<table>
<thead>
<tr>
<th>Submitted to: Santa Clara County</th>
<th>County of Santa Clara Office of Sustainability</th>
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<tr>
<td>Submitted by: ICF</td>
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<td>California Strategic Growth Council</td>
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Electric Vehicle Charging, GHG Emissions Reduction, Cost-Effectiveness and CEQA
Santa Clara County Driving to Net Zero Project

March 6, 2018
Driving to Net Zero

- Two year project funded by a grant from the Strategic Growth Council

- Objective: deliberately and effectively increase the adoption of zero emission vehicles throughout Santa Clara County

- Focuses on the role of county and municipal governments in the deployment of EV charging infrastructure
Relevant DNZ Resources

The DNZ website will be posting relevant resources for stakeholders, including:

- EV Best Practices Compendium
- EV Building and Zoning Code Evaluation and Recommendations
- CEQA Mitigation Mechanism Nexus & Proportionality White Paper
- EV Charging Station GHG Reduction Estimation Tool
Leading the Way in EVs

- California has ambitious goals for EV adoption
  - In 2012: set a goal of having 1.5 million ZEVs on the road by 2025
  - In 2018: increased goal to 5 million ZEVs on the road by 2030

- Santa Clara County is the leading region for early EV adoption

- ICF estimates that there will 250,000 EVs in Santa Clara County by 2025
Today’s Agenda

- CEQA Mitigation Requirements
- Establishing CEQA Nexus
- Establishing CEQA Proportionality
- Climate Action Plan and CEQA Precedents
- Sample CEQA Mitigation language
- Implementation Methods
- Estimating GHG Emissions Reductions
- Cost Effectiveness
CEQA Mitigation Requirements

- **U.S. Supreme Court**
  - *Nolan vs. California Coastal Commission*
    - Established that government exactions must be related to project impacts (“Nexus”)
  - *Dolan vs. Tigard*
    - Established that government exactions must be roughly proportionate to the project impacts (“Proportionality”)

- **CEQA Guidelines**
  - For significant impacts
  - Feasible, enforceable, verifiable
Establishing CEQA Nexus

- **Electric Vehicle Charging Stations (EVCS)**
  - Charging for electric vehicles (EVs) and plug-in hybrid EVs (PHEVs).
  - EVs/PHEVs small part of vehicle fleet, though growing.
  - Charging facilitates greater EV and PHEV use.
  - Electrical mode travel uses electricity instead of gas/diesel fuel.
  - Electricity GHG emissions are less than the tailpipe GHG emissions of gas/diesel vehicles.
    - EVCS GHG reductions have a nexus to GHG impacts of a project.
Establishing CEQA Proportionality

- Overall GHG mitigation can only be imposed to the extent necessary to address significant GHG impacts.
- Past thresholds
  - Based on AB 32 2020 target: reducing GHG emissions to 1990 levels by 2020.
- New thresholds
  - Based on SB 32 2030 target of 40% below 1990 levels by 2030
  - Projects beyond 2030 use target b/w 2030 and 2050 target of 80% below 1990 levels
- GHG mitigation
  - Mitigation for new development will be more substantial to meet new thresholds.
  - EVCS can be one of a suite of GHG mitigation measures.
Precedents – Local Climate Action Plans

- **Town of Los Gatos**
  - Complementary strategy to Measure TR-7.
  - “Install electric vehicle charging stations in high traffic areas through grant-funded programs encouraging electric vehicle use.”

- **City of Cupertino**
  - Measure M-VF-2, Alternative Fuel Infrastructure, as Action A. Install Electric Vehicle Charging Stations.

- **City of Mountain View**
  - Mechanism B.2 Publicly-Accessible EV Charging Facilities calls for “publicly-accessible [charging station] locations including commercial areas and municipally controlled areas.”

- **City of Los Altos**
  - Measure 1.3 Provide Alternative-Fuel Vehicle Infrastructure is supported by Actions A-D.
    - Action A: Continue to identify funding resources, locations, and existing station performance to support installing additional EV charging stations in public parking lots.
    - Action B: Encourage alternative-fuel vehicle charging stations in existing private development.
    - Action C: amend the Green Building Ordinance to include EV pre-wiring requirements and encourage EV charging installations in residential development.
    - Action D: amend the Green Building Ordinance to require EV charging stations in nonresidential projects 10,000 square feet or greater and encourage EV charging stations in projects under 10,000 square feet.
Precedents – Local Climate Action Plans

- **City of Milpitas**
  - **Measure 10.1.**
    - “revise parking standards for public and nonresidential development to include designated stalls for low-emissions, fuel-efficient vehicles and carpool/vanpool vehicles.”
  - **Measure 10.4**
    - “facilitate plug-in hybrid and electric vehicle charging stations for homes by promoting funding opportunities and streamlining permit procedures, including establishing maximum time frames for permit processing and simplified permit procedures.”

