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RE: EDF Comments on Proposed Scoping Plan for Achieving 2030 Target

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Introduction

Thank you for this opportunity to comment on the Proposed 2030 Scoping Plan Update. We appreciate the hard work of staff and the board that has gone into this process and that will continue as a Scoping Plan Update is adopted and implemented. EDF is committed to promoting science-based solutions to address climate change and bring greenhouse gas emissions to 40% below 1990 levels by 2030. California has made good faith efforts to try to fight dangerous emissions that impact our climate, and we commend the California Air Resources Board (CARB) for moving toward greater efforts in addressing climate warming and air quality impacts in its latest Scoping Plan update.

Supporting California's climate policies is an important organizational priority for EDF. California is providing a critical example to the global community of how to implement ambitious climate policies while balancing important policy priorities including economic prosperity, health, jobs, strong communities, and a clean environment. The Scoping Plan is an essential blue print for this important effort. California is setting a world standard for best practice through this process which has experienced important improvements and change since the initial Scoping Plan Process in 2008. EDF is particularly encouraged to see a commitment to increased outreach and public engagement with environmental justice communities, further incorporation of health considerations and local air quality issues in this Proposed Scoping Plan, and an even more rigorous engagement with expert agencies across California.

EDF Supports Adoption of the Proposed 2030 Scoping Plan

Staff Lead: Erica Morehouse

Below are comments on areas of this Proposed Scoping Plan in which EDF has particular interest and expertise. Overall, EDF supports adoption of the Proposed Scoping Plan. Our comments reflect suggestions that are consistent with the general proposed direction of the Scoping Plan. These comments also identify areas which we believe could benefit from refinement before the final adoption, areas we hope to work closely on, or where we would like

to see staff pay particular attention during implementation of this Scoping Plan Update.

EDF believes a cap-and-trade program is an essential part of a post-2020 scoping plan

EDF believes that a state-wide, post-2020 cap-and-trade program is an essential component of California's 2030 Scoping Plan. **The cap-and-trade program places an absolute limit on carbon pollution and ensures California does not exceed the carbon budget it has set for itself** while also providing some flexibility in meeting those requirements. This backstop is an essential companion to other Scoping Plan policies because it provides reduction certainty and ensures that Californians do not have to choose between ambitious climate action and a thriving economy.

Extending Cap and Trade in California sets the state up to continue as one of the foremost global leaders on climate action. Carbon pricing is gaining momentum globally and California's program has been a model for global action. Continuing Cap and Trade will send an important message to other global actors that ambitious climate action is workable. The cap-and-trade framework also provides more direct opportunities for cooperation through international linkages like the one California already has with Quebec. Ontario is on track to link their new cap-and-trade program to California and Quebec's in early 2018, showing the power of subnational leadership and the viability of California and Quebec's model. Others like Mexico and the state of Oregon are actively considering climate policy proposals including ones that might provide direct linkage opportunities with California**. EDF strongly supports keeping the pathway open to these linkages and partnerships, including those that focus primarily on information sharing and best practices and contribute to medium- and long-term amplification of California's climate ambition globally.**

Similarly, Cap and Trade provides an important opportunity for California to provide leadership in driving global carbon reductions through linkages such as sectoral offsets. EDF believes that California's role in discouraging deforestation and forest degradation in places like Brazil is critical for ensuring that forests are worth more alive than dead, and that programs to protect forests benefit the communities who depend on, manage, and defend them. **EDF continues to support a linkage with Acre, Brazil, to accept sectoral forest credits during the third cap-and-trade compliance period.**

Carbon pricing facilitated by Cap and Trade is most effective as a long-term signal that incentivizes emissions reductions, technology adoption, and innovation by internalizing the cost of emissions for polluters. Even switching to another form of carbon pricing like a carbon tax mid-stream would be disruptive. Many regulated businesses must make investment decision on multi-year time horizons and policy certainty and consistency is essential to encouraging and rewarding responsible climate action. Cap and Trade provides flexibility for those regulated so that the lowest-cost emissions reductions can be achieved first and regulators are not forced to dictate emission reduction strategies for sectors where the best path to reductions is uncertain.

The long-term economic signal created by the cap-and-trade market also provides an opportunity to incentivize reductions from difficult to regulate sectors like natural and working lands through the offsets program. Offsets also provide what we believe will be an

increasingly important cost-containment function as California work to achieve a much more ambitious 2030 target, all while maintaining the highest standards for achieving real, permanent, and verifiable GHG reductions.

EDF believes that the cap-and-trade program can work effectively with a suite of other climate and air quality policies that move California toward the cleaner, healthier, lower carbon economy Californians need.

EDF supports scoping plan measures that will fast track reductions of both GHGs and local pollutants that impact health

Despite decades of hard work by CARB and others and significant progress, local air pollution remains a serious threat to public health in many parts of California. It is low-income neighborhoods and communities of color that are often most impacted by poor air quality. To achieve greater environmental equity we must be constantly vigilant for opportunities to clean up our most impacted neighborhoods and air basins. EDF recognizes that many, but not all, reductions of GHGs could lead to corresponding reductions in local and toxic air pollutants.[1] **Because of this close but not one-to-one relationship between GHG pollutants and local or toxic air pollutants, it is important to consider the impact of pollutants beyond GHGs within the Scoping Plan process** and we appreciate the efforts by our environmental justice colleagues to bring this conversation into sharper focus. EDF also encourages CARB to fully and expeditiously implement the Adaptive Management Plan to address localized adverse air quality impacts.

EDF supports policies that can make direct and effective progress towards reducing harmful local pollution. One important example is EDF's close partnership with ARB in implementing, defending, and exporting California's pioneering clean car and clean truck standards. This Scoping Plan places an important focus on the transportation sector, the largest source of California's GHG emissions, and a sector that has an outsized impact on local health as well.

We do recognize that stationary sources are an area of particular concern for environmental justice communities as well. **We believe CARB's proposed refinery measures represent a strong starting point for a measure aimed at driving faster GHG reductions that could also contribute critical public-health co-benefits for communities**. The study released by OEHHA on the impacts of the cap-and-trade program identified the refinery sector as having one of the closest links between GHGs emitted and local and toxic air pollutants. By benchmarking requirements to the best-in-sector performance, ARB is ensuring that feasible progress is achieved. While measures that can reduce both GHG and local toxic air pollutants are ideal, we also believe California should explore measures that will independently accelerate the reductions of local and toxic pollutants where possible.

An important finding of the OEHHA study was that there are data gaps that hamper a full understanding of the connection between GHG emissions and other pollutants**. We urge CARB and will urge other decision makers to work towards meeting the recommendations for**

[1] Office of Environmental Health Hazard Assessment, *Benefits and Impacts of Greenhouse Gas Limits on Disadvantaged Communities* (February 2, 2017) https://oehha.ca.gov/environmental-justice/report/ab32-benefits

data collections proposed by OEHHA. EDF also believes that further progress on data collection and transparency beyond even what OEHHA recommended is possible, this could include steps such as updating the Mandatory Reporting Requirement to include reference to other disclosures so that comparison can be made between MRR and other relevant emissions data sets such as local and toxic air contaminants. Additionally, new data collection and monitoring methods are becoming increasingly available. For example, EDF has been working in partnership with Google to use mobile monitoring techniques to measure methane leaks. We believe these next generation methodologies could provide critical access to data that Californians need to protect their communities and decision makers need to do their jobs. We look forward to working with ARB and others towards exploring these new opportunities in this new context.

Comments on Electricity Sector Reduction Policies and Strategies

Staff leads: Jayant Kairam, James Fine, Andy Bilich, and Larissa Koehler

Introduction to electricity sector comments

EDF applauds the California Air Resources Board (CARB) for their forward and expansive thinking presented in its strategy regarding low carbon energy. The Proposed Scoping Plan Update (Scoping Plan) rightfully points out the nation-leading progress the state has made in ensuring that the electricity sector stays on track to meet the greenhouse gas (GHG) reduction commitments articulated in Assembly Bill (AB) 32.

