Autumn 2018

MIT CEEPR Newsletter

MIT Center for Energy and Environmental Policy Research

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MIT CEEPR

MIT Center for Energy and Environmental Policy Research

Two years after the U.S. federal elections heralded a far-reaching shift in the direction of national energy policy, it has become clear that deregulation and regulatory change cannot reverse the fundamental trends which are disrupting the energy sector. Investment trends, both domestically and abroad, continue to favor alternative energy sources and related infrastructure. Natural gas likewise remains strong. And while the age of coal is far from over, most scenarios see its use gradually decline over coming decades. Much attention has understandably focused on the drivers, barriers, and expected pace and scale of energy transition, an interest that also underlies several MIT CEEPR Working Papers published during the last six months. What tends to receive less attention are the social and distributional impacts on consumers and the broader public. And yet, we know that even where aggregate welfare effects of a transition may be positive, the costs will be distributed unevenly, and some communities will be net losers. Everywhere energy transitions are underway, decision makers are looking to better understand how different constituencies will be affected over time, and face pressure to offer a pathway forward to those whose traditional livelihoods and business models are under threat. Research at MIT CEEPR has traditionally addressed such questions, and continues to do so now: one CEEPR Working Paper featured in this newsletter assesses the role of market power when incumbent electricity generators exit a declining market as renewable technologies expand. Another reflects on the importance of fairness and equity when designing tariffs for distributed energy resources. A third Working Paper looks at acceptance issues with rising rents resulting from energy efficiency improvements by landlords. As the scope of transformation continues to expand, such issues will only gain in importance, and MIT CEEPR researchers will continue to deploy robust empirical and data-driven methods for their analysis.

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Who Closes First? Ownership and Collusive Early Exits in the Transition to Clean Energy

by: Matti Liski and Iivo Vehviläinen

Climate and energy policies lead to a declining market for the incumbent technologies in electricity markets. Facing the challenge of closures, incumbent firms have incentives to coordinate closures through cross-ownership to achieve a collusive phase-out. For the Nordic nuclear industry, a quantification shows a highly distorted phase-out, both for the consumer surplus and the environment.

Exit from a declining market is among the prime economic illustrations of a war of attrition. Exit by one firm increases the profits of the remaining firms, so all firms have incentives to free-ride on the other firms' exit decisions and thereby delay their own exit. This working paper[1] makes a simple but yet unnoticed observation: cross-ownership arrangements can eliminate the free-riding incentives and, effectively, achieve collusive exit decisions from the market.

The observation is relevant in the electricity sector. Climate and energy policies give rise to a rapidly growing market for renewable energy technologies, putting the demand remaining for old technologies on a downward trend and forcing incumbents to adjust their capacity utilization and, ultimately, exit the market. However, renewable energy expansion has led to adverse impacts, not just for the intended targets of the policies, but for all incumbent technologies. Such impacts can follow from flaws in policy design, but they can follow from voluntary choices as well. When there are a few large players in the market, there is no reason for them to take the policy-driven decline in their residual demand as given: Through early closures, the industry can influence the demand left for remaining capacity, thereby implementing a noncompetitive capacity phase-out. The possibility of market power in the capacity phase-out has gone largely unnoticed in the literature on energy transition.

To provide an illustrative quantification, we look at the dynamic exit decisions of the nuclear power plants in the Nordic electricity market, where the demand for nuclear power generation is declining due to increased wind power generation, which has grown to around 10% of the supply in 2017. Wind power reduces market prices as it replaces higher marginal cost thermal units. In contrast, nuclear power closures can offset the price decline and, temporarily, even increase the price level. The exit distortions that we illustrate in the Nordic nuclear industry seem relevant more generally. In the U.S., several plants have been closed and yet more may soon be decommissioned, although the reason is often different: it is the low cost of gas generation that is creating the downward pressure.

There is an intricate structure of cross-ownership between the main players in the Nordic nuclear industry (see figure 1). We compute the exit game outcomes for the existing ownership structure and for several counterfactual situations. The annual cost of procuring wholesale electricity from this market for the consumers will be ca. 13 billion euros per year in the coming decade. Removing the cross-ownership entirely forces the nuclear units to play a war of attrition game where almost all units remain running, which reduces the annual procurement cost to 8 billion euros. We find that the inefficient phase-out increases annual emissions by 37 $MtCO_2$, corresponding to roughly 40% of the current industrial emissions in the Nordic region.

