Poster Abstracts

Theme 1: Economic Risks and Opportunities of Decarbonization

IMAGINED: Intermodal Analytics for Green Infrastructure Network Energy Decarbonization (In-person)

Hiba Baroud[1]*, Hani Mahmassani*[2]*, Craig Philip*[1]*, Paul Johnson*[1]*, Pablo Durango-Cohen*[2]
[1]Vanderbilt University, Nashville, TN
[2]Northwestern University, Evanston, IL
hiba.baroud@vanderbilt.edu

The multimodal freight transportation and logistics system in the U.S. serves as a critical supply chain that links the nation's economy. Among the different modes, trucking dominates freight transportation and contributes the largest share of emissions. To achieve a greener freight transportation system, efforts must focus on improving multimodal freight transportation by streamlining the interaction between freight modes at transloading terminals to enable a larger share of more environmentally friendly modes such as rail and waterways. This work presents an overview of a framework aimed at developing a platform to inform the transition from existing fossil fuels to alternative/renewable energy sources. The platform consists of interrelated modules to support evaluation, selection, and roll out of infrastructure investments across the nation's multimodal freight network encompassing roadways, railways, and waterways, including the facilities and vehicles that connect them and ensure their safe and efficient operations. The research combines network analysis, optimization methods, economic modeling, and risk analysis to evaluate the benefit of making such investments by quantifying the anticipated reduction in emissions and increase in resilience. The anticipated outcome of the research will allow stakeholders to analyze the return on investing in the decarbonization of the freight system and its impact on enhancing the network connectivity and resilience to future climate disasters. Preliminary work focused on developing financial models to evaluate the return on investing in climate resilient infrastructure as well as an optimization model to streamline and decarbonize intermodal facilities that act as transfer points between different freight modes.

Climate Minsky Moments and Endogenous Financial Crises (Virtual)

Matthias Kaldorf[1] *and Matthias Rottner*[1]
[1]Deutsche Bundesbank, Research Centre
Disclaimer: The views expressed in this paper are those of the authors and do not necessarily represent those of the Deutsche Bundesbank or the Eurosystem.
matthias.kaldorf@bundesbank.de

Does the transition to net zero decrease financial stability and, if so, by how much? Since carbon taxes reduce the return on capital and the valuation of assets, ambitious climate policy might render the leverage of the financial system unsustainable. Should the financial system be unable to de-leverage fast enough, depositors might question the solvency of the financial system, which can trigger a system run on the financial system. In this paper, we develop a quantitative macroeconomic model with carbon taxes and endogenous financial crises to study such "Climate Minsky Moments". The model is calibrated to match salient features of financial crises and climate policy. We solve the model using global methods to study the non-linear transition dynamics along a shift towards ambitious climate policy. We show that a shift towards ambitious climate policy substantially elevates the financial crisis probability in the short run. The effect is particularly strong if the carbon tax path is steep or front-loaded. However, the economy experiences financial stability gains in the medium run since permanently lower asset returns prevent the buildup of excessive financial sector leverage. We define the "Excess Crisis Probability" as the average crisis probability induced by a given carbon tax path minus the crisis probability on a business-as-usual path without ambitious climate policy action. Using this measure of financial stability along different transition paths, we find that there is no pronounced trade-off between maintaining financial stability and achieving climate policy objectives – if future financial stability gains are not discounted too much.

