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Comments on 2022 Scoping Plan, Technical Scenarios Workshop (held August 17, 2021)

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Energy Innovation is grateful to the California Air Resources Board (CARB) for managing the complex task of developing California's 2022 Scoping Plan. We support CARB's initiatives to better quantify public health benefits and identify pathways to 2035 carbon neutrality in the analysis underpinning 2022 Scoping Plan development.

While we welcome these encouraging steps, initial plans for the Scoping Plan analysis still fall short of global best practices. To better realize the 2022 Scoping Plan's potential to inform California's decarbonization strategy, Energy Innovation offers four recommendations:

1. **Identify a Reference Scenario that captures the expected effect of California's existing decarbonization policies, providing an evaluation of the current strategy.** A Reference Scenario analyzes the combined effects of existing policies—an essential input for setting future strategy.

2. **Improve methods for modeling the cap-and-trade program to better evaluate its expected performance. Publicly report on the number of allowances banked following the compliance event in November of this year, as required by Board Resolution 18-51.** The 2017 Scoping Plan analysis attributed more emission reductions to cap-and-trade than to any other policy (per Figure 7). Energy Innovation was among those raising concerns about the 2017 Scoping Plan strategy's growing reliance on the cap-and-trade program. Year after year, more allowances have been offered than needed to cover emissions, allowing a surplus of allowances to build up, as has happened in other programs. CARB rejected such concerns, calling the predicted build-up of surplus allowances theoretical and unlikely. Recent analysis by the carbon market consultancy ClearBlue Markets estimated the surplus to have reached about 270 million to 290 million allowances, which will reduce future program effectiveness.

3. **Prioritize identification of near-term policy opportunities.** The 2030 target is statutorily mandated, and this is the last Scoping Plan that will meaningfully affect whether that target is met. Another reason to prioritize the search for near-term opportunities is the greater technological certainty. The 2030 target is achievable with currently available technology. Energy Innovation strongly supports consideration of carbon neutrality in the Scoping Plan process but notes the longer time frame it involves adds technological uncertainty.

4. **Consider new direct regulations, broadening the search for advantageous next steps.** This is possible exists thanks to existing authority in Assembly Bill (AB) 32, Senate Bill (SB) 32, and AB 197. Energy Innovation has recommended setting a greenhouse gas performance standard on cement and concrete production in combination with a carbon border adjustment on imported cement and concrete. The World Resources Institute has proposed a similar clean concrete standard, which would use the existing low carbon fuel standard as a design template.

Energy Innovation's relevant research and experience

Energy Innovation's California Energy Policy Simulator (EPS) is an open-source, system dynamics model offering a uniquely broad, integrated analysis of policy effects. The California EPS captures both the effects of the state's cap-

and-trade program and the effects of sector- and technology-specific policies. Initial findings were documented in Insights from the California EPS. We are currently updating the model to adjust for COVID-19 impacts and gathering input data underlying new model functionality. The EPS has added a macroeconomic module enabling analysis of policy effects on jobs, income, and growth.

Energy Innovation staff possess a rare historical perspective on the development of California climate policy. In 2006, the author of this letter, Energy Innovation Research Director Chris Busch, persuaded three Nobel Prize-winning economists to join a letter supporting AB 32 in the run-up to its passage.[1] In 2009, I was appointed to the Economic and Technology Advisory Committee established under AB 32. At CARB's April 21, 2010, board meeting, I delivered an invited presentation to board members on the updated economic analysis of the first Scoping Plan.[2]

The recommendations conveyed in this letter echo findings of previous research and comments delivered at CARB proceedings. For example, we delivered oral and written comments on the "Update on Implementation of the 2017 Scoping Plan" agenda item at the Board Meeting on April 23, 2020. We have also periodically updated CARB about the EPS and expressed an interest in deeper engagement. Next, our detailed recommendations:

