January 16th, 2018

Princeton University

Introduction

The following time capsules are a product of the Fall 2017 course "Time Capsules for Climate Change." The course is categorized as a science and technology freshman seminar, a class where students work closely with a small group of classmates and a leading scholar. Specifically, we — Gianna, Dora, Jason, Dana, Meléa, and Lauren — had the opportunity to learn from Professor Robert Socolow, a leader in the climate science and environmental policy field. For our semester-long project, Professor Socolow asked us to consider the collective future of humanity in relation to climate and envision it through time capsules. We each did extensive research to predict the impacts of climate change on the global and local scale. In considering this future, students split into two clusters, one focused on energy and the other on climate. The papers in the energy cluster discussed battery energy storage, electric cars, and photovoltaic energy while the papers in the climate cluster discussed sea level rise, direct air capture of CO_2, and stratospheric aerosols. In the papers, we considered four time periods, 2021, 2031, 2046, and 2071. These papers were placed into time capsules to be opened at our graduation in 2021, and at our 10^{th}, 25^{th} (also Princeton's 300^{th} anniversary), and 50^{th} reunions. Until these dates, the time capsules will be stored in Princeton's Mudd Manuscript Library. Throughout this introduction, we aim to contextualize the capsules within our personal lives, discussing our initial interests, our challenges, and our eventual growth as both students and global citizens. We also discuss "Destiny Studies:" how we learned to conceptualize the near and far-term future.

To begin, most of us were attracted to this seminar for similar reasons. Lauren, Dora, Dana, Meléa, and Jason were all enamored with environmental studies in high school and are still interested in how climate plays a role in our social, political, and scientific systems. These students were also similar in the sense that they were enticed by the time capsule aspect, which, as a part of their first semester at college, offered something that they could curiously reflect on in the future. However, Gianna's story is unique. When applying to freshman seminars, Gianna, apprehensive about the difficulty of Princeton courses, put FRS 151 as her fifth choice. She did not believe she had the science background needed keep up with the curriculum and her classmates. In September, she was notified that she was put into her first-choice freshman seminar, a psychology course that was more suited towards her strengths; unfortunately, it did not fit into her schedule. As a result, she hesitantly enrolled in her fifth-choice seminar and timidly attended the first class. When Professor Socolow presented the Representative Concentration Pathways, a complex trajectory graph adopted by the Intergovernmental Panel on Climate Change in 2014, Gianna became overwhelmed and her initial hesitancies were only amplified and subsequently dropped the class. Professor Socolow sent her an email and reeled her back in, convincing her to stay with the course and assuring that he would help her along the way. Since then, Giana is glad that she stayed with the course and has found it rewarding. In fact, her lack of science background has allowed her to contribute to class discussions in a different, yet insightful way.

Furthermore, each student surmounted challenges during the course, and in turn developed new skills. We concurred that the most significant growth has come in three areas: analyzing scientific texts, connecting humanity with science, making concrete predictions, and taking initiative in our own lives. Foremost, we noted significant growth in our ability to comprehend dense, scientific articles. In the beginning of the semester, we were intimidated when Professor Socolow proposed that we read articles from scholarly, scientific journals every week, an addition to the course suggested by Catherine Riihimaki of the Council on Science and Technology.

At that point, due to our unfamiliarity with much of the articles' content, namely the chemistry of ice cores and the composition of the atmosphere, we felt doubtful that we would ever comprehend the texts. However, over time, and through working in groups to decipher the assigned texts, we became increasingly more confident with the material. Nadir Jeevanjee, the course's teaching assistant, was especially integral to showing us how to break down this complex information, specifically the graphs, into something more digestible. By the end of the semester, we had all become more comfortable analyzing scholarly articles and learned how to critically examine professional research.

Our perspective on scientific work has also shifted, allowing us to understand a more personal side to science. We now see such work as less of a rote study and more of a collective human initiative. This realization specifically resulted from Professor Socolow requiring us to include at least one human source in our capsules; he asked us to have an in-person, phone, or email conversation with someone who played a role in our individual topics and its future. In the end, we were each able to approach an expert or community member for their opinion, diversifying the perspectives in the papers and making them more interesting, accessible, and multidimensional. For example, Jason initiated conversations with politicians, scientists, and even religious leaders to gain a better understanding of their thoughts on the future of climate change, specifically geoengineering. In speaking with his local bishop, Jason was stunned at how easily he discussed something that seemed so controversial to the average person. In fact, his bishop pondered the same scenarios as Jason and even reassured him of how all-encompassing the geoengineering movement really is. Jason's bishop truly added a unique and relevant perspective to Jason's paper. Similarly, the rest of us gained great insight from reaching out on our topics and learned how to better bridge the gap between science and humanity.

