



JULY 1, 2019–JUNE 30, 2020 | kleinmanenergy.upenn.edu

Kleinman Center for Energy Policy

**2019–2020
Annual Report**

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MISSION

The Kleinman Center creates the conditions for policy innovation that support a just and efficient transition to sustainable energy.

VISION

Our vision is an equitable energy system that optimizes productivity through smart demand, sustainable supply, and compensated externalities.

APPROACH

THE KLEINMAN CENTER FOCUSES ON PROJECTS THAT:

- **Foster thoughtful and impactful energy-related research.** We support Penn research through a variety of programs and bring distinguished and diverse energy leaders and scholars to Penn for visits and residencies.
- **Develop the next generation of energy leaders.** We encourage students from across disciplines to participate in energy-related courses, a certificate program, lectures, internships, seminars, and grants for research and professional development. We make every effort to connect all students with the resources they need to succeed.
- **Create conditions for energy policy stakeholders to explore options and develop agendas.** We convene thought leaders with diverse backgrounds and interests in settings that foster productive conversations and action.

HISTORY

The Kleinman Center for Energy Policy was established in 2014, with a generous term gift from **Scott (C'94, W'94) and Wendy Kleinman**. The center continues its work thanks to additional donor generosity, including last year's anonymous \$30-million gift.

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LETTER FROM THE DIRECTOR & DEAN

Dear Friends of the Kleinman Center—

In 2019 we celebrated the receipt of an anonymous \$30-million gift to the center. This gift allows us to set a new and ambitious vision, one that is matched by the extraordinary commitment of Penn President Amy Gutmann and Provost Wendell Pritchett, who have worked hard to help resource new energy policy faculty here at Penn.

This year we are pleased to announce the first of these hires, Jennifer Wilcox, Presidential Distinguished Professor of Chemical Engineering and Energy Policy, who joined the faculty this fall at the Kleinman Center and the School of Engineering and Applied Science. This collaboration with colleagues in SEAS is the first of many joint appointments we will make in order to grow our energy policy faculty on campus.

As our Center grows, our goal is to continue to serve students and faculty while informing smart, sustainable energy policy. Here are a few highlights from this year:

Student Engagement. This past spring we launched our first undergraduate fellows program, which gathered the best and brightest from around campus. Through a series of seminars, students met with visitors and authored commentaries and digests.

Partnerships. At Penn, many of our research interests cut across local, regional, and global issues. To take these interests to the global stage, we have partnered with schools, centers, and our faculty fellows—sharing applied research at the World Urban Forum, the United Nations Climate Change Conference, and the Urban 20 Summit.

Timely Response. COVID-19's impacts have not spared the energy sector. Center researchers published weekly commentary on topics at the intersection of the pandemic and energy policy, including everything from oil subsidies to the future of public transit.

In a year of upheaval and uncertainty, we at the Kleinman Center are reminded of the intractable global challenges we face. While the challenges associated with energy transition and climate change may seem intransient, we are fortunate to have a community of interested scholars dedicated to working with us to take on some of the world's biggest challenges.

Sincerely,



Mark Alan Hughes
*Founding Faculty Director,
Kleinman Center for Energy Policy,
and Professor of Practice,
Stuart Weitzman School of Design*



Frederick Steiner
*Dean and Paley Professor,
Stuart Weitzman School of Design*



“Mitigating climate change calls on designers and planners to work more closely with scientists and engineers, and Jennifer Wilcox will be instrumental in that work.”

—FREDERICK STEINER

“Jennifer’s arrival demonstrates the extraordinary commitment of the University to invest in energy research here at Penn.”

—MARK ALAN HUGHES

WELCOME, JENNIFER WILCOX



As a global society, our use of fossil fuels has resulted in an exponential rise in atmospheric CO₂ concentration. Our best approach would be to avoid such emissions by fully transitioning away from the combustion of hydrocarbons.

But that approach alone is no longer enough, says Jennifer Wilcox, the University of Pennsylvania’s newly appointed Presidential Distinguished Professor of Chemical Engineering and Energy Policy. Her research focuses on innovative ways to avoid new CO₂ emissions from entering the air as well as the removal of old emissions in order to mitigate the accumulating effects of fossil fuels on our planet.

We welcome Jennifer as our first faculty research appointment at the Kleinman Center. Her professorial appointment is in the School of Engineering and Applied Science’s Department of Chemical and Biomolecular Engineering, where she will advance her work on trace metal and carbon capture, while connecting these efforts to actionable energy policy.

“Although my work involves removing carbon dioxide from air, it doesn’t mean that it’s a silver bullet,” says Wilcox. “We need a portfolio of solutions. And we need to start treating CO₂ as a waste and figure out solutions to deal with it. We also need to recognize that the portfolio is broad and includes both deep decarbonization and direct removal.”

Her focus on carbon management has implications for a variety of applied technologies, including directly removing carbon dioxide from the atmosphere; capturing it at the source (from power plants and the industrial sector); and sequestering that carbon dioxide to safely reuse it or permanently store it back in the ground. Wilcox’s current research is funded in part by the National Science Foundation, the Department of Energy, and the private sector.

Wilcox comes to Penn from the Worcester Polytechnic Institute, where she was the James H. Manning Chaired Professor of Chemical Engineering. She has served on a number of committees including the National Academy of Sciences and the American Physical Society. She is the author of the first textbook on carbon capture, published in March 2012.

Zigzag carbon nanotube
molecular structure photo
courtesy of istockphoto.com/
portfolio/eugenesergeev



ONGOING RESEARCH

As a center, we focus on research that explores the interplay between local, regional, and national policy. This year, we focused on several Philadelphia energy issues, which represent the challenges that cities around the United States and around the world are facing.

CENTER RESEARCH

RESEARCH TEAM

Wan-Yi “Amy” Chu,
Assistant Professor, Mills College

Benjamin Paren, *Ph.D. Candidate,*
School of Engineering and
Applied Science

Giridhar Sankar, *MBA/MA Student,*
Wharton School

Oscar Serpell, *Research Associate,*
Kleinman Center

Our city of Philadelphia exemplifies many of the challenges that local governments face today: aggressive climate goals paired with aging infrastructure, a municipally owned utility, rapidly changing technology, and limited access to financing mechanisms, to name a few. In a large city with the nation’s highest poverty rate, our decision-makers must justify each dollar spent on climate and energy resilience to support constituent needs. But, Philadelphia is not unique. It represents the challenges that cities throughout the United States and around the world face.

GAS UTILITY OF THE FUTURE

Philadelphia Gas Works (PGW) is the largest municipally owned gas utility in the United States and is responsible for operating and maintaining an aging pipeline network spanning the entire city. Recent efforts have been made to reduce leakage from these pipes, but as a result of these maintenance costs and low natural gas prices, the utility has, for many years, been at varying degrees of financial stress.

This reality makes the utility, and therefore the city, extremely vulnerable

to the potential imposition of a price on carbon. In the event that PGW becomes financially responsible for its direct emissions, it could significantly threaten the city’s budget. For this reason the Kleinman research team researched options for decarbonizing the heating demand currently being met by natural gas. The team explored two alternative strategies, one involving the widespread electrification of end-use appliances in residential and commercial properties, and the other involving the decarbonization of the fuel by replacing it with synthetic methane

manufactured from hydrogen and CO₂ captured directly from the atmosphere.

This costly and technologically ambitious solution would remove the need to replace all end-use appliances and would avoid the additional load-balancing challenges of the electrification strategy. The team calculated that a carbon price of more than \$500 per ton of CO₂ would be needed before either decarbonization strategy became financial competitive with continued business-as-usual operations.



SEASONAL ENERGY STORAGE

Comparing two decarbonization strategies, this study found that the chemical process of electrolysis required to create “clean” hydrogen, coupled with costly and energy intensive direct air capture technologies, drove the cost of synthetic methane up—as compared to electrification. The electrification strategy in the PGW project did not consider the additional costs, however, to the regional electricity grid from the electrification of local heating demand and the potential increase in local electricity costs.

Upon further exploration of possible cost to the regional electricity grid, the Kleinman research team updated the projected cost of electricity for end users in an electrified heating scenario. These revisions, under most storage conditions, significantly increased the overall cost of the electrification strategy from the PGW project, bringing it closer with the cost of synthetic methane production.

Using the PJM interconnection as the boundary, our research team designed a model that seeks to approximate the amount of storage capacity (in kWh) that would be needed if grid generation was completely decarbonized (with wind and solar power replacing fossil fuels) and if all wintertime heating demand was electrified.

Under these projected future conditions, the team found that seasonal variability in grid demand and variable generation from renewable energy sources forces two suboptimal results. In one scenario, there is considerable over deployment of wind and solar capacity in order to ensure sufficient generation capacity year-round. In the other, there is widespread dependence on expensive storage technology such as lithium-ion batteries, pumped hydrological storage systems, or reversible hydrogen fuel cells—to supply shortfalls in the winter months.

