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PRESIDENT'S MESSAGE

So much for my predictions! When I last wrote I was optimistic that the coronavirus-19 pandemic was behind us. That was just before the omicron variant took off! I guess I will stay optimistic, however, and hope that omicron marks a transition from pandemic to endemic for this family of viruses. It does seem that the new variant is more easily transmitted but less dangerous, especially for those who are fully vaccinated. Let us hope that trend, and the trend toward finding better ways of treating people who get the disease, both continue.

While coronavirus has hogged the headlines for almost two years, and many of us were ready to have something else displace it, it may be another case of being careful what you wish for. The international situation certainly looks much more fraught with danger than even a year ago. We also appear to be "back to the future," experiencing higher inflation than in many decades, and soaring energy prices. As I write, Brent is trading at $95.10 a barrel ($16.71/MMBTU), TTF natural gas price at €77.43/MWh ($25.80/MMBTU) and JKM is $24.57/MMBTU. Not surprisingly, energy security, and the role energy plays in national security, are also very much back at the top of the agenda. There is no doubt that energy markets throw up a never-ending supply of issues for energy economists to investigate and discuss! I hope that you are all getting your research papers and reports ready to present at our upcoming conferences (see below) and to submit to our publications!

In my December 2021 message I mentioned that we are going to lose AMS as our Association Management Company (AMC) when our contract with them expires at the end of 2022. The "Transition Task Force" established at the beginning of 2022 has been working closely with AMS to write the RFP. Specifying all the services that AMS provides to the Association, and which we hope to retain with our new AMC, has been an eye-opening exercise. Nevertheless, we are also including a list of possible new services in the RFP that would address some of the information gaps, and other possible changes to our procedures and processes, that we have identified in past surveys and other communications with members.

I will end by mentioning our forthcoming conferences. We are trying to get back to holding as many of these as possible in person.

First, we hope that you have added the forthcoming 2022 International Conference in Tokyo to your calendar. We are extremely hopeful that the Tokyo conference will be in person, but it may also have an online component of even be completely online. As of now, this has not been decided. If it is in-person, however, we hope that you will plan to be there!

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President's Message (continued)

We very much want you all to think about our 2022 International Conference to be held in Tokyo from July 31 - August 3, 2022 as your "coming back" party! Please visit https://iaee2022.org/ for the latest conference information and Call for Papers.

Since the 2023 International Conference is being held in Riyadh, Saudi Arabia, it is going to be in the Northern Hemisphere winter, from February 4–9. We are very excited to be holding this event in the Middle East, a region of obvious importance to energy economics, and therefore energy economists, but also a region of growing importance to the IAEE. In what is, in a sense a prelude to the Saudi conference, IAEE is co-sponsoring a Middle East Symposium in the Kingdom of Bahrain from 2–3 March this year.

The second half of 2022 is also shaping up to be a busy conference season as the world tries to put the coronavirus behind us. The 17th IAEE European Conference will be held in Athens, Greece from September 21-24. The 8th ALADEE Latin American Conference will be held in Bogota, Columbia from November 20–22. Roughly midway between the European and Latin American conferences, the USAEE/IAEE North American Conference, we believe, will be held in October. The dates and other details are being finalized now. As with the Tokyo conference, it is unclear at this stage how many of these will be in-person, but we surely hope that they may all herald a return to "business as usual" for the IAEE.

Peter Hartley

Careers, Energy Education and Scholarships Online Databases

IAEE is pleased to highlight our online careers database, with special focus on graduate positions. Please visit http://www.iaee.org/en/students/student_careers.asp for a listing of employment opportunities.

Employers are invited to use this database, at no cost, to advertise their graduate, senior graduate or seasoned professional positions to the IAEE membership and visitors to the IAEE website seeking employment assistance.

The IAEE is also pleased to highlight the Energy Economics Education database available at http://www.iaee.org/en/students/eee.aspx Members from academia are kindly invited to list, at no cost, graduate, postgraduate and research programs as well as their university and research centers in this online database. For students and interested individuals looking to enhance their knowledge within the field of energy and economics, this is a valuable database to reference.

Further, IAEE has also launched a Scholarship Database, open at no cost to different grants and scholarship providers in Energy Economics and related fields. This is available at http://www.iaee.org/en/students/ListScholarships.aspx.

We look forward to your participation in these new initiatives.

Editor's Notes

Our request for research on COP26 and Climate Change has lead to a truly gratifying number of submissions. We will continue this topic in the third quarter Energy Forum.

Hoesung Lee writes that climate change is a negative externality problem. The solution is to internalize the externalities. There are several ways for internalizing climate change externalities. Setting global warming limits is one option. A combination of the precautionary approach and risk-based approach has led to the emergence of global temperature goals.

Majid Al Moneef focusses on environmental, social and governance (ESG) related issues from the perspective of environmental, social and governance. This has been gaining wide coverage and global efforts especially related to the E pillar of the ESG.

David Bourghelle, Fredj Jawadi, and **Philippe Rozin** provide a quick overview of the climate impact of carbon-based energy production and discuss the rules and policies required for an efficient ecological transition.

Marc Gronwald informs us that China faces increasing exposure to extreme heat and is also going through a rapid urbanisation process. It is the combination of these two that poses a particular challenge.

Fereidoon Sioshansi provides a thoughtful overview of the United Nation's 26th Conference of Parties.

David Robinson, who attended the COP26 offers his take on what was, and was not, accomplished in Glasgow. In spite of the disappointments, he still feels that there are reasons to remain optimistic.

Mamdouh Salameh argues that oil will continue to drive the global economy well into the future and that the very last barrel produced will most probably come from Iraq.

Tilak K. Doshi states that while the vilification of the Oil, Gas, and Coal industries continues, the majority of the global population will continue to develop and maintain mutually beneficial partnerships with these producers.

Josef Gochermann informs us that the energy transition can be mapped on four levels. While industry and the state should act on the national and international level, most of the energy transition is taking place at the regional and municipal levels. Here the small-scale and decentralized nature of the new energy world is reflected, where customized individual solutions are created.

Jackie Nock posits that electrification to meet decarbonization goals is a significant new risk facing regulators and utilities. This paper identifies potential changes to regulatory rate setting processes that could help lower the cost of electrification, including addressing regulatory siloes, aligning utility employee incentives, competitive pricing (such as rate discounting), and congestion pricing.

Philippe Benoit writes that climate taxes traditionally apply a uniform price for emissions, but emissions result differing types of underlying activities. Some meet critical basic human needs, while others serve highly discretionary extravagant lifestyles. This article proposes a tax on the extravagant carbon emissions of the wealthy to serve climate and equity considerations.

Alessandra Motz, Beatrice Petrovich, Stefan Gahrens, and **Rolf Wüstenhagen** detail that increasingly energy policies aim to bring the consumers to the centre of the energy transition. One popular approach is for homeowners and renters in single- and multi-family houses to become solar prosumers. A consumer survey in Switzerland sheds light on the early movers leading the shift towards decentralised energy production.

DLW

IAEE MISSION STATEMENT

IAEE's mission is to enhance and disseminate knowledge that furthers understanding of energy economics and informs best policies and practices in the utilization of energy sources.

We facilitate

- **Worldwide information flow and exchange of ideas on energy issues**
- **High quality research**
- **Development and education of students and energy professionals**

We accomplish this through

- **Leading edge publications and electronic media**
- **International and regional conferences**
- **Networking among energy-concerned professionals**

NEWSLETTER DISCLAIMER

43rd IAEE INTERNATIONAL CONFERENCE

Program and Registration Announcement

31 July - 4 August 2022

Mapping the Energy Future -Voyage in Uncharted Territory-

CONFERENCE OVERVIEW

The Institute of Energy Economics, Japan, and the National Graduate Institute for Policy Studies (or GRIPS) are pleased to host the 43rd IAEE international conference in Tokyo, between **31 July and 4 August 2022**.
The conference will feature 2 Plenary Sessions and 8 Dual Plenary Sessions complemented with a series of concurrent sessions for which the list of topics is quite extensive. Business leaders and practitioners as well as government officials will join discussions at Plenary and Dual Plenary Sessions.

Dual Plenaries : Session Themes

- Energy Geopolitics: Challenges and Opportunities for Asia
- Climate Change and the Challenges for De-carbonization: Risks and Opportunities
- Future Role of Fossil Fuels toward Decarbonized World
- Global Energy Transition: Is Market Reform a Feasible Solution?
- Hydrogen/Ammonia Society and its Impact on the Energy Market
- Clean, Affordable and Accessible Energy for All
- Nuclear Energy in the New Decades: Could it be Possible to Decarbonize All the Sectors?
- Future of Mobility and Energy Industries

Round Tables : Themes

- Decarbonization of fossil fuels
- New energy solutions

Photo: Masao Nishikawa

IMPORTANT DEADLINES

Notification of abstract: **8 April 2022**
Submission of full paper and Registration: **20 May 2022**
Make your registration after early March 2022 when the online registration system is open and submit your full paper after notification of abstract on 8 April 2022. https://iaee2022.org/

For further information, please contact: **iaee2022@jtbcom.co.jp**

CONFERENCE VENUE

IAEE Tokyo conference will be held in **hybrid conference**. You can participate either in Tokyo at the National Graduate Institute for Policy Studies (GRIPS) or online. The details will be updated on our website: https://iaee2022.org/

WHO SHOULD ATTEND

- Academics and scholars working in the fields of energy, natural resources or environmental economics,
- Policy makers and government officials, international institutions and regulatory agencies,
- Energy analysts working for local authorities, development agencies, consumer bodies, NGOs,
- Business leaders and practitioners.

