

The California Environmental Quality Act

On the Front Lines of California's Fight Against Global Warming



A Center for Biological Diversity Report



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Front cover photos:
Clockwise from top: US Fish and Wildlife Service,
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The Center for Biological Diversity is a nonprofit
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SUMMARY

The State of California has long been a champion of environmental protection and a national leader in climate change policy. California has a number of laws and policies that address the critical challenge of slashing California's greenhouse gas emissions by mid-century. Prominent among these laws, but as yet little utilized, is California's flagship environmental protection statute, the California Environmental Quality Act (CEQA).¹ CEQA requires state and local agencies to assess and reduce to the extent feasible all significant environmental impacts from new project approvals. The CEQA environmental review process is fully established throughout the state, with a proven track record of mitigating impacts relating to air pollution, water quality and availability, land use, endangered species, and many other aspects of California's environment. With regard to climate change, CEQA offers an opportunity and a legal mandate for cities, counties, and government agencies to consider the greenhouse gas emissions from new projects they approve and to adopt the many measures available to reduce those emissions.

This paper describes the tremendous benefits to California from analyzing and reducing greenhouse gas emissions of new development through the CEQA process, and presents a blueprint for agencies and project applicants to address greenhouse gas emissions at each step in the CEQA review process. The assessment and reduction of greenhouse gas pollution through the CEQA process is one of our most important tools on the front lines of California's battle against global warming. For this reason, we encourage full implementation and enforcement of CEQA review of global warming impacts.

¹ Public Resources Code § 21000 et seq.; Cal. Code Regs., tit. 14, § 15000 et seq. ("CEQA Guidelines").

I. GLOBAL WARMING: IMPACTS AND RISKS TO CALIFORNIA AND THE WORLD

Changes in the climate in California and throughout the world are painfully apparent. Changes already observed in California include warmer winter and spring temperatures; a smaller mountain snowpack that melts one to four weeks earlier in the spring; increased frequency and severity of droughts, floods, and wildfires; changes in plant and animal populations and ranges; and about seven inches of sea level rise.

The California Climate Change Center's summary report presents future impacts based on a low, medium, and high emissions scenario (Luers et al. 2006). In all impact categories from temperatures to heat related deaths to wildfire risk to loss of the Sierra snowpack, impacts become far worse under the medium and high warming scenarios. The low warming scenario presumes a rapid shift away from fossil fuels and towards clean and resource-efficient technologies.

In addition to impacts to California, the Intergovernmental Panel on Climate Change reports that global warming impacts are similar across the United States and worldwide (Adger 2007). The IPCC projects an increase in global average surface temperature by as much as 11.5 °F over the next 100 years; reductions in snow cover and permafrost; reductions in sea ice extent, with the arctic becoming ice-free in the summer in the second half of the century; increases in frequency of extreme heat and heavy precipitation events; an increase in the intensity of hurricanes; increases in the intensity of

El Nino weather patterns; and changes in precipitation patterns, increasing or decreasing regionally by as much as 20% or more. These changes are predicted to displace millions of coastal residents, negatively impact public health, and lead to the catastrophic loss of biodiversity.

There is a large and growing body of economics literature on the environmental costs of climate change. For example, the Stern Review of the Economics of Climate Change (2006), a comprehensive report commissioned by the British government, concluded that if greenhouse gas emissions are unabated, each ton of carbon dioxide emitted today will cause damage worth at least \$85. Further, Stern (2006) warns that allowing current emissions trajectories to continue unabated would eventually cost the global economy between 5 to 20 percent of global gross domestic product (GDP) each year within a decade, or up to \$7 trillion, and that these figures should be considered conservative estimates. By contrast, measures to mitigate global warming by reducing emissions were estimated to cost about one percent of global GDP, or \$300 billion each year, and could save the world up to \$2.5 trillion per year (Stern 2006).