PHILADELPHIA EFFICIENCY PLAN

Based on findings from the PGW and seasonal storage projects, the Kleinman research team concluded that the best way for the city of Philadelphia to pursue its emissions reduction goals in the short term is with an ambitious, well supported, and far-reaching efficiency plan. This report takes a deep-dive into many of the most successful efficiency strategies that have been implemented by cities around the world. The report proposes a three-pronged structure for a successful efficiency plan:

1. **Guide Through Investment:** By investing in public spaces and infrastructure, cities can influence the way residents and businesses engage with the city, thereby reducing energy use and improving the livability of the urban landscape. Further, by offering loans and cost sharing opportunities to property owners, cities can guide residents and businesses to think long-term about their energy costs.
2. **Enforce Through Regulation:** Efficiency standards, fees, and regulations can effectively limit wasteful energy practices and ensure that all members of the community are contributing their fair share to the city's vision. These regulations will only be effective if they are well enforced, if members of the community believe they are being well enforced, and if members feel that the city is investing resources to help them meet these regulations.
3. **Encourage Through Education:** Community-based education and initiatives can help to catalyze purposeful behavior change and community buy-in. They are just as necessary as investments in infrastructure and stringent regulations because without community buy-in, other initiatives will fail to deliver optimal results. This effort must work to inform the public of what steps the city is taking, and how voluntary steps by the public can benefit residents and businesses (cost savings, livability of the city, transportation efficiency, and public health).

With these three strategies, the City of Philadelphia could reduce city-wide carbon emissions, insulate the city's budget from the imposition of a carbon price, reduce residents' energy burdens, and improve the livability of the city.

SUSTAINABILITY OF PETROCHEMICALS

Climate change is so often talked about as an energy problem, when in reality it is a resource extraction problem. Granted, in our current economy, the vast majority of carbon containing oil, coal, and gas is used for energy generation. But these resources, and the potential to exploit them, will not disappear with the emergence of a renewable energy system.

This summer, the Kleinman research team examined a number of strategies, technologies, and policy solutions to prevent a large portion of the avoided carbon emissions from a clean energy system from being diverted into a growing petrochemical industry. These strategies included finding alternative sources of carbon-neutral feedstocks—such as bioethylene, electrolysis, and carbon capture; creating new incentives for plastic recycling at all points in the value chain; and developing new types of petrochemicals better suited for recycling or reuse. The research team concluded that the best incentive to eliminate global carbon emissions from the petrochemical industry is to ensure that the costs of embedded carbon are carried by producers rather than by consumers or end-of-life processors. Attributing the global costs of this pollution onto the end-of-life processor will not incentivize producers to change existing systems of production. Instead, the potential emissions from the processing of petrochemicals should be attributed to the chemical producers themselves, despite the embedded carbon being effectively trapped for as long as the product exists.



Already, the production of petrochemicals including plastics, synthetic fibers, and fertilizers use a considerable share of global oil, natural gas, and natural gas liquids (NGL) production as feedstocks (14%, 10%, and 50% respectively). As energy demand for fossil fuels declines and global demand for petrochemicals continues to grow rapidly, a business-as-usual approach to petrochemical production could significantly impede efforts to eliminate global carbon emissions—especially as the need for post-consumer processing of plastics increases in response to the growing plastic waste crisis.

FEATURED PUBLICATIONS

Our publications come from our center research efforts, visiting scholars program, and cohort of Penn faculty and students who receive our grants each year. This research crosses all disciplines—with energy related research in the fields of design, economics, health, political science, engineering, and more. The following pages feature a selection of this year's publications.



CLIMATE CHANGE AND FINANCIAL RISKS

Aymeric Bellon, *Ph.D. Finance Student, Wharton School*

Climate change exposes firms to significant new risks, writes Aymeric Bellon, a Wharton Ph.D. finance student and Kleinman Center grant recipient. In his research, he points out that rising sea levels and new natural disasters triggered by global warming cause big disruptions in production. As a result, assets of firms that rely heavily on fossil fuels are exposed to the risk of losing most of their value if households, governments, and firms move toward sustainable energies.

He explains that climate change creates new markets and new needs. And things like clean energy can create opportunities for new growth. Along with growth, however, climate change also brings new lawsuits, seeking to make those responsible for climate change financially accountable.

“Understanding how these risks affect all asset prices is crucial... Not only because they matter for financial stability, but also because financial markets play a key informational role in allocating resources in a market economy.”

He outlines three different risks that climate change creates for companies: transition risk, litigation risk, and physical risk. For companies that rely heavily on fossil fuels, transition risk is high when emissions reducing policies are enacted. Litigation risk also increases for businesses that emit more CO₂, as they are exposed to more climate change lawsuits. And, finally, there is physical risk for facilities located in places with climate-related disasters and political instability, such as rising temperatures or sea rise.

There are two ways that firms address these risks, points out Bellon: divestment and engagement. Investors can divest—or “walk away” from—firms with high climate risk. They can also try to influence a firm’s management decisions through shareholder proposals on climate-risk issues or invest in green bonds.



ROBUST CARBON MARKETS

Dallas Burtraw, *Darius Gaskins Senior Fellow, Resources for the Future*

If markets operated perfectly well and operated in a vacuum, putting a price on carbon would solve our emissions problems. But markets are imperfect and are affected by other policy levers, explains Dallas Burtraw, a Kleinman Center visiting scholar. This is why the Regional Greenhouse Gas Initiative (RGGI) approach is groundbreaking.

This is why companion policies like performance standards and support for new technologies exist wherever we find carbon pricing.

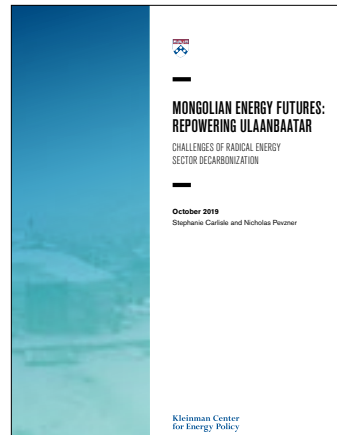
Case in point: The Regional Greenhouse Gas Initiative (RGGI) launched in 2009, introduced carbon pricing through an emissions cap-and-trade program to regulate emissions from electricity generators. The RGGI region, located in the northeastern part of the U.S., has observed emissions reductions of about 40 percent in the electricity sector since the start of the program.

“The climate crisis is urgent; but unless the carbon price is very high, carbon pricing takes time to have its effect.”

Three of the six proposals for a carbon tax introduced in Congress this year include RGGI-like adjustment mechanisms—demonstrating that carbon pricing is not likely to be sufficient as a single policy instrument.

Innovation in carbon pricing through features like RGGI’s price floor and emissions and cost containment reserves make markets more robust and cast carbon pricing in a more effective role.





MONGOLIAN ENERGY FUTURES

Stephanie Carlisle, *Lecturer, Landscape Architecture, Weitzman School* and Nicholas Pevzner, *Senior Lecturer, Landscape Architecture, Weitzman School*

In the wintertime, Mongolia's capital city faces horrific air quality that has become a public health crisis. The burning of coal in Ulaanbaatar has created a public health emergency, with wintertime air quality that regularly exceeds 100 times the recommended daily average concentration. Exposure to air pollution at such levels causes severe health effects for residents, particularly for children, the elderly, and other vulnerable populations.

But saying goodbye to coal in Ulaanbaatar is not just an energy challenge, it's an urban design challenge. These health challenges are felt most acutely in the city's quasi-informal *ger* districts—low-density areas that consist of hundreds of thousands of traditional nomadic dwellings—where families rely on burning raw coal in their homes as their primary source of heat in the frigid winters. The challenge of reducing Ulaanbaatar's coal dependency is also intertwined with the design of infrastructural systems that the city has inherited from its Soviet-era past, as well as the particular patterns of urbanization that have shaped Ulaanbaatar's recent development.

“With nearly sixty percent of the population unserved by adequate electricity or heating supply, environmental inequity in the city is directly tied to energy infrastructure.”

Weitzman School researchers Nicholas Pevzner and Stephanie Carlisle used their Kleinman Center grant to travel to Ulaanbaatar to investigate the challenges of moving the city's heating supply to electricity and suggest pathways—such as upgrading the centralized combined heat and power plant system—that the city might take toward a post-coal future.



FOLLOW THE CARBON

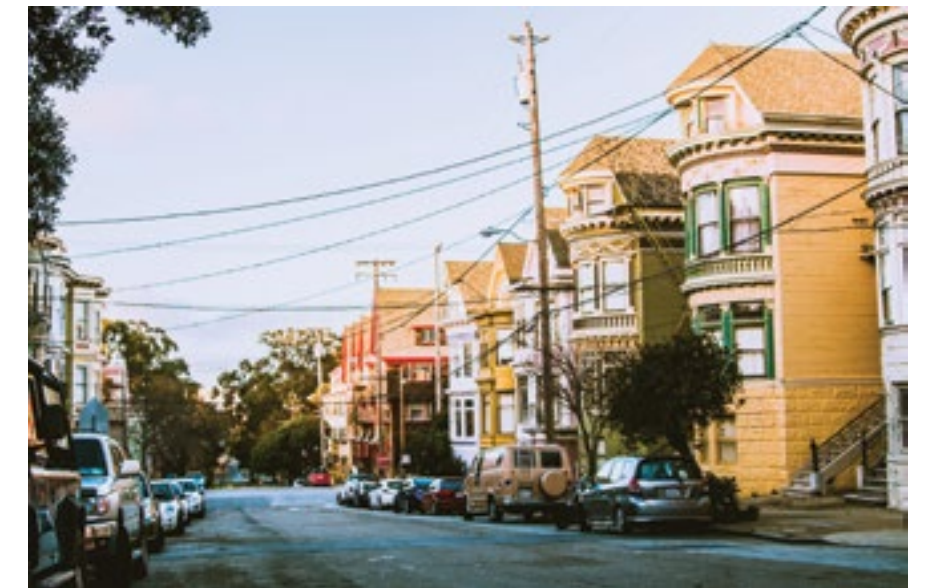
Daniel Aldana Cohen, *Assistant Professor of Sociology, School of Arts and Sciences* and Kevin Ummel, *Research Affiliate, Population Studies Center at Penn*

Typically, we measure emissions that occur within a geographic boundary. But Daniel Aldana Cohen, a sociologist at the School of Arts and Sciences, and his co-author Kevin Ummel wanted to look at the issue through consumption-based accounting. There they found a different story: that affluent communities depend heavily on polluting activity that occurs elsewhere.

