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Via electronic submittal to: Notice of Public Meeting to Consider the Draft 2022 Climate Change Scoping Plan (scopingplan2022)

**Re: Rondo Energy Comments to the Draft 2022 Climate Change Scoping Plan**

Rondo Energy, Inc. (“Rondo”) appreciates this opportunity to submit comments regarding the Draft 2022 Climate Change Scoping Plan (the “Draft Scoping Plan”). Rondo strongly supports CARB’s commitment to identify “*a technologically feasible, cost-effective and equity-focused path to achieve carbon neutrality by 2045.*”

Historically, it has been difficult to curb industrial greenhouse gas (GHG) emissions because of a lack of low carbon, high temperature heat solutions that cut across various industries. The emergence of *indirect industrial electrification technologies*, including the Rondo Heat Battery (RHB), provide an immediately feasible, cost-effective, and equitable way to decarbonize across the numerous and diverse industries that collectively contribute to a fifth of California’s GHG emissions.

**Technological Feasibility**

Rondo is a California-based company that has developed zero-carbon technology for industrial process decarbonization: The Rondo Heat Battery captures intermittent electricity, stores energy as high-temperature heat, and delivers continuous hot air or steam. When the electricity is renewably-sourced, the outputs become zero-carbon. The RHB is built of widely available, proven, sustainable, and durable materials and technologies with 50-100 year life spans. It stores heat energy at temperatures up to 1500°C—enabling use cases ranging from high-temperature steel, cement, and chemical manufacturing all the way to low-temperature food processing. The RHB meets the demanding needs of industry for safe, simple, low-cost energy and economically replaces fuel-fired furnaces and boilers.

Rondo’s first commercial installations with large-scale thermal storage capacity are coming online in California within the next year—and a substantial portfolio of California projects are currently in development. Together, these planned projects amount to GHG emissions reductions in California of more than 2 million tons CO<sub>2</sub>e per annum within the next few years.

**Cost-Effectiveness**

Indirect industrial electrification technologies are fundamentally more efficient and cost-effective than current zero-carbon alternatives. They capture intermittent electricity during periods of very low prices and/or curtailment, or are directly powered intermittently by local generation, and deliver the continuous high-temperature heat needed at low cost and without the energy losses of electrochemical conversion systems. The RHB already has a 98% efficiency—that is, 98% of the electrical energy used to charge the heat battery is stored and then delivered in the form of hot air or steam. This stands in contrast to hydrogen-

for-heat systems with efficiency of 52% (due to losses in electrolysis, compression and combustion) and with double the capital and operational costs of the RHB.

Indirect industrial electrification is already economical for many industrial players today. The Draft Scoping Plan noted that decarbonizing the industrial energy supply would have an average annual cost of \$356/ton in 2022-2045; while this may be true with other technologies, the combination of the low cost of intermittent electricity and the low capital cost and near-100% efficiency of electric thermal energy storage means that industrial decarbonization projects can be profitable both for industrial operators and renewable project developers at costs that match existing forecasts for the Cap-and-Trade system, below \$90/ton for the period. Most important, such projects can be profitable today with quite modest adjustments in policies and regulations.

## **Scope and Scale**

The scope and scale of the industrial heat GHG reduction opportunity makes it deserving of attention in the design of high-level policy documents like the 2022 Scoping Plan update, and regulations to achieve total GHG reductions. The opportunity to reduce criteria, toxic and greenhouse gas emissions by replacing fuels combusted for industrial heat in California with indirectly electrified furnaces and boilers is substantial—not least because such solutions can reduce most, if not all, of California’s industrial process heat emissions.

Furthermore, high-level policy direction would be particularly helpful because the actual renewable energy resources required to decarbonize industrial process heat is monumental, but unfortunately often misunderstood. For example, an industrial emitter subject to California’s Cap-and-Trade program releasing the threshold 25,000 MT of CO<sub>2</sub> per annum is burning 54 MMBTU per hour of natural gas around the clock. To directly electrify that process heat load with an electric boiler would require 12MW and add peak load to the grid. Decarbonizing that same process heat load with a RHB would require the installation of ~40-60MW of solar PV resources and would provide support for the grid during peak hours. Larger industrial emitters such as a cement kiln operate around the clock with an electric load of ~10MW and a natural gas process heat load equivalent to 450MW thermal. Generating the MWh’s needed to indirectly electrify the cement kiln requires the installation of roughly 1.5GW of wind or solar PV resources to charge the Rondo Heat Batteries for full decarbonization. And this is with the highly efficient Rondo solution; to decarbonize this same cement kiln with electrolytic hydrogen would require roughly double that—a 3GW solar field. The scale of industrial process heat is large, but electrifying it can cost effectively add large flexible loads to the grid and enable variable renewables to be used as large dispatchable resources.

