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SUSTAINABLE TRANSPORTATION ENERGY PATHWAYS
of the Institute of Transportation Studies

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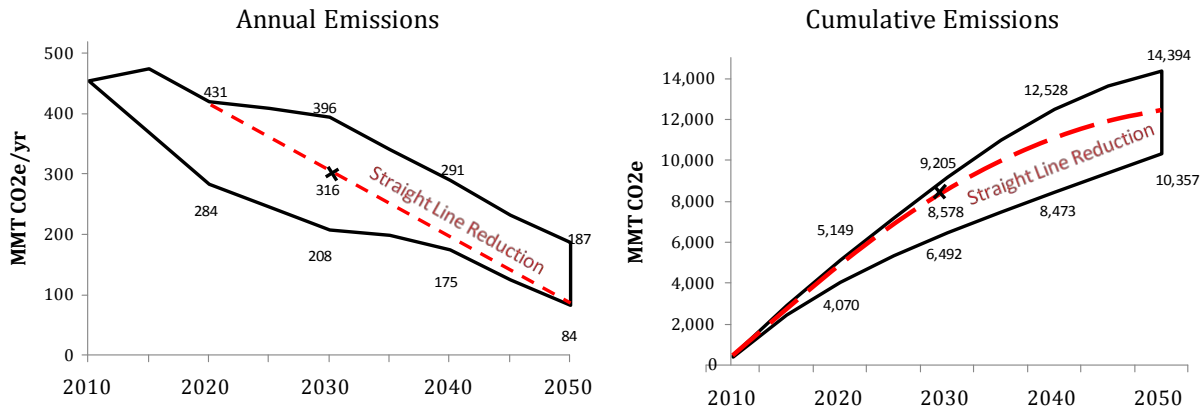
Full summary report

Energy and Climate Experts Find Wide Range of 2030 Emissions Targets on Path to 2050

The UC Davis Policy Institute for Energy, Environment and the Economy and the Sustainable Transportation Energy Pathways (NextSTEPS) program of the Institute of Transportation Studies (ITS-Davis) hosted a forum in December 2013 as part of the California Climate Policy Modeling (CCPM) project. Six of the models presented at the forum included "deep GHG reduction scenarios" that achieved either a reduction of 80% in GHG emissions by 2050 or cumulatively similar emission reductions. **These scenarios showed the potential to reduce greenhouse gas emissions 8-52% below 1990 levels by 2030 through a combination of strategies that include energy efficiency, renewable energy and low-carbon transportation solutions.**

The CCPM is an ongoing project to bring together policy makers, modeling groups, and key stakeholders to: 1) improve the knowledge of possible scenarios for future technology adoption, energy use, air quality, and greenhouse gas (GHG) emissions, 2) identify midpoint goals and/or targets for GHG emissions between 2020 and 2050, 3) discuss policy options for meeting the state's climate and air quality goals, identify policy gaps, and improve existing policies and, 4) improve the state of modeling, including identifying ways to make the findings more useful and accessible to policymakers.

Modeling teams represented at the forum included UC Davis; UC Berkeley; Stanford University; Lawrence Berkeley National Laboratory; National Renewable Energy Laboratory; and the private consulting firm E3. Representatives from the California Governor's Office, Air Resources Board, Energy Commission, Public Utilities Commission, and other stakeholders also attended the two-day conference and provided substantive input.



ANNUAL AND CUMULATIVE EMISSIONS IN SCENARIOS THAT ACHIEVE DEEP GHG EMISSIONS REDUCTIONS BY 2050.

Key insights from the forum included:

- **2030 annual emissions range from 208-396 million metric tonnes** (MMT) of CO_2e per year, or a reduction of **8-52% below 1990 levels**.
- Demonstrating the potential significance of early reductions, cumulative emissions range from **6,492-9,205 MMT (through 2030)** and **10,357-14,394 MMT (through 2050)**.
- De-carbonizing end-use energy consumption, including transportation and residential and commercial heating are key compliance pathways to meet the 2050 goals across all models. If pursued primarily through electrification, **total electricity generation for California will rise dramatically from today's level of approximately 323 terawatt hours (TWh) to between 436-1375 TWh in 2050**.
- Estimates of renewable generation, excluding large hydroelectric, wary widely from **30-55% in 2030 increasing to 38-94% in 2050**. The renewable fraction is largely driven by assumptions about the availability or lack of nuclear power and carbon capture and storage.
- **Absent further policy, non-energy related and high-global-warming potential GHG emissions could exceed the 2050 emission goal even if all other emissions are zero**.
- Transportation achieves the largest magnitude of GHG reductions of any sector from 2010 to 2050, while at the same time remaining the highest contributor to overall emissions of any sector with emissions of between **30-105 MMT in 2050**. Zero emission vehicles including **plug-in battery electric and hydrogen fuel cell vehicles dominate the light-duty market making up between 50-96% of the fleet by 2050**.
- Biomass is used almost exclusively for transportation. Due to feedstock limitations, maximum penetration of **biofuels in the transportation energy mix is estimated at approximately 40% across all modes supplying between 5.5-10.3 billion gallons of gasoline equivalent in 2050.**
- Strategies are needed that simultaneously reduce GHG emissions, particulate matter, oxides of nitrogen, and/or reactive organic gases related to ozone pollution consistent with both the near-term 2023 and midterm 2032 national ambient air quality standards and long-term 2050 GHG targets. For those scenarios that are also designed to consider air quality goals, **zero and near zero-emission goods movement solutions are needed by 2030, especially in the South Coast and San Joaquin Valley Air Basins**.
- Estimates of average carbon mitigation cost vary between models, across sectors and time periods. One model reports the **average mitigation costs (including savings from demand reduction and efficiency improvement) over the time period from 2010-2050 range from -$110 (savings) to +$220/tCO2e. In another the average mitigation cost from 2010-2050 is $109/tCO2e with the average in 2050 equal to $97/tCO2e.**
- More dialogue between modelers and policymakers is needed to guide decision-making and policy design, and to improve the value of future modeling efforts. Opportunities to improve the usefulness of modeling outputs include greater representation of explicit policies, uncertainty, scenarios impacts to other non-energy related metrics (e.g. water, land-use, air quality) and the use of a broader range of performance metrics for reporting the results. Modelers would benefit from greater access to relevant government-collected data and the status and plans for current and future policies.

For more information on the forum including the full summary, models, documentation and key publications and presentations, please visit the CCPM link at: policyinstitute.ucdavis.edu/initiatives/ccpm/