Their research showed that by tracing emissions to the neighborhood level, we can profoundly improve our understanding of the relationships between carbon emissions, inequality, and the built environment—three of the core concerns of policymakers. The creation of interactive maps linking cause and effect—footprints and vulnerability—would allow policymakers and members of the public to develop data-rich stories about our relationship to climate change.

The researchers hope that changing how we look at carbon emissions will enrich public debate and increase the chances that we make good decisions that will keep communities safe for decades to come. While the overall goal remains to reduce carbon emissions, how we shape the policies that achieve that outcome can have rippling impacts on our communities.

“This systematic carbon footprint analysis shows how consumption practices are socially and spatially structured. Slashing emissions isn't about individuals' choices.”





EV ADOPTION AND THE PRICE OF PARKING

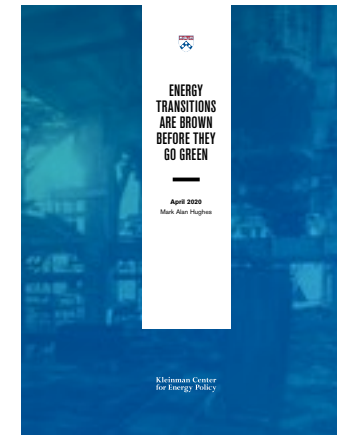
Erick Guerra, *Assistant Professor of City and Regional Planning, Weitzman School* and Ricardo Daziano, *Associate Professor of Civil Engineering, Cornell University*

What stops someone from purchasing an electric vehicle (EV)? A lack of widespread charging networks is one major hurdle. Cities have tried a variety of ways to help this problem, including discounted or reserved parking for EVs. In Philadelphia, a 2007 program allowed residents to apply for a dedicated EV charging station outside their home. But were residents more interested in lowering their impact with an electric vehicle or snagging a free parking spot?

Across the country, on-street parking policy has an important and complex role to play in the diffusion of EV charging systems and the adoption of EVs. Erick Guerra of the Weitzman School at the University of Pennsylvania and Ricardo Daziano of Cornell University found that drivers who are more likely to live in apartments in central locations, where parking is more challenging, tend to have a higher willingness to pay for on-street parking, but a much lower overall probability of choosing an EV.

“Targeting EV policies toward on-street parking may not be particularly effective.”

The authors assert that if residents value dedicated parking spaces substantially more than convenient EV charging systems then residential-based on-street charging systems are unlikely to ever be politically palatable. And a lack of existing charging networks presents one of the most substantial challenges to the widespread adoption of electric vehicles.



ENERGY TRANSITIONS ARE BROWN BEFORE THEY GO GREEN

Mark Alan Hughes, *Founding Faculty Director, Kleinman Center*

This academic year arrived on the heels of the largest Philadelphia energy story in recent history. Last June, the Philadelphia Energy Solutions (PES) refinery in Philadelphia was rocked by three explosions and resulting fires. A section of pipe in one of the refinery’s two HF alkylation units had corroded to “half the thickness of a credit card” according to the preliminary report by the Chemical Safety and Hazard Investigation Board (CSB). When that pipe failed, the explosions vaporized about 3,000 pounds of deadly hydrofluoric acid into the atmosphere.

“The PES refinery, with its ensuing bankruptcy and retirement, offers a preview of the challenges inherent in the energy transition. Building a “green” energy system requires addressing our existing “brown” energy system.”

Hughes, who served on the City of Philadelphia’s refinery advisory group as chair of the Environmental and Academic Committee, asserts in this policy digest that transitioning our energy system in a just and efficient way requires designing policy that effectively and consciously assigns the externalized costs of pollution and adequately values opportunities to avoid future emissions.

Carbon credits would have provided tangible value to the bid of any prospective buyer that did not intend to restart refinery operations. Doing so, might have increased the competitiveness of bids that planned to use the space for a new—and perhaps less immediately profitable—purpose.





THE ESSENTIAL ROLE OF NEGATIVE EMISSIONS IN GETTING TO CARBON NEUTRAL

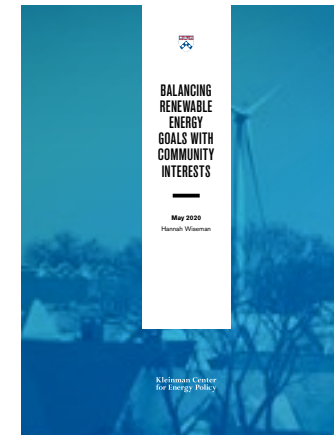
Jennifer Wilcox, (Formerly) James H. Manning Chaired Professor of Chemical Engineering, Worcester Polytechnic Institute

As much as we try to make strides to reduce our greenhouse gas emissions, it is evident that emission reductions alone will not be enough to cool our warming planet. Jennifer Wilcox, newly appointed Presidential Distinguished Professor of Chemical Engineering and Energy Policy, argues in her policy digest that a portfolio of carbon capture solutions is necessary—including direct removal from the atmosphere.

Negative emissions remove CO₂ from the atmosphere and store it on land, underground, or in oceans. Technologies that remove CO₂ from the atmosphere are generating growing interest and some have even demonstrated the ability to work at scale. Specifically, direct air capture works by using chemicals to remove CO₂ from the air. This is similar to planting a synthetic forest.

Along with efforts to achieve deep decarbonization, carbon capture and negative emissions have an important role to play in tackling the challenge of climate change. Wilcox makes the point that policy must be created such that there will exist economic incentives to both avoid CO₂ emissions and actively remove CO₂ from air at the tens of gigatonne scale to meet climate goals. A strong combination of decarbonization and negative emissions might be enough to achieve the goals outlined in the Paris climate agreement and avoid climate catastrophe.

“Although the costs of point-source capture are less than direct air capture, it has become increasingly clear that both efforts will be required to meet climate goals.”



BALANCING RENEWABLE ENERGY GOALS WITH COMMUNITY INTERESTS

Hannah Wiseman, Attorneys' Title Professor and Associate Dean for Environmental Programs, Florida State University College of Law

Even in progressive communities, green energy projects are often stymied by NIMBYism—residents don't want infrastructure projects to break ground in their backyard.

Visiting Scholar Hannah Wiseman, Attorneys' Title Professor and Associate Dean for Environmental Programs at the Florida State University College of Law, explores how can we remedy these challenges.

We need renewable energy projects to help power the energy transition needed to fight climate change and those renewable projects must be built somewhere. Local communities often raise concerns about local animal species, noise pollution, eyesores, and other issues to make the point that while renewable projects may be great, they belong somewhere else. Wiseman writes that addressing local concerns while also enacting more efficient regulatory processes can help advance these projects.

Wiseman says that partial, targeted statutory and regulatory exemptions; limits on local renewable development bans coupled with opportunities for local input; and carefully-designed just transitions statutes will be key to getting renewable energy projects over the finish line. It is a challenge to weigh both the rapidly needed transition to renewables while ensuring environmental and social protections, but finding balance is important to making the process work.

“Many local governments and their constituents—even those that strongly support renewable energy in theory—vehemently oppose individual renewable projects sited within their communities.”



Balancing Renewable Energy Goals with Community Interests photo courtesy of [istockphoto.com/portfolio/andykazie](https://www.istockphoto.com/portfolio/andykazie)

2019–2020 FACULTY & PH.D. GRANT RECIPIENTS

Implementing SDG7 in Informal Settlements: The Case of Accra, Ghana

Author: Eugenie Birch, *Lawrence C. Nussdorf Professor of Urban Research & Education, Weitzman School*

Hazard Vulnerability and Policy Responses for Coastal Resilience in South Korea

Author: Sa Min Han, *Ph.D. Student, City and Regional Planning, Weitzman School*

Guiding Energy Storage Capacity Investment for Renewable Grids

Author: Christian Kaps, *Ph.D. Student, Operations Information and Decisions, Wharton School*

Do Government Loans Crowd Out Private Borrowing?

Author: Ben Keys, *Rowan Family Foundation Associate Professor, Real Estate, Wharton School*

The Impact of Transportation Electrification on Urban Forms in China

Author: Zhongjie Lin, *Associate Professor, City and Regional Planning, Weitzman School*

The Effectiveness of Climate Adaptation Policies

Author: Mark Nevitt, *(Formerly) Lecturer in Law, Sharswood Fellow, Penn Law*

Promoting Energy Conservation on the Farm: Thinking about Waste as a Gold Mine Instead of a Headache

Author: Dipti Pitta, *Assistant Professor, Ruminant Nutrition, Veterinary Medicine*

Co-author(s): Veronica Kaplan Shabtai, *Research Fellow, Veterinary Medicine*



VISITING SCHOLARS

Each year we welcome renowned scholars in the fields of energy policy, science, and technology for collaborative visits. We were pleased to have four leading scholars join us this year for on-campus—and virtual—visits.