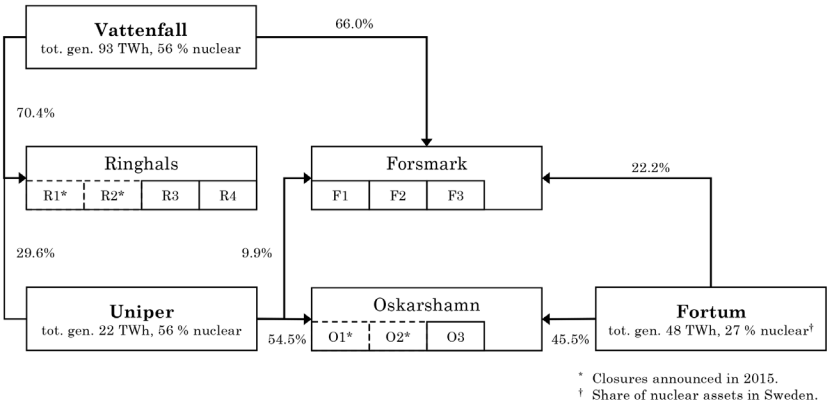
This quantification is just an illustration

Matti Liski

Iivo Vehviläinen

– it is not an empirical assessment – but the quantitative importance of the theory observation seems robust. Understanding why the industry is currently undergoing a period of activity in rearranging ownership should be of importance to the competition and environmental policy authorities. The results add the exit distortion to the complex short-term distortions caused by renewable energy policies. The findings also point out the need to pay attention to market power in the transition towards clean energy in deregulated electricity markets.

It is important to interpret the precise quantitative results with caution but we still believe the analysis delivers a strong policy conclusion. First, cross-ownership should be dissolved, or closures should be regulated. Second, once the incentives for early closures are removed, there is a case for running some units even when they run a deficit:



Notes: Ownership structure of the Swedish nuclear units R1–R4 in Ringhals, F1–F3 in Forsmark, and O1–O3 in Oskarshamn. The main owners are Vattenfall, Uniper and Fortum.

Figure 1. Cross-ownership of Swedish nuclear assets.

The consumer surplus covers the losses.

In general, our results contribute to the literature addressing the question "Why do firms have an interest in each others' equity?" This working paper submits exit dynamics as a potential explanation, and also illustrates the potential quantitative meaning of the mechanism.

[1] Matti Liski and Iivo Vehviläinen (2018), "Ownership and Collusive Exit: Theory and a Case of Nuclear Phase-out" *CEEPR WP-2018-010*, MIT, July 2018.

Fair, Equitable, and Efficient Tariffs in the Presence of Distributed Energy Resources

by: Scott P. Burger, Ian Schneider, Audun Botterud, Ignacio Pérez-Arriaga

Utilities, regulators, and academics no longer debate whether or not distributed energy resources (DERs) will reshape the power sector; they now debate what form this transformation will take and when it will take place. At the center of the new vision for the power sector is the consumer. DERs give consumers new options for sourcing and managing their electricity, while offering utilities and service providers new means to provide better services to their customers. This trend could deliver significant benefits to electricity consumers by lowering costs, increasing reliability, lowering emissions, and enhancing customer choice. However, if integrated poorly, DERs could increase power system costs and emissions.

Regulators, policy makers, consumer advocates, and utilities seek to ensure that DER integration increases - rather than decreases - the social net benefits of the power system. While many regulatory and market changes will be required to efficiently integrate DERs, changes to tariff design are one of the primary tools for increasing the benefits of customer engagement and DER adoption. The New York Department of Public Service concluded that value-driven DER adoption requires "more precise price signals for these new products and services that will, over time, convey increasingly granular system value further enabling increasingly accurate compensation and driving informed and therefore effective investment decisions." New York is not alone. In 2017, regulators in 45 of 50 U.S. states and the District of Columbia opened dockets related to tariff design or made changes to tariff design to better enable socially beneficial DER integration. Similarly, in November 2016, the European Commission issued a sweeping set of rulings designed to put consumers at the center of the European power system; tariff design was central to the new rulings.

Of course, economics is not the only consideration in tariff design. In order for regulators to adopt more efficient tariff designs, these tariffs must be socially and politically acceptable. The perception of the fairness and equity of a tariff are critical aspects of whether or not the tariff will be accepted, and fairness considerations have historically been critical components of regulatory decision making. For example, both the

The authors delineate various aspects of equity and fairness that regulators must grapple with when designing electricity tariffs. Their research shows that more economically efficient tariffs can improve several aspects of equity and argues that DER adoption under existing tariff schemes may increase inequities already present in the power system.

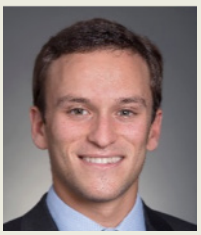
Massachusetts Department of Public Utilities (DPU) and the New York Department of Public Service list fairness as a core principle for tariff design, and the Massachusetts DPU recently cited fairness in a recent ruling denying a utility's petition for an increase in fixed charges. Similarly, the Nevada Public Utilities Commission recently overturned a previously approved increase in fixed charges, citing, fairness considerations. These anecdotes are supported by the fact that equity is central to commonly cited tariff design principles.

