



Rincon Consultants, Inc.

449 15th Street, Suite 303
Oakland, California 94612
510 834 4455 OFFICE
info@rinconconsultants.com
www.rinconconsultants.com

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Andre Duurvoort, Sustainability Manager
City of Cupertino, City Manager's Office
Via email: AndreD@cupertino.org

Subject: Cupertino GHG Emissions Inventory and Forecast Approach Review Memorandum

As part of Tasks 2 and 4 of the Cupertino Climate Action Plan (CAP) Update, we are providing this memorandum related to review of the Cupertino greenhouse gas (GHG) emissions inventory and forecast approach. Rincon Consultants, Inc. (Rincon) reviewed the protocol methodology, calculations, and data used to develop the GHG emissions inventories and forecast. Specifically, Rincon reviewed the 2010, 2015, and 2018 GHG inventories for methodology consistency across years, the methodology utilized for calculations and consistency with standard reporting protocols, and appropriateness of emission factors used. For the forecast, Rincon evaluated the methodology, including a review of the growth factors and climate-related legislation used to forecast future emissions, and the assumptions applied for the generation of the adjusted forecast. This review was completed based on the following documentation provided by City staff:

- GHG emissions calculation workbooks prepared for the 2010, 2015, and 2018 inventory
- Cupertino 2015 Community-wide and Municipal Operations GHG Emissions Inventory Report
- 2018-2050 forecast calculations workbook

This memorandum summarizes Rincon's findings from review of the GHG emissions inventories and forecast. This technical review does not include an evaluation of the source of activity data. For example, while Rincon did compare natural gas and electricity activity data trends over time, that activity data was assumed to be accurate.

GHG Inventory Review

City of Cupertino initially developed a 2010 baseline inventory as part of the 2015 CAP. In subsequent years, the City developed a 2015 inventory to track the City's progress implementing the 2015 CAP and has also recently prepared a 2018 inventory for the CAP update. Based on the 2010 baseline technical report, the community inventory was initially developed following the *U.S. Community Protocol for Accounting and Reporting of GHG Emissions* (Community Protocol). However, the documentation for the 2015 and 2018 community inventories indicates that the inventories were completed following the *Global Protocol for Community-Scale GHG Emission Inventories* (GPC), as this is the required protocol for The Global Covenant of Mayors for Climate and Energy (Global Covenant), which the City is a member. As such, during preparation of the 2015 inventory, the 2010 baseline inventory was also revised to follow the GPC protocol and include the global warming potentials from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5), so there would be consistency across the three developed inventories. The inventories were developed to capture GHG emissions from the community and government (i.e., municipal) operations. The community inventories included the following major sectors: transportation and mobile sources, residential energy, commercial energy, industrial energy,¹ solid waste, and wastewater treatment. The municipal-based inventory, a subset of the community

¹ Industrial emissions are an aggregated total of industrial- and agricultural-related energy emissions.



inventory, was developed following the Local Government Operations Protocol (LGO) and accounted for municipal operations from the following four major sectors: water treatment and pumping, buildings and facilities, solid waste services, and vehicle fleet. We understand that the inventory computations were carried out by City staff following GPC-recommended methodologies using an in-house Microsoft Excel-based tool developed by a consultant. The Cupertino 2015 Community-wide and Municipal Operations GHG Emissions Inventory Report details the methodology and activity data used by sector including energy, transportation, off-road, solid waste and wastewater sectors for the community inventory and facilities energy, vehicle fleet, solid waste, and water services sectors for the municipal operations inventory.

GHG Inventory Recommendations

Rincon reviewed the 2010, 2015, and 2018 inventory calculations provided by City staff that included the following: energy data and emission factors obtained from the utility company; off-road emissions calculated by California Air Resources Board (CARB's) OFFROAD2007 Model; on-road vehicle miles traveled (VMT) calculated using the origin-destination model developed for the City's General Plan and on-road vehicle-specific emission factors obtained through EMFAC; solid waste data obtained from the CalRecycle Disposal Reporting System; and wastewater data based on service population and treatment operations data from the San Jose-Santa Clara Regional Wastewater Facility. Rincon's review found that the activity data and emission factor sources for the inventory appear to be generally appropriate for the sectors evaluated. Rincon finds that the emissions were appropriately calculated using the principles and methods of the GPC and LGO protocols. However, the following comments and recommendations are intended to provide an opportunity to improve transparency of the calculations being utilized.