A robust Reference Scenario is essential

The Scoping Plan analysis must develop a Reference Scenario that models the expected effect of California's existing climate policy strategy, referring to the state's existing decarbonization policies. A Reference Scenario indicates whether the current strategy offers a strong probability of success or whether additional policies are needed. In short, a Reference Scenario will clarify where California is headed. Without such a current emissions outlook, there will be a disconnect between the modeling and the most important questions for the Scoping Plan: Is the state on track for the 2030 target under SB 32? Is a more ambitious pathway advisable considering new opportunities opened by innovation and maturing clean tech markets, and new understanding of public health benefits and the urgency of climate actions? What changes to the state's portfolio of policies are needed, if any, to redirect from where we are heading to where we want to go? Without a Reference Scenario, policymakers are in effect flying blind.

Prepared materials presented at the workshop did not discuss a Reference Scenario. During the workshop, Energy Innovation staff orally commented on the importance of developing a robust Reference Scenario and asked if the Scoping Plan analysis will include one. No definitive answer was given, though the reply mentioned the challenges associated with uncertainty. Uncertainty is inevitable in any future planning exercise. There are no crystal balls. Still, planning and strategy-setting are essential.

The report CARB commissioned on carbon neutrality recognizes the centrality of Reference Scenario development to economy-wide decarbonization planning, stating: "A 'reference' or 'counterfactual' scenario is not evaluated in this study but will be an important focus of CARB's next Scoping Plan," (page 21, Achieving Carbon Neutrality in California).

A Reference Scenario is also included in the transportation sector carbon neutrality report CARB commissioned. The report, managed by the U.C. Davis Institute for Transportation Studies, refers to a business-as-usual (BAU) projection instead, but its conceptual equivalence is clear in its definition: "The BAU projection reflects past trends and how those trends may continue (or change) into the future in the absence of new policies. This projection also considers how existing policies may 'bend the curve' of CO_2 and other key metrics of interest," page 129.

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[1] The three Nobel Laureates were George Akerlof, Ken Arrow, and Dan McFadden. Note that Stanford Professor Larry Goulder and U.C. Berkeley Professor Michael Hanemann had crafted the letter and added the lion's share of signatories.

[2] April 21, 2010, Board Meeting, agenda item 10-3-6, "Update for the Board on Assembly Bill 32 Economic Analyses," continuation from the March 25, 2010, Board Meeting.

The EU has advanced the state of the art in economy-wide policy analysis in recent years. In 2016 planning work, the EU's Reference Scenario documentation was 220 pages in length, illustrating the transparency and seriousness of efforts to establish the Reference Scenario, stating: "The Reference Scenario acts as a benchmark of current policy and market trends. As such, it can help to inform future policy debate and policy making," page 14.

In reviewing the Request for Proposal outlining tasks for modeling contractors, we observe that Reference Scenario modeling is included among the contractor's specified tasks.[3] This Reference Scenario-related work must be included in the publicly released Scoping Plan analysis. Additionally, CARB should define metrics for judging overall progress at the inventory level. We suggest laying out interim performance thresholds indicating annual emission reduction levels considered consistent with being on track versus off track.

Improve cap-and-trade modeling to better understand expected future performance

Improved modeling of cap-and-trade is needed as a matter of principle because it is one of California's major climate policies and there are also specific Scoping Plan-related reasons. Concerns regarding the 2017 strategy for reaching the 2030 target, which elevated the importance of the cap-and-trade program compared to prior strategy, have not been adequately addressed. Modeling tools additional to those proposed for the 2022 Scoping Plan will be necessary to better understand the program's likely future effectiveness.

Questions and outright doubts about whether expected cap-and-trade reductions portrayed in the 2017 Scoping Plan analysis are realistic were expressed by the Legislative Analyst's Office, the nonprofit Near Zero, Energy Innovation, and legislators. At the December 2018 Board Meeting, Ex-Officio Board Member Assemblyman Eduardo Garcia raised the issue of overallocation (referring to the availability of allowances in excess of emissions, per the transcript at pages 221-223). Assemblyman Garcia urged a more proactive evaluation of cap-and-trade, including metrics. He also called for developing policy options for responding to a large private bank of allowances (i.e., a surplus of allowances beyond those needed for current compliance).