This paper[1] builds on existing literature to examine the issue of whether or not efficient tariffs are fair and equitable. While many scholars have considered the economic and emissions implications of efficient tariffs and their relationship to DER adoption, comparatively few have examined fairness and equity considerations. This paper aims to fill this gap, with a special focus on the equity and fairness of efficient and inefficient tariffs in the presence of DERs.

This paper provides a clear definition of several key equity and fairness considerations in the context of electricity rate design and proposes distinct mechanisms for improving each consideration. Different groups and individuals often have different views of what is fair and equitable, and these views are sometimes grouped together or blurred in discussions regarding fairness and equity. The clear delineations we describe enable a better understanding of how efficient tariffs will impact different aspects of equity and fairness. This paper uses illustrative examples to highlight how properly designed, efficient tariffs can improve equity and fairness along many dimensions in the presence of DER adoption. Moving to more efficient tariff designs is critical to ensuring that customer choice and the resulting customer stratification benefit society as a whole, rather than a single customer or set of customers at the expense of others. As this paper highlights, in many cases, tariffs can be made more efficient without compromising equity and fairness.

[1] Scott P. Burger, Ian Schneider, Audun Botterud, and Ignacio Pérez-Arriaga (2018), "Fair, Equitable, and Efficient Tariffs in the Presence of Distributed Energy Resources." *CEEPR WP-2018-012*, MIT, August 2018.

Scott P. Burger



Ian Schneider

Audun Botterud

I. Pérez-Arriaga

Energy Efficiency, Information, and the Acceptability of Rent Increases: A Multiple Price List Experiment

by: Ghislaine Lang and Bruno Lanz

This paper provides novel empirical evidence on the role of imperfect information and attentional biases in the context of energy efficiency investments in rented properties. The authors employ a multiple price list experiment that quantifies how alternative informational interventions affect tenants' acceptance of rent increases in exchange for improved energy efficiency of their heating appliance.

Despite positive private and social returns expected from energy efficiency investments, the adoption of energy efficient technologies is slow, and considerable resources are being directed to policies stimulating take-up (e.g. Allcott and Greenstone, 2012; Gillingham and Palmer, 2014). Rented properties represent a particularly challenging case, since higher up-front investment costs associated with energy efficiency are borne by property owners, whereas tenants benefit from lower energy bills. The associated landlord-tenant split incentives constitute a major barrier to the improvement of energy efficiency in the stock of residential buildings (Gillingham et al., 2012; Davis, 2012).

Generating a positive return on energy efficiency investments requires the ability to increase rents. However, landlords may have difficulties to signal the value of future energy savings to tenants, leading to information asymmetries as documented in Myers (2018). In this paper[1], we provide experimentally controlled evidence on the role of information provision in a landlord-tenant split incentive context. We study a situation in which the landlord needs to replace the central heating appliance, and can either install a standard option (efficiency label B, Council of European Union, 2013) or a more energy efficient one (labeled A+). Holding the level of comfort fixed across alternatives, we design a multiple price list (MPL) experiment (Andersen et al., 2006; Anderson et al., 2007) in which we systematically vary rent increases associated with the more efficient option.

After a baseline MPL task, we quantify the impact of alternative informational interventions on tenants' valuation of improved energy efficiency. To do so, we follow Newell and Siikamäki (2014) and Allcott and Taubinsky (2015) and randomly assign subjects to alternative treatments providing information about financial implications of their choices, where each treatment combines two sequential information screens. We then employ a second MPL task to measure how within-subject information disclosure affects the acceptability of rent increases. Furthermore, a between-subject comparison provides forensic evidence across information conditions based on illustrative figures derived from the Swiss policy context, focusing on financial savings, energy bills variability, and CO_2 tax payments.

Our experiment is administered to an online panel of 406 Swiss tenants. We find that average willingness to pay (WTP) for efficiency label A+ relative to B is CHF 37.51 per month (about CHF 450 or USD 470 per year), roughly 3% of median rents in Switzerland. However, after providing specific financial information about expected energy savings associated with the more efficient option (namely CHF 40 per month), the endline average WTP estimate is CHF 64.87 per month (about CHF 780 or USD 810 per year). Informing tenants about CHF 1 in expected energy savings thus translates to an acceptable rent increase of CHF 1.62. Our results suggest further that adding information about past variability in energy bills dampens the impact of financial

information, whereas information about CO_2 tax payments has no incremental impact on tenants' WTP.