Beyond Offsetting: Leveraging the Voluntary Carbon Market as a Catalyst for Sustainable Development in Africa (In-person)

Idowu Kunlere[1] *and Kalim Shah*[1]
[1]Energy and Environmental Policy Program, Joseph R. Biden, Jr. School of Public Policy & Administration, University of Delaware, Delaware, US.
ikunlere@udel.edu

The voluntary carbon offset market (VCM) has traditionally been utilized for emissions reduction. While this and mitigating climate change remain paramount, this paper argues that the VCM has a dual nature and can be harnessed to drive sustainable development. Specifically, this paper explores how the VCM can be leveraged to catalyze improved clean energy access, environmental protection, and economic diversification in Africa. First, using a combination of theoretical analysis and case reviews, this paper describes how the VCM's challenges are linked to its defective market design and inherent limitations when used as a standalone decarbonization tool. These challenges include market transparency, the quality and integrity of offsets, and the uneven distribution of benefits. However, despite these challenges, the VCM presents significant opportunities for enhancing development initiatives. For instance, integrating the VCM with clean energy solutions can improve energy access in remote areas, foster economic growth, and improve quality of life. Second, the paper explores how the VCM can be designed to support sustainable development goals alongside emissions reductions. For example, it proposes a multi-pronged approach that combines market-based mechanisms with direct investments in clean energy infrastructure and technological development in Africa. Lastly, this paper aims to shift the discourse on the VCM by presenting a holistic approach that addresses decarbonization and sustainable development. It highlights the importance of rethinking market mechanisms to ensure they contribute effectively to climate goals while promoting socioeconomic benefits. This approach aligns with the broader macroeconomic landscape and supports a just transition towards a low-carbon future.

Incorporating an Investment Multiplier into DICE Supports Rapid Decarbonization (In-person)

Anders Fremstad[1]*, (submitted by) Mark Paul*[2]*, and* ***Gregor Semieniuk***[3]
[1]Department of Economics, Colorado State University, Fort Collins, CO.
[2]Bloustein School of Planning and Public Policy, Rutgers University, New Brunswick, NJ
[3]Senior Climate Change Economist, World Bank
markvpaul62@gmail.com, gsemieniuk@worldbank.org

Integrated Assessment Models (IAMs) assume that economies operate on the efficiency frontier, resulting in hard tradeoffs between decarbonization, consumption, and non-climate investments. Since climate action is costly, protecting future generations requires austerity today. This paper suggests that this perspective is misguided. We review the (neo)classical economic assumptions underpinning IAMs and incorporate modest Keynesian investment multipliers in DICE that reflect economists' uncertainty about how the economy operates. Our results suggest that decarbonization should be undertaken more rapidly than DICE recommends with optimal policy pathways within the range of 1.5-2°C, as outlined in the Paris Agreement. The addition of an investment multiplier also suggests that rapid decarbonization can lead to economic expansion.

Climate Change, Firms, and Aggregate Productivity (Virtual)

Andrea Caggese[1]*, Andrea Chiavari*[2]*,* ***Sampreet Singh Goraya***[3]*, Carolina Villegas Sanchez*[4]
[1]Universitat Pompeu Fabra
[2]University of Oxford
[3]Stockholm School of Economics
[4]ESADE Business School
sampreet.goraya@hhs.se

This paper employs a general equilibrium framework to analyze how temperature affects firm-level demand, productivity, and input allocative efficiency, informing aggregate productivity damages due to climate change. Using data from Italian firms and detailed climate data, it uncovers a sizeable negative effect of extreme temperature on firm-level productivity and revenue-based marginal product of capital. Based on these estimates, the model generates aggregate productivity losses higher than previously thought, ranging from 0.60 to 6.82 percent depending on the scenario and the extent of adaptation. Additionally, climate change exacerbates Italian regional disparities.

Theme 2: Barriers to Decarbonization and Opportunities

Energy Transitions in Sovereign Native Nations of the American West (In-person)
Tabitha M. Benney[1], *Jordan Giese*[1], *Jenna Murray*[1], *Scott Collingwood*[1], *and Brett Clark*[1]
[1]University of Utah
tabitha.benney@poli-sci.utah.edu