In the discussion that followed, staff indicated a willingness to examine overallocation concerns. Board Resolution 18-51 called for a workshop on the topic, to explore policy responses. The 2019 workshop held in response did not adequately counter concerns that overallocation would lead to fewer emission reductions than previously predicted.[4] Board Resolution 18-51 also obligates staff to quantify and report the number of allowances banked into the fourth compliance period, following the compliance event in November of this year. We strongly urge a public reporting of this data.

A large private bank of allowances has developed, despite CARB's assurances this was unlikely to happen. In a May 2021 analysis, the carbon market consultancy ClearBlue Markets estimates the private bank to have reached about 270 million to 290 million allowances. With each allowance permitting one tonne of carbon dioxide emissions, this surplus is larger than the cumulative reductions expected from the cap-and-trade program over the next decade

[3] Referring to documents found at https://caleprocure.ca.gov/pages/Events-BS3/event-search.aspx, by searching "event id": 0000017274.

[4] In brief, the conclusion advanced by Borenstein and Bushnell that changes to allowance supply are expected to have a smaller than expected emission reductions follows from assumptions that the supply of carbon price responsive abatement is relatively small. If true, if the supply of carbon-price-responsive tons is limited, that would contradict the Scoping Plan's portrayal of much larger emission reductions expected due to cap-and-trade program. If not true, if the supply of carbon-price-responsive tons is larger, consistent with the 2017 Scoping Plan analysis, that would undermine the conclusion put forth by Borenstein and Bushnell regarding the likely effects of an allowance supply adjustment. Energy Innovation's blog offers further discussion with even more deeper consideration in a technical appendix.

per the last Scoping Plan. Figure 7 in the 2017 Scoping Plan shows that analysis estimated the cap-and-trade program would lower emissions by 236 million tonnes over the 2021-2030 period.[5]

CARB has pointed to the increasing pace of cap reductions and the rising price floor as reasons for optimism that the program, as currently designed, can succeed in becoming a major driver of emission reductions. Energy Innovation's prior California EPS analysis found that an increasing carbon price, plus other policies included in the 2017 Scoping Plan strategy, failed to drive emissions low enough to reach the 2030 target. A rising carbon price fails to provide guarantees of success. Deeper examination of the likely emission reduction effect of the cap-and-trade program is essential as part of broader strategic assessment and recalibration in the 2022 Scoping Plan.

Best practice for modeling the effects of the state's cap-and-trade program calls evaluation using a computable general equilibrium model. The EU uses this type of model in its economy-wide climate policy analysis, specifically: a model known as GEM-E3. Closer to home, David Roland-Holst and colleagues run the Berkeley Economic and Resources (BEAR) model. This California-specific computable general equilibrium model has long been a mainstay of the state's climate and energy policy landscape, including projects for the California energy and public utility commissions. The BEAR model was a key player in the first Scoping Plan, providing independent analysis and results consistent with CARB's own modeling.

Importantly, the BEAR model provides finer-grained results than do the currently proposed modeling tools, which will yield statewide impacts. BEAR can differentiate results for varying income groups. It also provides spatially explicit results, by Census area, improving understanding of equity impacts.

CARB has arranged to use the Pathways and IMPLAN models in the 2022 Scoping Plan analysis. Pathways and IMPLAN, are effective, respected tools with their domains, but neither is apt for evaluation of the cap-and-trade program. The Pathways model provides excellent visibility into sector, technology, and fuel policies, but is not structured to model carbon pricing. IMPLAN, like the REMI model used in the 2017 Scoping Plan analysis, is an input-output-type economic model. Such models are appropriate for evaluating macroeconomic effects expected to follow from policy impacts quantified through other means, as intended in the 2022 Scoping Plan. But an input-output model like IMPLAN would not be a good choice to understand the expected impacts of a cap-and-trade program, or any carbon pricing policy, for that matter. Such models have a rigid production function, assuming fixed types and quantities of energy use for each unit of economic output produced. As a result, input-output models are incapable of modeling fuel-switching or efficiency investments expected in response to a carbon price signal. Therefore, additional modeling tools beyond those proposed will be needed for analyzing the likely effects of a cap-and-trade program.