In all scenarios considered in the Scoping Plan, reductions from the electricity sector are assumed to meet or come close to those mandated under existing law.[2] Per the Scoping Plan, the electricity sector (which encompasses in-state generation and imports) accounts for 20% of overall emissions. This is despite steady declines in electricity sector emissions like the Renewable Portfolio Standard – indeed, California is ahead of schedule in meeting the original 2020 target, with 25% of retail sales served by renewable energy in 2016.[3] This is a strong foundation to build upon, especially given Senate Bill (SB) 32's recently enacted goal of reducing GHG emissions 40 percent relative to 1990 levels. It is clear that the Scoping Plan recognizes that achieving the 2030 - and presumably the 2050 targets - hinges on the electricity sector's compliance with multiple clean energy targets. CARB's expectations for the rate of emission reductions from electricity between 1990 to 2030 are the most substantial of any sector evaluated on a percentage basis.[4] However, overreliance on any single policy solution and/or poor coordination between complementary reduction strategies may not result in maximum benefits – raising the question of whether it will be possible to achieve needed GHG emissions reductions while keeping costs low. **Accordingly, the most appropriate approach is an "all hands on deck" strategy that reliably and affordably integrates utility-scale investments alongside smaller, more flexible demand-side resources.**

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[2] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* at 41 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf.

[3] 2016 GHG Emissions Inventory Report

[4] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* at 55 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf.

As the composition of California's electric grid rapidly transforms, it is critical to take a holistic view toward the policy and resource opportunities and challenges. Foremost among these considerations is the dependence on natural gas to serve a grid reliability function, due to the proliferation of intermittent renewable resources making up greater portions of the resource mix. Even though California has some of the most stringent regulation over the oil and gas sector and methane emissions reduction in the country, they still emit dangerous pollutants in significant quantities, and the state remains heavily dependent on them for in-state net electricity generation and imported resources.[5] As clearly evidenced by the Aliso Canyon pipeline leak, the state's significant gas resources can have debilitating environmental and public health impacts if not regulated, retrofitted and monitored effectively.[6] Thus, rather than put misplaced and potentially increased reliance on these fossil fuel resources, it is critical to ensure the procurement of resources that can integrate excess renewable energy onto the system, reduce wasteful curtailment, and shift demand to times when energy is less expensive and cleaner. **Prioritizing and fully valuing energy storage and cost-effective, load-modifying resources like demand response (DR) and time-of-use (TOU) electricity rates will be an important complement to reforms designed to facilitate greater transparency into wholesale gas markets that will allow non-fossil resources to provide reserve capacities, load balancing, and other ancillary services.**[7]

Additionally, as we have seen with the drop in the costs in solar photovoltaics (PV) over the last ten years,[8] the rise of a particular technology in the market can be a monumental force in reshaping electricity planning.[9] **Opportunities to integrate clean, low-cost distributed energy resources (DERs) will only grow and facilitate the achievement of GHG targets that are possible with a higher RPS.**[10] DERs are estimated to have the potential to dramatically increase the utilization of renewable generation capacity, avoid GHG emissions from natural gas generation used to provide system "ramps," and significantly reduce system costs.

Yet, we need to acknowledge that the current incentive systems for the state's primary IOUs is leading to perverse outcomes that limit the optimization of such DERs. As recognized by the California Public Utilities Commission (CPUC) in the Integrated Distributed Energy Resources (IDER) proceeding, "if we hope to create a truly successful model for future distribution infrastructure planning and DER deployment, we cannot reasonably proceed without

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[5] U.S. Energy Information Administration, *California: State Profile and Energy Estimates*, https://www.eia.gov/state/analysis.php?sid=CA#58.

[6] Amanda Johnson, *CA Utilities Are Leaking Lots of Gas - but There's a Way to Stop It,* Environmental Defense Fund (Mar. 1, 2017), http://blogs.edf.org/energyexchange/2017/03/01/report-ca-utilities-are-leaking-lots-of-gas-but-theres-a-way-to-stop-it/.

[7] These reforms are further articulated in the Methane, Oil & Gas Operations section of EDF's Scoping Plan comments.

[8] Lazard's Levelized Cost of Energy Analysis – Version 10.0 (Dec. 2016), https://www.lazard.com/media/438038/levelized-cost-of-energy-v100.pdf;

[9] *See, e.g.*, Trieu Mai, *et al.*, *A Prospective Analysis of the Costs, Benefits, and Impacts of U.S. Renewable Portfolio Standards,* National Renewable Energy Laboratory and Lawrence Berkeley National Laboratory at 18 (2016), https://eta.lbl.gov/sites/all/files/publications/lbnl-1006962.pdf.

[10] *See, e.g.*, Ryan Wiser, *et al.*, *A Retrospective Analysis of the Costs, Benefits, and Impacts of U.S. Renewable Portfolio Standards*, National Renewable Energy Laboratory and Lawrence Berkeley National Laboratory at 17 (2016), https://eta.lbl.gov/sites/all/files/publications/lbnl-1003961.pdf.

acknowledging and attempting to address the conflict between the Commission's policy objectives and the utilities' financial imperatives." [11] **To that end, EDF supports exploring revision of the business model as a way to better align utility interests with use of more DERs, including a system in which revenue is contingent on meeting pre-determined performance metrics and a "fees for services" model in which, for example, utilities receive payment for connecting their customers to DER providers.** CARB would do well to recognize what the CPUC already has – that it is not a given that IOUs will optimize DERs under the current business model.

Finally, CARB has rightfully recognized cross-sectoral opportunities that exist between the electricity sector and the lead emitting sector, transportation. It will be imperative to continue to emphasize and expand opportunities for demand-side management strategies like "smart" EV charging designed to utilize excess renewable energy, and vehicle to grid (V2G) integration, especially as those technologies are further developed and become more prolific.

Creating a grid that fairly values increasingly available DERs and integrates growing amounts of renewable energy have been guiding principles for energy policy in the state for some time.[12] However, relative to the 2020 targets, the pathway to 2030 is considerably more challenging. The Scoping Plan should reinforce these principles and contemplate an "all hands on deck" approach – as they will be imperative to meeting SB 32 targets.

Impacts of a higher Renewables Portfolio Standard

The "Proposed Scoping Plan Scenario" assumes a Renewables Portfolio Standard (RPS) of 50% by 2030, increasing to 80% by 2050, while the "Alternative Scenario 1" assumes a 60% RPS by 2030, increasing to 80% by 2050[13]). These measures, coupled with current legislation proposing a 100% RPS for California by 2045,[14] highlight the need to more closely analyze an increasing RPS as an instrument for reducing GHG emissions and the costs associated with a higher penetration of renewables on the grid.

There is no doubt that the historical success of the RPS in California driving electricity markets towards low-carbon energy solutions, economic development and growth, and widespread environmental benefit needs to be recognized.[15]

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[11] Assigned Commissioner's Ruling Introducing a Draft Regulatory Incentives Proposal for Discussion and Comment, Order Instituting Rulemaking to Create a Consistent Regulatory Framework for the Guidance, Planning, and Evaluation of Integrated Distributed Energy Resources, R. 14-10-003 at 3 (filed Apr. 4, 2016).

[12] Senate Bill 350 (De León, 2015), https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB35; Assembly Bill 327 (Perea, 2013), https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB327.

[13] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* – Appendix D: PATHWAYS Modeling at 12-13 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/app_d_pathways.pdf.

[14] Senate Bill 584 (De León 2017), https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB584.

[15] Ryan Wiser, *et al.*, *A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards*, Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory (Jan.

As we continue to move towards higher RPS targets, it will be important to simultaneously develop and utilize other potentially lower-cost solutions, particularly on the demand side, to ensure cost-effective mitigation of GHGs. With current renewable penetration,[16], CAISO is already planning curtailment of 6000 – 8000 megawatts of renewable energy this spring, while recent analysis suggests that overall negative net loads (i.e., "the belly of the duck") are arriving faster and lower than predicted, with less seasonal variation.[17] Demand-side solutions like dynamic pricing, DR, energy efficiency, electric vehicles (EVs), and energy storage need to be explored more fully to ensure that the environmental and grid benefits of renewable resources are maximized in a cost- effective manner.[18]

Treatment of DR and flexible loads

EDF seeks to understand how CARB considered the potential of load-modifying DR in facilitating GHG reductions in the electricity sector. The comprehensive representation of load-modifying DR is important for the findings of the economic analysis, the potential for GHG reductions from the electricity sector, and in the transportation sector (specifically, the potential for demand flexibility from EVs). Additionally, there are interdependencies between marginal abatement costs and more broad consideration of DR and other DERS that may be important for the economic impact modeling, such as the extent of investment in new renewable generation capacity needed to meet the RPS.

