A note from the director:

*Of mice, men, viruses, and black swans.*

The novel Coronavirus and its associated COVID-19 are the ultimate black swan. How much our lives and plans have changed in a very short amount of time! The cost in human lives and economic loss are hard to imagine. But I think that we will survive this pandemic and emerge stronger than before. In that spirit, we bring you a new edition of the RiceENRI newsletter to help you visualize the world outside quarantine and lockdown.

Many wishes and blessings for continued great health to you and your loved ones.

Dr. Sergio Kapusta
A new decade – energy challenges and opportunities in the 2020s.

This article was originally written and published by Alex Rozenfeld and the Climate Impact Capital Team (www.climateimpactcapital.com). You can read the full version of the article here. Its relevance to the mission and goals of the Rice Energy and Natural Resources Initiative is summarized below.

2020s: The Decade of the Climate Emergency

Climate emergency emerged as the word of the year in 2019. The window of opportunity for prevention of a large (>1.5 degrees C) global temperature rise has likely closed. We are now facing the challenge of adapting and mitigating the effects of 2 degrees C or higher temperature change. Some predictions for the decade:

- Resiliency: The frequency of mega-disasters (floods, droughts, storms) will increase and with it the focus on resiliency. Distributed solar, wind and energy storage microgrids may become a solution to improve grid reliability.
- Asia: Asian countries will likely emerge as leaders in greener technologies. At the same time, coal continues to be a major source of energy in countries like India and China. How will this dilemma be resolved?
- Data: Will consumers recover control of their personal data? Will big data finally provide the expected societal benefits?
- Advanced chemistry: Advanced materials will be critical to the growth of new low-carbon technologies. Energy storage and conversion, degradable plastics, ethical batteries, CO₂ utilization, and novel uses for hydrocarbons will be central to decarbonization efforts. Will solar fuels emerge as a sustainable alternative for transportation?
- ESG (Environment, Sustainability, and Governance): Large corporations are often blamed for the climate emergency and they are also key players in finding the solutions. Engaging and collaborating with the energy sectors to find technically, politically, and economically viable solutions offers Rice University a wide space for participating in the ongoing debate. Quick and decisive action is needed to avoid missing this opportunity.

The challenges and opportunities of the “new reality” are enormous, and can only be addressed by collaboration across industry, universities, government and NGOs. So, what can, and should we (Rice University and friends) focus on? Our physical resources might be limited but our intellectual capacity is boundless. You are invited to contribute to this discussion. RiceENRI will coordinate a series of workshops with various stakeholders from academia, industry, and government to dive into many of these issues and identify how, when, and where we can direct our efforts.

Conferences and events.

Most of the events planned for the March – June time period have been either cancelled or postponed, including CERAWeek, OTC, the Summer Olympics, etc. We will continue to monitor the situation and follow the recommendations and regulations of both the health authorities and Rice University.

Profile: Women in Leadership

The Rice Center for Engineering Leadership organized a “Gender Factor: Leadership Double Standards in Tech” panel session. Visit www.rcelconnect.org/thegenderfactor for details. The session was well attended by students, faculty, and leaders of the School of Engineering, and it was moderated by Whitney Gartenberg, a senior bioengineering student.
Announcements in research.

The Carbon Hub.

Rice University has launched the Carbon Hub, a major research initiative to create zero-emissions future in which oil and natural gas provide both clean energy and advanced materials that help house, move, clothe, and feed people.

Inaugurated by Shell with a $10 million commitment, the Carbon Hub will partner with companies, universities, and the federal government to fundamentally change how the world uses hydrocarbons. Instead of burning them as fuel and releasing carbon dioxide, hydrocarbons will be split to make clean-burning hydrogen fuel and solid carbon materials to be used in buildings, cars, clothing, and more.