The severity of future global warming impacts is a collective societal choice: the longer it takes to reduce emissions, the worse the changes will be. Leading climate scientists warn that just ten more years of continued global "business as usual" greenhouse gas emissions will make it difficult or impossible to achieve the low warming scenario and avoid some of the worst impacts, including 20 feet of sea level

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rise in as little as a century, and the displacement of millions of coastal residents worldwide (Hansen et al. 2006, 2007). One scientific review determined that 35 percent of species may be committed to extinction by the year 2050 under a high emissions scenario (Thomas et al. 2004). Quite literally, continued unabated greenhouse gas emissions threaten life

on earth as we know it.

The importance of reducing greenhouse gas pollution cannot be overstated: reductions made today not only make economic sense, but will determine the type of climate and quality of life experienced by our children and grandchildren.

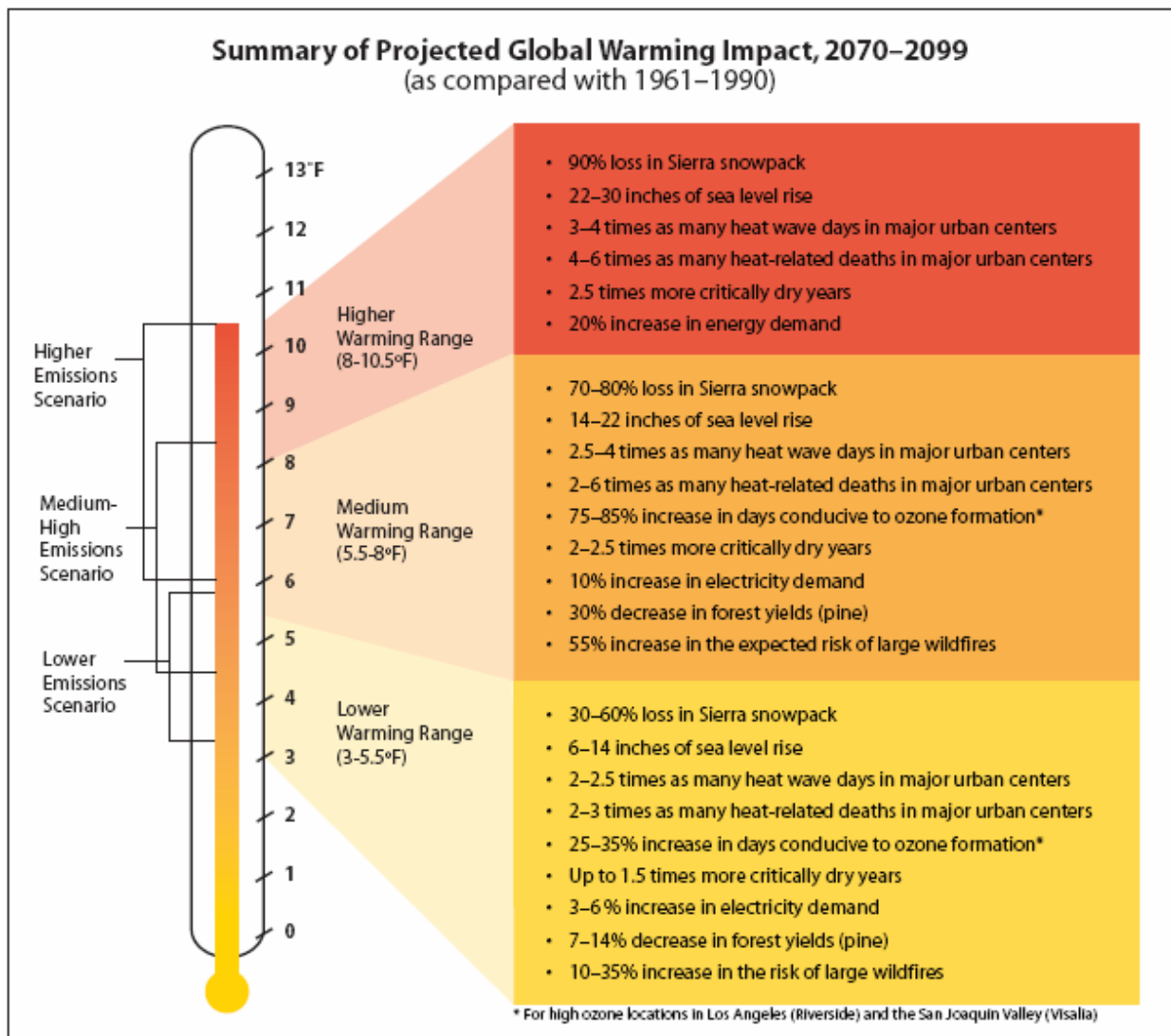


Figure from Luers et al. 2006.

II. CALIFORNIA'S COMMITMENT TO FIGHTING GLOBAL WARMING

The significant risks climate change poses to California as well as the considerable benefits of reducing the State's greenhouse gas emissions have resulted in many laws and policies designed to reduce greenhouse gas emissions and increase energy efficiency and the use of renewable energy. These include California's Clean Vehicle Law (AB 1493, 2002), Governor Schwarzenegger's June 2005 Executive Order S-3-05, the California Global Warming Solutions Act of 2006 (AB 32, 2006), and many others.

California's Clean Vehicle law was implemented through a 2004 California Air Resources Board (CARB) rulemaking and would result in an 18% reduction in greenhouse gas emissions from California light-duty passenger vehicles by 2020 and a 27% reduction by 2030. These reductions would also be achieved, according to the CARB staff analysis, at a net benefit to the California economy.

The Governor's Executive Order established greenhouse gas emission targets as follows: by 2010, reduce emissions to 2000 levels; by 2020, reduce emissions to 1990 levels; and by 2050, reduce GHG emissions to 80 percent below 1990 levels. The Executive Order also established the interagency California Climate Action Team to coordinate the State's reduction efforts and report back on the progress of those efforts as well as the ongoing impacts of global warming on the State.

The California Global Warming Solutions Act of 2006 is the nation's first mandatory cap on a state's overall greenhouse gas emissions. The Act states:

Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems.

The Global Warming Solutions Act requires the reduction of emissions to 1990 levels by the year 2020. The law will be implemented through a series of CARB rulemakings including establishing emission source monitoring and reporting requirements, discrete early action emission reduction measures, and finally greenhouse gas emission limits and measures to achieve the maximum feasible and cost-effective reductions in furtherance of the greenhouse gas emission cap.

Solving our climate crisis requires action on many fronts and pursuant to many different laws and policies. California's important new laws and policies are in addition and completely complementary to the existing obligation of state and local agencies to analyze the

greenhouse gas emissions from new project approvals pursuant to CEQA.²

Indeed, recognizing that CEQA provides an independent basis to combat global warming, the legislature recently passed SB 97 (2007), which requires the Office of Planning and Research to prepare by July 1, 2009, and the Resources Agency to certify by January 1, 2010, guidelines "for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions as required by [CEQA], including, but not limited to, effects associated with transportation and energy consumption."

III. ASSESSMENT OF GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE UNDER CEQA

The CEQA environmental review process requires state and local agencies to analyze and disclose all significant environmental impacts of their discretionary project approvals. CEQA provides for varying levels of review based on the nature of the project's impacts. A Negative Declaration indicates that an initial study does not reveal any potentially significant environmental impacts. A Mitigated Negative Declaration indicates that potentially significant impacts exist but can be avoided or mitigated to below significance. Where there is a "fair

² For example, the Global Warming Solutions Act states repeatedly that "[n]othing in this division shall relieve any person, entity, or public agency of compliance with other applicable federal, state, or local laws or regulations, including state air and water quality requirements, and other requirements for protecting public health or the environment." *Health and Safety Code* § 38592(b); see also *id.* § 38598.

argument" that the project would have one or more significant environmental impacts, an Environmental Impact Report ("EIR") must be prepared (*Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.* [1993] 6 Cal.App.4th 1112, 1123; see also Pub. Res. Code § 21082.2).