Organizers of 43rd IAEE International Conference

Finding Global Temperature Goals: How Science and Policy Interacted?

BY HOESUNG LEE

Abstract

Climate change is a negative externality problem. The solution is to internalize the externalities. There are several ways for internalizing climate change externalities. Setting global warming limits is one option. A combination of the precautionary approach and risk-based approach has led to the emergence of global temperature goals.

Hoesung Lee is Chair of the Intergovernmental Panel on Climate Change (IPCC), Endowed Chair Professor at Korea University Graduate School of Energy and Environment, and Chair of the Asian Development Bank President's Advisory Board on Climate Change and Sustainable Development. He can be reached at hoesung@korea.ac.kr

Many countries declared the goal of CO2 net-zero emissions by 2050. The carbon-neutral world by 2050 is the requirement to limit global warming to 1.5˚C. How did the world agree on a specific temperature limit?

The aspiration to limit global warming stems from Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992 which defines the ultimate objective of the Convention as "achieving stabilization of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" [UNFCCC, 1992]. The Convention did not specify what constitutes dangerous interference to the climate system but Article 3 binds the parties to take precautionary measures to mitigate climate change, noting that "lack of full scientific certainty should not be used as a reason for postponing such measures."

The issues related to Article 2 of the Convention were addressed in depth by the Intergovernmental Panel on Climate Change (IPCC) in its Second Assessment Report (SAR) in 1995 which recognized uncertainties about what constitutes dangerous anthropogenic interference with the climate system and about measures to prevent such occurrence but indicated that precautionary approach and availability of no-regrets options provide rationales for action beyond no-regrets [IPCC, 1995]. It summarized the challenge as "not to find the best policy today for the next 100 years, but to select a prudent strategy and to adjust it over time in the light of new information."

The first Conference of the Parties (COP) to the Convention held in 1995 decided to launch a two-year negotiation process to establish legally binding targets and timetables for reducing GHG emissions after 2000. The Alliance of Small Island States (AOSIS) proposed a draft protocol for emissions reduction because "they are being hit first and hardest by climate change that they are not responsible for and continuing emissions at present levels would be a disaster for all" [ENB,1995].

In 1996, the European Council - environment declared 2˚C as the global warming limit and the corresponding concentration levels lower than 550 ppm CO2 as guidance for global emission reduction efforts [EC, 1996]. This was the first instance that 2˚C was proposed by a political body as global warming limit to avoid dangerous interference with the climate system [Carbon Brief, 2014].

The Council attributed the decision to the scientific findings of the IPCC SAR which had assessed, among others, four different future profiles of CO2 concentrations and corresponding equilibrium temperature increases relative to 1990 that includes 2˚C as well as other warming levels. The IPCC reports are neutral, policy-relevant but not policy-prescriptive. The IPCC reports in 2001 pointed out that decisions on what constitutes dangerous interference are value judgments and what science can do is provide the information needed for decisions [IPCC, 2001].

The 2007 IPCC reports stated that "warming of the climate system is unequivocal" [IPCC, 2007] and the COP 13 held in the same year recognized in its decision the deep cuts that will be required to achieve the Convention's ultimate objective and the urgency to address climate change as indicated in the 2007 IPCC reports. The AOSIS called for stabilization well below 445 ppm, noting the inadequacy of 2˚C limit [ENB, 2007].

Subsequently, in 2008 COP14, both AOSIS and the Least Developed Countries urged 1.5˚C temperature limit and GHG concentrations of no more than 350 ppm, noting that "a 2˚C temperature rise would take the world into the danger zone" [ENB, 2008].

The COP15 in 2009 adopted the Copenhagen Accord which has a specific reference to 1.5˚C in calling for consideration of strengthening the long-term goal to be below 2˚C [UNFCCC, 2009]. And the Cancun Agreement in 2010 tightened the link between the long-term goal and 1.5˚C, recognizing the need for deep cuts in GHG emissions to limit temperature increase below 2˚C above pre-industrial levels and consider strengthening the long-term goal in relation to a global average temperature rise of 1.5˚C [UNFCCC, 2010].

Given the increasing concerns about the adequacy of a long-term goal, the UNFCCC decided in 2012 in COP 18 to assess the long-term goals [UNFCCC, 2012]. A series of formal dialogues were held during 2013-2015 between parties and the scientific community on the adequacy of the long-term goal in the light of Article 2 of the Convention and the overall progress made towards achieving the long-term global goal.

The IPCC 5th Assessment Reports released in 2013-2014 were the key input to this dialogue process. The IPCC reports provided updates on mitigation pathways associated with various warming levels, including

warming below 2˚C relative to pre-industrial levels, and projected changes in the climate system and their impacts on natural and human systems [IPCC, 2014]. The IPCC also informed that there are only a limited number of scenarios to limit warming to 1.5˚C by 2100.

The UNFCCC-organized science/policy dialogue which was completed six months before the Paris COP in 2015 characterized the 2˚C limit as a defense line and concluded that while the science on the 1.5˚C warming limit is less robust, efforts should be made to push the defense line as low as possible and consideration on the long-term goal of 1.5˚C should continue [UNFCCC, 2015a].

This conclusion was captured in Article 2 of the Paris Agreement adopted in 2015 [UNFCCC, 2015b] which stipulates the warming limit to be "well below 2˚C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5˚C above pre-industrial levels". And the parties to the Convention invited the IPCC to provide a special report in 2018 on the impacts of global warming of 1.5˚C above pre-industrial levels and related global emissions pathways.

The global mid-century net-zero CO2 emissions were one of the key findings of the IPCC special report on 1.5˚C warming [IPCC, 2018]. It identified global emissions pathways to limit warming to 1.5˚C, a reduction of global CO2 emissions to net-zero by 2050. The net-zero year moves to 2070 if the goal is to limit warming below 2˚C. The special report also identified significant differences in impacts between now -- already about 1˚C warmer -- and additional 0.5˚C warming and still additional 0.5˚C warming reaching 2˚C. It reported an unprecedented rate of warming in recent decades. The latest IPCC report confirmed these findings [IPCC, 2021]. There will also be major updates on the impacts of climate change and mitigation measures in 2022.

The temperature goal of 1.5˚C is the outcome of the 30-years of the global science-policy interface. Science provided information and evidence and policymakers made choices. Given the enormous differences across the countries in the state of socio-economic conditions, cultural underpinnings, and priorities, it is remarkable that we have a common goal to limit warming to 1.5˚C. The challenge is how the world will be able to realize this goal. An effective science-policy interface will continue to be crucial in meeting the challenge.

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National Oil Companies and the ESG Framework

BY MAJID AL MONEEF

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The recent focus on companies' environmental, social and governance (ESG) or how they serve the natural environment, workers, communities, customers, vendors and shareholders, has been gaining momentum. Companies investments into these three pillars are increasing remarkably, and benchmarking their relative performances in ESG indices is moving from being optional to essential. ESG reporting has been challenging to policymakers, boards and executives, and it is forcing companies to revamp their corporate strategies. ESG regulations have the potential to raise the cost of capital of oil and gas producers as well as the marginal cost of production, which will ultimately impact markets and prices.

Oil and gas contribute 50% of global carbon dioxide (CO2) emissions, with oil alone contributing around 30%. Oil and gas industry faces different challenges than others, especially when it comes to the 'E' pillar of ESG. With around half of the world's oil and gas production, and 40% of capital investment, National Oil Companies (NOCs) are especially impacted by the energy transition and ESG framework. Their performance in the three ESG pillars and their strategies and responses to the global energy transition will shape their future roles as well as the energy transition itself.

However, the ESG metrics and disclosure requirements have largely been from the perspective of developed markets and publicly listed companies. They have been driven by national and stock exchange listing regulations, shareholder and stakeholder pressure, and by pressure from international capital and equity markets to disclose data and strategies for future climate scenarios, including net-zero emissions. While NOCs have been historically insulated from this framework, their increasing access to the international capital markets exert further pressure on them to report and disclose ESG data and targets. However, the level of disclosure and transparency from NOCs is currently far lower than that of IOCs, reflecting different stakeholder pressures outlooks of future oil and gas demand, the scale of reserves and the costs of production. Their governments are also responding to the fiscal pressures of relying on hydrocarbon revenues and reforming the state-NOC relationship, including taxes and oversight. In addition, these governments are not mere bystanders, but increasingly engaging in the global climate change framework.

All NOCs play significant roles in the economies of their home nations. However, they are not monolithic: they differ in respect to their hydrocarbon reserves and production, the roles they play in their economies, the diversity of their assets and markets, and their levels of vertical integration. They also differ in the trade-offs they face in the energy transition, the flexibility they have to reshape their mandates, their relations with their governments, their technical skills, risk management, engineering capacity, balance sheets, and so on.