Energy transition in the United States often de-prioritizes the importance of rural and tribal communities, but these communities are critical to securing the energy infrastructure there. Tribal communities, for example, often have conflicting histories and identities that leave a notable legacy of distrust and produce varying capacity and incentive structures that run counter to the surrounding state. This makes both groups prone to energy vulnerability. From a political ecology perspective, the imbalances in power, uneven development, and the rural landscape and the livelihoods it supports, all play a further role in defining identities in the region. Together, these shortcomings present an obstacle for just transition. Understanding these sociological and political perspectives are critical to research on just transition and can enhance modeling and improve model specification. To better understand these complexities, we explore the theoretical underpinnings that explain why energy transitions unfolder uniquely in Tribal Nations. Next, we explore examples of energy transition in rural and tribal communities and then conduct an in-depth case study on energy transition in Wind River (WY). Based on this exploration, we offer some suggestions on the complexity of this policy arena and suggest how national and international energy transition policy will need to adapt to include the needs of these unique communities. Without doing so, current energy governance may leave key players behind, creating serious health and wellness impacts locally, and exposing the surrounding state to long term grid resilience and vulnerability issues.

Unique Data on Decarbonization Strategies in the 2023 Annual Business Survey (In-person)
Audrey E. Kindlon[1] *and Timothy R. Wojan*[1]
[1]National Science Foundation
akindlon@nsf.gov

Studying the socio-technical transition from a fossil fuel economy to a renewable energy economy needed to avert an increase in global temperatures of more the 2 C will require detailed data on the plans, strategies, and investments of businesses to decarbonize. These data have been lacking to date. This poster will provide an overview of the 2023 Annual Business Survey Climate and Sustainability Module that collected this type of information from a sample of 850,000 nonfarm employer businesses in the U.S. Questions that can be investigated include why businesses are pursuing decarbonization strategies absent a price on carbon; the ambition, time frame, and approaches used to decarbonize; and the regional characteristics associated with facilitating or hindering the socio-technical transition. The ability to link these data to the Manufacturing Energy Consumption Survey collected for the same reference year will allow establishing a baseline of carbon performance for industrial emissions along with preliminary analysis of the business and local characteristics associated with better carbon performance. These data should be available for analysis in the Federal Statistical Research Data Center system by early 2025. Information on the Standard Application Process required to gain access to these confidential data is also provided.

Geography versus Income: The Heterogeneous Effects of Carbon Taxation (Virtual)
Charles Labrousse[1,2] *and Yann Perdereau*[2]
[1]Insee
[2]Paris School of Economics
charleslabrousse@gmail.com

Distributive effects of carbon taxation are key for its political acceptability. We introduce geographical heterogeneity into a calibrated dynamic general equilibrium heterogeneous-agent model, where energy is both a consumption good and an intermediate input. We evaluate the aggregate and distributive effects of carbon taxation and obtain three key results. First, the distributive effects of carbon taxation are driven by geography more than income, with rural households suffering larger welfare losses. Second, taxing households' direct emissions is regressive, while taxing firms' direct emissions is progressive. Third, we simulate various revenue-recycling policies using targeted transfers. We find that it is possible to reduce emissions and mitigate welfare losses associated with the green transition.

Carbon Emissions and the Transmission of Monetary Policy (Virtual)
***Jose Nicolas Rosas*[1]**
[1]Universitat Pompeu Fabra
josenicolas.rosas@upf.edu

This paper studies the dynamic causal effects of monetary policy on carbon emissions in the U.S. Using high-frequency changes in interest rates around FOMC announcements (i.e. monetary policy surprises), I identify a structural monetary policy shock. A subsequence assessment of the effects of these shocks reveals that, in contrast to the consensus view, a contractionary monetary policy shock is associated with a *rise* in carbon emissions: while emissions of the industrial sector fall (as expected), non-industrial sectors' emissions rise significantly by 1.51pp in the short run. A detailed exploration reveals that the channels of monetary policy transmission vary in strength and relevance across sectors and help explain these heterogeneous responses: while the conventional *aggregate demand* channel appears to play a central role in the response of emissions from the industrial sector, the evidence points at a more relevant role of the *commodity price* channel of monetary policy for the transmission of shocks to the non-industrial sectors.