An EIR is a documented review of the significant environmental effects of a project, possible ways to minimize those effects, and a comparison of alternative versions of the project. The purpose of the EIR is to inform agency decisions with regard to projects, to improve projects by reducing and mitigating environmental effects, and to inform the public and facilitate public input into the decisionmaking process. Once an agency has determined that a project's environmental effects will be significant, the agency cannot approve the project as proposed if there are feasible alternatives or feasible mitigation measures that will avoid or substantially lessen those effects (Pub. Res. Code § 21002). This paper focuses on the EIR process to disclose and analyze the project's greenhouse gas emissions.

A. Environmental Impacts Analysis

A project impact must be assessed if it has "an effect on the environment within the meaning of CEQA" (See *Protect the Historic Amador Waterways v. Amador Water Agency* [2004] 116 Cal.App.4th 1099, 1111). Global warming affects the "environment" as defined by CEQA³

³ CEQA defines "environment" as "the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, noise, objects of historic or aesthetic significance." Pub. Res. Code § 21060.5.

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because global warming affects the physical conditions in all regions of California. Because a project that generates greenhouse gas emissions contributes to global warming, this impact must be fully disclosed and analyzed under CEQA.

In order to properly analyze a project's climate change impacts, an EIR should: 1) provide a regulatory and scientific background on global warming; 2) assess the project's contribution to climate change through an emissions inventory; 3) assess the effect of climate change on the project and its impacts; and 4) make a significance determination.

1. Providing a Scientific and Regulatory Background on Global Warming

As discussed above, climate change poses enormous risks to California. In order to assess a project's contribution to global warming, the EIR should provide an accurate and relevant summary of global warming and its impacts. The scientific literature on the impact of greenhouse gas emissions on California (and the world) is well developed and can provide the context for this discussion.⁴ The summary should make a good faith effort at full disclosure and avoid minimizing or discounting the severity of global warming's impacts (see CEQA Guidelines 14 C.C.R. § 15151; *San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus* [1994] 27 Cal.App.4th 713).

⁴ Reports issued by California agencies are available at <http://www.climatechange.ca.gov>, and IPCC reports available at <http://www.ipcc.ch/>.

The EIR should also include a brief discussion of other laws that address climate change, including California's mandate to reduce emissions to 1990 levels by 2020 and goal of further reducing emissions to 80% below 1990 levels by 2050. Achievement of state-mandated emissions reductions will be severely impeded if agencies across the state continue to approve new projects without incorporating measures to reduce the added emissions created by these projects.

2. Assessing the Project's Greenhouse Gas Emissions

To assess the project's greenhouse gas pollution, the EIR should complete an inventory of all of the project's emission sources. This inventory should include a "sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences," and should include direct and indirect sources included in all phases of the project (CEQA Guidelines §§ 15151; 15126; 15358(a)(2)). The greenhouse gas inventory can be conducted in conjunction with the assessment of the project's energy consumption, required by Pub. Res. Code § 21100(b)(3) (see also CEQA Guidelines § 15126.4).

While the exact contents of an inventory will vary depending on the project considered, sources to consider include the following:

- Electricity and natural gas usage in buildings;
- Vehicle trips generated by the project;

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- Water supply and transportation to the project;
- Operation of construction vehicles and machinery;
- Manufacture and transport of building materials;
- Waste disposal, including transport of solid waste and methane emissions from organics decomposition;
- Process emissions, such as from the production of cement or the refining of gasoline;
- "End use" emissions, such as the burning of the fossil fuels extracted by a production project;
- Agricultural processes, including methane from concentrated animal manure;
- Fugitive emissions, such as methane leaks from pipeline systems and leaks of HFCs from air conditioning systems.