Despite the growing consensus that the global growth in hydrocarbon demand will slow, with variations among regions and economies, the role of the oil and gas industry and NOCs in their home states will likely not abate. However, the way in which the industry operates and its contribution to economies and society most certainly will be transformed irrespective of the speed of the energy transition. There will likely be two responses by NOCs: those that will move away from hydrocarbons and those that will optimize the use of their hydrocarbon reserves. Generally, the low-cost, low-emission NOCs, especially in the Middle East, will be the last ones standing.

To start with, each oil and gas company must define where it stands within the ESG pillars and metrics and tailor its policies accordingly. Each company should identify its own priorities, driven by regulations, customer demand and debt financing requirements. NOCs, in particular, should align their respective strategies with their respective country's climate commitments and energy goals, including those for renewable energy. They need to conduct rigorous risk analyses around capital allocation decisions to target investment effectively and focus on projects that generate returns, given the constraints of energy transition and ESG framework. They need to emphasize public communication and develop shared national narratives on the energy transition to adjust the public's expectations of the hydrocarbon sector.

NOCs may pursue a variety of strategies to increase their resilience. Companies with greater technical capacity, access to capital, and project management skills, could become central actors in their countries' climate ambitions. Some may focus on staying competitive in their core businesses, or invest in clean technologies that can prop up demand for oil and gas. The low-cost, low-carbon intensity producers can invest in new technologies that will help decarbonize their production, such as carbon capture, utilization, and storage (CCUS) and direct air capture (DAC) of CO2. Others may redirect their investment portfolios to emphasize gas, which requires strong corporate governance and decision-making procedures. Needless to say, there are risks associated with each option, including diverting financial and human resources from the NOC's core business and the potential conflict between fossil fuels and renewable investments.

For the governments of NOCs, the transition might entail changes in the financial trajectory of the country's economy and its fiscal budget, as well as its domestic energy policies and subsidies. The prevailing hydrocarbon development and economic diversification models might witness changes. This will impact the

role of safeguards such as foreign exchange reserves and sovereign wealth funds, as well as the role of NOCs in their economies and globally, including their engagement with and standing in the ESG framework and metrics.

There are wide differences in the number of quantitative non-binding corporate and environmental reporting frameworks that provide guidance to corporate ESG and environmental metrics. Differences in the way in which individual metrics are calculated and weighed contribute to the wide variance of scores. However, most ESG metrics for the environment pillar are focused on the impact of companies' operational performances regarding emissions and flaring reduction from operations (scopes 1 and 2) and from their products (scope 3). Most NOCs have set operational targets of the first two scopes but expanding such commitments to scope 3 will remain problematic for many of them.

Issues of particular importance to NOCs, such as the carbon intensity of hydrocarbon production, the Circular Carbon Economy (CCE) and CCUS investments, have not been weighed adequately in the 'E' metrics. For example, KAPSARC developed a (CCE) Index that covers G20 countries, and the top-20 global oil-producing countries, to quantify and compare countries' performances and potential in developing CCEs. In the 2021 index, Saudi Arabia ranked sixth among oil producers, with higher-ranked economies Norway, the United Kingdom, the United States, Canada and China not as oil dependent.

Needless to say, NOCs usually follow national environmental agendas. For example, the Saudi government's recent green initiative, including its announcement to be carbon neutral by 2060, will certainly impact its NOC's corporate strategies and investment portfolios. How this might impact the future valuation of majority state-owned Aramco is uncertain. Needless to say that the current valuation of IOCs is tightly correlated with oil prices, and the size and lifespan of their proven oil reserves. This suggests that financial markets are not yet reflecting the transition plans of these companies, whose investments in low-carbon technologies or renewables still represents less than 2% of their total capital investments.

The social pillar of ESG, focusing on diversity, equity, anti-corruption and inclusion, are shared concerns for all industries. However, social issues vary significantly across geographies, especially between mature and emerging markets and between IOCs and NOCs. Currently, many ESG metrics address the economic development, diversification and employment issues in the home countries of the companies from their tax contribution angle . NOCs, by definition, have a national mission and differ in their historical, cultural and regulatory contexts. For most NOCs, their human resource development, contribution to the national economy and local community and provision of energy products to the local market are essential, and for many, are government-mandated.

For example, Saudi Aramco has been a leading force within Saudi Arabia's human resource development, technological innovation, industrial development and the promotion of locally sourced goods and services for its operations. Its programs such as the College Preparatory Program (CPP), professional development programs (PDP) and the Home Ownership Program have had a profound impact on its workforce, its communities and on the nation at large. Its In-Kingdom Total Value Added Program (IKTVA) has been a leading example of the country's national diversification strategies. None of these have been weighed in the 'S' metrics of ESG benchmarks.

The governance pillar of ESG focuses on policymaking, the distribution of rights and responsibilities of the board of directors and managers, and the oversight of executives. The successful pursuit of these areas has been critical to NOCs' with potential impact on the execution of environmental stewardship and social responsibility. Generally speaking, the quality of NOCs' governance, including their relationships with their governmental shareholders, and with other stakeholders in their home states, often determines their success. Needless to say, strong corporate governance, transparency, a clearly defined mandate, well-qualified and independent boards, and strong management accountable for measured performance against clear benchmarks will be essential tools for managing the challenges of the energy transition. Currently, ESG metrics for good governance are framed from a publicly listed company perspective. Issues such as board structures and relationships with governments do not take account of the shareholding structure of NOCs. In the case of Aramco, its governance has evolved over the years, with the most recent evolution being the process that led to its initial public offering (IPO) in late 2019. To prepare Aramco and the country for that IPO, the state promulgated a new hydrocarbon law, changed the hydrocarbon royalty and tax regimes, and renegotiated a new concession agreement with the company. To this end, the company's bylaws were redrafted, its business lines and assets restructured and its financial disclosure enhanced.

There are currently numerous efforts to develop a set of global sustainability ESG standards, including the Sustainability Standards Board of the International Financial Reporting Standards (IFRS), which aims to complement the International Accounting Standards. The other effort from the World Economic Forum's International Business Council identifies a set of 21 core ESG and 34 expanded metrics and disclosures. Of the NOCs, only Aramco and Equinor were engaged in developing these metrics. Aramco was often a lone voice in challenging the relevance of specific metrics to a developing market context, especially the predominant focus on emissions, and the disregard of the contribution of reliable and affordable energy in supporting social development. The latter is a critical measure of stakeholder value both within NOCs' home states and in global markets.

The existence of multiple ESG measurement and reporting frameworks and a lack of consistency and comparability of metrics hinder the ability of NOCs to meaningfully and credibly demonstrate the progress they are making on sustainability, including their contribution to the United Nations Sustainable Development Goals (SDGs). They face the challenges of prioritizing

a growing list of reporting frameworks and initiatives, and their relatively lower internal understanding of and capacity to implement these frameworks. NOCs' organizational maturities, their internal capabilities, global breadth, market power, and their engagement in the development of new standards, such as IFRS and WEF, will shape their ability to develop new assets, diversify their portfolios, enhance their efficiency and improve their ESG guidelines.

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Climate Change and COVID-19: Complexity and New Challenges

BY DAVID BOURGHELLE, FREDJ JAWADI, AND PHILIPPE ROZIN

Abstract

The aim of this note is twofold. First, we analyze the challenges of climate change in the context of COVID-19. We then discuss the ongoing measures being taken by policymakers to reduce and combat the risks related to climate change. Our analysis suggests that fossil fuels still constitute a major source of energy, the main cause of high carbon dioxide (CO2) emissions. Several decisions need to be taken to reduce fossil fuel-intensive production and to replace it by alternative forms of energy production with more intensive use of renewable energy resources. This energy transition requires the actions of a range of actors (consumers, stakeholders, firms, regulators, policymakers, etc.).

David Bourghelle and **Philippe Rozin** are Associate Professors and **Fredj Jawadi** is Professor of Finance and Econometrics at the IAE Lille University School of Management. Fredj Jawadi can be reached at fredj.jawadi@univ-lille.fr

Climate change has become a serious reality and an increasingly urgent issue (uncontrolled fires in Australia, fires in San Francisco, multiple and repeated hurricanes in the US, etc.). Indeed, as the world heats up, it has led to many more warnings about the need for change and immediate measures to reverse the trend. However, despite ongoing efforts to reduce carbon dioxide (CO2) emissions, and the drive to introduce new, less fossil-fuel intensive technologies and renewable energies, there is still widespread use of fossil fuels and coal in key industries in developed and emerging countries that remains a major source of carbon emissions (Figure 1).

From Figure 1, we can see that among all carbon-based energies, oil is by far the largest emitter of C02 into the atmosphere.

In this context, several meetings and discussions (COP21, COP26, G20 meetings, etc.) have attempted to extract ongoing and perfectible commitments to change or to reform current production models, giving rise to a number of promises and encouraging signals, despite the lack of international coordination between authorities and policymakers (the US with the Trump administration, India, China, etc.).

However, the recent coronavirus pandemic or COVID-19 health crisis has hampered this effort to tackle climate change. Indeed, COVID-19 seems to have had both positive and negative impacts on the change process. What are the main challenges? What are the opportunities? Which post-COVID-19 rules are expected to inform efforts to tackle climate change?