FEATURED VISITING SCHOLAR
DANIEL KAMMEN

Class of 1935 Distinguished Professor of Energy, University of California, Berkeley







Daniel Kammen is a professor at the University of California, Berkeley, with parallel appointments in the Energy and Resources Group where he serves as chair, the Goldman School of Public Policy where he directs the Center for Environmental Policy, and the department of Nuclear Engineering. Kammen is the founding director of the Renewable and Appropriate Energy Laboratory (RAEL), and was also the director of the Transportation Sustainability Research Center.

Under Secretary of State Hillary Clinton, he was the first energy fellow of the Environment and Climate Partnership for the Americas (ECPA) initiative. He began service as the science envoy for U. S. Secretary of State John Kerry in 2016, but resigned in 2017 over President Trump's policies.

He has served as a contributing or coordinating lead author on various reports of the Intergovernmental Panel on Climate Change. The IPCC shared the 2007 Nobel Peace Prize.

Kammen was educated in physics at Cornell (B.A. 1984) and Harvard (M.A. 1986; Ph.D. 1988), and held postdoctoral positions at the California Institute of Technology and Harvard.

HIGHLIGHTS

-  **PUBLIC LECTURE**
The Clean Energy Revolution is (Finally) Here!
-  **PODCAST**
Will the Clean Energy Transition Bring Energy Equality?
-  **SEMINAR SESSION**
A Career Conversation
-  **POLICY DIGEST**
Peak Carbon?

Above: In his public lecture, Kammen captured everyone's attention with a compelling presentation about where we have come in clean energy and the progress we have yet to make.



Kammen met with the Penn Electric Racing Club and took a turn sitting behind the wheel of the electric race car. Penn Electric Racing builds world class electric vehicles that have broken multiple records including the worldwide acceleration record.

Students from all over campus chatted with Kammen over lunch. Throughout the week, we hosted conversations with students from the Penn Science Policy and Diplomacy Graduate Student Group, Wharton MBA students, and our Undergraduate Climate and Energy Policy Seminar students.



Clean energy, Green New Deal, and the energy transition were just some of the topics Kammen explored with Dan Loney, host of the *Wharton Business Daily* live talk show.



While here, Kammen met with over a dozen faculty members from four different schools. He toured the mLAB, Real-Time and Embedded Systems Lab, and the tribology lab in the mechanical engineering department.

VISITING SCHOLAR

LEAH STOKES

Assistant Professor of Political Science, University of California Santa Barbara (UCSB)



Leah Stokes is an assistant professor in the Department of Political Science and affiliated with the Bren School of Environmental Science and Management and the Environmental Studies Department at the University of California, Santa Barbara (UCSB).

Stokes works on energy, climate, and environmental politics. Within American politics, her work focuses on representation and public opinion, voting behavior, and public policy—particularly at the state level. Within environmental politics, she researches climate change, renewable energy, water, and chemicals policy. Her research has been published in top journals including the *American Political Science Review*, *American Journal of Political Science*, *British Journal of Political Science*, *Nature Energy*, *Energy Policy*, and *Environmental Science & Technology*.

Stokes completed her Ph.D. in public policy in the Department of Urban Studies and Planning’s Environmental Policy and Planning group at the Massachusetts Institute of Technology (MIT). She also received a masters from MIT’s Political Science Department. Before that, she completed an M.P.A. in Environmental Science & Policy at the School of International and Public Affairs (SIPA) and the Earth Institute at Columbia University. Stokes also has a B.Sc. in psychology and East Asian studies from the University of Toronto. Prior to academia, she worked at the Parliament of Canada and Resources for the Future.

HIGHLIGHTS



PODCAST

How Interest Groups Shape U.S. Clean Energy Policy

VISITING SCHOLAR

JENNIFER WILCOX

(Formerly) James H. Manning Chaired Professor of Chemical Engineering, Worcester Polytechnic Institute



Jennifer Wilcox works on ways to test and measure methods of trace metal and carbon capture, to mitigate the effects of fossil fuels on our planet.

Wilcox’s research takes aim at the nexus of energy and the environment, developing both mitigation and adaptation strategies to minimize negative climate impacts associated with society’s dependence on fossil fuels. This work carefully examines the role of carbon management and opportunities therein that could assist in preventing 2° C warming by 2100. She is the author of the first textbook on carbon capture, published in March 2012.

Following her visit in the spring, Wilcox joined the Kleinman Center this fall as the Presidential Distinguished Professor of Chemical Engineering and Energy Policy.

HIGHLIGHTS



PUBLIC LECTURE

A Case for Carbon Dioxide Removal from Air



PODCAST

The Challenge of Scaling Negative Emissions



PENN TODAY ARTICLE

What to Do When Cutting Emissions Alone Is No Longer Enough



POLICY DIGEST

The Essential Role of Negative Emissions in Getting to Carbon Neutral



Jennifer Wilcox presents a detailed look at new carbon sequestration technologies.



VISITING SCHOLAR

HANNAH WISEMAN

Attorneys' Title Professor, Florida State University College of Law

Hannah Wiseman is the Attorneys' Title Professor and Associate Dean for Environmental Programs at the Florida State University College of Law. She teaches and writes in the areas of energy law, oil and gas law, environmental law, and land use.

Her scholarship spans these areas, focusing on multi-level governance challenges associated with energy and other forms of development. She has published articles in the *NYU Law Review*, *Georgetown Law Journal*, *Duke Law Journal* (co-authored), and *Environmental Science & Technology*, among other journals, and she is a co-author of the textbook *Energy, Economics, and the Environment*.

HIGHLIGHTS



PUBLIC LECTURE

Combating Climate Change Through Regulatory Relief



PODCAST

The Struggle for Local Control over Energy Development



POLICY DIGEST

Balancing Renewable Energy Goals with Community Interests



Hannah Wiseman presents online in the Kleinman Center's first webinar.



EVENTS

The Kleinman Center is privileged to have the Energy Forum as our gathering space, located in the Fisher Fine Arts building.

With fondness, we reflect on the events that brought us together last fall, before we continued our spring programming online under quarantine.



FEATURED EVENT
A WEEK OF ENERGY EDUCATION

Last fall, we launched our first ever Energy Week at Penn—featuring lectures and events from all corners of campus. The Kleinman Center and the Vagelos Institute for Energy Science and Technology organized five days of programming, which featured speakers from on and off campus, and partners from five schools and several campus groups.

WHY ENERGY WEEK?

Energy systems are complex and multifaceted, and Energy Week aims to show the cross-disciplinary efforts underway at Penn to bridge gaps and connect understanding.

ON THE GROUND

During this week dedicated to energy, schools, centers, and student groups hosted events that explored everything from practical tips on how to lower your energy bill to the latest research on trends in energy finance.

At the Energy Week Launch, the Kleinman Center debuted a video and publication that focused on the impact the School of Engineering and Applied Science has had on energy research at Penn, highlighting the policy implications of engineering research.

Students and faculty displayed their work in a poster session that highlighted a diverse array of energy research topics. Both faculty and student engineers were in the room to explain complex topics such as tribology and powering computers with wave technology.

Our partners in the Annenberg School hosted an informative event about the energy impacts of bitcoin mining. Kleinman Center Ph.D. grant recipient Zane Cooper organized the event with his team, which highlighted their research trip to Iceland and virtual-reality documentary about the industry. This project went on to be featured as a finalist in the Cannes Film Festival XD Showcase.

Above: Students from Penn Electric Racing displayed their electric car. The team builds world-class electric vehicles that have set a North American acceleration record.

“While much of the programming on display during this inaugural Energy Week at Penn originated in the schools, it all illustrates the collaboration across those schools that is a hallmark of both research and learning at Penn.”

—MARK ALAN HUGHES



An interactive display allowed participants to step into Iceland to see how bitcoin mining works and what the energy implications are for this technology.



Post-doctoral research fellow Penny Liao presented research about climate change, sea level rise, and flood insurance as part of our Energy Economics and Finance Seminar. The seminar is chaired by professor Arthur van Benthem and meets in the Kleinman Center classroom.



THE STUDENT EXPERIENCE

Students learned more about energy research happening at Penn at the Energy Week Launch event (right).

Events like those held during Energy Week gave students the ability to meet with professionals working in areas they might find themselves after graduation.



“What a fabulous week!”

—ZANE COOPER



At the Wharton Energy Conference (above), one of the largest student-run energy conferences, students convened dozens of leading experts to provide insights on the theme of energy transition. Research Director Angela Pachon (far right) directs a panel on the future of the electric grid.



“Fantastic initiative.
Thank you Kleinman crew for your leadership!”

—FREDERICK STEINER



FEATURED EVENT
HONORING A LEADER IN ENERGY REGULATION

This year, we awarded our fifth annual Carnot Prize to Cheryl LaFleur, former commissioner of the Federal Energy Regulatory Commission (FERC). LaFleur is a nationally-recognized energy leader who directed the FERC under a time of tense political battles.



AN IMPRESSIVE RECIPIENT

LaFleur has spent her career exploring complex energy issues. During her distinguished tenure at FERC, she successfully navigated nearly a decade of change in the nation's energy and power supply industries—as well as change in political leadership.

LaFleur is known for her work adapting the nation's energy markets and infrastructure to support new technologies and respond to climate change. She has been at the forefront of great transitions, including the growth of domestic natural gas and the subsequent U.S. shift away from coal; the world's growing emphasis on climate change; and the development of innovative clean energy technologies.

Former FERC colleagues, family members, and members of the Penn community gathered to honor LaFleur and her contributions to the domestic energy markets and regulation.