We also find significant heterogeneity across respondents, and quantify how the average treatment effect is driven by changes along the entire WTP distribution. Specifically, we document that around 30% of tenants adjust their WTP to bunch around the level of financial savings provided in our informational intervention. Around 20% of tenants oppose rent increase and do not respond to information, whereas tenants' valuation in the upper tail of the distribution exceeds financial savings, presumably on account of pro-environmental motives. Given the lack of impact of CO_2 tax information on WTP, our results contribute to a growing literature on consumers' perception of externality-correcting taxes (Houde and Aldy, 2017; Lanz et al., 2018).

Taken together, our results suggest that tenants are willing to support part of the additional investment cost through higher rents, and highlight the importance of providing realistic ex-ante estimates of financial savings associated with energy efficiency investments (see e.g. Fowlie et al., 2017). Moreover, interventions by a third party could be instrumental in reaching ex-ante agreements, so as to share the financial risk across multiple parties (Sorrell, 2007). Facilitating coordination between landlords and tenants, for instance by providing standardized pre-renovation contracts, could reduce transaction costs and therefore increase the rate of energy efficiency investments in rented properties.

[1]Ghislaine Lang and Bruno Lanz (2018), "Energy Efficiency, Information, and the Acceptability of Rent Increases: A Multiple Price List Experiment with Tenants" *CEEPR WP-2018-014*, MIT, September 2018.

Ghislaine Lang

Bruno Lanz

Dynamic Competition and Arbitrage in Electricity Markets: The Role of Financial Players

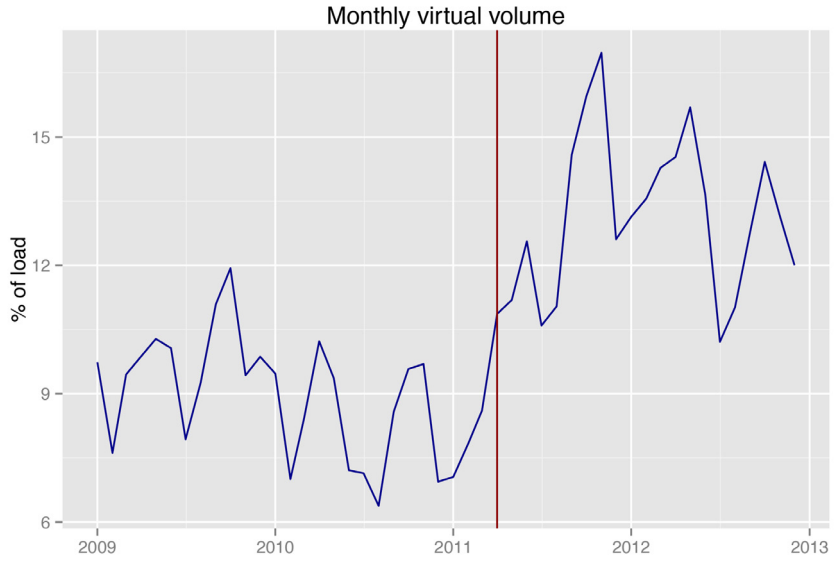
by: Ignacia Mercadal

Financial speculators have a controversial role in commodity markets. Though they are expected to bring benefits like higher liquidity and informational efficiency, they are often accused of increasing prices and manipulating markets. This paper[1] studies the role of financial traders in electricity markets, where they effectively compete with physical producers and restrict their market power. Using data on MISO, the wholesale electricity market of the American Midwest, I show that financial players can lead to lower prices and increase consumer welfare.

This paper shows that financial traders can increase competitiveness and lead to lower consumer prices by effectively competing with generators and restricting their market power.

In wholesale electricity markets, financial players trade alongside physical buyers and sellers of energy, which is possible because these markets are organized as sequential markets. There is first a forward market that schedules production a day in advance, and then a spot market to adjust unexpected shocks right before operation. Financial traders buy (sell) in the forward market and then their transaction is reversed in the spot market, as if they would sell (buy) the same amount. Therefore, their profits depend on the difference between the forward and the spot prices.

A forward premium, i.e. a higher price in the forward market, has been documented in several markets around the world. This forward premium comes from generators' market power, i.e. their ability to affect prices by changing the quantities they offer (Ito and Reguant, 2016). When producers have market power, they have incentives to sell less