1. An overview of CO2 emissions and sources of climate change

Oil has been an important production factor and oil-economy relationship has evolved over the time (Jawadi, 2019). However, this was not costless and its impact on climate change is becoming increasingly evident. The consumption of fossil fuels, in particular, has had a decisive impact on the production and emission of carbon dioxide (CO2) into the atmosphere. Greenhouse gases include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), all naturally occurring and resulting from human activity. The main pollutants are nitrogen oxide, sulfur dioxide, carbon monoxide and total unburned hydrocarbons. These forms of CO2 emissions that rise into the atmosphere are more

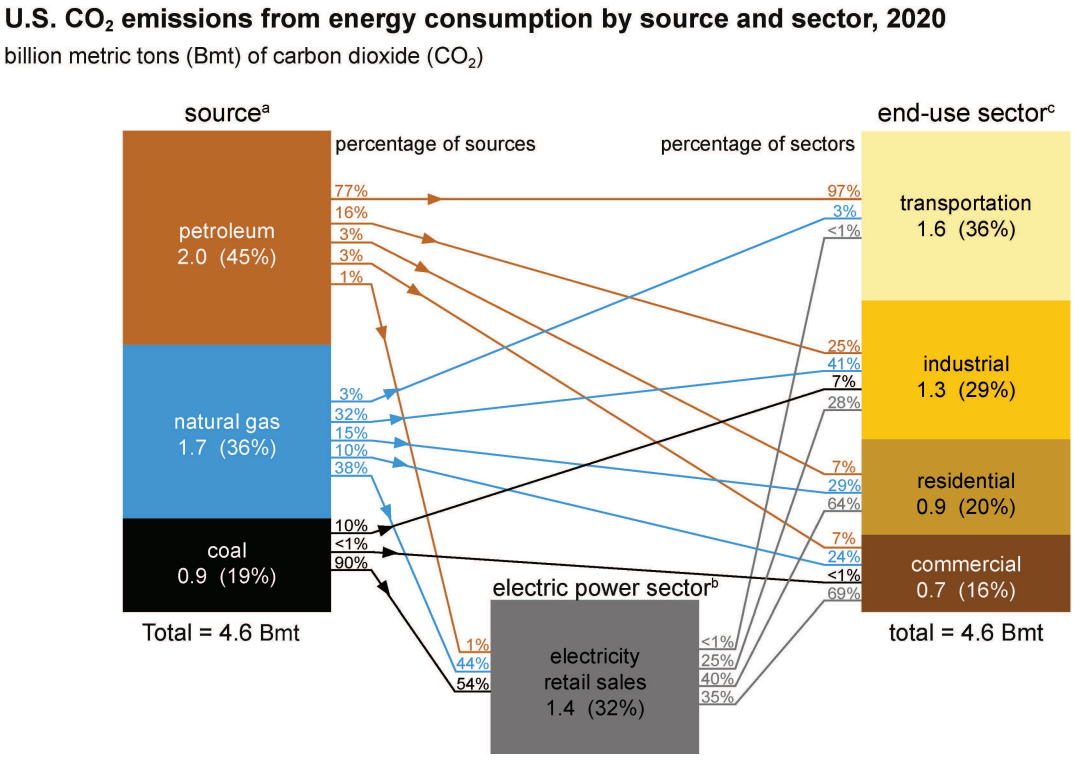

Figure 1: Overview of CO2 emissions

Source: EIA https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php

apparent in developed and large emerging economies, as shown in Figure 2.

To better characterize this phenomenon of CO2 emissions, it is important to recall that the technology currently applied to produce oil and gas from various facilities results in two main types of gas emissions, namely:

- Flue gases, consisting of carbon dioxides and minor amounts of carbon monoxide, nitrous oxide, N2O, SO2, and unburned hydrocarbons (methane and volatile organic compounds (VOCs)).
- Hydrocarbons, consisting of methane and primarily aliphatic VOCs emitted into the atmosphere or escaping from hydrocarbon processes through fugitive emissions.

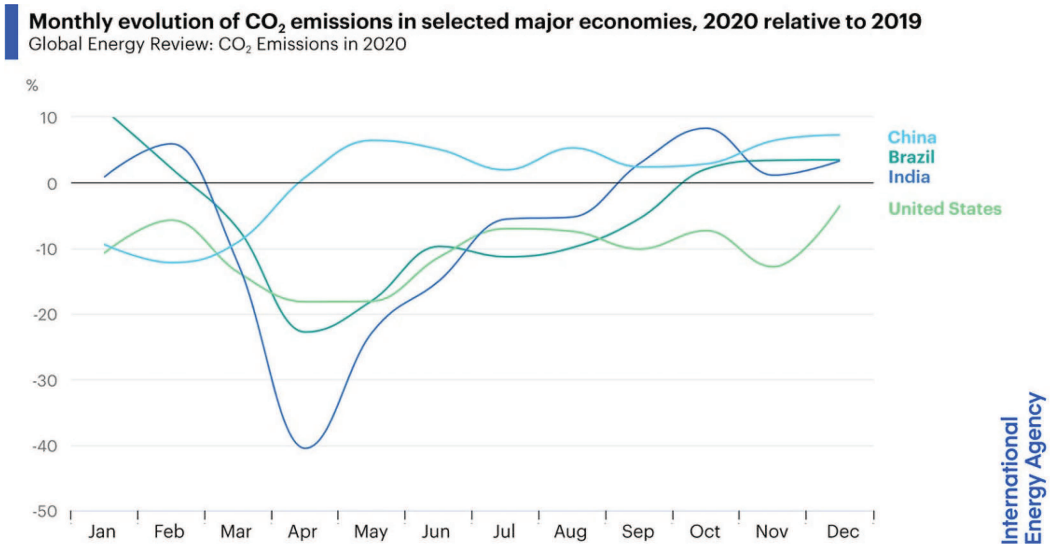

Figure 2: Evolution of CO2 in large economies

Source: https://www.iea.org/news/after-steep-drop-in-early-2020-global-carbon-dioxide-emissions-have-rebounded-strongly

According to Masnadi et al. (2018), the production, transportation and refining of crude oil into fuels such as gasoline and diesel accounts for ~15-40% of the lifecycle of GHG emissions of fuels transportation. It is thus critical to reduce emissions from oil production.

Despite the advent of electric cars, the still largely thermal vehicle fleet is almost entirely dependent on liquid petroleum products and there are limited prospects in the short term for the substitution of many of the uses of petroleum (e.g., electricity generation).

It should also be noted that, again according to this report, despite investment to improve efficiency, energy intensive oil and gas extraction in OECD countries increased by about 33% between 1980 and 2018.

Finally, the climate impact of conventional oil extraction is increasing as oil fields age due to reservoir depletion. Indeed, in the United States, the oil and gas sector is the second largest fixed sector emitter of greenhouse gases. In other fossil fuel exporting countries, such as Russia, Norway and Canada, over 20% of all national GHG emissions come from the oil and gas sector.

Generally speaking, four main sources contribute to CO2 emissions from the oil and gas industry:

- Engine, turbine and heater exhaust.
- Gas flaring.
- Well testing.
- Other carbon emissions such as CO2 from enhanced oil recovery operations.

Further, due to the lack of pipelines and gas processing facilities, up to 30% of the gas produced is flared or used to (directly) fuel hydraulically driven equipment that then vents the gas into the atmosphere.

For hydrocarbons, methane and volatile organic compounds (VOCs) are emitted from multiple sources: unburned fuel gas and diesel, tank emissions without a vapor recovery unit, offshore loading, venting, fugitive emissions (leaks and spills), gas flaring and well testing.

2. A complex climate change-COVID-19 relationship

The relationship between climate change and COVID-19 is serious and complex. Indeed, COVID-19 had a positive then negative impact on climate change. The positive impact was most likely due to reductions in production and the lockdown restrictions imposed by several governments in March-May 2020. Both impacted traffic across the world that lowered CO2 emissions to relatively low levels as traffic slowed down (see Figure 2). However, the positive effect was quite short lived as the vaccine and subsequent return to more or less normal life led to intense fossil energy production as industries tried to catch up on the pandemic-induced slowdown, particularly in India, China, Brazil and the US, while CO2 emissions again reached high levels. Further, during the pandemic and lockdown, many people adopted teleworking, which led to greater use of energy, electricity, etc. Thus, the climate change-COVID-19 relationship is clearly complex and ambiguous.

3. Climate change policies in the aftermath COVID-19

To enable people to live in a safe and clean environment, more policies and rules are required to reduce global CO2 emissions. It is now more necessary than ever to substitute fossil fuels by sources of low-carbon, renewable energy. Accordingly, decarbonizing policies are needed, involving higher taxes on pollution coupled with subsidies for the intensive production of alternative energy sources. Despite the economic recession induced by COVID-19, the challenge is to adopt safer,

more sustainable and economic renewable energy sources through more nuclear power for example, recycling innovations, and hybrid systems.

Obviously, pursuing search in renewable energy sources is essential. However, global governance and efficient coordination across major developed and emerging countries is also crucial to achieve the requisite transformation of our energy system and the energy transition needed. Indeed, the environment belongs to us all and we are all responsible and important actors (consumers, regulators, firms, investors, policy-makers, etc.). Of course, the conclusion of the COP26 meeting that enabled 196 countries to come to a common commitment is ambitious (keeping global warming under 2° by 2100; the commitment of 120 countries to stop deforestation by 2030; the promise by 100 countries to reduce the carbon dioxide (CO2) emissions by 2030; the decision of 40 countries, including Poland, Chili and Vietnam, to give up carbon, etc.). Further, the commitment of large cities and states to limit or stop the circulation and sale of fossil fuel-intensive cars is a key step. The agreement signed by 39 countries to stop public funding for fossil fuel projects by 2022 is a promising and much needed measure, especially if said funding is used instead for renewable energy projects and clean technologies.