“The idea of splitting hydrocarbons into hydrogen and solid carbon, isn’t new but for every ton of hydrogen, you get three tons of solid carbon. Finding a productive use for carbon at very large scale is the key and the novelty of the Carbon Hub is that we’re going to do something very useful with the carbon,” said Matteo Pasquali, director of the Carbon Hub.

You can read the official announcement of the Carbon Hub here.

For more information about the Carbon Hub:

Website: carbonhub.rice.edu

For inquiries and questions, email contact is carbonhub@rice.edu

DOE awards for bioenergy R&D.

The US Department of Energy plans to award up to $96 million for research and development of bioenergy projects. Awards will be granted to studies from seven topic areas consisting of scale-ups of bench applications, waste-to-energy strategies, algae bioproducts, and CO2 direct-air-capture and efficiency, bio-restore, efficient wood heaters, biopower and products from urban and suburban wastes, and scalable carbon dioxide electrocatalysis. Rice faculty are working in several of these research areas and could take advantage of this funding opportunity.

Follow this link for more information.

In other news.

Oil prices collapse among uncertainty, price war.

We are not telling you anything you don’t already know. The perfect storm of a large scale price war and rapidly dropping demand resulted in a collapse in oil prices. It is impossible to predict how the situation will play out, but it is likely to affect the energy industry for quite a long time. Stay tuned to your favorite news outlet or “energy guru.” I personally follow the Baker Institute for Public Policy’s Center for Energy Studies at Rice University for clear analysis.
Catalysis – a broad opportunity for optimization.

Dr. Anatoly Kolomeisky
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Catalysis, the process by which a substance speeds up a chemical reaction without being consumed or altered in the process, is of fundamental importance in research and industry. In this issue we highlight the work of Professor Kolomeisky, who has both theoretical and important practical applications in the design of heterogeneous catalysts, for instance in methane activation and methanol production.

Recent synthetic advances led to the development of new catalytic particles with well-defined atomic structures and multiple active sites, which are called nanocatalysts. Experimental studies of processes at nanocatalysts uncovered a variety of surprising effects. In particular that chemical processes at different catalytic sites might interfere with each other. This observation is very important in designing more active or more selective catalysts, to optimize the number and location of active sites. There is a wide distribution in the rates of product formations and dissociations on nanocatalysts, and the size of nanoparticles affects the dynamic surface restructuring, leading to temporal dependence of the catalytic activities.

Kolomeisky developed a theoretical method to analyze the dynamics of chemical processes of catalytic particles with multiple active sites. His analysis shows that the mean reaction times are inversely proportional to the number of active sites, i.e., more sites faster conversion rates. This result suggests that a nanocatalyst with multiple active sites can be viewed as one new effective catalyst with a single site of “average” activity. The analysis of experimentally obtained randomness parameters (the background “noise”) helps in determining the molecular details of the chemical reactions at each catalytic site, therefore leading to more active or selective sites. This result will be particularly important to heterogeneous gas-solid or gas-liquid reactions, for instance those involved in methane conversion to methanol or higher alkanes.

You can learn more about Professor Kolomeisky’s research by visiting his lab page here.

Carbon capture by natural methods – let photosynthesis do the work.

Professor Jim Blackburn
Co-director of the Severe Storm Prediction, Education, and Evacuation from Disasters (SSPEED) Center
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Carbon capture and storage (CCS) is one of the solutions to the climate emergency. Novel technologies to capture CO₂ for the atmosphere or from industrial emissions are being developed. But what about well-known technologies to remove CO₂ from air that have evolved in nature over millions of years? How can we create a market for transacting natural CO₂ removal credits?

Professor Blackburn’s research is concerned with the transition from the linear economy of today to the circular economy of the future. Blackburn’s research focuses on the carbon cycle and transactions involving the storage of carbon dioxide removed from the atmosphere by photosynthesis and stored in the soil. He has led the creation of both non-profit and for-profit ecosystem service exchanges and the formation of a working group on the development of a US standard for the storage of carbon in soil.

You can learn more about the SSPEED Center here.
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