The best practice, as evidenced in the EU, would be to use a computable general equilibrium model to evaluate the likely price and expected emission reduction effects of the cap-and-trade program under current design. At minimum, the 2022 Scoping Plan should analyze expected program effects at floor and ceiling prices to understand the range of possible effects.

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[5] ClearBlue Markets May 2021 brief, Figure 2, "WCI Supply and Demand Forecast Scenarios (Allowances)," shows the supply of allowances exceeding demand such that a cumulative maximum of 268,254,926 – 293,259,419 is reached. Note that these results encompass the Western Climate Initiative's cap-and-trade market, which links California and the Canadian province of Quebec. But California dominates the market, with covered emissions more than five times larger than those of Quebec. Figure 2 also shows the Western Climate Initiative market requiring emission reductions on the order of 211 to 263 million tonnes in 2030. A few words of explanation may help avoid misinterpretation of these results. On their face, these 2030 results could be read as not inconsistent with the cumulative emission reductions expected by cap-and-trade in the 2017 Scoping Plan, but that would be a mistake. These forecasted 2030 emission reductions due the Western Climate Initiative cap-and-trade program to implicitly assume other policies do little to reduce emissions, as is evident in Figure 2's portrayal of future emissions without the program, labeled WCI Emissions Forecast, as nearly flat through the 2020s.

Prioritize identification of near-term policy opportunities

The 2022 Scoping Plan is the last Scoping Plan that will meaningfully affect whether California achieves its 2030 target. The 2030 target is not merely a goal or a waystation on the way to carbon neutrality; it is explicitly required by statute. Considering the five-year Scoping Plan cycle, the next one should be completed around 2027. Any policy adjustments called for in the 2027 Scoping Plan would require further analytical and rule-writing work in other regulatory proceedings. This delay means new policy requirements would be unlikely take effect by 2029, leaving little time for policy changes to influence 2030 emissions.

Reduced technological uncertainty is another reason to increase emphasis on actions needed to reach the 2030 target. The 2030 target is fully achievable with commercially available technology. Since the last Scoping Plan, there has been remarkable innovation in renewable energy, electric vehicles, batteries, light emitting diodes, and advanced geothermal energy storage. Technological progress opens new opportunities for advantageous decarbonization policies.

Though technological progress has been faster than expected over the last decade, some of the most challenging emission sources still require further research and development before decarbonization solutions will be ready for large-scale commercial use. Identification of pathways to carbon neutrality helps illuminate priorities for further technological development. But Three of six key objectives for the 2022 Scoping Plan listed in the opening presentation directly relate to carbon neutrality, such as one emphasizing that this Scoping Plan seeks to "identify endpoints for the transition" The uncertainty inherent in transition endpoints underlines the importance of giving more emphasis to the 2030 target in a rebalancing of goals for 2022 Scoping Plan.

Another reason to increase the early action search relates to the ever more urgent scientific warnings about the need for rapid emission reductions. John Holdren, formerly President Obama's top science advisor, boils it down: "Everything we worried about is happening, and it's all happening at the high end of projections, even faster than the previous most pessimistic estimates." Earlier this year, leading researchers Dan Kammen and colleagues urged faster emission reductions in their article, *Accelerating the Timeline for Climate Action in California*.

In response to prior recommendations to elevate consideration of the 2030 policy strategy and the search for near-term opportunities, CARB has replied that "[assessing] progress towards achieving the 2030 target" is a top objective for the 2022 Scoping Plan. Such assurances are unpersuasive for two reasons. In the first instance, the proposed modeling tools CARB has assembled cannot answer key policy questions. Furthermore, CARB's past assessments have been primarily qualitative. The assessments have not attempted to understand the causal factors, including policies, determining emission trends.