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How will Climate Change affect China?

BY MARC GRONWALD

Abstract

China faces increasing exposure to extreme heat and is also going through a rapid urbanisation process. It is the combination of these two that poses a particular challenge.

Answering the question of how climate change will affect China begins, in good old statisticians' tradition, with a look at the data. Figure 1 displays global and Northern hemispheric temperature anomalies from 1850-2020 as well as those for China and Jiangsu province.[1]

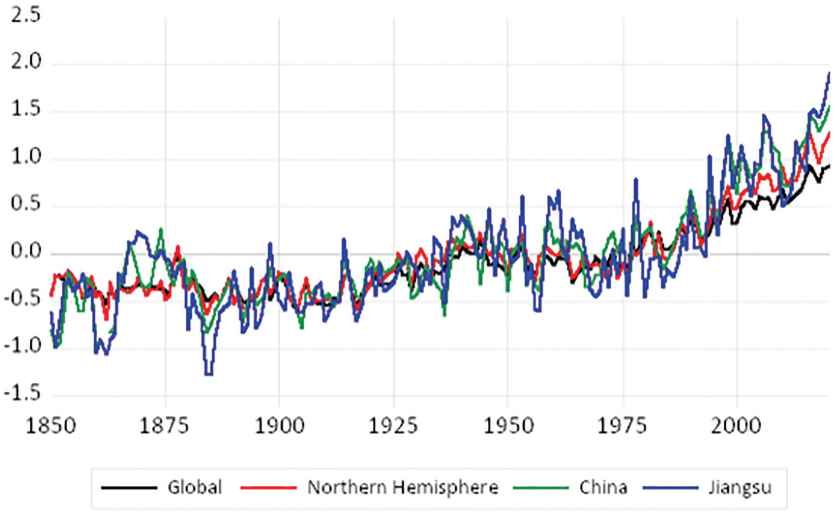

Figure 1: Temperature anomalies: Global vs China

The familiar picture emerges: up until around 1980, global temperatures fluctuated somewhat, but overall did not change dramatically. This has now changed; the increase since 1980 is evident. What is worth highlighting is that the increase in temperatures China witnessed during this period is even larger.[2]

Further interesting insights emerge from studying not only aggregate data, but also regional data from China. Jiangsu province, where the author of this article is based, witnessed even larger temperature increases.[3] It is also apparent, however, that up until 1980, the temperature anomaly in both China and Jiangsu province roughly followed the global trend; the deviation from that only started when the increase of temperatures began. Overall, it seems as if climate change seems to affect China stronger than other regions in the world.

How strong that effect is, however, depends crucially on which region in China we talk about.

The comparison of provinces from Northern and Southern China in Figure 2 and 3 show that there are enormous differences across this large country: while temperature increases in Heilongjiang province, located in the North, where China shares a border with Russia, are considerably larger than in Hainan, a tropical island in the South China Sea. The same applies to temperature increases in Inner Mongolia Autonomous Region compared to those in Yunnan province, which borders with Myanmar, Laos, and Vietnam.

This brief discussion of temperature data from China vividly illustrates that there is considerable heterogeneity in terms of changes in temperatures. The same can be said about health effects of climate change in China: as Cai et al. (2021) state, "every province in the country" is affected and "each province faces unique risks". The authors provide a very comprehensive assessment of the situation; they report 25 indicators within five domains. The summary they provide does not sound very optimistic: "climate-related health threats are worsening in China".

To give just a few examples: the authors document that, first, there is an increased exposure to heatwaves in China. In 2020, they find,

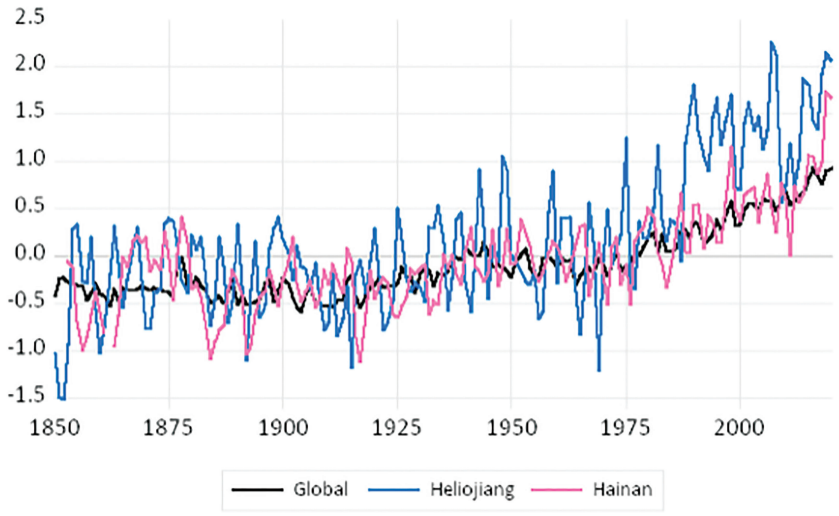

Figure 2: Temperature anomalies: Northern vs Southern China

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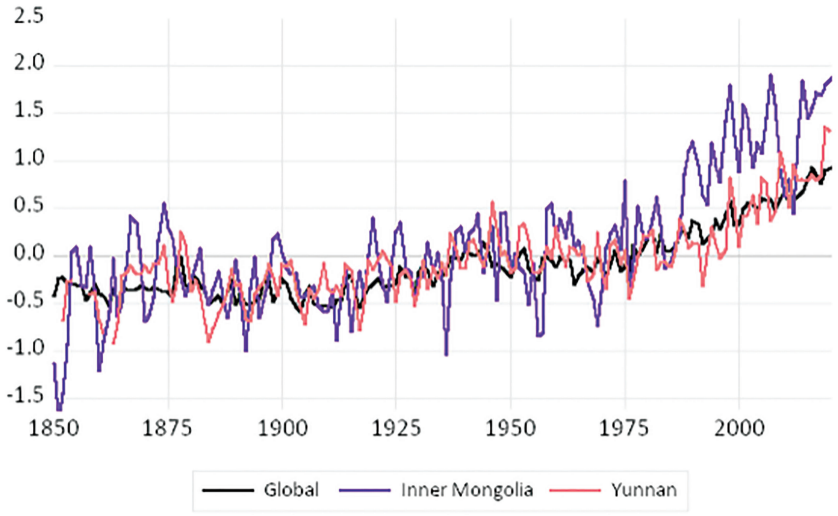

Figure 3: Temperature anomalies: Northern vs. Southern China, continued.

that heatwave exposure per person increased by 4.51 days, compared to the 1986-2005 average. The consequence is an increase in heatwave-related deaths of 92%. The number of deaths related to heatwaves in 2020 is estimated to be 14,500; which implies economic cost of $176 million. Not only that, increased temperatures also result in 31.5 billion hours lost work time, equivalent to 1.3% of the work hours of the total national workforce. This implies economic losses of 1.4% of China's annual GDP. Second, Cai et al. (2021) document that dengue risk is likely to going to be of increasing concern.[4] Third, flood events became more frequent and more intense; the 2021 Henan floods in July is still remembered by many. Obviously, there are differences across provinces in the extent to which they are affected by those threats: while heat-related mortality, labour loss and dengue risk is a particular concern in Guangdong province in China's South, flood and draught risk in particular affects Sichuan province, according to Cai et al. (2021).

The above-mentioned effect of heatwaves is of particular concern in China because of so-called total urban warming: increased exposure to extreme heat in combination with the heat-island effect experienced in urbanised areas. According to Tuholske et al. (2021), total urban warming "threatens the sustainability of rapidly growing urban settlements worldwide".

It is generally known that China went through a period of, as the United Nations (2018) document, rapid urbanization since the late 1970s; the numbers are nevertheless worth mentioning again.[5] The share of population in urban environments increased from about 20% in 1980 to about 60% in 2018. This relentless increase is not expected to end in the future: in 2030, this share is expected to be 70%, and 80% in 2050. China is expected to increase its urban population by 255 million people. Together with India and Nigeria, they account for 35 per cent of the growth in the world's urban population between 2018 and 2050. The level of urbanisation in China is now comparable to that of high-income countries. China stands out in Asia, where today the level of urbanisation is 50% - much lower than in Northern America (82%) and Europe (74%).

Tuholske et al. (2021) produce estimates of daily urban population exposure to extreme heat at global as well as regional levels. Their approach allows them to separate the contribution to exposure trajectories from urban population growth and total urban warming. Their key finding is that global exposure to extreme heat increased nearly 200% from 1983 to 2016. Total urban warming elevated the annual increase in exposure by 52% comparted to urban population growth alone. The authors, unsurprisingly, also state that there is a considerably degree of spatial heterogeneity, but their overall finding is that previous research underestimates extreme heat exposure.

In short, how climate change affects China depends on which part of China one has in mind. It seems to matter if it is Northern or Southern China, it also seems to matter if it is an urban or a rural area. However, the combination of being located in an area which already witnesses large temperature increases and the urbanisation process which is still ongoing, means climate change will have a considerable impact on China.