Among other factors, the GHG benefits from DR resources depend on the levelized marginal system costs, the hours where the DR occurs, and the other resources in the grid system, however, it is important to holistically consider and model the impacts of all potential DR resources, particularly the indirect benefits achieved through supporting higher renewable penetration and resulting limitation of curtailment.

In the Scoping Plan, CARB considers two main types of DR:

1. Conventional DR (aka "load shedding" resources) and

2016) https://eta.lbl.gov/sites/all/files/publications/lbnl-1003961.pdf; Trieu Mai, *et al., A Prospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards*, Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory (Dec. 2016) https://eta.lbl.gov/sites/all/files/publications/lbnl-1006962.pdf.

[16] Peter Maloney, *CAISO notches record, serving 56.7% of demand with renewable energy in one day*, Utility Dive (Mar. 28, 2017), http://www.utilitydive.com/news/caiso-notches-record-serving-567-of-demand-with-renewable-energy-in-one/439085/.

[17] Chris Vlahoplus, *et al., Revisiting the California Duck Curve: An Exploration of Its Existence, Impact, and Migration Potential* at 3 (Oct. 2016), Scott Madden Consultants, http://www.scottmadden.com/wp-content/uploads/2016/10/Revisiting-the-Duck-Curve_Article.pdf; *see also* California Independent System Operator, *Memorandum to Board of Governors* (Feb. 09, 2017), https://www.caiso.com/Documents/CEOReport-Feb2017.pdf.

[18] Gregory Brinkman, *et al., Low Carbon Grid Study: Analysis of a 50% Emission Reduction in California – Executive Summary* at 5 (2016), National Renewable Energy Laboratory and Center for Energy Efficiency and Renewable Technologies, http://lowcarbongrid2030.org/wp-content/uploads/2016/01/1601_Low-Carbon-Grid-Study-Analysis-of-a-50-Emission-Reduction-in-CA-Executive-Summary.pdf (The study noted demand response resources, smart charging EVs, and aggressive storage penetration can help California can much higher levels of renewables curtailment, avoid nearly a $1billion in increased operational costs, and capture greater GHG benefits).

2. Flexible load or "load shift" resources for residential and commercial electric water heating, space heating, air conditioning, and refrigeration on a smart TOU rate design

To effectively evaluate the treatment of DR resources in the Scoping Plan, **it is important to highlight the various types and potential of DR resources identified in the Lawrence Berkeley National Laboratory (LBNL) Demand Response Potential Study conducted on behalf of the CPUC.[19] Coordination with this LBNL study is important for two reasons: (1) the study provides benchmarks under a more comprehensive variety of price and policy conditions for the capacity of California's "shed" and "shift" resources; and (2) . The study describes the potential of two additional resources available to the state that CARB hasn't considered in its current Scoping Plan** (a short summary of these resources is found in Table 1 at the end of this section).

More specifically, the LBNL study highlights "load-shaping" DR as a significant, low-cost resource. If 20% of customers adopted load-shaping DR in the form of TOU pricing, an additional~7,500 gigawatt hours (GWh) of electricity demand could be served by renewables (an increase in utility-scale renewable utilization from 88 to 98 percent).[20] In so doing, EDF estimates that approximately eight million tons of carbon dioxide emissions can thereby be avoided, at a savings of $700 million a year.[21] Load following DR can provide up to 300 megawatts (MW) of cost-competitive resources under $50/kilowatts (kW) per year.[22] **Given the potential of all of these resources to provide reductions in energy use and GHGs, as well as indirect benefits in supporting other clean energy/low-carbon solutions, it is important for CARB to consider additional scenarios that optimize all DR resources as a function of price and policy or else risk leaving potentially significant cost (and emissions) savings unused**.

In addition to the above considerations, EDF has identified several questions and comments on the representation of demand response resources in the PATHWAYS modelling and Scoping Plan Update.

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[19] Peter Alstone, *et al., 2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* (Mar 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698.

[20] Peter Alstone, *et al., 2015 California Demand Response Potential Study – Charting California's Demand Response Future: Final Draft Study Results* at 64 (Nov 30, 2016), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442451706

[21] James Fine, *Like Clockwork: California Utilities Should Embrace Clean Energy Solutions when Testing Time-of-Use Electricity Rates*, Environmental Defense Fund (Jan. 5, 2017), http://blogs.edf.org/energyexchange/2017/01/05/like-clockwork-california-utilities-should-embrace-clean-energy-solutions-when-testing-time-of-use-electricity-rates/?_ga=1.77061597.999488634.1490123880.

[22] Peter Alstone, *et al., 2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 5-67 (Mar 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698; for further discussion of other types of demand resources identified by LBNL, please see Appendix A.

The scoping plan should more robustly consider the role of conventional DR

The Reference Scenario includes an increase of approximately 115 cumulative MW of conventional, load shedding DR through 2024, in addition to the approximately 2,000 MW of existing DR available in 2015.[23]

The Proposed Scoping Plan Scenario includes an increase of approximately 5,500 cumulative MW of conventional, load shedding DR by 2031, in addition to the approximately 2,000 MW of existing DR available in 2015.[24] This quantity is not an output of the modeling, but rather it is an input that reflects prior state goals to increase the availability of DR.

- The 5,500 MW of conventional shed is in the middle of the 2-10 GW range (at the $200 price referent and dependent on technologies and scenarios) suggested by the DR potential study, but the 2031 target set by CARB is 6 years after the LBNL target of 2025[25]).[26] Therefore, EDF recommends that additional iterations consider a best case scenario for DR in which the high end of the range of shed and shift DR can be achieved cost-effectively.
- As discussed below in the context of flexible load, it is not clear what the price context is for DR. Are the DR goals assuming a TOU price regime like the flexible load or do they assume existing tiered rates? Understanding the prices assumed for DR is important for benchmarking the DR goals with DR potential highlighted in the LBNL DR Potential Study. The LBNL study demonstrates that DR capacity varies significantly as a function of multiple factors - notably electricity prices, the level of adoption of TOU rates, and the presence of DERs on the system.[27] It will be similarly important for CARB to allow for the Scoping Plan to represent a range of conventional DR resources.
- The Reference Scenario is modelled to reflect "current programs" through 2024, but the types of DR and the assumptions on growth, learning curves, price regimes, and efficiency to reach the Proposed Scenario's 2031 goal are not clearly laid out. It is also unclear if the Proposed Scenario includes any additional growth on top of the 115 MW included in the Reference Scenario for the 2018-2024 period.

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[23] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* – Appendix D: PATHWAYS Modeling at 12 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/app_d_pathways.pdf.
[24] *Id.* at 13.
[25] Peter Alstone, *et al., 2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 6-2 (Mar. 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698
[26] *See, e.g.,* Peter Alstone, *2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 5-31 (Mar 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698.
[27] *Id.*

Expectations from cost-effective flexible loads

CARB defines flexible loads as the capacity embodied in 10% of forecasted 2018 demand for residential and commercial electric space heating, water heating, A/C, and refrigeration.[28] In the Proposed Scenario, CARB further recognizes the cost opportunity with flexible loads, noting that the range of a savings of $300 – 500 per metric ton (MT), makes flexible loads one of the best "values" of the proposed measures.[29]

As a result of the vast potential of flexible loads both in terms of capacity and environmental and economic benefit[30], **EDF encourages CARB to consider a more ambitious forecast for flexible loads and to model a range of scenarios for prices and resources. The basis for this assertion is the LBNL study, which posits that load-shifting DR in the form of TOU rates could result in a six-fold reduction in wasted renewable generation capacity.** That is, renewable curtailments in 2025 are estimated to be 12% of capacity with no TOU/critical peak pricing load shift, but only 2% (i.e., 98% capacity factor) if 20% of load is shifted to midday. The effective use of these TOU rates is critical for meeting GHG targets –using fossil-based natural gas ramping generation instead of zero-emissions renewables could mean an additional 8 million metric tons of carbon dioxide emissions annually.