Consider last year's "Update on the Implementation of the 2017 Scoping Plan," at the Board Meeting on April 23, 2020. It was framed in the agenda as "an update on the implementation of the 2017 Scoping Plan Update and ongoing efforts to continue progress toward achieving the 2030 greenhouse gas reduction target." Slide 2 in the staff presentation, which graphs the historical trend and portrays future targets, could be considered a rudimentary assessment, but there is no quantitative analysis of emission reductions included.

A deeper assessment of the emissions outlook—one that analyzes the combined effects of current and planned policies—is essential for the 2022 Scoping Plan. Without such an assessment, potentially valuable insights for policy optimization are sacrificed. Ultimately, the state risks loss of vital time.

Expand the search for advantageous early actions, including new direct regulations

As part of an invigorated search for advantageous early actions, we urge consideration of additional sector- and technology-specific regulations, i.e., new direct regulations. For example, the World Resources Institute proposed

a clean concrete standard in 2019, which CARB has the authority to adopt today. The World Resources Institute proposal suggests modeling a concrete-specific standard on the existing low carbon fuel standard. In brief, the policy requires the carbon intensity of concrete sold in California to decline over time but creates flexibility.

Borrowing from the low carbon fuel standard policy template would have advantages. CARB has successfully fended off court challenges to the policy, building confidence about its legal foundation and longevity. Additionally, as a lifecycle standard, the low carbon fuel standard covers emissions across the supply chain, both domestic and imported. In effect, a lifecycle policy indirectly creates a type of carbon border adjustment. As such, lifecycle policies akin to the existing low carbon fuel standard offer one possible approach to minimizing leakage, and offers an answer to the question posed in workshop materials: "How do we meet the statutory requirement to minimize leakage?"

Note that the cap-and-trade program's coverage of the emissions associated with imported power offers a different type of carbon border adjustment. In this case, end-of-pipe emissions at power plants generating electricity California imports are covered by the border adjustment. The imported power under cap-and-trade covers a narrower slice of emissions, reducing complexity.

This simplicity advantage led Energy Innovation to recommended pairing an emission standard covering cement and concrete production emissions in California with a border carbon adjustment in our initial California EPS recommendations. The border carbon adjustment would require cement imported from jurisdictions with weaker climate policies to pay a fee—the adjustment—to account for unregulated GHG emissions, leveling the playing field in the California market for in-state producers. AB 398 specifically urged consideration of border carbon adjustments: "The state board shall include recommendations to the Legislature on necessary statutory changes to the program to reduce leakage, including the potential for a border carbon adjustment, while maintaining the state's ability to reach its targets," (Section 38562.b.2.I.).

Drawing upon authority delegated in AB 32, the 2008 Scoping Plan included several policies not yet established in regulation or later addressed in separate legislation. It included the 33 percent Renewable Portfolio Standard, which was codified in 2011 in SB 2(1x). The initial draft of the 2008 Scoping Plan proposed the sustainable community strategies that would only later become the subject of SB 375. The 2008 Scoping Plan analysis delved into cap-and-trade design by modeling different program configurations, and the plan itself outlined cap-and-trade program design, before CARB had written the inaugural version of the regulation.

To limit the 2022 Scoping Plan to existing policies unnecessarily constrains the search for effective policy options. Taking this approach would be like a prize fighter entering the ring for the most important fight of her life with one hand tied behind her back. We urge consideration of new policy initiatives, particularly in industry and buildings, using existing authority under AB 32 and SB 32.

In conclusion

The Scoping Plan analysis is a challenging undertaking. Still, no other proceeding at CARB or any state agency has the broad perspective of the Scoping Plan. An all-out effort is compelled considering the urgency of deep decarbonization and the infrequent five-year cycle for reviewing the sum effect of California's plans as compared to its ambitions. We stand ready to contribute.

Thank you for considering these comments,

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