“We need the best and the brightest of the next generation who will take this work forward. I applaud the Kleinman Center and the University of Pennsylvania for providing that education.”

—CHERYL LaFLEUR

LESSONS FROM LaFLEUR

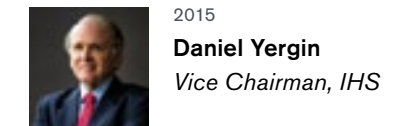
In her acceptance speech, LaFleur shared some advice on making policy decisions during contentious times:

- Focus on the facts
- When necessary, live with uncertainty
- Be willing to make hard choices
- Seek compromise with those who disagree with you

5 YEARS OF CARNOT

The Kleinman Center established the Carnot Prize to honor those who have made distinguished contributions to energy policy. Named after French scientist Sadi Carnot, who helped establish the second law of thermodynamics, the Carnot Prize similarly recognizes those who revolutionize our understanding of energy policy.

Since 2015, we have recognized leaders in industry and public service; at home and abroad, including:



2015
Daniel Yergin
Vice Chairman, IHS



2016
Fatih Birol
Executive Director, International Energy Agency



2017
Gina McCarthy
Former Administrator, Environmental Protection Agency



2018
Piyush Goyal
Minister of Railways, Minister of Coal, Government of India



2019
Cheryl LaFleur
Former Commissioner Federal Energy Regulatory Commission

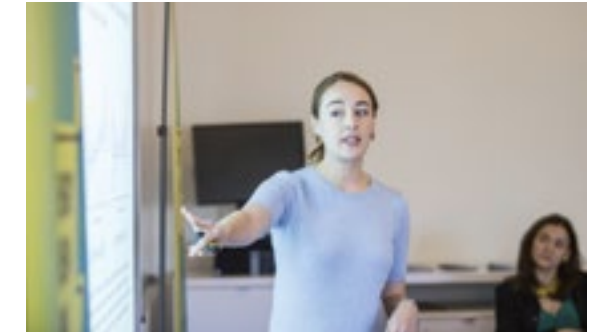


A DAY AT PENN



As a part of the Carnot Prize ceremony, the Kleinman Center welcomed LaFleur to campus for a day of energy learning, discussion, and celebration.

Before the award ceremony, the Kleinman Center hosted a student colloquium in LaFleur's honor. Doctoral candidate Caitlin Gorback presented her research on Uber and Lyft related emissions.



“It’s inspiring hearing lessons in energy policy leadership from former FERC Chair Cheryl LaFleur as she accepts the Kleinman Center’s Carnot Prize.”

—MIRIAM POSNER (MPA'16), ENERGY MANAGEMENT AND POLICY CERTIFICATE GRADUATE



Energy Policy Now podcast host Andy Stone chatted with LaFleur about the impact of partisan politics on energy regulation.

In addition to spending time with Kleinman Center students, LaFleur gave a talk at Penn Law. She spoke with current law students about her career path and job experience as a regulator.



“Cheryl LaFleur exemplifies the grit that defines this prize.”

—MARK ALAN HUGHES

From distinguished energy professionals to today’s energy students, the room was filled to recognize Cheryl LaFleur’s accomplishments and her efforts to create a safer, cleaner energy future.



LaFleur also chatted with reporters, like WHYY reporter Jon Hurdle (shown here) as well as a student reporter from *The Daily Pennsylvanian*.

FEATURED EVENT

ENERGY POLICY
THEN AND NOW

PANELIST

Rafe Pomerance, *Chairman, Arctic 21*

PANELIST

David Roberts, *Vox Energy and Climate Writer and former Kleinman Center Senior Fellow*

Since the late 70s, climate activist Rafe Pomerance has worked to raise awareness in Washington about climate change and its connection to fossil fuels. Pomerance joined David Roberts, *Vox* energy and climate writer and senior fellow at the Kleinman Center for Energy Policy, for a candid conversation about climate policy yesterday... and today.

The conversation on climate has come far since the 1970s. But although there is almost universal recognition of climate change as an issue, there are still constituencies dragging their feet. Pomerance and Roberts agree that if voters demand climate action and elect representatives that reflect their values, this new political reality could help push the United States toward more significant and impactful climate action.

“When I started working on [climate change] no one had ever heard of the problem. In over four decades it’s moved from zero to total recognition.”

—RAFE POMERANCE

“To the reactionary mind, climate change is not a call to cosmopolitan, global cooperation, but the opposite. It is a call to put up walls. . . to hoard resources while they are still available.”

—DAVID ROBERTS



COMMENTARY

As the coronavirus pandemic spread across the globe, it changed everything. In the world of energy policy, we saw the price of crude fall, project deployment come to a halt, consumers struggle to pay electric bills, and legislators attempt to plug the holes with relief packages.

Some cities saw blue skies for the first time, with reduced pollution as businesses shuttered and people no longer commuted to work. We followed these timely issues and more with a weekly commentary, written by members of the Kleinman Center team.

COVID-19 COMMENTARY HIGHLIGHTS



March 31
Bailout or Subsidy: Oil in the Age of Pandemic
Mark Alan Hughes

COVID-19 is disrupting all sectors of the global economy, including the oil industry. How should the government respond amid growing concerns over demand and storage?

“Assistance must not further subsidize obstacles to a clean energy system—a system that provides lower total costs, safer operations, and healthier environmental performance.”



April 15
When Emission Reductions Aren't Sustainable
Cornelia Colijn

An unexpected consequence of the pandemic is a drop in air pollution. But how should we be thinking about the relationship between emissions and COVID?

“The bottom line is in a recession no one wins. Instead, long-term climate success must be built from the deployment of new, clean technology and economic growth.”



May 6
A Shaky Future for U.S. Transit Systems... and Why We Need to Save Them
Angela Pachon

Even before the pandemic, transit ridership in the United States was on a downward slope. Can this vulnerable system rebound?

“The future of transit agencies is in peril. It's time to value public services for all the good they do.”



May 13
The COVID Carbon Crunch
Oscar Serpell

The world is experiencing a dramatic drop in emissions. Tools like carbon markets could help assure that some of these reductions are maintained as the global economy recovers and reopens.

“Reducing carbon allowances in existing carbon markets and introducing new markets would embed clean energy as a major feature of the global recovery, and delay the need to impose punitive costs on producers.”

Bailout or Subsidy: Oil in the Age of Pandemic photo courtesy of istock.com/AvigatorPhotographer

When Emission Reductions Aren't Sustainable photo courtesy of istock.com/Thomas Northcut

A Shaky Future for U.S. Transit Systems...and Why We need to Save Them photo courtesy of Flickr/raedmansour

The COVID Carbon Crunch photo courtesy of istock.com/kodda



BLOG HIGHLIGHTS

Throughout the year, our blog serves as a timely outlet for commentary and insights from faculty, students, and Kleinman Center staff. This year, we published more than 80 blog posts, on everything from oil markets to waste gasification.



August 7, 2019

Energy Consumption and Cost Burdens in Multi-Family Housing

Vincent Reina

Low-income households are more likely to be subjected to high energy cost burdens due to inefficient housing, but new energy disclosure data can be used to develop programs that retrofit properties and reduce this inequity.

“Energy cost burdens for the lowest income households can be as high as 20 percent. These burdens are driven by the inefficiency of the housing that low-income households can afford and access, as opposed to their consumption decisions.”



December 11, 2019

With COP25 in Full Swing, a Look at Chile's Energy Transition

Mary Lim

Through her Kleinman–Biorl fellowship at the International Energy Agency, Mary Lim looked closely at Chile's energy policies and objectives. With COP25 underway, she explored how the host country was measuring up to its own climate targets.

“Overall, Chile's progress and commitment to a clean energy transition has been noteworthy and its recent policies indicate that stronger advancements towards carbon emissions reductions will be made in the near future.”



March 23, 2020

Will an Election or Pandemic Derail Poland–U.S. Energy Cooperation? Nope.

Anna Mikulska and Wojciech Jakobik

With the world in upheaval, Poland is still poised for a steady energy policy path.

“While Coronavirus could possibly cause presidential election delays as well as economic hardship, there is not much it can do to Poland's energy policy path that, at least with respect to natural gas and U.S.–Poland cooperation, extends far into the 2040s.”



June 18, 2020

Reflections on the Anniversary of the PES Refinery Explosion

Oscar Serpell

One year ago, Philadelphia was rocked by an explosion at the PES refinery. On the anniversary, we consider the local risks inherent in our energy system and the inequity that often accompanies it.

“To ignore the local risks and adverse effects of our energy system is to ignore many of the most pressing instances of inequity and environmental injustice in our society.”

Energy Consumption and Cost Burdens in Multi-Family Housing photo courtesy of istock.com/WDnet

With COP25 in Full Swing, a Look at Chile's Energy Transition photo courtesy of istock.com/DancingMan

Will an Election or Pandemic Derail Poland–U.S. Energy Cooperation? Nope. photo courtesy of Pexels/KaboomPics

Reflections on the Anniversary of the PES Refinery Explosion photo courtesy of AP Photo/Matt Rourke

PODCAST HIGHLIGHTS

PRODUCER & HOST

Andy Stone,
Energy Policy Now



In its fourth season, *Energy Policy Now* with host Andy Stone presents half-hour conversations on current topics in the world of energy policy. This year, our podcast covered everything from the energy transition of an explosive Philadelphia refinery to the outlook for global carbon credit markets.



January 7

Is Climate Risk Insurable?