Footnotes

[1] Global and Northern hemispheric temperature anomalies are from the HadCRUT5 data set; see Morice et al. (2021). These anomalies are measured relative to a 1961-1990 reference period. Data for China and Chinese provinces are from Berkeley Earth; see www.berkeleyearth.org. Anomalies from this source are relative to a 1951-1980 average.

[2] It is well-documented that the Northern Hemisphere heats up faster than its Southern counterpart. The increase in temperatures in China also exceeds this additional benchmark.

[3] The larger fluctuation of regional temperature anomalies is attributable to the smaller number of stations this temperature data is based on.

[4] The exact finding is that "the vectorial capacity for the transmission of dengue by Aedes mosquitoes has increased by 25.4% in 2016–19 compared with 2004–07".

[5] All data in this paragraph is from United Nations (2018).

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Glasgow's COP26: A Cop Out Or A Baby Step Forward?

BY FEREIDOON SIOSHANSI

Greta Thunberg called it "A festival of business-as-usual," others say it's the best we can expect.

The United Nation's 26th **Conference of Parties** (COP) ended more or less as expected, with bickering, lack of unanimity on critical issues and little ambition. While everyone attending knew what had to be done, they couldn't agree on how or when to do it. For example, the issue of phasing out fossil fuel subsidies – the US envoy **John Kerry** called it the "definition of insanity" – was watered down in the final communiqué. Even the *phase out* of coal, the most polluting fossil fuel, had to be toned down to *phase down* at the insistence of India and China at the 11th hour. As is always the case, the delegates stayed beyond the official closure of the event to hash out a statement acceptable to all 197 nations represented – and those with the lowest ambition supported by the powerful fossil fuel lobby – essentially got what they wanted.

While some progress was made, as described in the following article from **David Robinson**, an eyewitness in Glasgow, it was at best modest compared to what had to be done. **Alok Sharma**, representing UK's delegation and the event's host, said, "I apologize for the way this process has ended." The young environmental activist **Greta Thunberg** called it "A festival of business-as-usual." According to Greta, COP26 "... succeeded in watering down the blah, blah, blah, which is quite an achievement." As many had predicted, politicians repeated their passionate speeches and pledges for meeting certain objectives by 2050, or in the case of China 2060, or 2070 for India.

Mocking the meaningless 2050 pledges without any significant change in the near term, **Greg Taylor,** a 73 year-old man from Sydney, Australia pledged that he would stop drinking beer starting in 2050. In the meantime, he would continue his current drinking habits until 2049, when he would turn 101, before stopping drinking. Point taken.

The fact that it has taken 26 gatherings to get to where we are speaks volumes. Even before the **Earth Summit** in **Rio de Janeiro** in 1992, the governments knew what had to be done, but here we are in 2021 debating when and if fossil fuel subsidies should be phased out or the use of coal curtailed. For the first time, however, there is an acknowledgment that the use of fossil fuels must be curtailed.

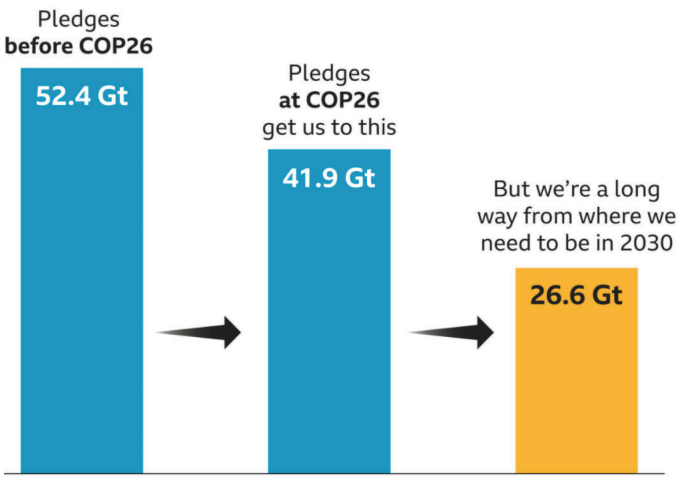
At the same time, one can sympathize with the politicians who cannot pledge much of anything because they do not have the full support of their own citizens and/or the backing of their political system. The US President **Joe Biden**, for example, was contradicted by Senator **Joe Manchin** of West Virginia a day after he spoke in Glasgow. **China** and **Russia**'s presidents did not even bother to attend. Australia's **Scott Morrison** found himself siding with oil exporting countries like **Saudi Arabia** to block language against fossil fuels – coal and oil, respectively.

Australia's only contribution to COP26, according to one observer, was to serve decent coffee at its pavilion. Over 40,000 attended the 2-week shindig, with the biggest delegation from the fossil fuel lobby. Many of the same will be at next year's event to be held in **Egypt** in 2022. The show must go on.

Despite the UN's obvious shortcomings – it can convene conferences but cannot demand unanimity, ambition or funding – there were a few hopeful signs of slow progress. **US** and **China**, rivals who account for over 40% of the global emissions, agreed to cooperate on climate issues. One cannot be sure what it means given the vague language of the communiqué.

More important, however, is the relentless pressure from the young activists and their supporters who continue to demand immediate action. The bankers, investors and corporate CEOs – attending or not – can no longer ignore the deafening call for change. And that may be the best outcome of COP26. The pressure is on and it will not go away.

Fereidoon Sioshansi is President of Menlo Energy Economics with over 4 decades of experience covering all aspects of the electricity power sector. He can be reached at sioshansi.1@osu.edu. This article originally appeared in the Dec 2021 issue of EEnergy Informer, a monthly newsletter edited & published by Fereidoon Sioshansi.



Ambition gap: What we need vs. what we got

Source: BBC News

COP26: The Clouds And Its Silver Linings

BY **DAVID ROBINSON**

Despite the disappointments, David Robinson says Glasgow offers hope for the future

David Robinson of the **Oxford Climate Policy**, who attended the COP26 offers his take on what was, and was not, accomplished in Glasgow. He points out that, "In view of the climate emergency we face and the short time we have to address it, no single COP outcome will ever be sufficient to meet the challenge – the COP26 no exception. Indeed, the sense of urgency has never been greater following the IPCC report in August that gave the world less than ten years to halve global emissions to have a reasonable chance of avoiding climate catastrophe. A process that requires consensus among nearly 200 countries, however, could never be ambitious or fast enough for everyone while the inevitable compromises and the sluggishness of the process are bound to disappoint almost everyone, especially the young, whose future is in play, and the people living in the areas most vulnerable to the effects of climate change who have no responsibility for causing it."

"Furthermore, a global agreement - like the **Paris Accord** that relies on voluntary pledges, the so-called **Nationally Determined Contributions** (NDCs) to mitigate emissions growth is always going to disappoint if one compares those pledges with what the science requires (visual). Political, corporate and national self-interests and the tendency to free-ride the system makes global agreements weaker than they need to be. At COP26, the power of a few polluting countries, notably the **US, China** and **India** to weaken the global pact to *phase down* rather than *phase out* coal was in full display.

Moreover, the unwillingness of the wealthy countries to compensate the poorest for losses and damages was also depressingly predictable. 'But the failure of the wealthy countries to meet their 2009 commitment to funnel $100 billion/year to the developing countries by 2020 was even worse**; failure to fund sustainable development** will result in emissions growth in the global south overwhelming reductions in the global north."

At the same time, it must be noted that many expect too much from a COP. World leaders, ministers and negotiators have limited options on what they can agree on and what concessions they are able to make with relatively *little* room for negotiations – not nearly as much as most people expect. This almost ensures that COPs will disappoint those who expect major breakthroughs."

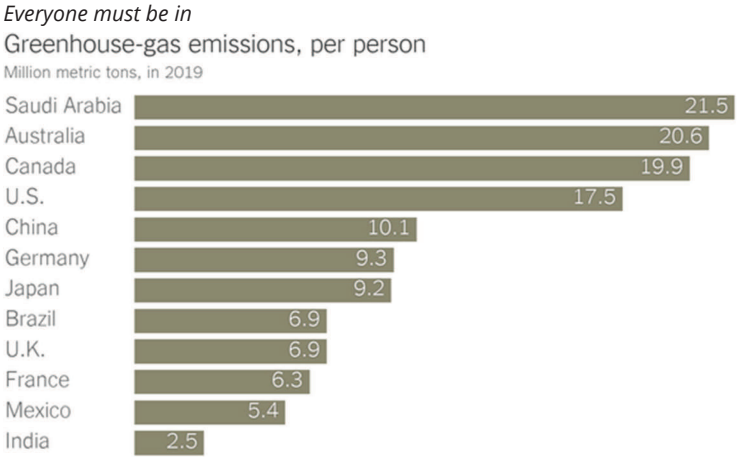
"Even when progress is made, it is open to debate – for example the **Powering Past Coal Alliance** does *not* include major coal consumers such as China, India and others. Commitments to climate neutrality in 30-50 years ring hollow when not accompanied by specific, near-term transition plans."