Examining a text in Mudd Library with University Archivist Daniel Linke. Photo by: Denise Applewhite

Next, we were challenged by the requirement to make predictions in areas where the future is widely unknown, even by experts in the fields of climate and energy. If such experts have only ambiguous guesses as to what the future holds, how could we, University freshman, make valid predictions on our subjects? Yet, as the course continued, Professor Socolow emphasized that we had the authority to thoughtfully make these predictions. In fact, we often practiced demystifying the math behind climate science modeling through simple calculations and conversions. This showed us that not only could we understand the data, but formulate it too. In the end, we were each able to craft an original calculation that aided us in our individual predictions. This is not to dismiss the complex and established work of many climate scientists, but simply indicates that climate science may be more accessible to the public, and us, than previously thought. Perhaps if more individuals were able to think independently and "do the math" on climate change, there would be greater support for the movement. We aim to demonstrate that you can indeed prove it to yourself.

The final area of growth lies in our renewed understanding of the human initiative, including our own, necessary to solve the climate problem. For one, we now have a better understanding of both how difficult it is to coordinate climate efforts, both domestic and international, yet how critical this coordination is if we want substantive and immediate change for future generations. We also all noted how our understanding had matured from associating climate change merely with related habits and individualist pursuits, like saving water, recycling, and riding bikes, to understanding climate change on a more global scale, including policy, non-profit work, and research. We now view ourselves within that larger system. For this reason, this course gave us a new sense of personal responsibility in relation to the climate change problem. So, through thoughtful discussion and research, we have a stronger grasp of our role and responsibility to aid a plagued planet.

In composing our capsule essays, we were compelled to consider the notion of "Destiny Studies" and envision the future at four different time points; we found commonalities across the papers regarding how we thought about the specific time frames. Below we discuss the four time frames in two categories: the short term (2021 and 2031) and the long term (2046 and 2071). Each report briefly discusses the issues raised among the papers by needing to think into the future to various extents.

To start, the year of our graduation and ten years afterwards represented our short-term capsule futures. For these periods, current political, social, and economic factors played a large role in our predictions. For example, the current Trump administration's skepticism of climate change and climate science influenced the energy cluster's predictions for the advancement or implementation of the technologies discussed. Similarly, current economic attitudes that fail to view climate change impacts as an urgent, society-wide issue influenced the trajectory of the climate cluster's predictions.

We noted that describing the United States in 2021 and 2031 was less difficult as a class because we have effectively been trained to think over the short term. During high school, we were able to plan ahead to think about college. Now that we are in college, we are expected to think about a major and possible plans after graduation. So, we found that this short-term planning "muscle" has been more exercized than the thought-process required to think 25 and 50 years into the future. In these proximate time periods, we could almost assume that society would mirror the structure and tendencies of the United States today. On the other hand, we found that, in some ways, the first two time periods were more difficult to illustrate than the 2046 and 2071 scenarios. With only three and a half years to in the first time capsule, and about 13 until the next one, some of us found it difficult to develop divergent paths with regard to their paper topic. For example, Meléa Emunah had to consider what factors in 2031 might encourage or discourage battery growth. For the first three years of her predictions, the social, political, economic, and technological factors that affect battery growth looked almost identical to current trends; this is simply due to the proximity of the first time step. In conclusion, both of the short-term capsule dates, 2021 and 2031, were primarily shaped by analyzing the current state research and policy in the United States.

Subsequently, our farthest predictions reached to 2046 and 2071; these predictions, based 25 and 50 years after our graduation, accentuated the long-term scope. When considering these time periods, we found that significant changes in global climate and society's response to unprecedented change had to be considered. We also grappled with the possibility of drastically different climate futures, based on what nations decide to do, or not do, to stem carbon emissions today and in the near future. For this reason, we felt that as freshmen—mere eighteen year olds experiencing the world for the first time—these dates were a bit more daunting.