A project's greenhouse gas emissions can be measured through a variety of straightforward inventory methodologies including protocols from the California Air Resources Board, the California Climate Action Registry, the California Energy Commission, U.S. Environmental Protection Agency, Intergovernmental Panel on Climate Change, and non-governmental organizations. Inventory methodologies are listed in the Appendix of this paper.

3. Assessing the Effect of Global Warming on the Project and the Project's Impacts

The EIR should discuss how climate change will affect the project and its

impacts. For example, a development project in a coastal area may be subject to flooding based on projected sea level rise. In addition, global warming may exacerbate or change a proposed project's impacts. Dewatering of rivers by pumping will be much more significant if surface flows are reduced by global warming; higher air temperatures will increase the formation of ground level ozone; and species at risk from temperature increases and changes in precipitation will be more sensitive to project impacts to their habitats. In sum, global warming may exacerbate a project's impacts or reduce the effectiveness of mitigation measures to reduce those impacts, and the EIR should include a discussion of these dynamics.

4. Making a Significance Determination

After disclosing and analyzing a project's greenhouse gas emissions, the agency must determine whether the impacts from those emissions are significant (Pub. Res. Code § 21082.2). A lead agency must determine not only whether a project's impacts will be significant in and of themselves, but also whether the impact will be significant on a cumulative basis. A project's impacts require a mandatory finding of significance if they are "cumulatively considerable" (Pub. Res. Code § 21083(b)). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects" (CEQA Guidelines § 15064(h)(1)).

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Climate change is a classic example of a cumulative effects problem: emissions from numerous sources combine to create the most pressing environmental and societal problem of our time. These sources may appear insignificant when considered individually, but assume threatening dimensions when considered collectively with other sources with which they interact (see *Los Angeles Unified School Dist. v. City of Los Angeles* [1997] 58 Cal.App.4th 1019, 1025). The solution to climate change lies not in any one single action, but in systematically reducing emissions from all possible sources.

While a particular project's greenhouse gas emissions represent a fraction of California's total emissions, courts have flatly rejected the notion that the incremental impact of a project is not cumulatively considerable because it is so small that it would make only a *de minimis* contribution to the problem as a whole (see *Communities for a Better Environment v. California Resources Agency* [2002] 103 Cal.App.4th 98, 117).⁵ An EIR may not use the magnitude of a current problem to trivialize the project's impacts (see *Kings County Farm Bureau v. City of Hanford* [1990] 221 Cal.App.3d 692, 719). Rather, "the greater the existing environmental problems are, the lower the threshold should be for treating a project's contribution to cumulative

impacts as significant" (see *Communities for a Better Environment* 103 Cal.App.4th at 120). In light of the magnitude and scope of the climate change impacts facing California and the mandate of both the California Global Warming Solutions Act of 2006 and Executive Order S-3-05 that existing levels of greenhouse gases be significantly reduced, any new emissions generated by a project should be considered cumulatively significant.

Consistent with CEQA's treatment of cumulative impacts, lead agencies have explicitly determined that *any* increase in greenhouse gases above existing levels is a significant impact under CEQA (see *Marin Countywide Plan Update DEIR*, 2007; *San Diego Ass'n of Governments Regional Transportation Plan DEIR*, 2007). Other agencies have declined to make a significance determination on global warming impacts based on the assertion that doing so would be "speculative." In the case of climate change, there is nothing speculative about the fact that: 1) new sources of greenhouse gases add to existing levels; and 2) the state has determined existing levels are unacceptable and must be reduced within a fixed timeframe.