Information about Climate Transition Risk and Bank Lending (Virtual)
***Bhavyaa Sharma*[1]**
[1]University of California, Santa Cruz
bsharma5@ucsc.edu

Is there any evidence for climate transition risks being priced in syndicated corporate loans? Empirical evidence shows a role for bank specialization in pricing climate transition risk. However, this role varies across geographies and regulatory and technological aspects of climate transition risk (measured using firm-level GHG emissions and forward-looking exposure to climate regulations and green technologies). Moreover, bank specialization does not necessarily translate into higher lending rates for negatively exposed firms after an oil supply news shock. I explain the role of bank specialization as a source of heterogeneity in costs of private information acquisition through a theoretical model of costly screening in a competitive bank lending structure. I allow for non-Bayesian belief updates by the banks about the borrowers' exposure to transition risk. Optimal private information acquisition steeply increases when banks under-react more in response to public information. Conditional on the signals from screening, the expected interest rates in the equilibrium are higher for borrowers for whom the public signal points towards greater exposure to transition risk. However, the interest rate differential between more and less exposed borrowers is smaller when banks under-react more to public information. This effect becomes stronger as the average borrower quality decreases, and even lower levels of under-reaction can result in the interest rate differential declining sharply in favor of more exposed borrowers. These results imply that even with high-quality public information and communication about decarbonization, lowering the cost of acquiring information about firms' climate change exposures through standardized firm-level disclosures and comprehensive climate-stress testing guidelines for banks is important for reducing financing costs for greener firms.

Theme 3: Incorporating Modeling Insights into Policy Design

MATE-AR: Model for the Analysis of Energy Transformations in the Argentinean Residential Sector. A Key Tool for Energy Policy Design (Virtual)
***Pedro Chévez*[1,2]**
[1]Instituto de Investigaciones y Políticas del Ambiente Construido. Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)
[2]Universidad Nacional de La Plata (UNLP)
che.pedro@hotmail.com

Due to the conditions of inequality among Argentine households, in recent years energy policies have been implemented that incorporate segmented tariff structures and targeted subsidy systems, considering the diverse realities of the population. Within this framework, the development of diagnostic methodologies becomes crucial to identify the specific energy characteristics of the different sectors of the population, providing data and arguments that can support decision making. In this line, this poster presents the main results of the MATE-AR (Model for the Analysis of Energy Transformations in the Argentinean Residential Sector). These results are unprecedented for the country, since this is the

first time that the residential energy consumption in Argentina is organized by province, income level (quintiles), sources and end-uses. Also, a set of key performance indicators that allow periodic comparisons for the future evaluation of their trajectories are presented. This set of results are useful to design energy policies for the residential sector. The developed methodology is based on the micro-dataset of the National Household Expenditure Survey 2017/2018, which has 21 547 households surveyed throughout the 24 jurisdictions of the country. For this purpose, the called "energy block" questionnaire is mainly used, which includes a survey of more than one million household appliances with their respective usage habits. In this instance, the necessary equations were established to obtain the energy used by each of the declared equipment within each dwelling and, thus, reconstruct the energy consumption of each of the energy vectors used by the Argentinean residential sector.

US Electric Grid Decarbonization Pathways under Market and Policy Uncertainties (In-person)
Vladimir Dvorkin[1]*, Audun Botterud*[2]*, and Dharik Mallapragada*[3]
[1]University of Michigan, Ann Arbor, MI, USA
[2]Massachusetts Institute of Technology, Cambridge, MA, USA
[3]New York University, New York, NY, USA
dvorkin@umich.edu