By 2046, we will have been removed from Princeton for two-and-a-half decades, hopefully making our mark on the world in our different sectors. Perhaps we will be married; perhaps we will have children. In some cases, this time period presented an interesting opportunity for us to insert our own prospective professional lives into the future trajectory of our topics. In this way, the far term predictions required imagination. So, the 2046 time period was a valuable intermediary in that it allowed us to conceive a world more removed from its current state; by the same token, the 25th reunion is still close enough to the present to be heavily affected by the choices that current legislators and citizens make now. By 2071, the possibilities of the future are even grander. The future cultural, political, and scientific landscape of the United States will be markedly distinct from what it is today; this allowed us to take even more creative license in envisioning the future. In the end, the far-term is a slippery concept, easily shaped and changed by unknown factors. Even when we consider the trajectory of our personal lives, we have so many uncertainties. So, when we think of the long-term effect of climate change, our vision of the world easily veers toward two different paths. Yet, this freedom has allowed us to conduct rewarding thought experiments that are perhaps unimaginable in today's carbon-reliant world.

Professor Socolow, Meléa, and Dora (left to right) discussing in class. Photo by: Frank Wojciechowski

Conclusively, on behalf of our class, we would like to extend our thanks to the enlightening professionals that have expanded our understanding of climate change, in a global and local context, this semester. Frank Derby, a Class of 1984 Alumnus, addressed our class on the events of Reunions and the logistics of opening the time capsules. Daniel J. Linke, an University archivist and historian, provided us a tour of the Mudd Library Archives, specifically pointing out how to preserve the time capsules. Thomas A. Nyquist, the Director of Campus Energy and Engineering, gave us a tour of the University heating facilities and allowed us to explore the inner-workings of a cogeneration energy system. Shana S. Weber, Director of Princeton University's Office of Sustainability, outlined the University's carbon and energy plans, including its reduction goals. Andrew Zwicker, a Democratic New Jersey Assemblyman of the 16th District, spoke with us about the politics of climate change and the government's role in its solution. We would like to thank these individuals for sharing their time as each was integral to the formation of the capsules.We also want to thank three more individuals for the work they put into making this course a truly memorable experience. We’d like to thank Caitlin Daley, an administrative assistant for the Princeton Environmental Institute, for her work in helping us schedule and organize different events for the seminar. We’d also like to thank Nadir Jeevanjee, a postdoctoral fellow in the Geosciences department and the teaching assistant for the seminar, who dedicated hours of his time, helping us grow as budding climate scientists and assisting us with our final papers. Finally, we’d like to thank Professor Socolow, the teacher and creator of this course, for all of his guidance throughout this semester. We are grateful for his vision and the work he put into making FRS 151 an experience that will stay with us throughout our time at Princeton and beyond.

Enjoy the capsules.

Meléa Emunah	Dana Iverson	Jason Kong
Gianna Mavica	Lauren Sanchez	Dora Zhao

January 16th, 2018

Princeton University

Climate Cluster Summary

When envisioning climate, we are pulled towards concepts of grandeur: the ferocity of the oceans, the range of clouds, the vastness of the land. In comparison, humans appear to occupy a miniscule role—seemingly tiny when confronted by these forces of climate that drive the way we live. However, this is not the case. As evidenced by the anthropogenic causes of climate change, humans have made a significant impact, and, in turn, these changes have affected the way we live. Thus, in the "Climate, Consumption, and Lifestyle" cluster, we will make these universal ideas more personal by exploring how climate will influence our lives and the world around us in the near and far future. It is important to note that this is not solely a consideration of the scientific principles that will influence our lives. Climate change is not solely a scientific problem; it is a *human* problem. Each of the selected topics does not solely exist in the realm of science. Fittingly, the cluster papers will address a multiplicity of other factors—including politics, religion, and socioeconomics—that all play a role in shaping our visions for the future. As we look at climate through a variety of lenses, from sea level rise to geoengineering, we hope to bring a sense of immediacy to these concepts that will carry over from our time as freshmen writing these papers to our 50th Reunion as we open our final time capsule.