- **City of Santa Clara**
  - **Measure 6.3, Electric Vehicle Parking** which would: “Revise parking standards for new multi-family residential and nonresidential development to require that a minimum of one parking space, and a recommended level of 5% of all new parking spaces, be designated for electric vehicle charging.” To do this, the City of Santa Clara would:
    - Install EV charging stations in public parking lots.
    - At the time of the next comprehensive Zoning Code update, amend code to require a portion of new nonresidential parking spaces to include EV charging facilities.
    - At the time of the next comprehensive Zoning Code update, amend code to require that all new multi-family residential and nonresidential development contain at least one new EV charging station and to encourage a recommended maximum of 5% of all new multi-family parking spaces include EV charging stations.
Precedents – Newhall Ranch

- Large planned community
  - Santa Clarita Valley in northern Los Angeles County
  - 21,500 residential units, 1,000 acres commercial, and 2 business parks

- Original EIR challenged, including on GHG emissions.

- Case went to California Supreme Court
  - Court invalidate their GHG threshold approach

- Project Proponent decided to go net carbon neutral ("Net Zero Newhall")

- Three mitigation measures related to EVCS are included in the project:
  - GCC-4, Residential EV Chargers and Vehicle Subsidy ($1,000 per residence)
  - GCC-5, Commercial Development Area EV Chargers (7.5% of parking spaces)
  - GCC-12, Off-Site EV Chargers (2,000+ chargers)
  - Voluntarily agrees to additional 1,000 chargers
Sample CEQA Mitigation Language

- **Electrical Vehicle Charging/Preferential Parking**
  - The Project shall provide preferential parking in all parking lots for electric vehicles and shall also provide charging equipment, as follows:

- **Residential Use:**
  - A total of 10 percent of the required parking spaces shall be provided with a listed cabinet, box, or enclosure and connected to a conduit that links the parking spaces to the electrical service in a manner approved by the building and safety official.
  - Of the listed cabinets, boxes, or enclosures provided, 50 percent shall have the necessary electric vehicle supply equipment installed to provide active charging stations that are ready for use by residents.
  - The remainder shall be installed at such time as they are needed for use by residents.
  - Electrical vehicle batteries and charging technology may change substantially over the next 15 years. As such, the City shall have the discretion to modify the specific requirements for this measure over time, provided that 10 percent of the spaces have electrical service and 5 percent have active charging, depending on what the technology at the time requires.
Sample CEQA Mitigation Language

- **Commercial Use:**
  - New commercial uses shall provide the electrical service capacity necessary as well as all conduits and related equipment necessary to serve 10 percent of the parking spaces with charging stations in a manner approved by the City’s Building Official.
  - Of these parking spaces, 50 percent shall initially be provided with the equipment necessary to function as online charging stations upon completion of the Project.
  - The remainder shall be installed at such time as they are needed for use by customers, employees, or other users.
  - Electrical vehicle batteries and charging technology may change substantially over the next 15 years. As such, the City shall have the discretion to modify the specific requirements for this measure over time, provided that 10 percent of the spaces have electrical service and 5 percent have active charging, depending on what the technology at the time requires.
Implementation Methods

- **EVCS through Building Codes**
  - Building codes for development can be updated to require installation of EV-ready wiring and/or EVCS.
  - Thresholds of project size can be identified when requirements are triggered.
  - Details of specific requirements can be included.
  - Model building codes could be shared between neighboring jurisdictions or throughout the County.

- **EVCS as Part of a Climate Action Plan**
  - As already done by 6 jurisdictions in Santa Clara County.
  - Recommend separate measures for existing and new residential, non-residential, and institutional land uses.
  - GHG reduction benefit should be quantified using the methods discussed in the white paper.
Implementation Methods

- **EVCS Program**
  - Program could be developed that would evaluate the optimal public charging places throughout a jurisdiction or throughout the County.
  - Economies of scale for purchase and installation.
  - Uniform methods for estimating GHG reductions and cost-effectiveness.
  - Program received CEQA mitigation fees or other sources of funding.