## **Equity**

Indirect industrial electrification technologies can play a critical role in achieving carbon neutrality with greater social equity. Many historically disadvantaged communities have borne disproportionate impacts of industrial pollutants, but also rely on these industries for local employment. By replacing fuel-fired furnaces and boilers with heat economically provided by renewable electricity, heat battery installations reduce not only GHG emissions, but also the local air pollutants associated with the burning of fossil fuels; at the same time, heat battery installations preserve the competitiveness of the industrial facilities making the clean energy transition, and thus preserve the industrial jobs such communities depend on. For example, the Rondo Heat Battery will unlock economical industrial electrification and business growth in communities such as Kern County, Fresno County, and LA County that already suffer from poor air quality.

## **Ambitious Industrial Emissions Reductions are Possible Now**

The Draft Scoping Plan devotes significant attention to distant-future and uncertain-cost carbon dioxide removal (CDR) technologies, particularly in the context of industrial emissions. Though such negative

emissions technologies may be an important tool in the climate action toolbox, the current plan's focus on such technologies emphasizes action that is unnecessarily backloaded and costly and fails to focus on ways to encourage indirect electrification's much lower cost, much faster reductions. For example, at least 40% more solar energy capacity will be needed to capture CO<sub>2</sub> released by fuel combustion than is needed to replace the same fuel combustion using indirect industrial electrification; and indirect electrification technologies such as the RHB are ready for deployment now, not years or decades in the future.

Rondo respectfully requests that CARB consider adding to the final Scoping Plan a discussion about early action that can be taken with innovative source reduction technologies. We further suggest that the deployment of indirect electrification of industrial heat is an immediate action opportunity, deserving of attention into the means to eliminate regulatory obstacles across agencies, and of supportive programs to encourage early deployment. We further suggest that plan development should include evaluating the benefits to the grid and to the competitiveness of a decarbonized California.

**It would greatly benefit the development of indirect industrial electrification if the final 2022 Scoping Plan contained discussion on the following topics:**

**(1) Industrial electricity rate reforms that reflected real electricity market dynamics and the true value that decarbonized industrial heat loads bring to the grid.** As mentioned already in the Draft Scoping Plan, we request that CARB and California's state agencies seriously consider changes to industrial rate structures that can catalyze the development of indirect industrial electrification. Currently, industrial customers cannot reap the benefits of the abundant renewable resources that have been integrated with the Californian grid. And, although heat batteries are instantly switchable loads that can (i) absorb intermittent peak-hour electricity at very large scale, (ii) be managed directly by grid operators to provide balancing services, and (iii) reduce the need for additional transmission or thermal generation resources, such heat battery projects are unable to fully take advantage of wholesale market pricing variability as an interconnected load. Established industrial offtake rates do not reflect the value of load shifting and grid balancing that indirect industrial electrification solutions create.

For example, on a sunny day in July when solar energy is curtailed and the wholesale electricity cost is \$0/MWh, a factory in Fresno, California is forced to burn natural gas because the plant cannot buy electricity at less than \$100/MWh. Curtailed renewable energy, instead of being wasted, can be used to decarbonize industrial facilities, bolster grid reliability, and reduce local emissions. The benefits of grid reliability services will only become more pronounced as California builds out the approximately 90GW of solar energy that the Draft Scoping Plan projects that the state will need to meet its 2045 target.

Specifically, the CAISO transmission access charge (TAC) is a volumetric electricity charge that adds \$13-33/MWh to all electricity load charges, regardless of time of use or relationship to the coincident peak grid demand. And so, even during hours of negative \$10/MWh prices, an industrial load that theoretically could access real time prices could be paying \$23/MWh after the TAC fees; this makes direct and indirect electrification not cost competitive with natural gas, even with Cap-and-Trade carbon prices. We thus recommend that the Scoping Plan identify the need for CAISO to finalize its Policy Initiative for Transmission access charge structure enhancements to modify the current volumetric billing determinant to better reflect customer usage and the cost causation and benefits of the transmission system. This policy update has been on hold since 2017 and is a major impediment for the cost-effective indirect electrification of industrial loads.

The lack of a robust direct access and retail choice for sophisticated large industrial loads is an additional impediment to implementing indirect electrification for decarbonization. Traditional CPUC-approved tariff design does not provide flexibility for industrial facilities to shape their load to respond to wholesale market prices. Non-bypassable charges, non-coincident demand charges, annual stand-by fees and the lack of real time pricing tariff options all prevent the cost-effective implementation of large (>1GW) price responsive loads, such as indirect electrification with Rondo Heat Batteries. We recommend that CARB identify in the Scoping Plan the need for the CPUC and CAISO to provide tariff and market access reform to encourage sophisticated industrial loads to be meaningful participants in wholesale prices and allow widespread competitive electricity supply.