According to Robinson, in spite of the disappointments, there are reasons to remain optimistic:

- More than prior COPs, Glasgow will accelerate the process of decarbonization. The dramatic decline in the cost of renewables, batteries and electric vehicles confirms the potential for policy support, innovation, competition and scale to change the game. The pressure on the fossil fuel industry will intensify as global finance increasingly focuses on green energy. Even though the world will continue to rely on fossil fuels for some time, the hydrocarbon industry is acutely aware that their future depends on becoming part of the solution. That is why investment in oil and gas has been falling while those in renewables are growing – although not nearly enough.
- The many ambitious pledges by State and non-State actors are a reflection of the pressures they face and the fact that taking action is increasingly attractive from an economic perspective.
- COP26 has begun to address issues that had previously been ignored or barely covered. In Glasgow 196 countries agreed to "accelerate efforts towards the *phase-down* of *unabated coal* power and *phase out of inefficient fossil fuel subsidies*" – not nearly as bold as most countries were hoping for.
- Progress is especially evident in the engagement of the private financial sector with over 400 of the world's largest financial institutions with over $120 trillion of assets joining the **Glasgow Financial Alliance for Net Zero**. When banks realize that the world must invest $4 trillion a year to address climate change, that is a *game changer*.

David Robinson is a Senior Research Fellow of the Oxford Climate Policy. This article originally appeared in the Dec 2021 issue of EEnergy Informer, a monthly newsletter edited & published by Fereidoon Sioshansi.

Everyone must be in



Source: New York Times, 1 Nov 2021

- Glasgow finalized the rule book for the Paris Agreement, in particular on transparency, to ensure that signatories make pledges that can be verified, on a common time frame that leads to greater ambition, and on a global carbon trading framework. The rules – while far from perfect – provide the necessary framework towards low cost decarbonization.
- **China** and the **US**, the two largest emitters, reached an unexpected – if vague – agreement to collaborate on climate change.
- Developed countries agreed to "urgently" deliver on the $100 billion goal through 2025 while continuing the dialogue on **loss and damage**.

According to Robinson, prior to Glasgow, the UN estimated that NDCs would lead to 2.7ºC global warming by 2100. With the new pledges especially the **Global Methane Pledge**, we can expect a temperature rise in the 1.8-2.4 C range – certainly not good enough, but at least moving in the right direction.

The most positive message from COP26, Robinson notes, "Is the evidence that citizen activism matters and can have an effect, especially in countries with democratic systems – even when the activists are totally disappointed with the outcome. While not involved in negotiations, their presence – including the sound of helicopters controlling the street demonstrations – is a powerful reminder that they are watching what is taking place behind the closed doors and will not be silenced."■

- CALL for PAPERS -

The Hellenic Association for Energy Economics (HAEE) is pleased to host the 17th IAEE European Energy Conference "The Future of Global Energy Systems", in Athens, from 21 to 24 September 2022, the first physical IAEE European Conference in the post Covid-19 era.

CONFERENCE OVERVIEW

We live in a time of unprecedented challenges for the energy sector. As the world begins to recover from the COVID-19 crisis, it becomes evident that the pandemic has brought to the surface economic and societal vulnerabilities, while its repercussions on energy systems have already started to become apparent.

On top of that, addressing the challenges of the energy trilemma seems more imperative than ever. National energy systems' resilience is dependent on their energy mix and the changes brought by decarbonization, digitalization and demand disruption. Additionally, although efforts are being made, millions of people still lack undisturbed access to affordable, reliable and sustainable energy, and hence energy equity is still lagging behind. As for the environmental sustainability of energy systems, many nations' struggle for decarbonization is counterbalanced by the rapid increase in energy consumption. Taking also into account that different national contexts lead to divergent energy policies and associated costs, there can be no single way for an effective energy transition.

In this framework, the Conference will provide an excellent platform where government officials, institutional leaders, renowned academics and corporate leaders will have the chance to meet, exchange views and address all the pressing issues of the energy sector.

WHO SHOULD ATTEND

The conference is intended for:

- Academics and scholars working in the fields of energy, natural resources or environmental economics
- Policy makers and government officials, international institutions and regulatory agencies
- Energy analysts working for local authorities, development agencies, consumer bodies, NGOs
- Business leaders and practitioners

ABSTRACT FORMAT

All abstracts must briefly describe the research or case study. They must include overview, methodology, results, conclusions and references, conforming to the structure outlined in the abstract template. Abstracts are limited to no more than two pages in length.

Abstracts submissions & registration fees.

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Speakers/Chairs (IAEE Members)	600 €	700 €
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Students (IAEE Members)	350 €	450 €
Students (Non IAEE Members)	450 €	550 €

For more information please visit: haee2022.eventsadmin.com/Register

ATTENDANCE AT THE CONFERENCE

At least one author of an accepted paper must pay the registration fees and attend the conference to present the paper. While multiple submissions by individuals or groups of authors are welcome, the abstract selection process will seek to ensure as broad participation as possible: each speaker is to present only one paper in the conference.

No author should submit more than one abstract as its single author. If multiple submissions are accepted, then a different co-author will be required to pay the reduced registration fee and present each paper. Otherwise, authors will be contacted and asked to drop one or more paper(s) for presentation.

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- CCs & CCU methods and solutions
- Economics and geopolitics of oil and natural gas
- Role of conventional energy sources under low carbon society
- Development of LNG markets
- Distributed generation under uncertainty
- Nuclear energy
- Energy sector investment and ð€†inancing
- Efficient use of energy
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IMPORTANT DEADLINES

Deadline for early bird registrations: **15 March 2022**
Deadline for abstract submission: **18 April 2022**
Abstract acceptance: **30 May 2022**
Full paper needed: **11 July 2022**

The Arab World Will Produce the Last Oil Barrel

BY DR MAMDOUH G SALAMEH

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Overview

Not a day passes without claims being made by experts, analysts and organizations prominent among them the International Energy Agency (IEA) about climate change, global energy transition, net-zero emissions, peak oil demand and the end of oil.

Whilst some claims about climate change are credible enough with rising sea levels, wild-fires, heatwaves and extreme weather events already wreaking havoc everywhere and costing the global economy a staggering $1 trillion dollars over the next five years in crumbling infrastructure, reduced crop yields, health problems, and lost labour, others are either unsubstantiated or controversial.[1]

Still, the global economy can neither take such claims nor can it fulfil them. And contrary to these claims, oil will continue to drive the global economy throughout the 21st century and probably far beyond underpinned by both rising world population and growing global economy.

There could neither be a global economy nor a modern civilization as the one we know and enjoy without oil. How could the world feed a growing population projected to rise from 7.9 billion today to 9.7 billion by 2050 and a global economy projected to grow in size from $91 trillion in 2021 to $245 trillion also by 2050 without oil?[2]

Environmentalists who call for an abrupt end to fossil fuels and a sudden adoption of renewable energy fail to recognize the obvious lack of logic in this. On their own, renewables aren't capable of satisfying global demand for electricity and energy because of their intermittent nature.

While the process of global energy transition will continue to move forward, a total energy transition is an illusion. Even a partial one will never succeed without huge contributions from natural gas and nuclear energy.[3]

The notion of net-zero emissions is a myth. It will never be achieved in 2050 or 2100 or ever. In fact, the percentage of fossil fuels in the world's energy mix—coal, oil and natural gas—is still lingering well above 80%, a figure that has changed little in 30 years.[4] That remains the case despite being challenged by serious environmental policies and despite a global expenditure of $ 3.0 trillion on renewable energy during the last decade. This is a hefty price to pay just to gain only a percentage point of market share from coal.[5]

Therefore, the best way to combat climate change is for the global oil industry to focus on reducing carbon emissions from fossil fuels and not their actual use.

Of recent times various claims were made about peak oil demand. This topic has

become one of the most contentious and fascinating debates in the oil industry over the past few years with forecasts for the pending peak seemingly creeping closer to the present with every new claim. The precise dates vary from late 2020s to 2040's. While an increasing number of electric vehicles (EVs) on the roads coupled with government environmental legislations could slightly decelerate the rate of demand growth for oil, EVs could never replace oil in global transport throughout the 21st century and far beyond.

Moreover, talk about weaning all airlines off fossil fuels by 2050 is a pie in the sky. Biofuel, electric and hydrogen planes are all non-starters. Biofuel planes will deprive a world facing the threat of food shortages in the very near future of agricultural land that is better used to bolster food production and feed a population projected to hit 9.7 billion by 2050. A blending of aviation fuel with a small percentage of biofuels might prove a better alternative. Still, it will only lead to a minuscule reduction in global CO2 emissions. Moreover, the theory that we end up with zero emissions when burning organic matter because the carbon produced must have been absorbed while the organic matter was growing wouldn't stand scrutiny.[6]

Electric planes aren't going to fare better than EVs. Moreover, carrying a number of very large and heavy batteries on board is neither practical nor safe. Furthermore, the emissions from making and de-commissioning lithium batteries are estimated to match if not exceed those from jet fuel.[7]

Whether green, blue or grey, hydrogen is a non-starter. It needs far more energy to produce than it will eventually provide. Moreover, the safety factors alone will be a real drag on the practicability of hydrogen planes.[8]

In the final analysis, the most efficient way to reduce emissions from the aviation industry is improving fuel efficiency. So the claim that it may become possible in the future to fly emission-free will remain a myth for the foreseeable future.