Moreover, even where there is no universally accepted methodology as to what constitutes a significant impact, a lead agency must still meaningfully attempt to quantify a particular impact and determine whether the impact is significant (see *Berkeley Keep Jets Over the Bay Committee v. Board of Port Commissioners* [2001] 91 Cal.App.4th 1344, 1370-71). Accordingly, the lack of established greenhouse gas thresholds does not

⁵ See also *Massachusetts v. EPA*, 127 S.Ct., 1438, 1457 (2007) (U.S. Environmental Protection Agency arguments for not regulating carbon dioxide from vehicles under the Clean Air Act "rests on the erroneous assumption that a small incremental step, because it is incremental, can never be attacked in a federal judicial forum [. . .] Agencies, like legislatures, do not generally resolve massive problems in one fell regulatory swoop.").

shield a lead agency from making a significance determination on global warming impacts. Because the legislature has determined that California's current greenhouse gas baseline is so high that it requires significant reductions, and any additional emissions will exacerbate existing conditions, it is difficult to see how a new source, even a small one, can be cumulatively insignificant.

Because additional greenhouse gas emissions from new projects will nearly always qualify for a mandatory finding of significance under CEQA as a cumulative impact, an agency's determination of whether the emissions should be considered significant in and of themselves may assume less importance as a practical matter. While the authors believe that agencies should consider emissions from large projects significant in their own right as well as cumulatively, agencies will exercise their discretion in this regard and further clarification will likely come in the form of case law or guidance.

It does not follow from this analysis, however, that every project that generates greenhouse gas emissions will require an EIR. As with any other potentially significant impact, the project may include measures to reduce the impact of greenhouse gas emissions to below significance, allowing for a Mitigated Negative Declaration (Pub. Res. Code § 21064.5). As discussed below, there are many mitigation measures available for housing and other types of projects that can do so.

B. Evaluation of Alternatives

A rigorous analysis of alternatives is essential to avoid or substantially lessen environmental impacts in the first instance (Pub. Res. Code § 21002; CEQA Guidelines §§ 15002(a)(3), 15021(a)(2)). "Without meaningful analysis of alternatives in the EIR, neither courts nor the public can fulfill their proper roles in the CEQA process" (*Laurel Height Improvement Ass'n v. Regents of University of California* [1988] 47 Cal.3d 376, 404). With regard to development projects, an EIR should examine alternatives that call for higher density development, mixed use, and site locations in urban areas that would reduce vehicle miles traveled. In the case of fossil fuel related energy projects, an EIR should examine the feasibility of energy generation utilizing renewable energy sources. Impacts should be avoided wherever possible through the adoption of environmentally superior alternatives.

C. Adoption of Feasible Mitigation Measures

Mitigation of a project's significant impacts is one of the "most important" functions of CEQA (*Sierra Club v. Gilroy City Council* [1990] 222 Cal.App.3d 30, 41). Once an agency has determined that a project's greenhouse gas emissions will be significant, the agency cannot approve the project as proposed if there are feasible alternatives or feasible mitigation measures that will avoid or substantially lessen the project's significant environmental effects (Pub. Res. Code § 21002).

The applicability of mitigation for global warming impacts was recognized by the

legislature in SB 97, which sets a deadline of January 1, 2010, for the Resources Agency to certify and adopt guidelines developed by the Office of Planning and Research "for the mitigation of greenhouse gas emissions as required" by CEQA. While SB 97 clarifies that the legislature considers global warming to be an impact requiring mitigation under CEQA, nothing in SB 97 postpones or defers the current obligation of agencies to mitigate greenhouse gas emissions from proposed projects prior to the adoption of guidelines by the Resources Agency.

Agencies should utilize a hierarchy of options to avoid and reduce greenhouse gas emissions before moving on to other types of mitigation. For example, with regard to energy use, the agency should first look at reducing the energy required by the project, then at measures to generate the remaining energy from renewable sources, then at measures to offset any remaining energy related emissions. (See Pub. Res. Code § 21100(b)(3); CEQA Guidelines, App. F; see also *Anderson First Coalition v. City of Anderson* [2005] 130 Cal.App.4th 1173). Measures to reduce climate change impacts may not be deferred until some future time or be so vague that it is impossible to evaluate their effectiveness (see CEQA Guidelines § 15126.4(a)(1)(B)).