**(2) Carbon market reforms to reflect high renewable penetration grids and provide capital assurance.** In the low carbon fuel standard (LCFS) program today, there are five or six different methodologies for the scoring of the carbon intensity of electricity used in the production of vehicle fuels or directly in electric vehicles. For example under the current regulation, on a February day from 11-12 am, an ethanol plant in California using grid electricity to produce steam for fermenting operations would be assessed carbon emissions of 370.22 kg CO<sub>2</sub> for every MWh consumed in that hour, while that same ethanol plant with an electric vehicle charger in their parking lot participating in the Smart Charger program would be assessed carbon emissions of 0 kg CO<sub>2</sub> for every MWh. This disincentivizes the ethanol plant from electrifying to absorb midday low carbon electricity and prevents the lowering of the carbon intensity of the ethanol produced at the plant. With the continuing growth of renewable penetrations in grids around the world, the Scoping Plan should identify the need for the LCFS program to provide a standardized methodology available to every pathway and program for the accounting of metered, real-time, grid electricity consumption carbon intensity. We recommend that CARB adopt what the CPUC has used in the Self-Generation Incentive Program (SGIP) for behind-the-meter energy storage. The SGIP uses WattTime to provide a real-time marginal emissions signal to validate the CO<sub>2</sub> emissions reduction of that incentive program. The tool provides historical, forecast and real-time signals for the grid carbon intensity and is used as the official record for the incentive compliance.

In addition, there is a widespread and persistent belief among even sophisticated energy parties that the LCFS program sunsets in the year 2030. For capital intensive large renewable projects with 30-year asset lives, CARB needs to clearly and unequivocally state that the program will continue past 2030 and will have more stringent targets to meet 2045 carbon neutrality. A strong and clear communication will create market certainty for the investment community into these large decarbonization assets.

In California's Cap-and-Trade program, there is an underused provision allowing for the opt-in of covered entities whose emissions are below the obligation threshold. Under the current regulation, an emitting entity that produces less than 25,000 MT of CO<sub>2</sub> per annum can choose to opt-in to the Cap-and-Trade program, receiving Allowances and participating as if they were obligated. However, upon voluntarily opting in, an opt-in entity does not receive Allowances equal to the full amount of its emissions. This disincentivizes such an entity from opting in and investing in decarbonization projects. For example, an entity emitting 10,000 MT CO<sub>2</sub> per annum that chooses to opt-in to Cap-and-Trade will be given at most 7,300 Allowances. If that entity then does a decarbonization project that reduces their emissions by 50% (5,000 MT CO<sub>2</sub> per annum), the entity would only have 2,300 allowances to sell—despite the fact that the entity would not have been subject to the Cap-and-Trade program to begin with. We thus request that CARB re-evaluate the implementation of the opt-in covered entities and provide an opt-in entity with Allowances equal to their full emissions. This will provide the full carbon price

signal, incentivizing the investment of these otherwise exempt parties into decarbonization projects and allowing the long tail of small emitters to contribute to California's decarbonization goals.

**(3) State support of indirect industrial electrification pilots and project development.** To help accelerate the adoption of indirect industrial electrification, we strongly recommend that California aggressively support pilot projects that validate the adoption of these technologies in every industry (food processing, cement, steel, fuels, etc.). Such support could help de-risk these new technologies and pave the way for such technologies to obtain more traditional financing and achieve the rapid scale we need to help achieve California's zero carbon goals.

Smaller, locally owned, and less creditworthy facilities in California would benefit most from state support for indirect industrial electrification. Rondo is already exploring working with local food processing businesses to help them decarbonize, as well as reduce their cost and reliance on volatile natural gas prices. For many of these facilities, adopting indirect industrial electrification may also be their only opportunity to fully decarbonize, as they are too small to adopt carbon capture technologies.

**(4) Cross-cutting policy amendments and regulatory clarity regarding how a heat battery can engage with third-party, off-grid solar projects.** [Section 218 of the California Public Utilities Code](#) currently severely constrains how a heat battery can purchase electricity from a nearby third-party owned solar project. Specifically, the requirement that the projects be on property that is “immediately adjacent” and the lack of clarity surrounding the regulation of broker entities are just two examples of how regulations could be amended to better enable heat batteries to charge from otherwise curtailed electricity from solar plants nearby.

**(5) A 2030 and 2045 target of 3 and 20 MMTCO<sub>2</sub>e, respectively, for indirect electrified heat (heat battery) technologies.** These targets are practical, low risk, equitable, and economically beneficial. The Draft Scoping Plan proposes a target for mechanical carbon dioxide removal (CDR) technologies, and underscores the urgency of early deployment. The Draft Scoping Plan mentioned a target of achieving “1–2 MMTCO<sub>2</sub>e in annual CDR in California through a combination of nature-based and mechanical method” by 2030. The Draft Scoping Plan mentioned that doing so would establish California as a leader in carbon dioxide removal (CDR). Similarly, establishing a target goal for heat batteries would enable California to become a national and global leader of indirect industrial electrification—a once-in-a-generation market opportunity with a global emissions reduction potential of over *9 billion metric tons of carbon dioxide emissions* that can be addressed today.

California policymakers can count on significant industrial emissions reductions with indirect industrial electrification technologies that already exist. With a greater focus on industrial emissions, CARB's final Scoping Plan can guide California in kickstarting a new wave of industrial decarbonization that can immediately reduce GHG emissions and local air pollutants in a technologically feasible, cost-effective and equity-focused way not just in California, but worldwide, with California leading the way.

Thank you for the opportunity to provide these comments. We look forward to continued discussions.

Sincerely,



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Caroline Jo

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