EXHIBIT L

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Audi CO_2 Cy Près Settlement Fund

We are grateful for the opportunity to provide these solutions which address carbon issues and climate action from MIT's Departments of Earth, Atmospheric & Planetary Science, and Mechanical Engineering. The principal scientists leading these research groups endeavor to identify issues and scale actionable solutions from campus- to worldwide-levels.

SUMMARY: Our challenge, in broad strokes: MIT must lead in decarbonizing the world's economy with new ideas, transformed into practical solutions, in record time. We will discover affordable, equitable ways to bring economic sectors to net-zero carbon emissions. At the same time, we must adapt to effects of climate change we cannot prevent; to do so, we are pursuing two ideas simultaneously and at maximum speed:

- We must go as far and as fast as we can with existing technology and methods, including science, technology, policy, markets, infrastructure, and levers for behavioral and cultural change.
- We must invest in, invent, and deploy new tools – and promote the new institutions and policies that it will take to reach the climate goals.

Our success depends on breakthroughs; current tools alone will not suffice. By infusing this research with the best work of MIT's students guided by faculty, we educate and empower the next generation, as they will inherit the impacts of this problem and the ongoing challenge of it.

The four research projects described within represent a spectrum of scientific approaches to carbon capture, mitigation and storage. These lean towards applicable solutions and represent applications from the shovel-ready to those proven in concept now in need of scaling.

Thank you again for the honor of participating in this unique program. We are happy to elaborate on any of these research descriptions, and look forward to hearing how the priorities of the Audi CO_2 Cy Près settlement fund will closely align with MIT's best solutions.

Sincerely yours,
John Nissenbaum
Senior Leadership Gifts Officer

Earth, Atmospheric & Planetary Sciences

Carbon sequestration by mineralization – 3 years, $900,000.

Creation and deployment of CO_2 removal and storage sink systems through process driven advances in negative emissions technologies and global sequestration.

Mechanical Engineering

Alkali-swing electrochemical CO2 reactor – 3 years, $900.000

Enable proof-of-concept and technology development to control CO_2 release from the captured state with an unprecedented electrochemical swing process, which will then be coupled with spatial precision for delivery of CO_2 to electrocatalysts for utilization.

Efficient production of solar fuels via thermochemical H20/CO2 co-reduction using redox cycles -- 2-3 years, $1M

Accelerate development of green/alternative fuels to decarbonize global industry, transportation, and process heat via renewable sources and CO_2 reutilization.

Developing Carbon-Neutral Aluminum/Cellulose Fuels for Clean Energy Conversion – 2-3 years, $1M

Change principles of combustion for global transportation and energy by creating novel composite fuels with aluminum and cellulose.

MIT *Department of Earth, Atmospheric and Planetary Sciences*

Carbon Sequestration by Mineralization: Integrated geophysical and geochemical investigation of field and laboratory data

Matěj Peč, Ph.D. -- Assistant Professor and Victor P. Starr Career Development Chair

Bradford Hager, Ph.D. -- Professor and Cecil & Ida Green Chair

Overview: Rapid development and massive distributed deployment of carbon capture and storage (CCS) is critical for continued habitability. We must curtail CO_2 emissions and actively remove CO_2 already in the atmosphere to keep global warming to acceptable levels (IPCC 1.5˚C report). Our future depends on safe, secure and long-term carbon storage sinks; one promising CCS strategy is CO_2 mineralization, the conversion of gaseous CO_2 into carbonate minerals, resulting in permanent storage. This approach has been demonstrated at small scale but will it work at a meaningful scale in the US?

The major uncertainty in predicting the capacity and economics of CCS via mineralization is that carbonation is accompanied by a positive volume change. The precipitation of minerals and increasing volume might clog pore space and reduce permeability. But there is geologic field evidence that this volume increase can lead to opening cracks that increase the permeability of the rock, leading to a positive feedback and promotion of increased storage. If this "carbo-cracking" is the dominant process, the number and storage capacity of potential reservoirs would be vastly increased. And, because the carbonation reactions lead to more easily observable changes in the mechanical properties of rocks, monitoring, modeling, and verification of secure storage would be unusually straightforward.

To ensure the subsurface integrity of geological formations during CO_2 injection and to accurately evaluate the reaction rates in such reservoirs, targeted studies of the feedbacks between deformation and reaction are required. We will conduct an integrated geophysical and geochemical investigation to gain an understanding of the coupled chemo-mechanical processes accompanying CCS to bring this technology into wide-spread practice. Our research would promote collaboration between geophysicists and geochemists to address the complexities of CCS, improve laboratory infrastructure suitable for studying CCS, and train several PhD students and post-doctoral researchers for future careers in the fields of negative emissions technologies and global carbon sequestration.

Impact of Funding. We can measure geophysical and geochemical signatures that are sensitive to pore structure and pore fluids, and there are multiple approaches that can be adapted to the lab and field settings that we will explore. The novelty of our work is in creating cracking, damage and precipitation in rock samples, measuring the related changes in non-linear parameters, and calibrating these measures to create a relatively fast and robust tool for monitoring mechanical change in subsurface reservoirs to maximize the efficiency of carbon mineralization. Then, industrial and government partners can advance carbon policy to remove atmospheric CO_2, and safe Global Carbon Sequestration technologies can be scaled around the world, enabling both developed and developing countries to meet critical carbon emission reduction targets and to protect the future of this planet.