This work addresses the impact of market and policy uncertainties on investment decision-making within the US electricity grid's decarbonization efforts. The current reliance on deterministic models for guiding investments into the electricity sector does not adequately account for variable renewable investment costs, electricity demands, and policy uncertainties. As a result, the planned deterministic investment trajectories may fall short in satisfying the 2035 net-zero target set for the electric power grid in the US in a feasible and economically efficient way. To overcome the limitations of deterministic planning, this work develops optimization-based tools that produce decarbonization pathways (e.g., investments in renewable power and energy storage systems) that are informed by many representative scenarios of market and policy uncertainty and provide formal guarantees to satisfy the decarbonization target with prescribed probability requirements. For example, it is possible to internalize the tolerance for CO_2 emission constraint violation in 2035 to produce decarbonization trajectories with different trade-offs between the investment cost and the degree of carbon policy constraint satisfaction. Moreover, a policymaker can specify the degree of stochasticity of decarbonization pathways and sample investment trajectories with varying degrees of randomness, with more certain trajectories typically featuring a higher investment cost. Our case study based on the U.S. Southeast power system quantifies the trade-offs between the cost and stochasticity of decarbonization pathways, the cost of 100% satisfaction of decarbonization targets, and how they can be reduced by marginal relaxation of carbon constraint satisfaction requirements.

Strategic Interventions for Urban Carbon Reduction: A Bottom-Up Archetype Approach for Sustainable Cities (Virtual)
Siavash Ghorbany[1] *and Ming Hu*[1]
[1]University of Notre Dame, Notre Dame, IN 46556
sghorban@nd.edu

The construction industry accounts for approximately 40% of global greenhouse gas emissions, making it a critical sector for addressing carbon emissions. Urban areas are particularly significant contributors. However, tackling this issue has been challenging due to a lack of comprehensive data and methodologies for assessing the building sector's impact on such a large scale. This study aims to develop a methodology for collecting data and simulating embodied carbon emissions across the entire lifecycle of buildings at an urban scale. It demonstrates the effects of various scenarios on embodied carbon emissions, including changes in building lifespans, renovation and replacement strategies, area per building, and new construction volumes. Using a bottom-up archetype approach, the study models cities and evaluates the impact of six mitigation strategies on urban-scale carbon emissions. Additionally, it develops standalone software to simulate, assess, and predict the embodied carbon emission in these scenarios and their economic impacts at the national level in the United States. As a pilot, this approach was applied to Chicago, demonstrating potential reductions in embodied carbon emissions by 65 to 80 percent through strategic interventions. The findings underscore the profound influence of urban planning decisions on city decarbonization and offer valuable software for policymakers and researchers aiming to evaluate and implement effective carbon reduction strategies across American cities.

Modeling the Impacts of Policy Sequencing on Energy Decarbonization (In-person)
Huilin Luo[1,2], *Wei Peng*[2]*, *Allen Fawcett*[3], *Jessica Green*[4], *Gokul Iyer*[3], *Jonas Meckling*[5], *David Victor*[6]
[1]Department of Civil and Environmental Engineering, Pennsylvania State University, University Park, PA, USA
[2]School of Public and International Affairs and Andlinger Center for Energy and the Environment, Princeton University, Princeton, NJ, USA
[3]Joint Global Change Research Institute, Pacific Northwest National Laboratory, College Park, MD, USA
[4]Department of Political Science, School of the Environment, University of Toronto, Toronto, Canada
[5]Department of Environmental Science, Policy and Management, University of California, Berkeley, CA, USA
[6]School of Global Policy and Strategy, University of California San Diego, La Jolla, CA, USA
hxl5625@psu.edu
*weipeng@princeton.edu

Many countries have embraced a climate policy strategy that starts with large subsidies to clean energy (“carrots”) and later introduces more punitive policies (“sticks”). This policy sequence has proven to be more politically feasible than the reverse, but little is known about its ability to drive energy decarbonization and deliver long-term mitigation goals. Using a state-level energy system model for the United States (GCAM-USA), we represent this policy sequence and evaluate its impacts on the energy system and the future level of efforts needed for sticks. We identify three mechanisms for the carrot first approach to lower future stick level: reducing emissions early on, driving down technology cost, and accelerating the shift to sticks. The implementation of carrots also results in uneven distributional effects across technologies (e.g., supply vs. demand side) and sectors (e.g., fossil-based vs. low-carbon). Our results thus suggest an important role for integrating political economy research with energy system modeling to better understand the drivers, impacts, and timing of policy choices.