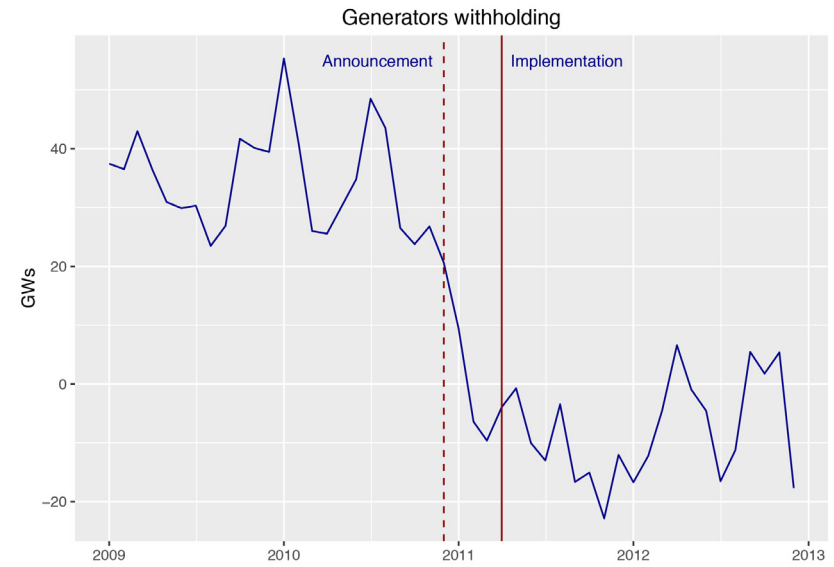


than their intended production in the forward market, in order to increase the price, and then sell the remaining production in the spot market at a lower price, a strategy that results in a higher forward price.

Generators typically have market power because electricity cannot be stored, demand is not price responsive and has to be met by supply at every moment, and limited transmission capacity does not always allow to cover demand with the cheapest generation. These characteristic features of electricity make it scarce, and though financial players do not increase the amount of energy produced, they are able to restrict producers' market power by arbitraging the forward premium.

Because a forward premium leads to inefficient planning and higher production costs (Jha and Wolak, 2018), many makets have introduced financial traders in order to arbitrage this forward premium. In the MISO electricity market the premium persisted in spite of the presence of financial traders because high transaction costs prevented them from fully arbitraging it (Birge et al., 2018). On April 2011, these charges were significantly lowered, and financial trading increased significantly, as Figure 1 (above) shows.

While transaction charges were high, generators exerted market power by withholding sales in the forward market (Figure 2, below). Moreover, they did not only exert less market power in the forward market in response to increased financial activity, but they did so when the regulatory change was announced, months before it was implemented. This behavior is surprising since firms only lost market power when financial trading became cheaper, not at the time of the announcement.



In order to understand the generators' anticipated response, I estimate a static model of optimal behavior for a generator deciding how much to sell in the forward and spot markets. This requires estimating the demand faced by each firm, for which it is necessary to know who the firm's competitors are, i.e. it requires defining the market in which each firm participates. This is not straightforward in a nodal market, where prices vary across over 2000 nodes or locations according to the capacity of the transmission grid that transports electricity. As I do not observe locations, I use machine learning tools to define markets according to price correlation and develop a measure of fit that indicates they accurately represent the competitive structure of the market.

Results indicate that the firms' anticipated response to increased financial arbitrage is consistent with tacit collusion. Firms are able to cooperate only as long as they know that the agreement can be sustained in the future, but incentives vanish when they learn this will not be possible in the future. Consumers are better off because they pay less for the same quantity, saving roughly $1,800,000 a day on average.

[1] Ignacia Mercadal (2018), "Dynamic Competition and Arbitrage in Electricity Markets: The Role of Financial Players." *CEEPR WP-2018-015*, MIT, October 2018.

Ignacia Mercadal

CEEPR and E2e Launch a New Driving Habits Study

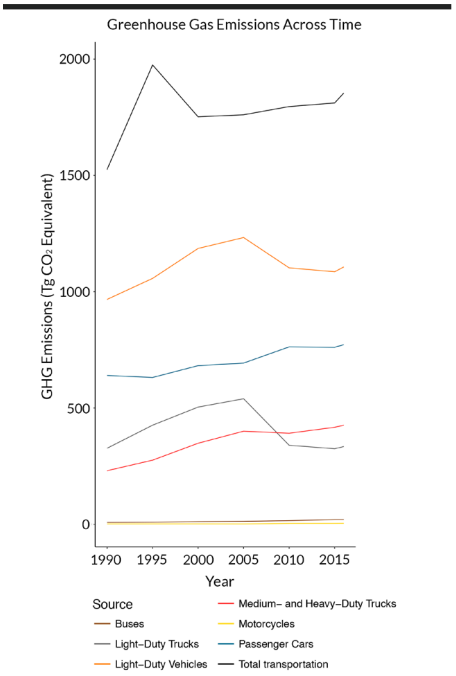
by: Paula Meloni and Leila Safavi

In 2016, the transportation sector was the largest contributor to greenhouse gas (GHG) emissions in the U.S., representing approximately 28% of total emissions, 83% of which came from motorcycles, cars and trucks. Despite significant fuel economy increases for passenger cars and light trucks, overall fuel consumption for the sector has increased over the past several decades because of an increase in the number of vehicles and the number of miles traveled per vehicle. Considering their significant share of total U.S. GHG emissions, it is thus essential to target this sector to achieve our emissions reduction goals. Policies have primarily sought to address this by promoting increases in fuel economy (e.g., fuel economy standards) and the use of alternative fuels (e.g., renewable fuel standards).