- **EVCS as CEQA Mitigation on a Project by Project Basis**
  - GHG reduction potential based on project-specific parameters
  - Cost-effectiveness analysis help determine mitigation feasibility
  - Lead agency could establish acceptable methods using the white paper and tool to help streamline analysis.
Estimating GHG Emissions Reductions

- Method 1: EVCS Charging Activity Approach.
  - VMT is estimated based on the expected charging activity per day.
  - GHG reductions for an EVCS are only related to the charging activity.
  - Requires estimation of daily charger use
  - This is approach used in the tool and for Newhall Ranch

- GHG Emissions Reduced = GHG Emissions of Fleet Vehicles – GHG Emissions of EVs

- GHG Emissions of EVs = Charging Utilization (kwh/day)*Electricity Emissions Factor (CO2e/kwh) * days

- GHG Emissions of Fleet Vehicles = VMT (miles/day)*vehicle GHG efficiency (CO2e/mile) * # of days

- VMT (miles/day) = Charging Utilization (kwh/day)*EV efficiency (miles/kwh)
Estimating GHG Emissions Reductions

- **Method 2: Location-Based VMT Approach.**
  - VMT for EVs is based on the land use and location of the EV charger, the number of vehicle charges per day, and vehicle trips associated with that land use.
  - **Residential EVCS**
    - Option 1: assigned the benefit of shifting all residential fossil-fuel vehicle VMT to EV VMT.
    - Option 2: to home-based trip VMT.
  - **Non-residential EVCS,**
    - Option 1: VMT per charging parking space need to be estimated or
    - Option 1: VMT could be assigned based on work-trips only.

- \[ \text{GHG Emissions Reduced} = \text{GHG Emissions of Fleet Vehicles} - \text{GHG Emissions of EVs} \]
- \[ \text{VMT (miles/day)} = \text{Determined by VMT associated with land use} \]
- \[ \text{GHG Emissions of Fleet Vehicles} = \text{VMT (miles/day)} \times \text{Fleet Vehicle GHG Efficiency (CO2e/mile)} \times \# \text{ of days} \]
- \[ \text{GHG Emissions of EVs} = \text{VMT (miles/day)} \times \text{EV Efficiency GHG (kwh/mile)} \times \text{Electricity Emissions Factor (CO2e/kwh)} \times \# \text{days} \]
### Table 1: GHG Reduction Estimates (MTCO2e/Year)

<table>
<thead>
<tr>
<th>Source</th>
<th>Method, Year</th>
<th>New Residential</th>
<th>Existing Residential</th>
<th>Non-Residential</th>
<th>Public Lots</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Los Altos CAP</td>
<td>Method 2, 2020</td>
<td>4.29</td>
<td>4.23</td>
<td>1.77 (new)</td>
<td>1.60</td>
</tr>
<tr>
<td>City of Milpitas CAP</td>
<td>Method 2, 2020</td>
<td>0.72 (1)</td>
<td>--</td>
<td>2.30 (new)</td>
<td>--</td>
</tr>
<tr>
<td>Santa Clara CAP</td>
<td>Method 2, 2020</td>
<td>3.30 (2)</td>
<td>--</td>
<td>2.75 (commercial, new)</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.61 (industrial, new)</td>
<td></td>
</tr>
<tr>
<td>Newhall Ranch EIR</td>
<td>Method 1, 2030</td>
<td>5.06 (3)</td>
<td>--</td>
<td>19.6 (new) (4)</td>
<td>--</td>
</tr>
<tr>
<td>ICF EVCS Tool</td>
<td>Method 1, 2020</td>
<td>3.39 (5)</td>
<td>3.39 (5)</td>
<td>4.82 (6) weekdays only</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.77 (6) all days</td>
<td></td>
</tr>
</tbody>
</table>

Note: Estimates are for single year GHG reductions
(1) Only includes pre-wiring which will reduce installation costs. Does not include charger itself.
(2) Multi-family housing only
(3) Includes both EVCS and subsidy for EV purchase.
(4) This is an estimate for on-site EVCS in commercial area. Assumes 10 hours charging/day at max kw of 6.25 kw/hour
(5) Assumes average daily charging to cover 38 miles/day (~14,000 miles/year).
(6) Assumed average daily charging time of 3.6 hours/day, with max kw delivered of 7 kw/hour. Higher utilization would result in higher GHG reductions. For example, if utilization is 10 hours/day, then GHG benefit would be 18.83 MTCO2e/year for all days.

Source: For Los Altos, Milpitas, and Santa Clara CAPs – see Appendix A; Newhall Ranch – See Appendix B; ICF EVCS tool – see tool
Table 2: EVCS Costs

Cost Range, Single Port EVCS, non-residential

<table>
<thead>
<tr>
<th>Cost Element</th>
<th>California Existing Building (1)</th>
<th>SF Bay Area Existing Building (2)(3)(4)</th>
<th>SF Bay Area New Building (2)(3)(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Hardware</td>
<td>$400</td>
<td>$6,500</td>
<td>$400</td>
</tr>
<tr>
<td>Permitting</td>
<td>$3,553</td>
<td>$3,553</td>
<td>$145</td>
</tr>
<tr>
<td>Installation</td>
<td></td>
<td></td>
<td>$1,497</td>
</tr>
<tr>
<td>Total</td>
<td>$3,953</td>
<td>$10,053</td>
<td>$2,042</td>
</tr>
</tbody>
</table>