In the Scoping Plan, rate design changes are assumed to result in the participation of flexible loads on the grid to help balance renewable generation. Specifically, the plans include flexibility goals for residential and commercial electric water heating, space heating, air conditioning, and refrigeration, as well as "smart charging" goals for EVs.[31] Given the models' assumptions in both scenarios, EDF believes the following considerations are critical for achieving the maximum potential of flexible loads to contribute to cost-effective emissions reductions in the electricity sector.

- First, as the LBNL study did,[32] it is important for CARB to consider additional technologies and areas where flexible load resources can be developed. The 10% flexible load goal in the Scoping Plan[33] only applies to electric space heating, water heating, A/C, and refrigeration, but neglects consideration of other

[28] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* – Appendix D: PATHWAYS Modeling at 12-13 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/app_d_pathways.pdf
[29] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* at 65 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf.
[30] Peter Alstone, *2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 6-2 (Mar. 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698.
[31] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* – Appendix D: PATHWAYS Modeling at 12-13 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/app_d_pathways.pdf
[32] *See, e.g.*, Peter Alstone, *2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 5-31 (Mar 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698
[33] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* at 57 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf.

technology and appliances like lighting, motors, pumps, and batteries that can provide substantial shed capacity – not to mention industrial and agricultural processes that can add to the resource capacity.

- Second, the Scoping Plan only highlights flexible load targets for 2018;[34]EDF encourages CARB to model potential growth and development of flexible load capacity between 2018 and 2030.

Accounting for the capabilities of EVs and storage

The Scoping Plan gives limited attention to two emerging and rapidly growing technologies: electric vehicles (EVs) and storage. As discussed earlier, both of these technologies have tremendous potential to ensure the electricity sector achieves its SB 32 targets.
The growth of EVs is poised to accelerate in the coming years due to a number of favorable policies, including SB 350's mandate of "widespread transportation electrification,"[35] as well as goals in SB 1275 and the Governor's ZEV mandate aiming to put a minimum number of ZEVs on the road by 2023 and 2025, respectively.[36] In addition, multiple agencies and stakeholders have concluded that achieving California's targets means electrifying the sector responsible for the largest portion of emissions: transportation. **Focus needs to be put on ensuring that electrified transport is well-integrated into the grid as a clean energy resource through mechanisms like a price signal, and used smartly as a grid asset (rather than having their presence necessitate a ramp-up of fossil-fuel powered energy).**

Although having EVs capable of discharging energy back to the grid is in a very nascent stage, it is rapidly evolving and these types of vehicle-to-grid (V2G) strategies should be considered among the suite of solutions capable of helping to achieve GHG reduction targets. EDF contends that recently released transportation electrification applications can be enhanced by including exploration of V2G to strengthen the grid, potentially with help from Volkswagen settlement funds.[37] The same holds true here.

Similarly, storage – both EV batteries and other forms of storage - should be an explicit part of the Scoping Plan. **EDF struggles to understand why storage is minimally mentioned in the Scoping Plan update, given the increasing focus being given to this resource in California.** In implementing AB 2514's storage mandate,[38] the CPUC states the mandate was designed to abide by three core principles:

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[34] California Air Resources Board, *The 2017 Climate Change Scoping Plan Update: The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target* – Appendix D: PATHWAYS Modeling at 12-13 (Jan. 20, 2017), https://www.arb.ca.gov/cc/scopingplan/app_d_pathways.pdf
[35] Public Utilities Code Section 701.1(a), 740.12(a)(1)(D).
[36] Senate Bill 1275 (De León, 2014), http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB1275; Executive Order B-16-2012, https://www.gov.ca.gov/news.php?id=17472.
[37] United States Environmental Protection Agency, *Volkswagen Clean Air Act Civil Settlement,* https://www.epa.gov/enforcement/volkswagen-clean-air-act-civil-settlement#investment *("*"The CAA 2.0 liter partial settlement requires Volkswagen to invest $2 billion in ZEV charging infrastructure and in the promotion of ZEVs. To that end, Volkswagen will invest $800 million in California and $1.2 billion throughout the rest of the nation, over the next decade").
[38] AB 2514 requires the Utilities Commission to open a proceeding and adopt a target for energy storage procurement. Public Utilities Code Section 2836(a)(1). That target was set by the Commission in

1. The optimization of the grid, including peak reduction, contribution to reliability needs, or deferment of transmission and distribution upgrade investments;
2. The integration of renewable energy; and
3. The reduction of greenhouse gas emissions to 80 percent below 1900 levels by 2050, per California goals.[39]

Given the Commission's emphasis on meeting GHG targets as a core purpose for the setting of the storage mandate, and its confidence that the mandate will achieve those purposes,[40] the Scoping Plan should recognize and incorporate this important resource as a way to help California meets its GHG emission goals.

Coordination with key California Public Utilities Commission proceedings

In order to best understand how different clean energy resources will facilitate achievement of AB and SB 32 goals, **it will be important to coordinate with CPUC proceedings that are actively studying how to best deploy a variety of clean energy resources so that processes among the two agencies are mutually informing.** These include, but are not limited to, the following topics:

- Residential TOU Rate Pilots - As discussed above, load shifting DR in the form of TOU rates can have a tremendous and positive impact on integration of renewable energy – and as a consequence, on the achievement of GHG reduction targets. Additionally, TOU rates are an inevitability, with the CPUC and the investor-owned utilities (IOUs) in the midst of developing default pilots.[41] As such, it is imperative that CARB consider how to integrate lessons learned in the residential rate design proceeding in order to best harness the potential of flexible loads.

- EVs – There are several proceedings at the Commission designed to study how to accelerate EV adoption in the state in light-, medium- and heavy-duty sectors. The three

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Rulemaking 10-12-007 at 1,325 megawatts. *Decision Adopting Energy Storage Procurement Framework and Design Program,* Order Instituting Rulemaking Pursuant to Assembly Bill 2514 to Consider the Adoption of Procurement Targets for Viable and Cost-Effective Energy Storage Systems, R. 10-12-007 (Oct. 17, 2013) (Final Decision).

[39] *Order Instituting Rulemaking to consider policy and implementation refinements to the Energy Storage Procurement Framework and Design Program (D. 13-10-040, D. 14-10-045) and related Action Plan of the California Energy Storage Roadmap,* R. 15-03-011 at 2-3 (emphasis added).

[40] *Assigned Commissioner's Ruling Proposing Storage Procurement Targets and Mechanisms and Noticing All-Party Meeting,* Order Instituting Rulemaking Pursuant to Assembly Bill 2514 to Consider the Adoption of Procurement Targets for Viable and Cost-Effective Energy Storage Systems, R. 10-12-007 at 2 ("energy storage has the potential to offer services needed as California seeks to maximize the value of its generation and transmission investments: optimizing the grid to avoid or defer investments in new fossil fuel-powered plants, integrating renewable power, and minimizing greenhouse gas emissions").

[41] *Decision on Residential Rate Reform for Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company,* Order Instituting Rulemaking on the Commission's Own Motion to Conduct a Comprehensive Examination of Investor Owned Electric Utilities' Residential Rate Structures, the Transition to Time Varying and Dynamic Rates, and Other Statutory Obligations, R. 12-06-013 (Jul. 3, 2015) (Final Decision).

major IOUs in the state are currently carrying out approved pilots to deploy charging infrastructure in workplaces and multi-unit dwellings, the Commission continues to review EV policy, and the IOUs have pending applications pursuant to the SB 350 directive to pursue widespread transportation electrification.

- Integrated resource plans – These plans, pursuant to SB 350, will greatly increase the renewables in the state and theoretically ensure their effective integration. **Ramping up to and beyond a 50% RPS will require an "all hands on deck" approach that includes input from CARB. With the roll-out of the IRP delayed, there is concern that the timelines of the Scoping Plan and the utility resource planning are not aligned. Moreover, CARB needs to be cognizant of the lack of clarity currently present regarding key consideration like the role of DERs in the IRP, which will impact IRP inputs to the Scoping Plan assumptions for the electricity sector.**

- Storage – As mentioned before, the energy storage procured pursuant to the Commission's mandate will be an important consideration when cataloging resources available to help meet GHG targets.

- Distributed energy resources – Related to IRPs, the Commission has undertaken multiple proceedings in order to determine how to source distributed resources and establish distribution system needs.[42] Having flexible distributed resources on the grid will enhance the resiliency and the reliability of the grid, as well as helping the state meet its GHG targets. Putting an emphasis on DERs is going to require effort by both CARB and the CPUC in order to ensure that these resources are geographically placed where they are most needed, including in disadvantaged communities. In addition, as stated above, incentives need to be aligned in order for the DER market to be truly successful; this will require serious inquiry into how to revise the utility business model to better ensure this important subset of resources is adequately considered.