The first paper in the "Climate, Consumption, and Lifestyle" cluster is written by Dora Zhao and addresses the resiliency of urban centers, specifically New York City, in the face of rising sea level. Sea level rise is an inexorable event, and human intervention will not be able to prevent sea level rise from happening within this century. Additionally, many of the places most threatened by sea level rise in the United States are our urban centers—areas of highly concentrated populations and property. At the moment, predictions for sea level rise, relative to measured levels in 2000-2004, show anywhere between 1.5 feet to 4.5 feet of increase in the year 2071. Such a change could result in the total submersion of low-lying urban areas. Even for those that are not totally inundated, these encroaching waters threaten the lifestyles of urban dwellers as they are faced with the possibility of increased flooding and stronger storm surges. Thus, to save these important assets, these cities will need to adapt to these rising waters. This can take many forms, from elevating buildings above the floodline to implementing managed retreat from the coastline. Not only the sea level rise but also outside factors, such as psychological attachment, political incentives, economic limitations, also have to be taken into consideration. As someone who plans to live in New York City after graduation, Dora imagines her future, living in a city that may be slightly battered but is not broken by these rising waters.

The second paper in this cluster has to do with geoengineering by way of stratospheric aerosol injection. Jason internalizes that emissions mitigation may not yield enough change before consequences like sea level rise will be on the horizon. Strongly believing that a Plan B needs to be created, he suggests that stratospheric aerosol injection poses as the only method of albedo enhancement that can drastically change the global average temperature within just a few years. Moreover, stratospheric aerosols are much more affordable and can be readily implemented at a moment's notice. As of now, stratospheric aerosols can seem taboo for much of the population as it entails many unintended consequences. However, motivation for research is strong due to the feasibility and effectiveness of albedo enhancement. Scientists inevitably will have to point back to research for answers about whether or not aerosol injection should be deployed. Furthermore, governance structures need to be created as stratospheric aerosols affect more than just one region in the world if enough is deployed. Consequences like enigmatic variations in weather and precipitation in some areas may lead to political unrest as crops may take a toll. Choosing to take fate into his own hands, Jason predicts that stratospheric aerosols will be valuable approach for the global community to take against possibly volatile carbon emission in the future. He does acknowledge that albedo enhancement should ideally be paired or followed by emissions mitigation and, possibly, geoengineering by way of carbon dioxide removal as stratospheric aerosols merely serves as a buffer and not something that should be as excuse to cut direct addressment of emissions.

The third paper in this cluster has to do with geoengineering by way of carbon dioxide removal, or more specifically Direct Air Capture of CO_2 with chemicals. Gianna internalizes that methods of solar radiation management would merely mask the problem of anthropogenic carbon emissions, and therefore, it is necessary that a carbon dioxide removal plan be implemented. In this paper, she analyzes Direct Air Capture of CO_2 with chemicals as a CDR option, noting the pros of its large scale implementation and acknowledging its challenges in becoming the climate mitigation solution. DAC does not need to be sited directly at power plants, does not have a large land footprint, and because it does not require biomass inputs, does not have to compete for agricultural land, but in order for DAC systems to be climatically significant, the industry would have to be as large in physical scale as the modern oil and gas sector, so Gianna notes that challenges such as energy, cost, policy, social acceptability, and pairing with CCS would have to be overcome. Gianna concluded that although DAC may appear to be far-fetched and unrealistic given the insurmountable challenges associated with it indicating that another CDR strategy should be pursued, certain technological and process breakthroughs could make DAC a legitimate climate mitigation solution. With this, Gianna envisions two futures for DAC: one where DAC is implemented on a vast scale by 2071 and the other where solar radiation management technologies are deployed while DAC and other CDR options work in the background to combat emissions.

As all three of our papers deal with the climate, many connections tie together our topics. Climate begs a broad range of responses that range from addressing the problem to dealing with the inevitable consequences of our current emissions futures. Dora's topic of sea level rise paints a vivid picture of an ex-post world where cities must deal with the consequences that have happened in their present days as a result of the rising global temperatures. For fear that dealing with sea level rise and other consequences may prove too fruitless, Jason and Gianna delve into the ex-ante approaches that the global community can take to prevent the onset of such cruel feedbacks. More specifically, Jason's stratospheric aerosol injection argument builds itself upon the feasibility, affordability, and effectiveness of deployment in the short term. Stratospheric aerosol deployment costs much less than building machines and planting trees to remove carbon emissions from the air. Moreover, based off of modeling of past volcanic eruptions, stratospheric aerosols promise fast feedback from the Earth's energy balance. Therefore, the Earth's temperature can be rapidly cooled within a few years of deployment. However, stratospheric aerosol injection merely masks the problem with rising anthropogenic carbon emissions. Furthermore, resulting lower temperatures may serve as a false indicator that can fail to incentivize emissions mitigation. With less emissions mitigation, the deployment of aerosols must be increased to unknown amounts to offset the greenhouse effect caused by humans. At this point, Gianna's carbon dioxide removal argument sees light because it directly addresses the amount of carbon dioxide emitted by humans. Notwithstanding, carbon dioxide's low-risk and controllability entails more costs and a longer feedback timeline. Machines take much more capital and time to build. In addition, the efficiency of said machines is questionable and may not yield enough change in emissions to have noticeable effects in the short term.