There is a large body of economic literature evaluating both fuel economy standards and renewable fuel standards as policy tools to reduce emissions (Anderson and Sallee, 2011; Goldberg, 1998; Jacobsen 2013; Holland, Hughes, and Knittel 2009; Holland, Hughes, Knittel, and Parker 2015; Lade, Lin, and Smith, 2014), but little literature exists on the potential impact of behavioral-based changes on vehicle emissions.

This study, led by Prof. Christopher Knittel, currently in the experimental phase, explores the persistence and magnitude of information-based interventions on driver behavior and its impact on the fuel economy. In the context of a randomized controlled trial, drivers are assigned to different treatments with varying degrees of information feedback. Through the use of a mobile application developed jointly with Cambridge Mobile Telematics, we track key drivers' metrics such as distance traveled, acceleration, idleness and turn smoothness. With this information, we evaluate the impact on driver behavior of differing frequency and type of feedback in the form of disaggregated metric scores and performance against other drivers. By eliciting drivers' willingness-to-pay at the end of the study, we will estimate how much drivers value this information. This will further our understanding of diffusion of new technologies. In addition, through the data on driving metrics, this project will also provide valuable insight into how driving habits affect real-world fuel economy and how well fuel economy ratings match field observations.

The lack of literature analyzing the potential for reductions in consumption within transportation fuels operating through behavior changes, stands in stark contrast to electricity. Electricity markets have a number of parallels to fuel standards, such as appliance and renewable portfolio standards, but policymakers within electricity markets have also relied on behavioral interventions to reduce consumption – most notably, informational interventions such as those from Opower. One argument for this is that it is difficult to implement behavioral changes through informational interventions in transportation markets. However, one could claim that not only would it would be trivial for automobile manufacturers to include technologies designed to give instant feedback to drivers on their driving habits, but that it should also be easy to incentivize manufacturers to do so. Modern day automobiles already collect information on instantaneous fuel economy, acceleration, and deceleration through their on-board diagnostic (OBD) system. Many vehicles also broadcast fuel economy data, and discussions with automobile engineers suggest that it would be simple to include additional information. Perhaps more importantly, Corporate Average Fuel Economy (CAFE) Standards could provide a direct incentive to offer such information. While CAFE standards regulate the average fuel economy of the vehicles a manufacturer sells, there are already a number of "credits" provided to manufacturers to reduce greenhouse gas emissions via other means. For example, manufacturers receive greenhouse gas emission credits for including start-stop systems, altering their air-conditioning systems or using high-efficiency lights. If presented with conclusive evidence that informational interventions would reduce fuel consumptions, the EPA and NHTSA could include such technologies within CAFE.



GHG emissions across time for the U.S. transportation sector. *Source: EPA.*

Given the large focus on reducing emissions, technologies and policies that encourage behavioral changes and more efficient driving behavior may also be cost-effective ways to reduce emissions and mitigate the effects of climate change.

Paula Meloni

Leila Safavi

2018 International Energy Policy Conference

Sir Sebastian Wood, the British Ambassador to Germany, giving the dinner keynote.

Two sunny days in in early July 2018 saw the continuation of a fruitful and long-standing cooperation between the Center for Energy and Environmental Policy Research (CEEPR) at MIT and the Energy Policy Research Group (EPRG) at the University of Cambridge: the annual instalment of the joint CEEPR-EPRG European Energy Policy Conference, convened this year in Berlin, Germany, with the generous support of EnBW Energie Baden-Württemberg AG. A long-term view guided this instalment's overarching theme: "Transforming the Energy Sector: Solutions on the Way to 2050."

In his opening keynote, Frank Mastiaux, Chief Executive Officer of EnBW, reminded the audience of the unprecedented challenges currently facing the energy sector, making predictions difficult even – and especially – for incumbent players. As one of Germany's four large established utilities, EnBW's business model has been fundamentally affected by the country's Energiewende, or energy transition, affording Mastiaux a unique platform from which to comment on the attendant challenges and opportunities. In his remarks, he formulated a catalogue of principles that EnBW has chosen to follow as it responds to the concurrent trends of decarbonization, digitization, and decentralization.
The opening session of the conference ventured an outlook into the world of 2050. MIT's Henry D. Jacoby and Karsten Neuhoff of the German Institute for Economic Research (DIW) offered their views on the future, citing the importance of improved resource efficiency, credible and stable long-term policy frameworks, and the importance of action in the short term to sustain longer-term decarbonization pathways aligned with the objectives and ambition cycles of the the Paris Agreement.