GUEST: CAROLYN KOUSKY



Carolyn Kousky, executive director of the Wharton Risk Center, takes a look at insurers' struggle to manage natural disasters of unprecedented scale, the challenge of communicating climate risk, and how climate risk is being felt in the energy industry.



March 19

200 Years of Energy History in 30 Minutes

GUEST: JESÚS FERNÁNDEZ-VILLVERDE



Jesús Fernández-Villaverde is a professor of economics in the School of Arts and Sciences. He is also the author of an upcoming book on global economic history, with a major focus on the role of energy in economic development.

As climate-related disasters become more severe and frequent, insurers and governments face an economic black hole.

The insurance industry specializes in understanding the nature of risk, and in estimating the likelihood, and cost, of future damages. A major challenge for the insurance industry is to understand how climate change alters the likelihood of future natural disasters, from floods to wildfires, and how to accurately reflect these risks in the premiums it charges to consumers and businesses.

The current energy transition is fraught with economic and social implications, not to mention abundant political squabbles. An economist looks at the past two centuries of global energy history and finds that difficult transitions are nothing new.

The world faces an urgent need to transform energy systems toward cleaner, renewable fuels.

In this episode, Jesús Fernández-Villaverde explores the extent to which energy has come to underpin modern economies, and how energy resources of all types have become inseparable from our everyday lives.



April 2

A Hard Look at Negative Emissions

GUEST: GLEN PETERS



Glen Peters, research director at the Center for International Climate Research (CICERO) in Oslo, Norway, takes a close look at negative emissions, from their potential to the political and economic challenges that need to be overcome if they're to have a meaningful impact on climate.

Much faith is being put in the ability of negative emissions technologies to slow the pace of climate change. Glen Peters of Norway's Center for International Climate Research looks at the potential of negative emissions strategies, and the steep challenges to implementing them.

The goal of the Paris Climate Accord is to limit global warming to 2 degrees Celsius, the point beyond which the impacts of climate change are feared to be most severe and enduring. Staying below the 2-degree limit will require two complementary strategies. The first, mitigation, is now familiar and involves limiting carbon dioxide emissions today by turning to cleaner energy and greater energy efficiency.

The second strategy is equally important in limiting future climate impacts, yet has received much less attention in public dialogue and policy circles. Negative emissions doesn't yet exist in any practical sense, yet it will be counted upon to remove decades worth of carbon dioxide emissions from Earth's atmosphere by the end of this century.



ABOUT THE PRODUCER & HOST

Andy Stone is a former senior reporter at *Forbes* magazine, where he began covering the energy industry more than a decade ago. In addition to the podcast, Stone continues to write energy-focused articles for *Forbes*, as a regular contributor.

Like many podcasters across the globe, he scrambled to create a new home recording studio—complete with a microphone, soundproof padding, sound editing tools, and remote interview software.

STUDENT PROGRAMS

This year we continued our usual offerings for students: our certificate program, grants program, internship opportunities, and energy policy courses.

In addition, we developed a new student fellows program in climate and energy policy and sent our fourth Kleinman Birol fellow to Paris...*malheureusement*, virtually.

UNDERGRADUATE STUDENT SEMINAR

This past spring, under the direction of Research Associate Oscar Serpell, we launched a new student seminar series designed for undergraduate students with an interest in climate and energy policy.

Seventeen student fellows participated—chosen competitively and from diverse disciplines. Twice a month, they met at the Kleinman Center for a lunchtime lecture and discussion with leading energy faculty and Ph.D. researchers.

Under the quarantine, the seminar programming continued virtually.



Joshua Anumolu
Undeclared, College of Arts and Sciences



Anunya Bahanda
Urban Studies, College of Arts and Sciences



Ari Bortman
Mechanical Engineering and Applied Mechanics, School of Engineering and Applied Science



Kelly Chen
Materials Science and Engineering, School of Engineering and Applied Science



William Deo
Vagelos Integrated Program in Energy Research (VIPER), School of Engineering and Applied Science, College of Arts and Sciences



Matthew Fouts
Psychology and Earth Science, College of Arts and Sciences



Emma Glasser
Vagelos Integrated Program in Energy Research (VIPER), School of Engineering and Applied Science, College of Arts and Sciences



Ryan Kim
Economics and Environmental Studies, College of Arts and Sciences



Eric Knorr
Economics, Wharton School



Wonbin (Brian) Lee
Economics, Wharton School



Richard Ling
Vagelos Integrated Program in Energy Research (VIPER), School of Engineering and Applied Science, College of Arts and Sciences



Leah Narun
Materials Science and Engineering, School of Engineering and Applied Science



Brandon Nguyen
Economics and Political Science, Wharton School and College of Arts and Sciences



Summer Powers
Economics, Wharton School



Jonathan Szeto
Earth Science and Political Science, College of Arts and Sciences



Zachary Whitlock
Vagelos Integrated Program in Energy Research (VIPER), School of Engineering and Applied Science, College of Arts and Sciences



Rachel Zaff
Political Science and Environmental Studies, College of Arts and Sciences

LECTURE SERIES

January 22

Changing Tides: Public Attitudes on Climate Migration

Presenter: Sabrina Arias, *Ph.D. Student in International Relations, School of Arts and Sciences and Chris Blair, Ph.D. Student in International Relations, School of Arts and Sciences*

January 29

The Role of Insurance in Climate Change Adaptation

Presenter: Carolyn Kousky, *Executive Director of the Wharton Risk Center*

February 12

Nuclear Energy as an Option in the Fight Against Climate Change?

Presenter: Reto Gieré, *Chair of the Earth and Environmental Science Department, School of Arts and Sciences*

February 19

Carbon Taxation and the Impact of the Energy Transition on the Domestic Labor Market

Presenter: Ioana Marinescu, *Assistant Professor of Public Policy, School of Social Policy and Practice*

February 26

The Clean Energy Revolution Is (Finally) Here

Presenter: Daniel Kammen, *Professor of Energy at the University of California, Berkeley*

March 4

The Impacts of Climate Change on the Galápagos Archipelago

Presenter: Michael Weisberg, *Chair of the Philosophy Department, School of Arts and Sciences*

March 18

Visualizing Energy Infrastructure

Presenter: Nicholas Pevzner, *Senior Lecturer in Landscape Architecture, Weitzman School of Design*

April 15

Climate Change, Inequality, and Environmental Justice

Presenter: Daniel Aldana Cohen, *Assistant Professor of Sociology, School of Arts and Sciences*

April 22

The Impacts of Emissions Regulation and Automation on the Global Transportation Sector

Presenter: Steve Viscelli, *Lecturer in Sociology, School of Arts and Sciences*

STUDENT FELLOWS BLOG POST HIGHLIGHTS

Seminar students concluded their work by writing a blog post or policy digest on a related topic, for publication on the Kleinman Center website. Several students connected their research to timely issues at the intersection of climate, energy, and the pandemic.



April 9
Wind Developers Pressured by Pandemic Concerns & 2020 PTC Deadlines
Ryan Kim

With concerns about a global recession and looming 2020 PTC deadlines, wind developers and investors are being forced to revisit project strategies.



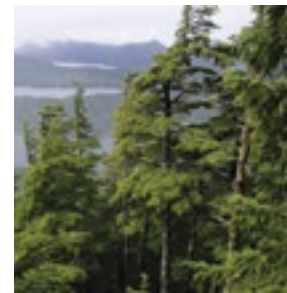
April 23
Challenges Facing Renewable Energy in Northern Canada
Brandon Nguyen

In the remote northern territories of Canada, a legacy of off-grid systems and limited infrastructure makes energy transition difficult.



May 1
Climate Change and the Need for Community
Anunya Bahanda

For the past 50 years our trend has been less engagement in civic life and less investment in public spaces. To cut carbon emissions and adapt to a changing climate, we must re-invest in our communities and the social infrastructure that upholds them.



June 10
Trump's Plan to Plant Trees Disregards Mature Forests' Role in Carbon Sequestration
Rachel Zaff

Though President Trump recently pledged to join the WEF's Trillion Trees initiative, his attempts to lift forest protections undermine the initiative's goal of climate change mitigation.



June 16
The Green New Deal Is the Solution to the Jobs Issue
Emma Glasser

The Green New Deal allows us to mitigate and adapt to climate change, create millions of good jobs, and ensure no one is left behind.



June 29
It's Time to Rethink Flood Insurance
Brian Lee

The National Flood Insurance Program should actively help reduce aggregate flood risk in the United States by facilitating voluntary buyouts and managed retreats.

The Green New Deal Is the Solution to the Jobs Issue screenshot from "A Message from the Future"

Climate Change and the Need for Community photo courtesy of istock.com/Michael Wels

Challenges Facing Renewable Energy in Northern Canada photo courtesy of istock.com/Henry Baillie-Brown

Trump's Plan to Plant Trees Disregards Mature Forests' Role in Carbon Sequestration photo courtesy of U.S. Forest Service

It's Time to Rethink Flood Insurance photo courtesy of istock.com/RoschetzkyIstockPhoto

“I loved that the certificate program fosters a diversity of thoughts and pushes you to take classes from other schools to broaden your perspective.”

—HAYLEY McCURDY

FEATURED CERTIFICATE GRADUATE INVESTING IN OUR ENERGY FUTURE

STUDENT

Hayley McCurdy (MES'20),
Kleinman Center Certificate Graduate



When Hayley McCurdy came to Penn, she knew from day one that she wanted to get involved with the Kleinman Center.