[42] *Order Instituting Rulemaking Regarding Policies, Procedures and Rules for Developing Distribution Resources Plans Pursuant to Public Utilities Code Section 769*, R. 14-08-013 (Aug. 14, 2014); *Order Instituting Rulemaking to Create a Consistent Regulatory Framework for the Guidance, Planning and Evaluation of Integrated Distributed Energy Resources*, R. 14-10-003 (Oct. 02, 2014).

Table 1: LBNL Identified Demand Response Resources

DR Type	Description	Examples	Potential	Reference
Shed	Describes loads that can occasionally be curtailed to provide peak capacity and support the system in emergency or contingency events - at the statewide level, in local areas of high load, and on the distribution system, with a range in dispatch advance notice times.	Examples of Shed technology pathways we include are interruptible processes, advanced lighting controls, air-conditioner cycling, and behind-the-meter storage.	A large potential resource of Shed DR exists in 2025, ranging from 2 to 10 GW, depending on the technology costs and performance scenario, when evaluating the value of DR using the $200/kW price referent.	Peter Alstone, *2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 3-13 and 6-1 (Mar. 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698.
Shift	Represents DR that encourages the movement of energy consumption from times of high demand to times of day when there is surplus of renewable generation.	Examples of Shift technology pathways include behind-the-meter storage, rescheduling flexible batch processes like EV charging fleets or pre-cooling with HVAC units.	With 20% of load shiftable, there is up to ~$700 million/year in benefits, and economically cost-effective DR is estimated at up to ~10 percent of daily energy shifted in 2025 (for the high-curtailment, mid-AAEE scenario)	Peter Alstone, *2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 3-13 and 6-1 (Mar. 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698.
Shape	Captures DR that reshapes the underlying load profile through relatively long-run price response or on behavioral campaigns - "load-modifying DR" - with advance notice of months to days.	Examples of Shape resources include TOU and CPP pricing.	An additional ~7,500 GWh of electricity demand would be served by renewables (an increase in utility-scale renewable utilization from 88 to 98 percent) with a 20% TOU/CPP load shift. EDF estimates that approximately eight million tons of carbon dioxide emissions can thereby be avoided, at a savings of $700 million a year."	Peter Alstone, *2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 3-13 and 6-1 (Mar. 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698.
Shimmy	Involves using loads to dynamically adjust demand on the system to alleviate short-run ramps and disturbances at timescales ranging from seconds up to an hour.	Examples of Shimmy technology pathways we include are advanced lighting, fast response motor control, and EV charging.	The DR potential study's levelized system value analysis indicated that ~300 MW of Shimmy Load Following Service resources are cost competitive under $50/kW-yr. For Shimmy Regulation DR, the study found ~300 MW to be cost competitive under $85/kW.	Peter Alstone, *2025 California Demand Response Potential Study – Charting California's Demand Response Future: Final Report on Phase 2 Results* at 3-13 and 6-1 (Mar. 1, 2017), available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442452698.

Comments on Economic Impact Analysis with a Focus on the Electricity Sector and Long-term Targets

Staff leads: James Fine and Erica Morehouse

EDF appreciates the extensive and thoughtful effort by CARB staff to help stakeholders understand the economic consequences of policy choices available for pursuing 2030 GHG cap limits. EDF concurs with and supports the conclusions that the 2030 goal "can be achieved with minimal impact on the growth of California's economy, and that the Proposed Plan is preferred to the alternatives examined" (SP, Appendix A, pg.1).

EDF notes that this finding is particularly robust in light of the many non-monetary and long-term benefits not included in the study. CARB notes (App A, pg. 2) the analysis is focused, "exclusively on the economic effects in California of taking action to reduce GHG emissions" and does not calculate several significant benefits:

- the "economic, environmental, and health benefits of avoiding climate change",
- the dollar value of criteria and toxic pollutant emission reductions,
- the economic value of conserving natural and working lands is not examined.

In the face of significant uncertainties, EDF also supports CARB's ongoing effort to conduct "sensitivity analysis of GHG emission reduction and cost estimates; and analysis of the distribution of economic impacts across regions of the state, including disadvantaged communities" (SP, Appendix A, pg.2). In undertaking that inquiry, EDF notes the importance of considering clean energy resources that have to date been underrepresented in forecasts, undervalued in resource adequacy assessment, and that have significant additional potential to yield benefits for disadvantaged communities and cost-competitively avoid GHG emissions.

Specifically, the economic study of the electricity sector is missing consideration of load-modifying demand response as a strategy to reduce the costs associated with meeting the RPS, with reducing bill impact risks associated with the transition to time-variant electricity pricing, and enhancing the financial rewards and thus penetration and utilization of distributed energy resources (DERs), including load shifting to align demand with cheap solar-sourced electricity and using electric vehicles to store, provide and massage energy.

What is load-modifying demand response in tangible terms for rate payers who may not be plugged into the Internet of Things (IoT), EVs or rooftop solar PV? In fact, it's simple, cheap and intuitive. For most households and many small businesses, the first step is to weatherize the building shell, and then use precooling strategies in advance of evening peak prices. For the growing number (500,000 thus far, with more than 10,000 being sold nationally each month) of EVs, the potential for smart charging is significant.

The Scoping Plan ought to treat behaviors built around EVs, HVACs and IoT as strategies to reduce household energy bills (for electricity, natural gas and gasoline). Doing so will also support electricity and transportation sector decarbonization. For example, enrolling EVs in providing electricity storage reduces both electricity sector natural gas power plant ramping emissions and transport-related GHG emissions. Similarly, encouraging demand shifting to line up with wind and solar generation, as is planned with broad adoption of time-variant electricity

pricing, can enhance the utilization of available renewable, clean, cost-effective generation capacities.

Comments on Methane, Natural Gas, and Oil and Gas Operations Emissions

Staff leads: Tim O'Connor and Irene Burga

Introduction to oil and gas comments

While the progress of the state to cut climate pollution thus far is promising, California has much more to do to address emissions from across the oil and gas value chain, from reducing leaks to reducing combustion. By cutting pollution from this sector more than ever before, not only will California reduce greenhouse gases, it will also cut smog forming co-pollutants, limit toxic air contaminants, reduce energy waste, and increase energy system resiliency. And, as the state achieves the end-points, CARB can improve the conditions of low-income communities and communities of color in California, making the agency's efforts a key part of the strategy to address environmental justice concerns.

Given this context, EDF submits the following comments as suggested improvements to the proposals for reducing emissions from the oil and gas sector:

The Scoping Plan must include a comprehensive discussion and approach to the oil and gas sector and move away from the piecemeal approach that currently exists across multiple agencies and initiatives

California has a number of active and important processes aimed at cutting climate pollution from the numerous array of oil and gas industry segments. As demonstrated time and again, such efforts not only reduce climate change gases, but can result in significant co-pollutant benefits, improve worker safety, reduce needless waste, and protect water and ecosystem health. Among these, efforts include:

- Pursuant to Senate Bill (SB) 1383, California has an overall target of 40 percent reduction in methane for 2030 from 2013 levels, including oil and gas;
- CARB recently adopted the "Proposed Regulation for Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities," the strongest such regulation in the country for regulating methane emissions and health-harming co-pollutants from new and existing oil and gas production facilities;
- California's Department of Oil, Gas and Geothermal Resources (DOGGR) has adopted emergency rules for gas storage, and is now developing new permanent rules for natural gas storage sites so as to prevent incidences like the Aliso Canyon natural gas storage field disaster;
- DOGGR is also said to be in the planning stages of a new rule for oil and gas well operations to ensure improved overall well construction, operation and maintenance;
- DOGGR is also in the process of planning for a revamped program to manage and decrease the state's abandoned and idled well inventory;
- Pursuant to SB 1371, the California Public Utilities Commission (CPUC) is requiring natural gas utilities to undertake emissions reduction programs by requiring best industry practices to find, fix and prevent leaks;

- At the local level, Air Districts are undertaking action to cut point source pollution from oil and gas facilities like refineries and production sites;
- In the Scoping plan itself, CARB also has proposed a 20% reduction in emissions from refineries;
- Across the state, at the California Energy Commission (CEC), CARB, local Air Districts, municipalities, and academic institutions - numerous research studies are under way to examine the sources of pollution from the oil and gas sector, including refineries, processing plants, active and abandoned wells, with emphasis on equipment located in hot-spots and urban centers;
- As an outgrowth from the 2016 budget bill (SB 839), at the CEC, the agency is presently required to develop a report on the cost and possibility of developing a tracking system for gas imported into California, while at CARB the agency is required to develop a model that can quantify leaks from oil and gas infrastructure across the value chain;
- At present, CARB is considering extending the timeframe for cap-and-trade to cover large stationary oil and gas facilities past 2020; and
- At present, CARB maintains the operation of the Low Carbon Fuel Standard, a regulation that should facilitate lower lifecycle emissions from oil and gas development by creating market signals for industry operators.