While the specific array of feasible mitigation measures varies with the diversity of project proposals in California, there is a common suite of avoidance and mitigation measures for many types of projects. Below we discuss two of the most common project types, proposals for new residential or

commercial buildings and municipal general plans.

1. Avoiding and Mitigating a Building Project's Greenhouse Gas Emissions

California has access to nearly year-round sunshine in vast areas of the state and already has more stringent energy efficiency requirements than the rest of the nation as a whole. This has placed our state in an enviable position: by increasing green building practices, it is feasible today to build many structures with vastly reduced energy needs for heating, cooling, lighting, and other needs. Mitigation measures agencies should consider include the following:

- Constructing highly energy-efficient buildings to decrease heating, cooling, and other energy demands, including using passive heating, natural cooling, and reduced pavement;
- Utilizing high-efficiency heating and cooling systems, lighting devices, and appliances;
- Minimizing and recycling construction-related waste;
- Using salvaged and recycled-content materials, and other materials that have low production energy costs, for building materials, hard surfaces, and non-plant landscaping;
- Maximizing water conservation measures in buildings and landscaping;
- Installing photovoltaic solar energy arrays on buildings to meet energy needs;

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- Installing solar hot water systems to meet hot water needs; and
- Cooperating with local transportation agencies to secure public transportation, and contributing to public transportation infrastructure.

2. Mitigating a Municipal Plan's Greenhouse Gas Emissions

The adoption and updating of municipal general plans and transportation plans offer exceptional opportunities to examine the impact of agency planning and policy on greenhouse gas pollution and to adopt measures to reduce that pollution. Mitigation measures incorporated into these multi-year plans would not only reduce the greenhouse gas emissions and global warming impacts of the plans, but facilitate the development of future projects with lower impacts and greater opportunities for mitigation. For example, municipal plans can include provisions for:

- Expanded public transportation service and infrastructure, such as bus and light rail lines;
- Energy efficiency/green building requirements, adopted via ordinances, codes, and regulations;
- Installation of electric vehicle charging stations;
- Expanded infrastructure for pedestrian and bicycle circulation;
- Public awareness and education programs;
- Conversion of state, local, and private fleets to alternative fuel vehicles, and requirements and incentives for fleets to run on alternative fuels;

- Capture and control of methane from municipal landfills and composting facilities; and
- Incentives to focus housing development along existing travel corridors, urban areas, and as in-fill.

3. Offsetting Greenhouse Gas Emissions

Once all measures to avoid and minimize greenhouse gas emissions have been adopted, the project will need to offset the remaining greenhouse gas emissions. Offsets are a type of offsite mitigation in which the greenhouse gas emissions of the project are balanced by an action to reduce greenhouse gas emissions elsewhere. Credit is given in the amount of emissions avoided or sequestered by the offsite project. It is critical that offsets be real, verifiable, and permanent, and not have adverse impacts on communities or the environment. For example, offsets can include a retrofit of previously existing buildings in the project area to make them more energy efficient, or the installation of photovoltaic arrays or solar water heating systems on offsite buildings.

However, offsite mitigation and offsets should be pursued only after all feasible onsite actions have been undertaken to maximally avoid and reduce the project's greenhouse gas emissions. Furthermore, any offsite mitigation should give the highest priority to offsets within California in order to contribute to state-wide greenhouse gas emissions reductions and to help ensure that the offsets comply with California environmental laws and emissions standards.

D. Statements of Overriding Considerations

If a proposed project will still have a significant impact on the environment after all feasible alternatives and avoidance and mitigation measures have been adopted, an agency may still approve the project if it adopts a "Statement of Overriding Considerations" (CEQA Guidelines § 15092). Thus, CEQA does not prevent agencies from approving new sources of greenhouse gas emissions, it simply provides a time-tested mechanism for agencies to explore and adopt options to reduce greenhouse gas emissions. It also serves an important informational purpose – the public and decision-makers can track a jurisdiction's approach to greenhouse gas reductions and the success of that approach through the CEQA process. CEQA will continue to illuminate, as the Legislature intended, the way that local elected officials balance factors, including the environment and greenhouse gas emissions, in their project approvals.