“Before I decided to go to Penn, the Kleinman Center was something I mentioned in my application as a place where I wanted to get involved,” said McCurdy.

Through the Kleinman Center student grants program, McCurdy interned at the Philadelphia Energy Authority her first semester on campus. She went on to be a conference co-chair for the Wharton Energy Conference, score a summer internship at Energy Impact Partners, a 1.2 billion dollar venture capital firm, and work for the Wharton Initiative for Global Environmental Leadership (IGEL).

Last spring, McCurdy graduated with a master’s degree in environmental studies, a degree she made her own by including an individualized concentration in environmental sustainability and energy management and the Certificate in Energy Management and Policy from the Kleinman Center.

The Kleinman Certificate Program offers graduate students multidisciplinary course offerings across five different schools—including our own energy courses, like Introduction to Energy Policy. McCurdy said this course was a highlight of her time in the certificate program.

“It was so fun to be in a class full of students from different schools, undergrads and graduate students. It was great to be surrounded by people who really cared about energy and who brought new perspectives and diverse backgrounds to the table.”

“I learned so many important topics in that course that I was able to reference in interviews and that are applicable in the real world.”

Another favorite course was Faculty Fellow Arthur van Benthem’s challenging Energy Markets & Policy course. Although the class is a lot of work, it pays off.

This summer, McCurdy joined the over 25 Penn students who have entered the workforce with the Kleinman Certificate credential. Harnessing work experience and knowledge she gained in the certificate program, McCurdy moved to Washington, D.C. to work as an Equity Research Analyst at Terra Alpha Investments, a private investment fund that is founded on a belief that if you harness environmental data and analysis you will achieve superior returns.

McCurdy says she is motivated by the Intergovernmental Panel on Climate Change (IPCC) report that says we have to invest a trillion dollars beyond business as usual to make a dent in our collective climate crisis. She wants to ensure companies are working to further these investment goals and explore how investment can drive the energy transition to a low carbon future.

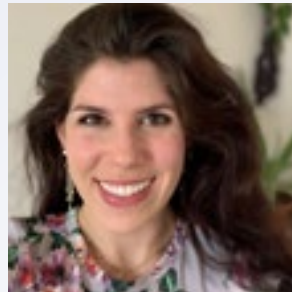
This interdisciplinary and future focused thinking starts in the classroom but goes on to create a lifetime of positive impact.

FEATURED STUDENT FELLOW:

RESEARCHING
DIGITIZATION...
DIGITALLY

STUDENT

Amber Hassanein,
2020 Kleinman Birol Fellow



How do we fully move our urban power systems into the digital age?

This is a question city planning master's student Amber Hassanein explored during her summer as a Kleinman Birol Fellow at the International Energy Agency (IEA). As a fellow, she researched the multiple benefits of integrated demand-side management and digitization of power systems. She also focused on case studies in her hometown of Cairo, Egypt to illustrate these benefits in the real world.

Digitization offers vast and varied advantages—when coupled with integrated demand-side management technologies like energy efficiency and demand-response programs. Digitization brings job creation, capacity building, and environmental and social benefits to local communities.

“It is my hope that this research will urge communities, academics, policy-makers, and elected officials to consider digitization and its multiple benefits as a means of resolving urban inequalities—maximizing existing opportunities, and enhancing future resilience in their own cities,” said Hassanein.

The IEA fellowship was the perfect meld of Hassanein's interests. She grew up in Egypt and has always appreciated the value of an international perspective on policy and energy conversations. And she also has an impressive background working in energy efficiency.

Hassanein's career in energy started during her undergraduate studies with an internship at Pacific Gas & Electric, the largest privately held utility in the nation. There she broadened her understanding of sustainable development and ultimately landed a job at the utility.

Hassanein said that she was attracted to working for a utility, because it provided a basic service that everyone needs and deserves. “You can improve someone's quality of life instantaneously through utility services—gas and water and electricity,” she remarked.

At PG&E she also took a deep dive on energy efficiency. She helped the California Public School system save \$21 million in avoided energy costs through energy efficiency measures.

“Energy efficiency is not always the most glamorous tool in the sustainability toolbox, but it's the lowest barrier to entry, highly cost effective, and provides immediate economic and environmental benefits.”

Because of her interest in planning for a greener and more economically just future, Hassanein was drawn to city planning. When looking at Penn, the Kleinman Center immediately jumped out as a place where she wanted to get involved.

“I had to pinch myself when I saw this IEA fellowship available, because the Kleinman Center was a big draw to coming to Penn over other schools. Even before this fellowship, I had dreamed of working for IEA,” said Hassanein.

Unlike our past Kleinman Birol fellows, Hassanein was not gazing at the Eiffel Tower from her desk at IEA headquarters this summer. But even though she could not travel to France, the situation was not without its benefits. Typically, the IEA has multiple interns and fellows over the summer, but Hassanein was the only student at IEA who was able to work remotely. This offered her valuable one-on-one time with some of the top energy minds in the field.

“You can improve someone's quality of life instantaneously through utility services—gas and water and electricity.”

—AMBER HASSANEIN

STUDENT GRANT RECIPIENTS

CONFERENCES, COMPETITIONS, AND EVENTS

*GREEN Program: Iceland

Michael Cellucci
*Materials Science and Engineering,
School of Engineering and
Applied Science*

Conference: 99th Transportation Research Board Annual Meeting

*Conference: World Society for Transport and Land Use Research

Shengxiao (Alex) Li
*Ph.D. in City and Regional Planning,
Weitzman School of Design*

*Philomathean Society 2020 Annual Oration

George Hollyer
*Materials Science and Engineering,
School of Engineering and
Applied Science*

GREEN Program: Peru

Adam Ritter
*Chemical & Biomolecular Engineering
and Theater Arts, School of
Engineering and Applied Science,
School of Arts and Sciences*

2020 Penn Science Olympiad

Rohil Sheth
*Systems Engineering, School of
Engineering and Applied Science*

*World Climate Simulation

Alisa Sukhina
*Cell and Molecular Biology,
Perelman School of Medicine*

INTERNSHIPS

Philadelphia Energy Authority

Jennifer Lessick
*Master of Environmental Studies,
School of Arts and Sciences*

Department of the Interior

Serena Nichols
*Environmental Studies, School of Arts
and Sciences*

RESEARCH PROJECTS

Permeability of Building Envelope Systems

Nan (Nancy) Ma
*Ph.D. in Architecture,
Weitzman School of Design*

The Economic Impact of the Carbon Tax

Akshay Malhotra
*Computer Science and Finance,
Data Science, Wharton School*

*Clean Energy and Sustainable Agriculture

Mackenzie Marcotte
*Environmental Studies, School of Arts
and Sciences*

*Due to the pandemic's limitations on travel and events, this student grant was awarded but not fully completed this year.

“This past semester, I was lucky enough to receive a Kleinman Center grant that allowed me to intern at PEA, specifically working on the third relaunch of the solar campaign.”

—JENNIFER LESSICK, MASTER OF ENVIRONMENTAL STUDIES, SCHOOL OF ARTS AND SCIENCES



Read Jennifer's post:

kleinmanenergy.upenn.edu/blog/2020/02/06/one-year-later-solar-energy-philadelphia-still-rise



“In addition to learning how to do your own research, or learning how to work in a research environment, you just meet so many people who are so unique and have such different experiences from your own. More than the research per se, [the Kleinman Center] opens the door to so many further opportunities.”

—RICHARD LING (VIPER'20)



“The GREEN program was the opportunity of a lifetime and something I will never forget. Stepping through these facilities and seeing firsthand their operations has reinvigorated my passion for environmental engineering.”

—ADAM RITTER, CHEMICAL & BIOMOLECULAR ENGINEERING AND THEATER ARTS, SCHOOL OF ENGINEERING AND APPLIED SCIENCE



“Hearing about the Kleinman Center definitely influenced me to attend Penn when I applied, and I'm sure it will influence future Penn students as well.”

—ROHIL SHETH, SYSTEMS SCIENCE AND ENGINEERING, SCHOOL OF ENGINEERING AND APPLIED SCIENCE

WHO WE ARE

A research center relies on the work of specialists. From our staff and leadership to our faculty fellows and advisory board, we depend on those that support our policy work. This year, we welcomed our first faculty hire. In the years to come, we will expand our research and teaching capacity with additional faculty.

STAFF



WILLIAM COHEN

Center Coordinator

Bill oversees office needs, supervises public events, tracks our budget, and provides technical support across many platforms. When possible, he dives into design and research projects.



LINDSEY SAMAHON

Director of Communications

Lindsey oversees our communications and marketing strategy. She directs all digital and print media, prepares content for publication, and serves as press contact.



CORNELIA COLIJN

Executive Director

Cory envisions, plans, and manages all center programming, while building connections with students, faculty, and leaders in the energy industry.



OSCAR SERPELL

Research Associate

Oscar is a researcher, writer, and data analyst. He is part of several key research projects and also writes blog posts and policy digests on timely energy policy topics.



MARK ALAN HUGHES

Founding Faculty Director

Mark provides the vision and direction for all center activities while also leading several major research projects, including Decision-Making Under Deep Uncertainty.



MOLLIE SIMON

Communications Coordinator

Mollie supports all digital and print communications. She manages the center's social media accounts, maintains our website, and regularly posts to our blog.



ANGELA PACHON

Research Director

Angela manages our faculty grants program and develops scholarship and research collaborations across campus and beyond. She is also the author of several policy digests.