The central role of a robust policy framework also featured in the second session, which highlighted the political dimension of energy transition. Peter Matuschek of the forsa Institute for Social Research and Statistical Analysis shared insights from recent polling conducted in Germany, while David M. Reiner of EPRG provided a nuanced and critical discussion of the political economy of climate action.
Sir Sebastian Wood, the British Ambassador to Germany, concluded the first day with a thoughtful and often humorous retrospective on energy and environmental policy developments in the United Kingdom.

The second conference day featured rich discussions on several topics of current relevance, ranging from sector coupling and the role of fossil fuels in electricity markets to power grids and the decarbonization of the transportation sector. On the evolving role of fossil fuels, Philipp Gerbert of Boston Consulting Group presented a comprehensive study on decarbonization pathways for Germany, followed by EPRG's Robert Ritz, who focused on evolving global gas markets and the implications for coal-to-gas switching in power generation. Focusing on the key functions of infrastructure, Christoph Müller of Netze BW GmbH issued an appeal for fair and innovation-incenting remuneration of distribution grids, complemented by a forward-looking assessment of the role of Distribution System Operators (DSOs) in future electricity systems by EPRG's Michael G. Pollitt.

CEEPR Director Christopher R. Knittel kicked off the session on decarbonizing transportation with a cautious outlook on the impact of evolving consumer preferences, the timeline for a transition to electric vehicles, and the energy-saving potential of autonomous vehicles, followed by remarks from Barbara Lenz of the German Aerospace Center DLR. In the concluding roundtable, Jörg Jasper of EnBW, MIT's Chris Knittel, David Newbery of EPRG, and Tobias Paulun of the European Energy Exchange (EEX) jointly discussed the role of innovation and disruption in the energy sector, shedding light both on the continued importance of research and development in the global energy transition.

Uli Huener of EnBW (far left) poses a question to Tobias Paulun of EEX, Jörg Jasper of EnBW, Christopher Knittel of MIT, and David Newbery of the Univ. of Cambridge (left to right), during a roundtable on innovation and disruption in energy.

UPCOMING WORKSHOPS

May 16-17, 2019, Cambridge, MA
November 21-22, 2019, Cambridge, MA

Notable Changes

This semester, CEEPR added two new members to our cohort of research assistants, which now includes six students working on energy policy issues with CEEPR faculty members.

Tomas Wesley Green, a new graduate student enrolled in the MIT Technology and Policy Program, will be supervised by CEEPR Director Christopher Knittel. His research project focuses on State-level energy and climate policy, analyzing broad trends in emission monitoring and reporting, market regulation, and renewable energy portfolios. The goal of this research is to better understand the efficiency of State policy and the barriers to effective implementation, considering increased attention of States on climate change.

Professor Knittel will also supervise Andrés Inzunza Besio, another member of the 2018 class of matriculating MIT TPP graduate students. His research focuses on quantifying the value of energy storage in California's electricity markets, analyzing the profitability of storage technologies given the current market design and detecting necessary advancements in the regulatory framework in order to adequately remunerate services provided by energy storage facilities.

In addition to new graduate students, CEEPR has also hired two Research Associates to assist Professor Knittel on continuing research.

Emil Dimantchev, previously a Research Assistant with the MIT Joint Program on the Science and Policy of Global Change who obtained his Master's degree from MIT this past summer, joins CEEPR as a Senior Research Associate. He will be working on systems costs analysis associated with decarbonization of the electricity sector in the Northeast U.S. as well as topics related to the electrification of transport globally.

Finally, Paula Meloni has been hired as a Research Associate. Her research focuses on studying the effects of a large-scale behavioral intervention on household electricity consumption in New England using machine-learning to study heterogeneity in treatment, as well as other topics related to informational inteventions on driver behavior.

Emil Dimantchev

Paula Meloni

Tomas Green

Andrés Inzunza

Recent Working Papers

WP-2018-015
Dynamic Competition and Arbitrage in Electricity Markets: The Role of Financial Players
Ignacia Mercadal, October 2018

WP-2018-014
Energy Efficiency, Information, and the Acceptability of Rent Increases: A Multiple Price List Experiment with Tenants
Ghislaine Lang and Bruno Lanz, September 2018

WP-2018-013
Does the U.S. Export Global Warming? Coal Trade and the Shale Gas Boom
Christopher R. Knittel, Konstantinos Metaxoglou, Anson Soderbery, and André Trindade, September 2018