Health and Environmental Outcomes of US Policies Related to Carbon Capture in the Power System (Virtual)
Paola Furlanetto[1], *Michael Ash*[1], *Erin Baker*[1], *Bridget Diana*[1], *Tim Donaghy*[2], *and Golbon Zakeri*[1]
[1]University of Massachusetts Amherst, Amherst, USA
[2]Greenpeace USA, Research Manager, Oakland, CA
ppimentelfur@umass.edu

Recently proposed rules, including the 45Q Tax Credit and EPA Rule 111, are designed to encourage the adoption of carbon capture in the power system. We evaluate how these rules will impact the emissions of co-pollutants in a networked electricity system. We evaluate combinations of these two rules and the EPA Good Neighbor, under a range of plausible technical and economic scenarios, the pace of renewable deployment, and the structure of the power grid. We employ a Power Flow model of a three-node, mixed-source network in which fossil fuel power plants may invest in CC via retrofit. Co-pollutants (non-GHG emissions from fossil fuel generators, like NOx, SOx, PM25 and NH3) are harmful for those directly exposed; and may have particular consequences for low-income and marginalized populations who are often disproportionately represented near polluting power plants. We report on the extent of CC adoption, the energy source mix, the airborne emissions (CO2 and co-pollutants), and the distribution of monetized damages across population types. We find that the CC tax credit can generate perverse incentives to increase fossil fuel generation while stalling the expansion of renewables, and the results are worse when combined with EPA Rule 111. We also observed scenarios with an increase in co-emissions and damages to public health; these, however, can be ameliorated by imposing strict limits on co-pollutants. Our work shows that CC policy design must carefully consider environmental and societal impacts and look beyond GHG reductions.

Deep Decarbonization Targets are Shallower than they Appear (In-person)
Amir Sharafi[1,2], *Alyssa Pfadt-Trilling*[1], *Sam Markolf*[1], *Marie-Odile Fortier*[2]
[1]University of California, Merced
[2]University of Nevada, Las Vegas
amir.sharafi@unlv.edu

Regional decarbonization or climate action plans in the US generally do not employ life cycle assessment (LCA) in their development. At most, they rely instead on average carbon footprints of electricity generated by renewable energy systems instead of detailed geospatial carbon footprint data. Still, many simply assume that most renewable energy systems equate to “zero emissions.” California uses the latter approach in its decarbonization plan, the 2022 Scoping Plan for Achieving Carbon Neutrality. However, our analysis of California’s prospective electricity sector changes through 2045

highlights the risks of omitting life cycle greenhouse gas (GHG) emissions and their geographic variability in decarbonization planning. The total GHG emissions of the proposed power sector in California through 2045 were calculated to be 54.1% higher than reported by the state's Scoping Plan, even when designed to minimize the overall carbon footprint while meeting the same capacities by energy source. The lack of life cycle accounting in decarbonization planning risks setting and aiming for a target that does not genuinely lead to its emissions reduction goal. The massive associated infrastructure shift and its macroeconomic consequences may then be insufficient to prevent catastrophic climate change. To avoid such shallow decarbonization outcomes, we use our California analysis to present methodology to overcome complications in conducting geospatial LCA for decarbonization planning. System siting decisions, future climate conditions, and technological choices can be modeled and assessed using open-source approaches and datasets to minimize the life cycle GHG emissions of future energy systems. Effective decarbonization policies require life cycle accounting.