As aforementioned, we hope that our papers bring about a sense of immediacy to the climate problem. Enjoy our cluster's capsule.

Gianna Mavica Jason Kong Dora Zhao

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Energy Time Capsule

Energy plays an important role in the story of climate change. Today, most of the energy in the United States is sourced from fossil fuels. However, a national shift in energy sources, use, and storage is critical if the United States is to adequately lower carbon dioxide emissions and avoid a change in average global temperature above 2º C.[1] Energy demands will increase substantially in the future as the population continues to grow and countries globally continue to develop. Even as the population of the United States is projected to stabilize, its energy policy will set a precedent that will find global solutions on how to accommodate increasingly more energy-intensive lifestyles. Can the Earth sustain more people with energy-intensive lifestyles? How will we provide for that energy requirement? Will low carbon sources be the future or will there be a fossil fuel-dominated energy system? These questions are all relevant to the role that energy will play in creating either a sustainable future or a future that experiences the consequences of global warming.

The first paper in this cluster is focused around the future of solar energy. It attempts to answer how prevalent solar will be in the future energy demands of the United States and if through passive solar engineering the U.S can decrease its energy intensive lifestyle. As of 2016, solar makes up around 0.5% of US energy demands[2] and 0.9% of total electricity demands.[3] However, it has been expanding rapidly and for the past decade has been experiencing an annual

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[1] Henson, R. (2014). *The Thinking Person's Guide to Climate Change*. Boston, MA: American Meteorological Society. and http://dx.doi.org/10.1016/j.rser.2016.07.028

[2] "Solar." *IER*, Institute for Energy Research, instituteforenergyresearch.org/topics/encyclopedia/solar/.

[3] United States, Congress, "What Is U.S. Electricity Generation by Energy Source?" *What Is U.S. Electricity Generation by Energy Source?*, Energy Information Administration, 18 Apr. 2017. www.eia.gov/tools/faqs/faq.php?id=427&t=3.

average growth of 68%[4]. The main barriers to a widespread adoption of solar have been high costs; however a trend of decreasing costs associated with better technologies, higher conversion efficiencies, and the benefits of economies of scale are making solar much more competitive with traditional fossil fuel sources. This paired with political interest in the potential of solar power as is expressed through the abundance of state led initiatives to subsidize and incentivize solar show a bright future for solar energy. Yet there is uncertainty in this future because of policies proposed by President Trump and the introduction of unconventional fossil fuel sources. This paper strives to assess the possibilities of two different solar futures—a high scenario and a low scenario—and discuss the conditions of each world. It then expresses the author's personal prediction about the future of US solar across the given time span. It also includes smaller scale predictions regarding solar in the author's personal future as well as the future of Princeton University.

The second paper will discuss the role batteries play in allowing the grid to accommodate a large influx of renewably-sourced electricity. Storage is an often-overlooked piece of the energy puzzle, as introducing renewables such as photovoltaic solar and wind would also introduce chronic intermittency and unpredictability of the power supply. Electrical energy storage is essential to time-shift periods of oversupply (i.e., in the middle of the day when solar production is at its peak but demand is at its lowest) and store energy to make up for supply gaps (i.e., at night when no solar is produced and during times of no wind). Batteries are a promising form of grid-application energy storage. Compared to capacitors and flywheel storage that have similar power energy and capacities, the energy stored in batteries is more dispatchable.[5] While hydropower

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[4] "Solar Industry Data." *SEIA*, Solar Energy Industry Association, www.seia.org/solar-industry-data.
[5] Andlinger Center for Energy and the Environment at Princeton University [ACEE]. (2014). *Grid-scale Electricity Storage: Implications for Renewable Energy*. Princeton, NJ: Socolow, R. H., Arnold, C., Davies, G., Kreutz, T., Powell, W., Schwartz, M., Steingart, D.