IV. CONCLUSION

The solutions to climate change are multi-faceted, including the need for a federal commitment to reducing greenhouse gas emissions, a world-wide transition away from fossil fuels and towards renewable and low-carbon energy sources, and a general adoption of all possible means of systematically reducing emissions from all sources. These challenges will be made even more difficult if we continue to engage in land use and planning decisions that do not take global warming into account.

The solutions to climate change, then, are also highly local. In California we are extremely fortunate to already have an established and straightforward mechanism for evaluating and ameliorating the greenhouse gas emissions from local project approvals. Taking full advantage of the CEQA review process to do so will continue to be an important and integral part of solving the climate crisis.

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APPENDIX: METHODOLOGIES FOR CALCULATING A PROJECT'S GREENHOUSE GAS EMISSIONS

The following resources are available for calculating a project's greenhouse gas emissions. No single protocol will necessarily fulfill CEQA's requirement to assess all of a project's direct and indirect emissions. It may be necessary to combine more than calculation protocol to include all of the project's impacts.

- The **California Climate Action Registry**, <http://www.climateregistry.org/>, is developing inventory protocols for many greenhouse gas emission sources, including: electricity use; motor vehicles; stationary combustion sources such as power plants, refineries, manufacturing processes, and furnaces; purchased steam, heat, and power from co-generation plants; fugitive emissions; cement manufacturing; forestry operations; and livestock operations.
- The **California Energy Commission** 2006 "*Inventory of California Greenhouse Gas Emissions and Sinks: 1990-2004*," Appendix B, describes methodologies for the calculation of CO₂ and methane emissions from a variety of sources. The report is available at: http://www.climatechange.ca.gov/policies/greenhouse_gas_inventory/index.html;
- The **California Air Resources Board** has developed the **Emission FACTors (EMFAC)** model computer program to calculate CO₂ and methane emissions from motor vehicles. The model and data are available at: http://www.arb.ca.gov/msei/onroad/latest_version.htm.
- The **U.S. Environmental Protection Agency** 2007 "*Inventory of U.S. greenhouse gas emissions and sinks: 1990-2005*" provides an inventory of greenhouse gas emissions by state, and methodologies for estimating CO₂, methane and N₂O emissions from a variety of sources. The report is available at: <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>.
- The **U.S. Environmental Protection Agency** provides a clearinghouse of online programs for calculating greenhouse gas emissions from homes and businesses, motor vehicles, and solid waste, and for converting emissions to CO₂ equivalents. The clearinghouse is available at: <http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterToolsCalculators.html>.
- The **U.S. Environmental Protection Agency** Climate Leaders Program offers a **Greenhouse Gas Inventory Protocol** based on the Greenhouse Gas Protocol (GHG Protocol) developed by the World Resources Institute and the World Business Council for Sustainable Development Emissions Inventory Improvement Program. The program and documents are available at: <http://www.epa.gov/climateleaders/resources/index.html>.
- The **Intergovernmental Panel on Climate Change 2006 Guidelines for National Greenhouse Gas Inventories** provides methodologies for calculating greenhouse gas emissions from energy production, transport, and use; industrial processes and product use; agriculture, forestry, and other land use; solid waste and wastewater treatment. The guidelines are available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm>.
- **World Resources Institute** and the **World Business Council for Sustainable Development** (WRI/WBCSD) provide standards and guidance for a greenhouse gas emissions inventory, covering the six greenhouse gases covered by the Kyoto Protocol--CO₂, methane, N₂O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆). The protocols are available at <http://www.ghgprotocol.org>.