal, ARB posted two different versions of an AOC calculator. One version was posted on the ARB website on 8/28/2018, and the second posted on an unknown date in early 2019. Common characteristics of the two versions are:
- Years and MPO areas are provided from year 2005 to year 2050.
- Reliance on CEC fuel price forecasts (which in turn are a limited range of Department of Energy/Energy Information Administration "Energy Outlook" forecasts). Based on the CEC documents, the forecasts are based on the 2017 series "mid-range" forecasts and are adjusted to reflect the difference between national average and California prices (though no specifics on this adjustment are

provided). In the ARB AOC calculator, the forecasts end at 2030, and 2030 values are flat for years 2031 through 2050. Fuel price forecasts do not appear to vary by region.

- Non-fuel cost per mile are sourced to AAA "Your Costs of Driving" up to 2017, and are held constant for years 2018 through 2050 in the calculator. Non-fuel costs appear to vary slightly by region—even though AAA "Your Costs of Driving" are based on national data.

Appendix B provides a comparison of the two versions of the ARB AOC calculator for SACOG. The two versions are strikingly different, making it very difficult to rely on either version for our SCS. Most importantly, neither version was available in early 2018, when SACOG needed to finalize AOC inputs to analyze SCS alternatives.

In addition, ARB and SACOG staff have had discussions on recent research[1] showing that the effect of increasing vehicle efficiency (i.e., MPG) on propensity to travel is significantly less than the effect of increasing fuel cost. There is growing evidence that the impact of increasing vehicle efficiency has a smaller "rebound" effect than previously thought. Rebound is defined as: the percentage of expected fuel/emissions savings, based on an increase in vehicle efficiency, lost due to increased use of vehicles as a result of reduced AOC. Rebound was thought to be about 20 percent, which would imply that the response to reduction in cost from increased vehicle efficiency was equivalent to the response to reduction in cost from declining fuel cost. More recent research puts rebound at 8 to 14 percent, or 40 to 70 percent of prior expectation.

SACOG has developed an approach to reflect this differential weighting of change in cost due to higher vehicle efficiency, compared to higher fuel cost. A description of the approach was shared with ARB staff for comment on June 7, 2019. An advantage of this approach is: it is more consistent with the treatment of rebound effect described by ARB staff in the SB 375 target re-setting process. SACOG is willing to use this approach in combination with the more recent posting of the ARB AOC calculator as an alternative to the approach proposed in the TM submittal. The formula and table below provide an accounting of the approach. Appendix B provides an application, assuming the vehicle efficiency "beta" set at 55 percent (mid-range of the recent research on rebound).

AOCp (fy) =
NFC(fy) + {FUELCOST(fy) / {MPG(by) + BETA * [MPG(fy) - MPG(by)]}
Where:
AOCp(fy) = Perceived auto operating cost in future year (cents per mile)
NFC(fy) = Non-fuel cost in future year (cents per mile)
FUELCOST(fy) = Price per gallon equivalent of fuel in future year (cents per gallon)
MPG(by) = Fleet average miles per gallon in base year
MPG(fy) = Fleet average miles per gallon in future year
MPG BETA = Weighting factor for fleet MPG change (0.4 to 0.7)

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[1] Gillingham, Kenneth, "The Rebound Effect and Fuel Economy Standards: Comment on the Saver Affordable Fuel-Efficient (SAFE) Vehicles Propose Rule for Model Years 2021-2026 Passenger Cars and Light Trucks,", October 24, 2018.

Step	Description	Options
1	Set base year MPG	EMFAC or ARB AOC calculator
2	Set future year MPG	"
3	Set future year fuel price	MPO method
4	Set future year non-fuel cost	MPO method
5	Beta value for change in MPG	Range 0.4 to 0.7

III. *Incremental Progress Analysis*

At the time of SACOG's TM submittal, ARB indicated a desire to receive an "incremental progress" analysis of SCSs as part of the statewide dialog on the preparation of SCS evaluation guidelines. No requirement for such an analysis was in place at the time of our submittal, and the submittal did not include any proposed methodology for an increment of progress analysis. Based on evaluation guidance published in March 2019, the purpose of the incremental progress analysis is to identify the steps that MPOs are taking to make progress from one SCS to the next. This goal can be achieved in part through a comparative analysis of the policies included in the 2020 SCS, compared to the 2016 SCS, and this comparative analysis will be provided in the documentation of the GHG reduction calculation prepared by SACOG. ARB staff has proposed that a part of this analysis be based on modeling, and that an effort by the MPOs be made to normalize key factors and input assumptions for the current and immediately preceding SCS. SACOG will provide this information. The table below provides the proposed approach for normalizing key factors and input assumptions. The comparison of results of this analysis will be provided at regional level and by community types, and will focus on key transportation metrics (e.g., VMT and trips by mode), and at regional level for passenger vehicle GHG.

Factor or Assumption	Steps to Normalize
Version of SACSIM model	2016 SCS to be modeled w/ SACSIM19
Version of EMFAC	2016 SCS vehicle emission estimated using EMFAC2014
Auto Operating Cost	2016 SCS modeled w/ 2020 SCS AOC method
Inter-regional travel	2016 SCS modeled with 2020 SCS assumptions
Household Income	2016 SCS to be adjusted to 2020 SCS regional median income