While the state has these numerous laudable goals and efforts to cut oil and gas emissions, (and EDF supports the timely implementation of each), there does not appear to be any single initiative to aggregate all efforts within a single strategic plan or vision, or an effort to fully and accurately quantify the full scope of emissions reductions possible through implementation. Similarly, while oil and gas operators, gas utilities, refinery managers, etc. are going to be covered by a new series of rules, regulatory oversight and enforcement appears to be disaggregated into multiple state and local entities, meaning greater coordination and communication will be key to the overall success of the program.

In furtherance of these observations, EDF recommends the Scoping Plan Update be expanded to include the formation of a standing interagency oil and gas working group for California whose mission is to coordinate and communicate across multiple efforts to reduce pollution from all oil and gas operations within the state. Notably, this is not a recommendation for CARB to perform all of the enforcement and implementation functions of the initiatives laid out above, such a result would be inappropriate. Rather, the Scoping Plan should lay out the processes of reductions and oversight more clearly, while helping ensure the state's multiple agencies are working together in a cohesive and complementary manner. By creating this group and better coordinating and communicating the efforts of the state, California can take advantage of a higher level of synergy across multiple agencies, communicate efforts externally more effectively, and work towards a unified system-wide pollution reduction target that is greater than the sum of the reductions of the individual parts.

Emissions reduction efforts should be based in part on social cost evaluations that include the social cost of methane and nitrous oxides

EDF strongly supports the proposed Scoping Plan Update's inclusion of the Federal Environmental Protection Agency's Interagency Working Group's (IWG) Social Cost of Carbon ($SC\text{-}CO_2$) estimates in compliance with Assembly Bill 197. The social cost estimates were

determined a part of a transparent and peer reviewed process, by outside experts. SC-CO_2 represents the best conservative estimate of the actual costs associated with the emission of carbon dioxide, and therefore should be included in California's regulatory analysis. Incorporating the external costs of carbon dioxide emissions is key to ensuring that regulations evaluate the full range of costs and benefits associated with an action that impacts CO_2 emissions.

The Proposed Scoping Plan, however, fails to mention the social costs related to the emission of other greenhouse gas social costs including methane and nitrous oxides. Estimates of the social cost of methane (SC-CH_4) and nitrous oxide (SC-N_2O) have been developed by the EPA based on the peer-reviewed article: *Marten et al.*[43] which takes a reasonable (although conservative) approach and currently constitutes "the best available science" to inform agency regulation.[44] Specifically, *Marten et al.* builds on the methodology used by the IWG to develop the SC-CO_2, and in their latest technical support update, the IWG adopted the Marten methodology and included estimates of the social cost of methane and nitrous oxide for agencies to apply in their regulatory impact analyses.[45] The *Marten et al.* methodology thus provides reasonable, direct estimates that reflect updated evidence and provide consistency with the Federal Government's accepted methodology for estimating the SC-CO_2. Furthermore, *Marten et al.'s* social cost of methane and nitrous oxide estimates directly account for the gas-specific characteristics that determine the link between emissions and monetized damages. This means that no conversion using global warming potentials to convert the social cost of carbon per ton of CO_2 into a social cost per ton of methane or nitrous oxide is needed because the SC-CH_4 and SC-N_2O *directly* measures the social cost of a ton of methane or nitrous oxide emitted to the atmosphere. EDF concurs with the Institute for Policy Integrity recommendation that CARB should use the SC-CH_4 and SC-N_20 when regulating those pollutants.[46]

Use of pollutant specific social costs will help to avoid the inaccuracies associated with using a global warming potential multiplier, and will remove the required choice of what time horizon to use. Proposed regulations that specifically concern methane or nitrous oxide should consider the specific social costs to those pollutants. CARB should include these values in the Scoping Plan to ensure that when considering regulating specific pollutants the most accurate estimates of the social cost are used in a cost benefit analysis. As CARB is the lead agency tackling California's greenhouse gas emissions, it is important that the scoping plan clearly illustrate how the social costs of multiple pollutants are to be considered going forward, for other agencies to follow.

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[43] *Alex L. Marten et al., Incremental CH4 and N2O Mitigation Benefits Consistent With the US Government's SC-CO2 Estimates,* Climate Policy (2014): *Available at*: http://www.tandfonline.com/doi/full/10.1080/14693062.2015.1070550.

[44] See Executive Order 13,563, 76 Fed. Reg. 3821 (January 18, 2011).

[45] Interagency Working Group on the Social Cost of Greenhouse Gases, Addendum: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide 3 (2016) ("This addendum summarizes the Marten et al. methodology and presents the SC-CH4 and SC-N2O estimates from that study as a way for agencies to incorporate the social benefits of reducing CH4 and N2O emissions into benefit-cost analyses of regulatory actions").

[46] Institute for Policy Integrity, NYU Law School, Comments on Discussion Draft, 2030 Target Scoping Plan Update (Dec. 2, 2016) *available at*: http://policyintegrity.org/documents/Policy_Integrity_ARB_use_of_SCC_under_AB_197_FINAL.pdf

Updating the state's greenhouse gas facility emissions rates based on the best science around methane will create new opportunities to ensure emitters are accountable for the full amount of their emissions

Recent evidence from state-sponsored, local-sponsored, and external peer-reviewed scientific studies indicate that individual facility estimates at large stationary sources in the oil and gas sector have undercounted and underreported their emissions of methane. Although methane emissions from oil and gas is a relatively small number compared to the rest of the statewide inventory, due to methane's potent global warming impact (84x that of CO_2 on a 20-year basis), this undercounting can represent a large number on a per facility basis and is capable of having a demonstrable impact on the overall statewide inventory for greenhouse gases. Accordingly, it should be fixed.

Between 2014 and 2016, the CEC conducted a series of flyover studies on refineries, gas fired power plants, and other facilities using aerial measurements to estimate, among other things, methane emission rates. In this study, as detailed in a 2016 presentation to the CEC in the Integrated Energy Policy Report,[47] the CEC found that refinery methane emissions rates are anywhere between 4 and 25 times higher than reported to the state and the US EPA for the purposes of facility emissions inventories. By way of follow-up and to assess facility inventories and hot-spots in their areas of jurisdiction, local Air Pollution Control Districts like the Bay Area Air Quality Management District conducted similar studies and found similar, if not more detailed and alarming results. Similarly, in March 2017, scientists from Purdue University and EDF published a paper[48] finding refinery emissions may be 11 to 90 times higher than previously reported. For natural gas power plants, the numbers were even more striking, with Purdue and EDF finding emissions rates 21 to 120 times higher than prior reported emissions estimates.

With typical CO_2 emissions from a refinery anywhere between 1.5 and 6 MMT CO_2 per year, refineries and gas plants are among the largest point source emitters in the state – meaning these new science based estimates are worth a hard look. For example, using back of the envelope conversions and comparisons, the importance of methane's contribution to facility inventories can easily be seen by turning observed methane rates (30 to 750 kg of methane per hour) into carbon dioxide equivalencies based on methane's 20 year GWP. As these facilities try to run 24 hours a day every day of the year, these emissions rates for methane equate to between 22,000 and 550,000 metric tons CO_2e per year, or anywhere between 1 and 10% of total facility emissions. Accordingly, if facilities do not have to report these emissions in their annual inventories, and are not required to manage those emissions, California will be losing a key opportunity to control a potent greenhouse gas.