- Emissions from on-road transportation for the inventories were calculated based on VMT estimates obtained from an origin-destination VMT model developed by Hexagon for Cupertino as part of the General Plan. The model calculated 2010, 2013 and 2040 VMT however was not available to calculate VMT for the 2015 and 2018 inventory years. To estimate VMT for the 2015 and 2018 inventory years, the Metropolitan Transportation Commission (MTC) 2010-2015 and 2010-2020 VMT growth rates were applied to the 2013 VMT model data to estimate 2015 and 2018 VMT, respectively. While this approach is reasonable, it may improve transparency to simplify the approach and use a readily available VMT model (like the MTC model) for these and future inventory years. A disadvantage to the current approach is it will not include any VMT reduction benefits as the City moves forward with its VMT reduction actions.

GHG Forecast Review

Rincon reviewed the forecast methodology described in the Cupertino 2015 CAP Appendix B (GHG Inventory and Reductions Methodology) and the calculations utilized in the in-house Microsoft Excel-based tool and provided by the City staff. The forecast calculations were reviewed for consistency with the developed inventories and for consistency with best practices for forecasting and State legislation expected to result in emissions reduction Statewide. In accordance with best practices, the City developed two emissions forecast scenarios: a business-as-usual (BAU) forecast scenario without State measures, based on population and employment growth metrics, and an adjusted business-as-usual (ABAU) forecast scenario, which layers State-level legislation expected to result in emissions reductions onto the BAU scenario. Based on the review of the above noted documents and Excel tool, the ABAU forecast scenario includes the following legislation: Clean Car Standards for on-road transportation, Low Carbon Fuel Standard for off-road fuel use, Renewable Portfolio Standard for electricity emission factors, New Residential Zero Net Energy Action Plan for residential building energy and Senate Bill (SB) 1383 for



organic waste diversion from landfills. Population/employment growth are based on projections from the General Plan Preferred Land Use Alternative, the highest-growth alternative and same growth assumptions utilized in the VMT projections to prepare the 2010 baseline inventory and subsequent inventories.

Under the BAU forecast scenario, residential energy usage emissions were forecasted based on population growth rates, but assumed electricity carbon intensity factors from PG&E remain static over time. Commercial and industrial energy usage and emissions were forecasted based on employment growth rates and static electricity carbon intensity factors based on PG&E emission factors. On-road VMT was forecasted based on daily VMT provided through the MTC Vehicle Miles Traveled Data portal, where 2035 and 2050 data were linearly extracted based on 2010, 2035, and 2040 data. Under the ABAU forecast scenario, residential energy usage was adjusted to factor in energy reductions associated with the New Residential Zero-net Energy Action Plan. The carbon-intensity factors for PG&E electricity and on-road VMT were adjusted per the PG&E Renewable Energy Portfolio Procurement Plan through 2030 and CARB 2017 EMFAC model, respectively. Direct-access electricity is based on CARB-provided State-level data on direct-access electricity and Silicon Valley Clean Energy data on direct-access electricity emission factors. Also, off-road emissions were adjusted to account for reductions anticipated from the Low Carbon Fuel Standard. Upon review of the data, growth factors, and methodology, the forecast is generally appropriate and accurate. However, Rincon has identified the following inconsistencies and recommendations.