can be a compelling alternative, its response time is in a range of minutes, a time period that is significantly slower than batteries that can respond in the range of milliseconds to seconds.[6] So, research into decreasing cost and improving the lifetime and energy capacity of batteries is necessary to allow their broad adoption on the national grid. In the scenario that batteries pervade the grid by 2071, they could either be implemented in a predominantly centralized or decentralized manner. An alternative outcome could involve another energy storage technology eclipsing batteries, the use of natural gas as an temporary solution to the intermittency of renewables, or the effective abandonment of renewable energy over the next fifty years. Finally, vehicle batteries could potentially play a role in grid storage, and in consequence redefine the boundaries of the electric grid. The fate of grid-application batteries will depend on economical, political, social, ideological, and technological factors discussed in this paper.

The final paper in the capsule addresses the applications of renewable energy, specifically within the context of electric vehicles (EV). In 2016, ninety-two percent of total energy in the transportation sector was derived from petroleum. Further, fifty-five percent of that energy was consumed as liquid petroleum, known as gasoline, the most common fuel for personal vehicles.[7] Such petroleum is non-renewable and is often extracted through fracking, a highly destructive drilling method; in addition, when burned, it releases CO_2 into the atmosphere. So, petroleum-powered cars contribute significantly to our carbon and energy footprint. All-electric cars present an alternative that could alleviate this hazardous consumption. Instead of being fueled by gasoline, electric cars are charged by electricity. In this way, combustion engines are replaced by batteries, and gas stations are traded for garage outlets. Yet, there is still uncertainty as to how

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[6] Meng, Shirley. (30 November 2017b). [Personal interview.] and http://dx.doi.org/10.1016/j.rser.2014.10.011

[7] United States, Congress, “Energy Use for Transportation .” *Energy Use for Transportation* , U.S Energy Information Administration, 17 May 2017.www.eia.gov/energyexplained/?page=us_energy_transportation.

and if electric cars will be more sustainable. For instance, owning an electric car often requires some noteworthy lifestyle changes, and may be, at times, inconvenient. Will consumers be willing to adapt to these changes? Furthermore, how will electric cars compete in the long established gas-car market? In 2010, the average price of a standard gasoline vehicle was $20,000, whereas the average price of an EV was $60,000.[8] Although research and innovation has made EV's increasing more affordable, there is still a price gap that may continue to deter consumers. Finally, it is even possible that electric cars will inversely expand our carbon footprint. One must consider the carbon-content of the electricity source, and if it is derived from sustainable resources, like solar, or non-sustainable ones, like coal. So, in the end, the electric vehicle paper aims to predict what role electric cars will play in our energy future.

These three subjects are connected through the common theme of energy but are also joined in the ideas of generation, storage, and utility. Theoretically, solar energy will be the source that generates the energy stored in batteries that will be utilized by electric cars. When these trends coincide, the overall demand for high carbon-energy decreases. However, that may not be the case, and only some of these fields may be successful. For instance, would electric cars still curb CO_2 demands, even if they were powered from carbon intensive electricity sources? Will solar only operate on large scale grids, ending the future for rooftop photovoltaics, or will growth stabilize at current levels? How might the scale of renewable generation influence the battery technologies that are favored for further research? If cost-effective batteries fail to develop, will this preclude the success of electric vehicles? Or could there be a future where solar

[8] United States, Congress, Chase, Nicholas, and John Maples. "Fuel Economy and Average Vehicle Cost Vary Significantly across Vehicle Types." *Fuel Economy and Average Vehicle Cost Vary Significantly across Vehicle Types*, Energy Information Administration, 22 July 2014. www.eia.gov/todayinenergy/detail.php?id=34512.

energy has eclipsed fossil fuels in electricity generation, but the transportation sector remains high-emissions because of a lack of electric powered transportation vehicles?

In conclusion, this energy capsule aims to address these questions and their consequences within several contexts: local and national, personal and abstract, as well as scientific and human. The capsule will include both research and evidence but will also seek to consider solutions in a social light. We understand that, in order to create tangible change, the conversation about climate change and possible solutions must be translatable to a diverse array of audiences. Human initiative and empathy, not just scientific impetus, is required to implement these solutions. Thus, these capsules aim to mobilize people for a common cause, by studying three related facets of the future of energy in the United States.

Lauren Sanchez Dana Iverson Meléa Emunah