[47] Fischer M., *From Wells to Burners: Methane Emissions from California Natural Gas*, June 7st, 2016
[48] Lavoie T., et al., *Assessing the Methane Emissions from Natural Gas-Fired Power Plants and Oil Refineries*, Environ. Sci. Technol., 2017, 51 (6), pp 3373–3381

The Scoping Plan is a unique opportunity the bring together many energy market reform processes that ensure a transition away from heavy reliance on fossil fuel energy and towards a lower carbon, more reliable energy system

The Proposed Plan builds on key programs and adds new initiatives that aim to continue to shift the California economy away from heavy dependence on fossil fuels and towards a thriving sustainable future that delivers continued economic growth, job generation, and a wide range of environmental benefits to all California communities. However, more specificity as to how the Scoping Plan will achieve a reduction in California's heavy reliance on natural gas for energy system balancing – with achievable metrics beyond what is currently laid out - is needed in order to attain this somewhat general goal. Furthermore, while the Proposed Plan pays out the goal of achieving a 50 percent Renewables Portfolio Standard (RPS) by 2030, some wholesale energy market mechanisms in California do not support the transition and integration of vast amounts of flexible clean energy resources into the grid, in particular those that can balance resources such as intermittent wind and solar. In order for the state's climate and renewable energy goals to be achieved, CARB must work with other state agency to create a system that will allow the successful large-scale penetration of renewables onto the grid.

In the existing system, market design gaps impede effective price formation/price discovery necessary to foster large scale investment in flexible energy resources. That's why enhanced flexible capacity requirements that ensure long-term supply of flexible resources are needed. When flexible energy resources aren't properly compensated to reflect the value of their services to the grid, as in the current system, price signals will be distorted. For example, CAISO's current market design doesn't allow generators to reflect sub-day variations in fuel procurement costs in their market bids, muting price signals that reflect the true costs of gas fired generation. The design also doesn't allow generators' actual costs of gas procurement to be reflected in their market bids (a gas price index is used to calculate fuel costs), thereby obscuring price signals in the wholesale electric market. When these market design gaps are corrected, overall competition in the energy system will increase, and yield reduced overall reliance on gas as the single fuel source. Additionally, it is important to highlight that California's heavy reliance on natural gas is projected to increase as greater amounts of renewables are integrated into the grid to meet California's greenhouse gas reduction targets.

EDF urges CARB to consider the Scoping Plan as a unifying strategic document that takes on the issue of facilitating coordinated market design changes that help address this increasing reliance, and include a discussion of market refinements within the scoping plan document. We ask that your agency work with the CPUC, CEC, CAISO and local municipalities like LADWP in developing mechanisms, including adoption of Integrated Resources Plans (IRPs) that engage and enlist utilities to pursue the procurement of resource mixes capable of achieving deep carbon reductions while maintaining reliability in alignment with a model resource mix. These mechanisms will allow utilities to balance variable electric generating units with low-carbon, low- cost and reliable energy resources.

Reduce the footprint of imported gas into California

Under AB 32 and under the principles of good governance, the state has the responsibility to ensure the benefits of its actions aren't being over-counted, or that those actions aren't otherwise

causing undesired impacts. Thus is the case with methane emissions from within the value chain of the natural gas the state uses, even though much of those emissions occur outside of state lines.

As we have written to CARB previously, AB 32 requires the state board to minimize leakage of greenhouse gases to achieve climate pollution goals. Under the law, the definition of leakage is "a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside the state." Pursuant to the definition, EDF argues that emissions from upstream sources of natural gas imported into California fit squarely into the framework of AB 32, and thus reducing this source of emissions must be within the goals of the agency and included in the Scoping Plan and SLCP strategy. Pursuant to this requirement, CARB must undertake an effort to propose and implement solutions to account for and reduce emissions associated with equipment and processes that are engaged in the production, processing and transmission of natural gas imported into California. Unfortunately, however, while the Proposed Scoping Plan mentions methane emissions from upstream emissions, it neither attempts to quantify the amount of gas leaked, or propose emission reduction measures – this is a critical shortcoming.

California imports nearly 90 percent of its natural gas from regions across western North America. Using figures from the California gas report associated with gas imported over interstate transmission lines for core and industrial customers, and assuming a leakage rate of 2.1%, EDF calculated the emissions associated with leakage from gas imports into California is approximately 60 MMTCO2e using a 20-year global warming potential for methane. EDF presented these figures to CARB and the CEC in a June 2016 workshop and to date, has not received information contradicting this assessment as too high (notably some have argued it is too low). With this analysis, EDF is concerned that leakage of methane within the natural gas value chain can and will undermine the climate benefit of using that natural gas in California – as has been done for several decades as part of the comprehensive air and climate pollution reduction program. Put simply, while natural gas may be cutting in-state emissions, the increased use of natural gas in California pursuant to the state's long term emissions reduction efforts is being undermined by methane leaks from pipes and equipment that produce and transport gas into California from other states.

California is on a good path toward addressing its own methane pollution problems, recently adopting the most stringent standards in the nation for methane emissions from oil and gas production, but if California is to truly address the climate and air quality damage that comes from its natural gas use, it has to play an active role in efforts by other states. For these reasons, we urge the Board to specify in the Proposed Plan methods for targeting leakage reduction in upstream imported natural gas. Ample opportunities exist, EDF respectfully requests the Board the take this challenge head on.

Comments on Natural and Working Lands Including Agricultural Lands

Staff Lead: Robert Parkhurst

EDF is committed to promoting science-based solutions for farmers, ranchers, and landowners to help the state address the impacts of climate change and bring greenhouse gas emissions to 40% below 1990 levels by 2030. We are dedicated to understanding the value and promoting the

implementation of practices which increase the climate benefits that working lands provide. We also appreciate the continued effort that CARB, CDFA, and CNRA have put into identifying how climate-smart agriculture can be a part of the climate solution.

We appreciate the effort CARB plans to take to "expand the scope of the inventory using the most recent data available and plans to update… emissions estimates for soil carbon, urban forestry, and croplands by mid-2018." This approach will help all stakeholders better understand both the baseline inventory for natural and working lands as well as better understand the potential emission reductions and carbon sequestration from these lands.

Working land carbon and nitrogen cycling is complex and the science in this area continues to evolve. There is a growing body of research, much of it funded by CARB, about the nitrous oxide emissions from a number of California crops including tomato, wheat, lettuce,[49] rice,[50] alfalfa,[51] and cotton. There is additional research on the carbon sequestration potential of various practices on California rangelands.[52] Even with all this research, **much of the GHG impacts of practices on working lands are not well understood and have high levels of uncertainty. Studies are also limited by geography, practice and soil type**.

It is with this background in mind that we offer our comments on the updates to the 2017 Scoping Plan Update (hereafter referred to as the Update).

Long-term objectives

One of the most important tenets in the Update is CARB's ongoing reliance on the best available science to select and promote actions to mitigate or adapt to climate change. EDF supports CARB's objective to establish "agriculture sector GHG emission reduction planning targets for the mid-term time frame and 2050." We urge caution, however, at the objective to "Enhance the resilience of and potential for carbon sequestration on those lands through management and restoration."[53] This is an area where the best available science is limited. As stated in previous comments on the state of the science for soil carbon sequestration**, recommendations for practices that sequester carbon and targets for state-level sequestration must address potential constraints: "(i) the quantity of C stored in soil is finite, (ii) the process is reversible and (iii) even if SOC is increased there may be changes in the fluxes of other**

[49] Horwath, W.R., Burger, M. "Assessment of Baseline Nitrous Oxide Emissions in California Cropping Systems." California Air Resources Board, Contract No. 08-324. https://www.arb.ca.gov/research/apr/past/08-324.pdf.
[50] Pittelkow, C.M., Assa, Y., Burger, M., Mutters, R.G., Greer, C.A., Espino, L.A., Hill, J.E., Horwath, W.R., van Kessel, C., Linquist, B.A. "Nitrogen Management and Methane Emissions in Direct-Seeded Rice Systems." *Agronomy Journal* 106.3 (2014): 968-980.
[51] Burger, M., Haden, V., Chen, H., Six, J., Horwath, W. "Stand age affects emissions of N2O in flood-irrigated alfalfa: a comparison of field measurements, DNDC model simulations and IPCC Tier 1 estimates." Nutrient Cycling in Agroecosystems 106.3 (2016): 335-345.
[52] Ryals, R., Hartman, M.D., Parton, W.J., DeLonge, M.S. and Silver, W.L., 2015. Long-term climate change mitigation potential with organic matter management on grasslands. *Ecological Applications*, *25*(2), pp.531-545.
[53] Scoping Plan Update, p 109.

greenhouse gases, especially nitrous oxide (N_2O) and methane."[54] Furthermore, because of the potential for leakage, yield impacts are a key variable and all metrics should can into account both absolute and yield-scaled emission reductions.