(4) Values shown are average of the low or high values shown in the studies for San Francisco (PG & E and Energy Solutions 2016) and Oakland (Energy Solutions 2016).
# Table 3: Cost Effectiveness

## Example Cost-Effectiveness, EVCS/non-residential

<table>
<thead>
<tr>
<th>Source</th>
<th>GHG Reductions (MTCO2e/year and /10 years) (2)</th>
<th>Charger and Installation Cost (3)</th>
<th>$/MTCO2e reduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Los Altos CAP</td>
<td>1.77 / 17.7</td>
<td></td>
<td>$426</td>
</tr>
<tr>
<td>City of Milpitas CAP</td>
<td>2.30 / 23.0</td>
<td>$7,547</td>
<td>$328</td>
</tr>
<tr>
<td>Santa Clara CAP</td>
<td>2.75 / 27.5</td>
<td></td>
<td>$274</td>
</tr>
<tr>
<td>Newhall Ranch EIR</td>
<td>19.6 / 196</td>
<td></td>
<td>$39 (4)</td>
</tr>
<tr>
<td>ICF EVCS Tool Example</td>
<td>6.47 / 64.7 (5)</td>
<td></td>
<td>$117 (5)</td>
</tr>
</tbody>
</table>

1. Assumes single-port Level 2 charger.
2. The GHG reduction values are from Table 1 above. Assumed 10 year EVCS lifetime. As noted therein, methodologies and assumption vary and thus estimates of cost-effectiveness are not strictly comparable.
3. Average charger and installation cost from Table 2 above, average value for Level 2 charger installation in existing buildings in SF Bay Area.
4. The Newhall Ranch estimate presumed 10 hours per charging per day.
5. The ICF estimate applied data for 2019 - 2029 the tool assumed only 3.6 hours charging per day. If an assumption of 10 hours charging per day were used, then the cost benefit would $42/MTCO2e.
Cost Effectiveness: Social Cost of Carbon

- Meant to be a comprehensive estimate of climate change damages
  - Includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning.
  - Current modeling and data limitations
  - Can also include social cost of methane and nitrous oxide

- Values vary depending on assumed discount rate and year
  - 2015, 3% discount rate = $36/MTCO2; 5% discount rate = $11/MTCO2
  - 2030, 3% discount rate = $50/MTCO2; 5% discount rate = $16/MTCO2
  - 2050, 3% discount rate = $69/MTCO2; 5% discount rate = $26/MTCO2

- Increase over time is due to increased climate change damages over time

### Table 4: Cost Effectiveness w/Social Cost of Carbon

<table>
<thead>
<tr>
<th>Source</th>
<th>GHG Reductions (MTCO2e/year and /10 years) (2)</th>
<th>Charger and Installation Cost (3)</th>
<th>Social Cost of Carbon ($, MTCO2e) (4)</th>
<th>$/MTCO2e reduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Los Altos CAP</td>
<td>1.77 / 17.7</td>
<td></td>
<td>$42</td>
<td>$384</td>
</tr>
<tr>
<td>City of Milpitas CAP</td>
<td>2.30 / 23.0</td>
<td>$7,547</td>
<td>$42</td>
<td>$286</td>
</tr>
<tr>
<td>Santa Clara CAP</td>
<td>2.75 / 27.5</td>
<td></td>
<td>$42</td>
<td>$232</td>
</tr>
<tr>
<td>Newhall Ranch EIR</td>
<td>19.6 / 196</td>
<td></td>
<td>$50</td>
<td>-$11 (5)</td>
</tr>
<tr>
<td>ICF EVCS Tool Example</td>
<td>6.5 / 64.7</td>
<td></td>
<td>$42</td>
<td>$75 (6)</td>
</tr>
</tbody>
</table>

1. Assumes single-port Level 2 charger.
2. The GHG reduction values are from GHG table above. Assumed 10 year EVCS lifetime. As noted therein, methodologies and assumption vary and thus estimates of cost-effectiveness are not strictly comparable.
3. Average charger and installation cost from cost table above, average value for SF Bay Area for existing building.
5. The Newhall Ranch estimate presumed 10 hours per charging per day.
6. The ICF estimate using the tool assumed only 3.6 hours charging per day. If an assumption of 10 hours charging per day were used, then the cost would be a net of $0/MTCO2e.
EVCS GHG and Cost Effectiveness Tool

Santa Clara Driving to Net Zero
GHG Reduction Estimation Tool for Electric Vehicle Charging Stations

Version 1
February 2018
Developed by ICF International
Questions?