Budget. $900,000 for 2-3 years to demonstrate proof-of-concept prototypes.

MIT *Department of Mechanical Engineering*

An alkali-swing electrochemical CO_2 reactor

Betar Gallant, Ph.D. -- Assistant Professor & American Bureau of Shipping Career Development Chair

Overview. We propose to explore a technology concept that can re-shape how CO_2 is managed from point of emissions to downstream conversion or storage. This proposed electrochemical technology aims to address the significant shortfalls in today's CO_2 capture and conversion processes. CO_2 capture, CO_2 conversion, and CO_2 storage are conventionally disparate fields, each facing unique hurdles: (1) CO_2 capture relies on high energy inputs to drive a thermal regeneration step, which can require up to 30% of a power plant's capacity; (2) Conventional CO_2 electrocatalysis requires large energy inputs to electrolyze water while reducing CO_2, and reactions currently have poor selectivities towards desired products; (3) Storage is site-specific, slow, and relies on post-separation CO_2 with the indicated energy penalties. The basis of the concept rests on two advances to be made in this collaborative effort: An approach to precisely control CO_2 release from the captured state using an unprecedented electrochemical swing process; and an approach to couple this controlled release of CO_2 with spatial precision to afford targeted delivery of CO_2 to electrocatalysts, where it can be utilized.

Impact of Funding. Support will enable proof-of-concept and technology development needed to establish a larger effort and attract additional outside funding to expand research in the PI's concept of direct capture-conversion. The Gallant group at MIT has pioneered this concept and obtained the first scientific evidence of its feasibility over multiple publications, and these efforts are now being picked up by leading researchers around the world. However, because this research rests at the intersection of more conventional and established funding opportunities (CO_2 capture, CO_2 conversion) finding the right fit with federal agencies in the U.S. will require time and relationship-building. This funding will be a critical bridge between laboratory and demonstration-scale needed to show feasibility and a higher technology readiness level, and conduct needed feasibility and technoeconomic assessments.

Budget. $900,000 for 2-3 years to demonstrate proof-of-concept prototypes.

Efficient production of solar fuels via thermochemical H_2O/CO_2 co-reduction using redox cycles

Ahmed F. Ghoniem, Ph.D. -- Ronald C. Crane (1972) Professor

Overview. We propose to achieve a ~10% solar-to-fuel efficiency via high temperature solar thermochemical H_2O/CO_2 co-reduction using redox cycles. The produced syngas can be further processed to liquid fuels compatible with the current fuel infrastructure via Fischer-Tropsch processes. Conventional solar-driven CO_2 and H_2O reduction systems using thermochemical redox cycles face challenges associated with the need for extremely high reduction temperatures (> 1500 ^oC for the ceria-based system), and sluggish reaction kinetics at the lower temperature oxidation step (< 1000^o C,

contributing to their low overall solar-to-fuel efficiency (< 5.25%). Fundamental understanding of the coupled physics and chemistry across multiple length and time scales is required for the design and optimization of the solar reactor, the key component of these cycles. We aim to quantify these effects in the form of multiscale multi-physics design models and to develop a physical realization of the optimal design to demonstrate a high-performance solar fuel processing system.

Impact of Funding. The support would enable us to make significant progress towards the production and utilization of green alternative fuels for decarbonizing difficult to decarbonize sectors such industry, long haul transportation, and process heat, using renewable energy and CO_2 reuse. The Reacting Gas Dynamics (RGD) Laboratory has contributed significantly to the fabrication, experimental investigation, mathematical modeling and techno-economic analysis of ceramic membranes for oxygen separation, fuel (H_2 and CO)and chemicals (C_2) production, and metal oxides for chemical looping processes, including perovskite oxides and fluorites.'

Budget. $1M for 2-3 years to develop models and prototype.

Research on CO2 Mitigation: Developing Carbon-Neutral Aluminum/Cellulose Fuels for Clean Energy Conversion

Sili Deng, Ph.D. -- Assistant Professor, Deng Energy & Nanotechnology Group d'Arbeloff Career Development Chair

Overview. We aim to develop a novel composite of aluminum and cellulose as a carbon-neutral fuel. Aluminum is the most abundant metal on earth with twice volumetric energy density of fossil fuels. Cellulose is widely available in plants and serves as the energetic binder to enhance the ignition and combustion behavior of aluminum. We propose cellulose as an additive to facilitate the ignition of aluminum combustion so that the fuel composite requires low ignition energy and enhances its combustion efficiency. Meanwhile, cellulose improves the stable storing time by physically encapsulating each aluminum particle with the cellulose polymer. We will explore the synthesis method of the composite and characterize its energetic behaviors.

Impact of Funding. The composite can be utilized as a promising additive to hydrocarbon fuels or a standalone fuel that enables high-efficiency-low-emission energy conversion. Trained as a combustion scientist, Professor Deng is working at the intersection of energy, environment, and materials. As the society is working towards clean and low-emission energy utilization scheme, her research program aims at developing fundamental understanding and novel technologies that contributes to every stage of the transition.

Budget. $1M for 2-3 years to prototype experimental designs and eventually attract industrial scale up for energy and environment applications.