We recommend that CARB take a similar approach to soil carbon sequestration as taken to CARB-supported research on GHG emissions from nitrogen fertilizer between 2008 to 2016.[55] A comprehensive look at practices which can sequester carbon in California's complex agricultural landscape is needed to identify and fill gaps in scientific knowledge and assist in setting a "comprehensive and strategic path forward."[56] Only then can practices be identified and promoted with California's farmers and ranchers.

Challenges with NRCS conservation practice standards

CARB and several of its sister agency programs, such as the Healthy Soils Initiative, are relying on USDA Natural Resource Conservation Service Conservation Practice Standards for identification of practices which can be implemented to reduce GHG emissions. More than 100 standards have been developed over decades and represent the best technical information on the implementation of science-based conservation practices. It is important to note, however, that these NRCS practice standards were not developed with a specific focus on GHG emission reductions. Caution should be taken in recommending practices where there is clear environmental value in their implementation, but not significant science to support the reduction of GHG emissions.

Evaluating modeling estimates

We request a detailed list of data and references used to create the California natural and working lands carbon model (CALAND) be made public. In the current version of the Update few references are provided and those that are noted do not have sufficient information for investigation. For example, on page 7 of Appendix G, the reference for urban vegetation is listed as Bjorkman et al. 2015. A Google scholar search for this reference did not provide any articles related to urban vegetation, but several articles related to forestry. Furthermore, no references to the cropland estimates were provided in Appendix G.

Only when the references and supporting documentation for the model are made available can our team fully evaluate the model and its objective of informing the goal, target acreage, and practice recommendations for achieving GHG benefits from practices on agricultural lands. Clarification on the emissions scope and boundaries, whether soil organic carbon or related methane and N_2O flux, should be explicitly identified for this model, since there can be a substantial impact on methane and N_2O through the implementation of different management scenarios. Further, no additional information has been provided on the calibration, validation, or

[54] Powlson, Whitmore and Goulding, 2010. Soil carbon sequestration to mitigate climate change: a critical re-examination to identify the true and the false. European Journal of Soil Science, Feb 2011, 62, pp.42-55

[55] A great summary of all the research conducted on nitrous oxide emissions can be found at https://www.arb.ca.gov/ag/fertilizer/meetings/meetings.htm

[56] Scoping Plan Update, p. 110.

uncertainty in the model outside of the very limited information provided in the presentation at the December 14 workshop. **Any and all supporting journal articles, references, and research for the model, abatement calculations, and uncertainty analyses should be shared with the public.** This is common practice for natural and working lands GHG quantification methodologies. Without this information, it is not possible to assess the degree to which "[t]he modeled management strategies" were based on "well-established science" and the certainty to which "the strategies increase carbon sequestration and resilience."[57]

Cover crops and carbon sequestration

We note that in the Update there is still an indirect mention to cover crops and vague references to other practices that promote carbon sequestration. Cover crops have been shown to improve soil health, and EDF supports and promotes the planting of cover crops through our Sustainable Agriculture program. However, we do not report the carbon sequestration benefits because varied results in the scientific literature indicate that cover crops may actually increase or decrease overall sequestration depending on soil type, geography, and additional interacting practices. Therefore, **extreme caution should be taken regarding the sequestration potential of any practice without conducting additional research** as recommended above. Even then, the practices should be specified by crop, geography, and soil type at a minimum.

A recent meta-analysis concluded that cover crops can sequester soil carbon, although the extent of carbon uptake is ultimately limited by SOC saturation.[58] However, increasing soil organic carbon can increase N_2O emissions, leading to uncertain net impacts in greenhouse gas emissions.[59] Another recent meta-analysis likewise concluded that the impact of cover crops on N_2O emissions was extremely variable, in some cases leading to a decrease but in other cases leading to an increase in N_2O emissions.[60]

The one practice where there is significant science to support carbon sequestration is the avoided conversion of rangelands to croplands or urban infrastructure. There are well-reviewed protocols by both the Climate Action Reserve and American Carbon Registry already in place for avoided conversion of grasslands. When grasslands are disturbed, such as when the land is tilled for crop cultivation, a significant portion of the stored carbon oxidizes and decays, releasing CO_2 into the atmosphere. This is carbon which has been stored in the soil over decades by natural cycles of growth and decay. By preserving intact grasslands or rangelands, CARB can maintain the carbon sequestered throughout the state. This is particularly important as rangeland ecosystems cover approximately half the land area of California.[61, 62]

[57] Scoping Plan Update, p. 113.
[58] Poeplau, C. and Don, A., 2015. Carbon sequestration in agricultural soils via cultivation of cover crops–A meta-analysis. Agriculture, Ecosystems & Environment, 200, pp.33-41.
[59] Bos, J.F., ten Berge, H.F., Verhagen, J. and van Ittersum, M.K., 2016. Trade-offs in soil fertility management on arable farms. Agricultural Systems
[60] Basche, A.D., Miguez, F.E., Kaspar, T.C. and Castellano, M.J., 2014. Do cover crops increase or decrease nitrous oxide emissions? A meta-analysis. Journal of Soil and Water Conservation, 69(6), pp.471-482
[61] Brown, S., A. Dushku, T. Pearson, D. Shoch, J. Winsten, S. Sweet, J. Kadyszewski. 2004. Carbon supply from changes in management of forest, range, and agricultural lands of California. Winrock

Methane emissions from the dairy and livestock sectors

Approximately half of all methane emissions come from California's dairy sector and it is estimated that about half of the dairy emissions come from enteric fermentation and the other half from manure management. However, measuring these emissions has been an elusive and evolving science. As a colorless and odorless gas, methods to measure these emissions have been largely based on bottom-up emission calculations. For example, the U.S. EPA estimates relative methane emissions from different livestock pathways based on per cow averages of biological factors, adjusting for different regions.[63] Unfortunately, farmers have neither proven tools to determine their methane emissions nor information on how best to minimize those emissions on their farms.

EDF is working to better quantify farm-wide methane emissions from different methane sources at California dairies. This work builds on EDF's earlier efforts to develop good estimates of methane released through the energy sector where we pioneered tools to measure methane emissions from oil and gas exploration – the largest source of U.S. methane emissions – through 16 independent scientific studies.[64] The precise measurements that resulted have facilitated efforts to reduce methane emissions from oil and gas operations. Drawing on this experience, EDF is testing ways to measure and inventory emissions from livestock operations. Over the past year and with several partners, we conducted measurements at two dairies in California. We conducted these measurements based on three methodologies to measure methane: one taken by aircraft above the dairies and two using different methods taken on the ground. This comparison is intended to help clarify differences in reported emissions and establish a clearer baseline for emission reductions. EDF expects to have a paper published in the next year to document the results of these measurements.

Conclusion

Thank you for this opportunity to provide these comments on the Proposed 2030 Scoping Plan. For questions please contact the staff lead identified for each section. We look forward to working with CARB, their sister agencies, and other stakeholders to implement California's ambitious commitments to reduce danger climate pollutants while creating myriad other benefits for California.

International, for the California Energy Commission, *PIER Energy-Related Environmental Research*. 500-04-068F. 144 p

[62] Havstad, K., D. Peters, B. Allen-Diaz, J. Bartolome, B. Besterlmeyer, D. Briske, J. Brown, M. W. Burnson, J. Herrick, L. Huntsinger. 2009. The Western United States Rangeland: A Major Resource. Grassland: quietness and strength for a new *American agriculture. American Society of Agronomy* 75-94

[63] EPA, U. S. 2016. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014. Annex 3.10. Methodology for Estimating CH4 Emissions from Enteric Fermentation. April 15, 2016. U.S. Environmental Protection Agency.

[64] EDF. 2016. Methane Research: The 16 Study Series. http://www.edf.org/sites/default/files/methane_studies_fact_sheet.pdf