WP-2018-012
Fair, Equitable, and Efficient Tariffs in the Presence of Distributed Energy Resources
Scott Burger, Ian Schneider, Audun Botterud, and Ignacio Pérez-Arriaga, August 2018

WP-2018-011
Coordinating Separate Markets for Externalities
Jose Miguel Abito, Christopher R. Knittel, Konstantinos Metaxoglou, and André Trindade, July 2018

WP-2018-010
Ownership and Collusive Exit: Theory and a Case of Nuclear Phase-out
Matti Liski and Iivo Vehviläinen, July 2018

All listed and referenced working papers in this newsletter are available on our website at ceepr.mit.edu/publications/working-papers

MIT CEEPR

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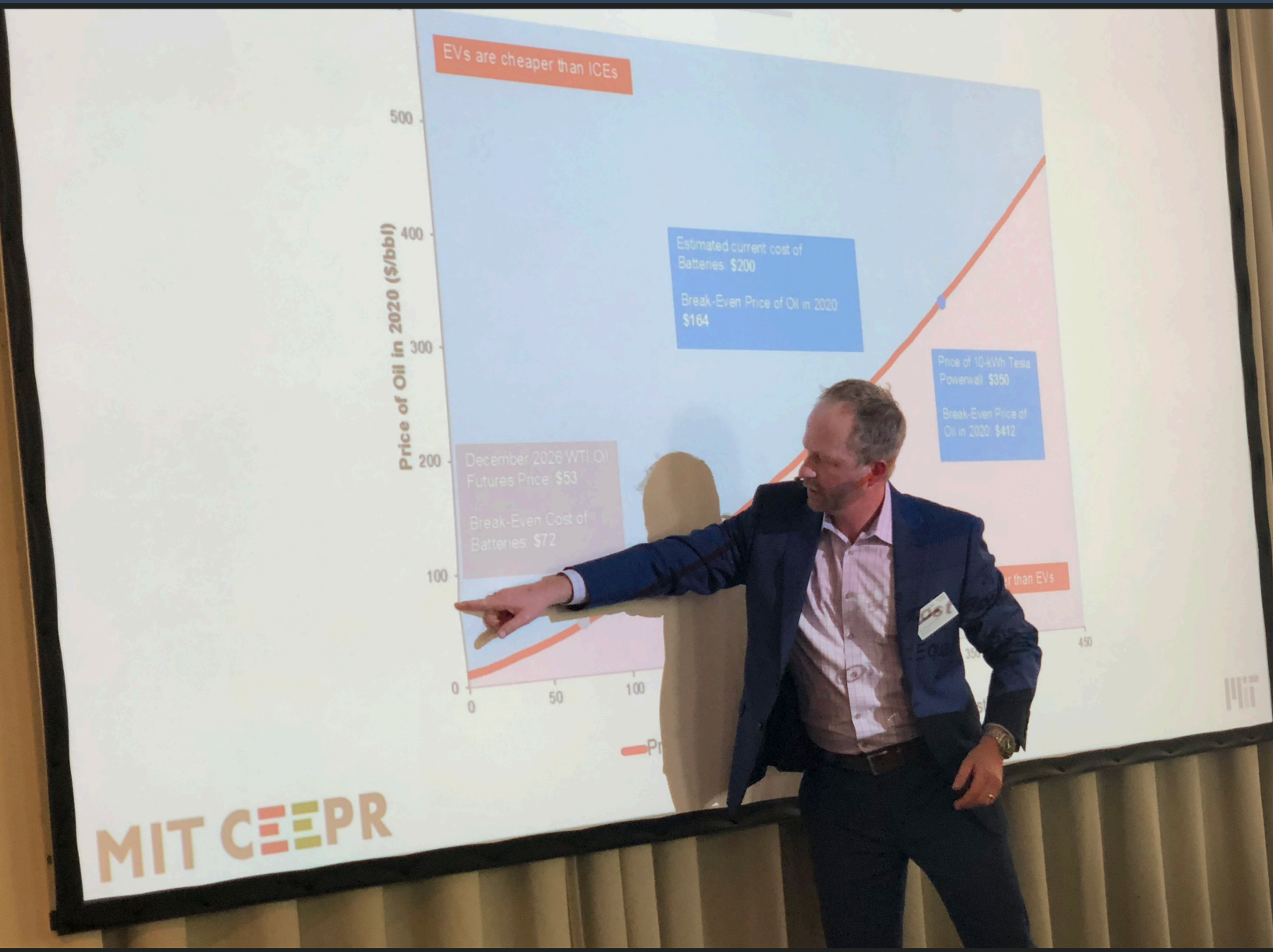

During the 2018 CEEPR and EPRG International Energy Policy Conference in Berlin, Germany, CEEPR Director Christopher R. Knittel presents a slide from "Decarbonizing Transport: Three Great Hopes."