Theme 4: Global Interactions

A Global and Inclusive Just Labor Transition: Challenges and Opportunities in Developing and Developed Countries (In-person)

*Brigitte Castañeda[1], **Luis Fernández Intriago[2]**, Raphael J. Heffron[3], and Minwoo Hyun[4]*
[1]Universidad de Los Andes, Colombia
[2]Environmental Defense Fund
[3]Universite de Pau et des Pays de l'Adour, France
[4]University of California, Santa Barbara
lfernandezintriago@edf.org

This research identifies challenges and opportunities for achieving an inclusive just transition (JT) to a low-carbon economy, focusing on promoting an equitable workforce while advancing a sustainable economy in developed and developing countries. We conduct a two-stage comparative analysis of JT labor-oriented policies between developed and developing countries. We draw lessons from some developed countries that have implemented national and local initiatives to revitalize resource-rich communities that have experienced a downturn in the energy sector. We argue that these countries face common challenges in achieving a JT by ensuring "quality" jobs, compensating for displaced workers, and determining the appropriate extent of governmental interventions. In assessing developing countries, we recognize the heterogeneity among these countries, so we focus on a sample from the global south that allows us to characterize the labor market within the transitioning sectors, thereby identifying both challenges and potential avenues for creating new employment opportunities, facilitating skill retraining, and ensuring the integration of communities. Many of these countries are in the initial phases of a just energy transition, and notably, within the developing countries, we also explore the nascent just energy transition partnership efforts. Also, we advance opportunities and lessons drawn from advanced economies' experiences and the recent efforts of developing countries that could help achieve a global and inclusive JT. These findings demonstrate some key steps many countries can take towards beginning and achieving their JT journey. Finally, we present a tool to measure progress towards JT, our JT Progress Scale, and apply the scale to the previously analyzed countries.

Decarbonizing Transport: Ensuring a Sustainable and Ethical EV Supply Chain between the US and Africa (In-person)

National Academies of Sciences, Engineering, and Medicine *(submitted and presented by **Moses Ogutu**, Associate Program Officer)[1]*
[1]National Academies of Sciences, Engineering, and Medicine, Washington, DC

The global shift towards electric vehicles (EV) is crucial for decarbonizing transport, as the sector contributes about one-quarter of global greenhouse gas emissions. However, this transition also carries substantial risks. For example, unethical practices in the supply chain, such as child labor, poor working conditions, and environmental degradation, particularly in the mining of key EV components like lithium, cobalt, and nickel, can undermine the equity and sustainability of the decarbonization process. This poster will present the findings of a recent study on the Decarbonisation of Transport in Africa, which assessed the current status and reviewed crosscutting issues such as policy, institutional and technical capacity, technologies, financing, and social, legal, and regulatory frameworks essential for facilitating the transition to

net-zero transport in Africa. Within the theme of global interactions and other cross-cutting issues, the presentation will underscore that decarbonizing the US economy should be centered on an equitable and sustainable supply chain for products essential to the transition, such as sourcing critical minerals. Discussions will explore how collaborative policies between the US and African nations can accelerate EV adoption while ensuring ethical and sustainable practices in the mining of key EV components. Macroeconomically, addressing these social equity issues is crucial, as failure to do so might result in future expenses, such as providing refuge to climate migrants or increasing development aid to support affected communities. Additionally, the presentation will explore how these relationships can drive economic growth and development in African countries while supporting the US's transition to a low-carbon economy.

Other Cross-cutting Themes

Energy Consumption and Inequality in the U.S.: Who are the Energy Vulnerable? (In-person)
Octavio M. Aguilar[1] *and Cristina Fuentes-Albero*[1]
[1]Board of Governors of the Federal Reserve System, Washington, DC, USA
octavio.m.aguilar@frb.gov

This paper documents the empirical regularities of within-home and overall—including energy for transport—energy consumption in the U.S. using the PSID survey over the 1999-2021 period. For the U.S., we propose redefining standard indicators measuring energy vulnerability by using overall energy expenditures instead of just within-home energy consumption. We show that, depending on the definition of energy consumption and on the indicator, between 10% and 28% of U.S. households are energy vulnerable. Using our preferred measure, 18% of households are energy vulnerable, and 94% of these households have incomes below the median, with their median income being 59% lower than that of non-energy-vulnerable households. In addition, we estimate the marginal propensity to consume (MPC) for households in our sample and conclude that energy-vulnerable households have substantially larger overall MPCs and energy MPCs compared to non-energy-vulnerable ones. This suggests that fiscal interventions affecting energy prices would have significant distributional effects.