- The forecast has been developed by applying future anticipated growth rates of population, employment and service population to the 2018 inventory totals for residential emissions, commercial/industrial emissions, and waste/wastewater emissions, respectively. Transportation emissions were forecasted based on VMT data provided by MTC. This is not consistent with standard forecasting practices which typically apply growth rates to the baseline inventory activity data and then calculate emissions using emission factors by each source. Rincon recommends revising the forecast to calculate emissions using inventory activity data and applying the growth rates to that data. This will allow for each source category to be forecasted rather than just the overarching sector of residential, commercial/industrial, transportation, and waste/wastewater that is currently forecasted. This will improve granularity of the data and allow for greater specificity in calculating GHG reduction measures to the sources of the emission growth. Without activity data forecasts, it is very difficult to generate defensible GHG reduction estimates for GHG reduction measures.
- The forecast is aligned and consistent with the population and employment projections within the Cupertino General Plan based on the Preferred Land Use Alternative, which is the highest-growth alternative assumed for Cupertino. When Rincon reviewed the most recent RHNA housing allocation numbers, we found a current allocation of more than 4,500 units by 2031. However, the current forecast assumes approximately that same growth by 2040. Rincon advises to update the forecast with the most recent housing and population numbers.
- It is appropriate to utilize the service population growth factor for forecasting waste and wastewater emissions. However, the forecast has been developed using the average growth of the population and employment combined. Because employment and population are growing at different rates it is more appropriate to use a weighted average to account for service population growth. Rincon recommends including a line item in the forecast showing the service population as the population in addition to the employment numbers and developing the growth rate for forecasting off of the service population numbers rather than using a straight average of population and employment as is currently utilized.



- It appears in the calculations workbook that the VMT projections are based solely on MTC data, while the inventories were developed based on the MTC growth rates applied to 2013 VMT data from the VMT model utilized in the General Plan. As such, the origin-destination VMT data utilized in the forecast does not appear to be consistent with the VMT data utilized in the 2010 inventory. Further, daily VMT in the inventory is annualized using a factor of 325.78, while daily VMT in the forecast is annualized using a factor of 338.06. Rincon recommends updating VMT and annualization factors utilized in the forecast to be consistent with the inventory activity data and/or to provide reasoning for the methodology differences to improve transparency, accuracy, and defensibility. Without a consistent methodology to estimate on-road VMT and associated emissions, it will be difficult to develop GHG emission reduction measures and estimate GHG reductions that are defensible. As on-road transportation makes up over 30% of the Cupertino GHG emission profile, limitations in GHG emission reductions in this sector may have major implications to Cupertino’s ability to reach their GHG emission reduction goal.
- It appears incorrect values are applied for Title 24 electricity use reduction. Rincon recommends updating the calculations to reflect Title 24 for all new residential and commercial construction.

Title 24 Building Efficiency – CEC Reference vs. Forecasted Values

Building/Energy Type	Efficiency Increase from 2016 to 2019 ¹	Current Factor Used in Forecast
Residential/electricity	53%	60%
Residential/natural gas	7%	30%
Commercial/electricity	30%	30%
Commercial/natural gas	0%	60%

1 https://www.energy.ca.gov/sites/default/files/2020-03/Title_24_2019_Building_Standards_FAQ_ada.pdf

Furthermore, the forecast assumes 50% of existing commercial buildings will use 30% less gas and 60% less electricity by 2030 (Zero Net Energy Buildings Action Plan). Rincon suggests removing this from the forecast as there are no actions to support this effort and can cause issues with double counting when conducting electrification measure estimates.

- SB 1383 was incorporated in the ABAU forecast to account for anticipated reductions in waste emissions. In Rincon’s experience, municipalities have not yet been able to show compliance with SB 1383 under current waste services. As such, it may be appropriate to exclude SB 1383 from the ABAU forecast or provide evidence to show that the City achieved a 50% reduction in organic waste by 2020 and is in line to achieve a 75% organic waste diversion by 2025. Otherwise, Rincon suggests including SB 1383 as a CAP Update measure with specific actions. This results in the same GHG reductions, but we feel it is more defensible and implementable than assuming the reductions will happen as part of State actions within the forecast.
- It appears that the 75% organic waste diversion associated with SB1383 has been applied to all solid waste emissions in the ABAU forecast. If SB 1383 is to be applied to waste emissions as part of the forecast, it should be adjusted to ensure that the anticipated reductions are only applied to organic waste to avoid overestimation of emission reductions.

Concluding Remarks and Recommendations

Rincon finds the data sources and methodologies used by Cupertino to quantify the inventories and forecasts generally appropriate and accurate. Rincon finds the inventories to be consistent with standard protocols and to use appropriate emission factors and methodologies. Inventory recommendations are for improved transparency and calculations simplicity but are not necessary to move forward. Whereas the items detailed regarding the forecast require clarification and/or updates to the calculations before Rincon can recommend Cupertino proceeding to a gap analysis.