KIMBERLE SZCZUROWSKI

Administrative Assistant

Kim oversees scheduling, budgeting, event planning, and office administration. She also helps manage our active student grants program.

AFFILIATED FACULTY



ARTHUR VAN BENTHEM

Faculty Fellow

Arthur van Benthem is a professor of business economics and public policy at Wharton. Before his doctoral studies he worked as an energy economist at Royal Dutch Shell. His recent work explores the unintended consequences of environmental legislation and the economic efficiency of energy policies.



NICHOLAS PEVZNER

Faculty Fellow

Nicholas Pevzner is a senior lecturer in the Department of Landscape Architecture in the Stuart Weitzman School of Design. He is also co-editor-in-chief of *Scenario Journal*. His research focuses on the public and civic potential of infrastructure, and the integration of urban ecological systems and their metrics into design methodology.

FEATURED FACULTY FELLOW

VAN BENTHEM: SEMINAR SERIES

For a fourth year, Faculty Fellow Arthur van Benthem directed his Energy Economics and Finance Seminar Series, convening faculty and advanced students for rigorous discourse on working papers and publications. This year's workshops, hosted at the Kleinman Center, included the following:

September 25, 2019

The Marginal Congestion of a Taxi in New York City

Alejandro Molnar, *Assistant Professor of Economics at Vanderbilt and Economist at World Bank*

October 23, 2019

How Hurricanes Sweep Up Housing Markets: Evidence from Florida

Penny Liao, *Postdoctoral Research Fellow at the Wharton Risk Center*

November 6, 2019

Climate Teams: Generating High Integrity Supply of International Units

Suzi Kerr, *Chief Economist at the Environmental Defense Fund*

November 19, 2019

Neglected No More: Home Prices, Mortgage Lending, and Sea Level Rise

Ben Keys, *Associate Professor of Real Estate at Wharton School*

Philip Mulder, *Ph.D. Economics Student at Wharton School*

December 4, 2019

The Limits of Limited Liability: Evidence from Industrial Pollution

Ian Appel, *Assistant Professor of Finance at Boston College*

SENIOR FELLOWS



WILLIAM HEDERMAN

William Hederman is Independent Senior Adviser at Deloitte and Touche, LLP and Executive Adviser at Agile PQ, Inc. He was Senior Advisor to Secretary Ernest Moniz at the U.S. Department of Energy.



SCOTT MOORE

Scott Moore is the director of the Penn Global China Program. He is a political scientist whose research focuses on environmental politics and policy reform, especially climate change, water resources, and ocean issues.



KENNETH KULAK

Ken Kulak is a partner at the law firm of Morgan Lewis where he advises clients on energy regulation and complex energy transactions. His clients include utilities, developers, investors, and cooperate energy users.



CHRISTINA SIMEONE

Christina Simeone is a doctoral student in advanced energy systems at the Colorado School of Mines and the National Renewable Energy Laboratory, a joint program. She is the former Kleinman Center director of policy and external affairs.



ANNA MIKULSKA

Anna Mikulska is a nonresident scholar in Energy Studies and Rice University's Baker Institute. Her research interests center around European energy markets and energy policy.



STEVE VISCELLI

Steve Viscelli is a lecturer in the Department of Sociology. His research focuses on work, labor market economics, and economic regulation. He is currently working to improve fuel efficiency in the trucking industry.

ADVISORY BOARD



PAUL BONNEY

Paul Bonney is an energy industry consultant and adjunct professor at Clemson University. He was formerly a senior vice president of Exelon Corporation.



JOHN QUIGLEY

John Quigley is the founding director of the Center for Environment, Energy & Economy at the Harrisburg University of Science and Technology and former secretary of Pennsylvania's Department of Environmental Protection.



MARK BROWNSTEIN

Mark Brownstein is senior vice president of energy at Environmental Defense Fund, and a member of EDF's executive team.



LYNN SCARLETT

Lynn Scarlett is chief external affairs officer at The Nature Conservancy and former deputy secretary of the U.S. Department of the Interior.



EMILY DUNCAN

Emily Duncan is director of federal government affairs at National Grid, an electric and natural gas transmission and distribution utility.



MARVIN SCHLANGER

Marvin Schlanger is the former chairman of the supervisory board of LyondellBasell Industries N.V.



SCOTT KLEINMAN (C'94, W'94)

Scott Kleinman is co-president at Apollo Global Management, Inc. and founder of the Kleinman Center for Energy Policy.



FREDERICK STEINER

Frederick Steiner is dean and Paley Professor of the Weitzman School of Design at the University of Pennsylvania.



SONNY POPOWSKY

Sonny Popowsky served for more than two decades as the consumer advocate of Pennsylvania.

SOCIAL MEDIA ROUNDUP

kleinmanenergy
University of Central Florida



18 Likes

kleinmanenergy This week, the Kleinman Center's Cory Colijn and Oscar Serpell participated in a panel on the future of graduate education in energy and sustainability as a part of the annual AES Conference at the University of Central Florida (@ucf.edu)

kleinmanenergy
Denver, Colorado



14 Likes

kleinmanenergy This week, KCEP Executive Director Cory Colijn and Faculty Director Mark Hughes are at the #ARPAE Energy Innovation Summit. The summit is celebrating 10 years of turning energy ideas into reality. #ARPAE19 @energy

kleinmanenergy



14 Likes

kleinmanenergy Watch video archives of the #1point5 minute climate lectures from @PennSAS: bit.ly/21pnqDO

kleinmanenergy
Madrid, Spain



17 Likes

kleinmanenergy Some more photos from last week at #COP25! The Kleinman Center and our friends from @perryworldhouse, Penn IUR, and across @uofpenn were alongside world leaders in Madrid for this year's @unitednations climate conference (@cop25cl). See more of what the Penn delegation was up to by exploring the hashtag #PennCOP25 on Instagram and Twitter!

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2 Likes

kleinmanenergy "Cities are where the battle against climate change will be defined, and thus will require a vast infrastructure transformation to make them climate-resilient," –Mauricio Rodas (@mauriciorodasec), former mayor of Quito and current visiting fellow at @perryworldhouse @PennIUR.

kleinmanenergy



4 Likes

kleinmanenergy Happening now at REACT@Penn: KCEP Research Director Angela Pachon moderates a panel on technology solutions to urban challenges.

kleinmanenergy



3 Likes

kleinmanenergy A great panel underway now on energy security issues related to LNG and cyber security. Featuring two KCEP Fellows: Anna Mikulska (@anna_b_mikulska) and Bill Hederman. #EnergyAtPenn

kleinmanenergy
TU Delft



14 Likes

kleinmanenergy This week, the Kleinman Center was at 2019 DMDU Society Conference at @tudelft. The KCEP team chaired a session titled "Embracing Uncertainty in Regional Energy Planning and Management" #DMDU2019

kleinmanenergy
Philadelphia City Hall



20 Likes

kleinmanenergy Today, KCEP Faculty Director Mark Hughes gave testimony at City Hall about the future of the #PES Refinery site. You can read more about the accident at the refinery and its previous bankruptcy filing on our website.

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15 Likes

kleinmanenergy Hey @UofPenn students! There is still time to apply for a Kleinman Center student grant. Adam Ritter used his Kleinman Center grant to travel to Peru with the @greenprogram. While there he visited hydroelectric facilities and learned about agriculture, irrigation, and energy history. Deadline is Feb 1! More info on the website.

kleinmanenergy
Abu Dhabi, UAE



5 Likes

kleinmanenergy Genie Birch (@Genie_Birch) of @PennIUR and James Mensah (left) presented their work, funded by the Kleinman Center, that looks at the policy challenges and potential solutions to electricity access in settlements in Accra, Ghana. #WUF10

kleinmanenergy
Washington, D.C.



16 Likes

kleinmanenergy Last week, Bill Hederman and Ken Kulak, two KCEP senior fellows, were panelists at the IEEE Power and Energy Society conference on Innovative Smart Grid Transformation (ISGT) in Washington, D.C. @ieeesmartgrid #PESISGT @IEEEorg

PARTING SHOTS



Above: Bill Cohen

Right: Kim Szczurowski



Above: Mollie Simon

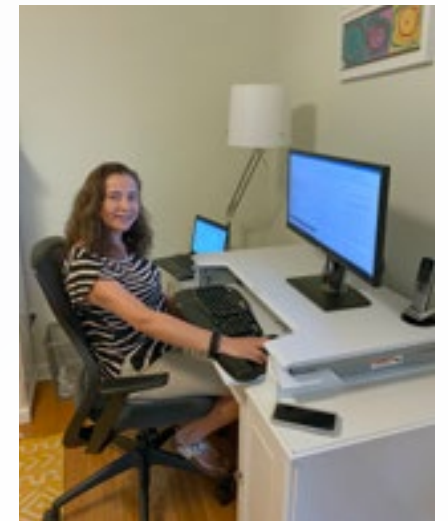


Right: Mark Alan Hughes

Below: Lindsey Samahon



Right: Angela Pachon



Above: Oscar Serpell

Right: Cory Colijn





University of Pennsylvania
Stuart Weitzman School of Design
Fisher Fine Arts Building, Suite 401
220 S. 34th St.
Philadelphia, PA 19104


P 215.898.8502

F 215.573.1650

kleinmanenergy@upenn.edu

kleinmanenergy.upenn.edu

 [@KleinmanEnergy](https://twitter.com/KleinmanEnergy)

 [@KleinmanEnergy](https://www.instagram.com/KleinmanEnergy)

 facebook.com/kleinmanenergy