The Distributional Effects of Carbon Pricing and the Implications for Vulnerable Households in Taiwan (Virtual)
Daigee Shaw[1], ***Yu-Hsuan Fu***[1], *Yu-Ting Hsu*[2], *Wen-Hsiu Huang*[3], *and Shih-Mo Lin*[4]
[1]Institute of Economics, Academia Sinica, Taiwan
[2]Department of Economics, National Chengchi University, Taiwan
[3]Department of Public Finance, Feng Chia University, Taiwan
[4]PhD program in Business, Chung Yuan Christian University, Taiwan
bopoznjuz@gmail.com

Carbon pricing is indispensable to meeting the 2050 net-zero target. A key challenge is achieving an equitable transition across the economy and society while reducing emissions. Many studies have analyzed the distributional effects of carbon pricing and how revenue recycling can help reduce inequality. However, most studies focus only on the short-term distributional effects on income groups, revealing that carbon pricing without revenue recycling would be regressive. However, other characteristics of households, such as family types, having elders, genders, occupations, educational attainments, and areas, may also be essential factors of distributional effects. This study examines the distributional effects of carbon pricing in Taiwan when considering household characteristics. We apply the E3ME-FTT model (a global, macro-econometric model) and develop a methodology to use the rich data of the Taiwan Family Income and Expenditure Survey to assess the distributional effects of different carbon pricing scenarios in the short and long term. Based on the results, we further illustrate how to achieve equitable distributions with revenue recycling. The results show that lower-income households have a higher ratio of carbon pricing burden on income. Second, regarding the characteristics of households, we find that households with elders, low educational attainments, unemployment, or farm households could be more vulnerable to carbon pricing. Last, with revenue recycling, the results suggest that Taiwan can achieve win-win solutions in terms of economic growth and equitable society while reducing emissions effectively.

Equity in Transition: Analyzing the Distributional Effects of Low-Carbon Technology Subsidies (In-person)

Yagmur Menzilcioglu[1]
[1]Georgetown University, Washington, DC, USA
ym406@georgetown.edu

One concern about low-carbon technology subsidies is that they tend to benefit high-income households more. For example, the top income quintile in the United States is receiving almost 70% of investment tax credits for residential energy efficiency improvements. These subsidies can be regressive and may exacerbate income inequality. At the same time, if we consider the environmental and learning-by-doing external economy effects, they may not be as regressive. This paper quantifies the overall distributional effects of low-carbon technology subsidies by developing a heterogeneous agent dynamic stochastic general equilibrium (DSGE) model with climate change and costly clean energy technology adoption. Since wealthy households account for the lion's share of aggregate residential emissions, speeding up their transition to low-carbon technologies will yield the most environmental damage prevention benefits. Moreover, when positive spillovers through learning-by-doing are considered, subsidizing early adopters could reduce the high adoption costs faster to make adoption feasible for more income groups. We compute the transition path from the high-carbon energy-fueled steady-state to a terminal steady-state fully fueled by the low-carbon technology and evaluate the heterogeneous welfare effects of introducing the subsidy across the joint income and wealth distribution. By calibrating the model to reflect the U.S. economy, we quantify the equity and efficiency of the recent energy transition policies, such as tax credits implemented under the Inflation Reduction Act. Finally, we conduct counterfactual policy experiments to evaluate the relative regressivity of alternative climate policies.