There could never be a post-oil era throughout the 21st century and probably far beyond. It is very doubtful that an alternative as versatile and practicable as oil, particularly in transport, could totally replace oil in the next 100 years and beyond. What will change is some aspects of the multi-uses of oil in electricity generation and water desalination which will eventually be mostly powered by solar and nuclear energy.[9]

Oil and gas will continue to be the core business of the global oil industry well into the future. While the oil industry is investing huge amounts in renewables, such investment pales in size when compared with that in oil and gas. The slower pace of oil majors toward alternative energies is due to two key reasons. The first

is that they all believe that oil and gas will continue to be needed well into the future. And the second reason is that financial returns from renewables are nothing compared to those for oil and gas.

Therefore, humanity has two choices. One is to accept at face value climate alarmism and misleading information about the imminent existential threat of climate change that the environmental activists have been propagating over the past three decades, threats that may or may not happen and the other is ditching fossil fuels and precipitating a collapse of the global economy resulting in starvation, plagues and nuclear wars with major powers trying to grab available energy resources and the eventual demise of humanity. I am sure that the overwhelming mass of humanity would accept even a high level of emissions and global warming rather than face an immediate death.

The Last Oil Barrels?

If oil and gas will continue to drive the global economy well into the future, then where will the last barrels of oil come from?

In my opinion, these barrels will come from the Arab world, Venezuela and Russia with the very last barrel produced most probably by Iraq.

(i)- Iraq

Iraq sits on the world's largest oil reserves estimated to exceed 400 billion barrels (bb) of oil between proven and semi-proven reserves according to international experts who assessed Iraq's oil potential.[10] Moreover, Iraq has the cheapest production costs in the world estimated at $2-$3 a barrel. Furthermore, only 70% of Iraq's territory has been explored for oil.

Iraq's oil potential is vastly underestimated partly because the current assessment is based on a recovery rate of 15%-20% of its oil-in-place (OIP). This compares with a global average of 34%-35% and also with rates above 45% in the United States, UK, Canada and Norway. Iraq has never implemented advanced technologies, like 3-D exploration techniques, or deep and horizontal drilling and hydraulic fracturing, to find or tap new wells.[11]

Despite its long history as a producer, Iraq is largely untapped as far as oil development is concerned, according to the assessment made by the International Oil Companies' (IOC's) who were awarded re-development contracts between 2009 and 2011. Since production began at the dawn of the twentieth century, only 2,300 wells (both for exploration and production) have been drilled there, compared with about one million in Texas alone. A large part of the country, the western desert area, is still mainly unexplored.[12]

If more than eighty major oilfields discovered in the country, only about twenty-one have been partially developed. Given this state of underdevelopment, it is realistic to assume that Iraq has far larger oil reserves than documented so far, probably about 200 billion barrels (bb) more. These numbers make Iraq the fulcrum of any future equilibrium in the global oil market.[13]

Based on its potential, Iraq could be expected to supply the global oil market with 12-13 million barrels a day (mbd) in the next two decade and will most probably produce the very last oil barrel in the world.

(ii)- Venezuela

The second barrel before the last will probably come from Venezuela which currently has the world's largest proven reserves estimated at 303.8 bb.[14] Venezuela alone accounts for 92% of Latin America's proven oil reserves.

While both Venezuela's economy and oil industry are currently in a shambolic state, they will rebound quickly when the world realizes how dependent on Venezuela's oil it will be in coming years.

The late Canadian Prime Minister Pierre Trudeau was once quoted saying about the United States that "living next to you is in some ways like sleeping with an elephant. No matter how friendly and even-tempered is the beast, if I can call it that, one is affected by every twitch and grunt". For Venezuela, sitting on the world's largest proven oil reserves next to the world's largest consumer of oil must be a cause of worry. No matter how Venezuela's neighbour is good and neighbourly, it must still cast some envious eyes on such unbelievably huge oil wealth.

(iii)-Russia

The third barrel will come from Russia's Arctic region. It is estimated that the Arctic contains 13% of the earth's oil reserves and a quarter of its untapped gas reserves. Russia's untapped and inexhaustible reserves of oil and gas at the Arctic are estimated at 125 bb of oil and 3004-3534 trillion cubic feet (tcf) of gas. If these are added to Russia's current proven reserves of oil and gas, the figures then mushroom to 233 bb of oil and 4324-4854 tcf lasting from 1-2 centuries. Thanks to the Arctic, Russia will maintain its position as the world's energy superpower throughout the 21st century.[15]

Russia seems intent on selling the world's very last barrel of oil. As other energy supermajors and petro-states around the world scramble to diversify their economies and establish a foothold in energy transition, Russia is going ahead in further enhancing its fossil fuels industry and is vying for the distinction of being the last man standing in the global oil industry. It's more than probable that the world still has an appetite for hundreds of billions of barrels of oil and Russia will be more than happy to supply them.[16]

The Arctic is, in my opinion, Russia's 'Wild West' to borrow a phrase from America's history. President Putin has long ago recognized the great importance of the Arctic for the Russian economy and the Russian oil industry. That is why he has been pouring hundreds of billions of dollars into the region.

The Changing Balance of Power in the Global Oil Market

The power structure of global oil markets is already undergoing a major transformation exemplified by the rising power of the National Oil Companies (NOCs) and the declining influence and power of IOCs. In coming years, this power structure is set for a major shakeup if the reserve lifespan of IOCs continues to decline.

This shift could be evidenced from a comparison of Saudi Aramco's net income in 2018 with ExxonMobil and Shell. Saudi Aramco's net income of $111 bn was almost 6 times that of ExxonMobil ($20.8 billion) or Shell ($23.4 billion) (see Chart 1).

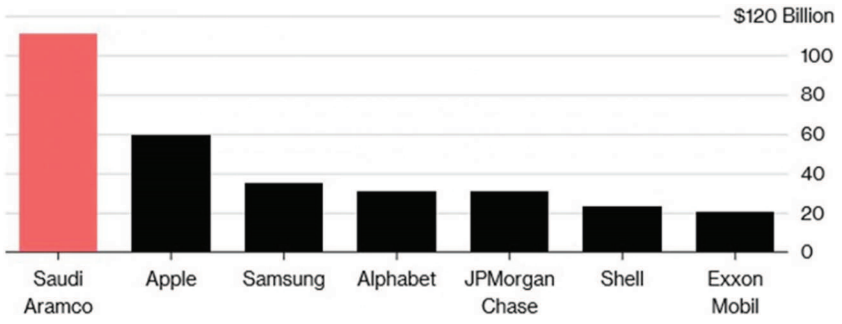

Chart 1. Oil Supermajor's Net Income in 2018

Source: Oilprice.com accessed on 20 November 2021

Whilst top IOCs such as Total, BP, Shell, Chevron, ENI, ConocoPhillips, ExxonMobil, Equinore and Repsol have reserve estimated to last from 8.0-10.5 years, the NOCs of countries like Saudi Arabia, Iraq, UAE, Venezuela, Russia and Kuwait to name but a few have access to proven reserves which could last from 66-91 years at the 2019 production levels.[17]

Between 1998 and 2002, top IOCs replaced 99.7% of oil produced. This declined to 51.7% between 2003 and 2007. Overall average IOCs' reserves in place have fallen by 25% since 2015 with less than 10 years of total annual production available. For instance, oil supermajor Shell expects to have produced 75% of its current proven oil and gas reserves by 2030, and only around 3% after 2040.[18]

This transformation has been inevitable since the birth of OPEC almost sixty one years ago. The formation of OPEC marked a turning point toward national sovereignty over natural resources and OPEC decisions have come to play a prominent role in the global oil market and international relations.

High oil prices have enhanced the bargaining power of oil-exporting countries. As a result, major IOCs have struggled to secure access to new oil reserves and their production has dropped in recent years. The reason is rising resource nationalism.

Resource nationalism has been on the rise around the world underpinned by governments wanting to fully control whatever hydrocarbon and mineral resources they have in order to maximize their revenues, growing global demand for these resources and also growing influence of the NOCs. That is why resource nationalism has become a major threat for the IOCs.

As a result of resource nationalism, IOCs are not welcome in the major oil-producing regions of the world, the Middle East, North Africa and much of Latin America. These regions in which IOCs most want to operate, are becoming extremely difficult operating environments due to political and regulatory constraints. Much of the major IOCs' production comes nowadays from the North Slope in Alaska, the Gulf of Mexico and the North Sea, areas which are witnessing rapid decline and where production is becoming increasingly more expensive. North America and the North Sea account for an estimated 60% of the IOCs' oil.

Profit margins per barrel are also a major investment issue as IOCs have been looking at the more challenging environments, such as deepwater, offshore, Arctic, or shale, while NOCs still have major conventional reserves in place.

Some analysts claim that the current reserve crisis is no real issue, as most IOCs are going through an energy-transition phase. However, to invest in the energy transition these companies need plenty of cash to cope with the planned multi-billion-dollar wind, solar, and hydrogen projects while also keeping investors and shareholders happy. Almost 80% of this cash flow is generated from oil and gas. As one chairman of an IOC put it succinctly "Black pays for Green".

Major IOCs have been earning an estimated 20% return on investment, a healthy figure by industry standards. Without doubt, high oil prices have enabled them to generate unprecedented profits but they have also fuelled a resurgence of resource nationalism, which along with increased industry competition severely limited areas open to IOC investment. It is becoming increasingly difficult for IOCs to find attractive ways to reinvest their profits and it will not get easier given that there are limited drilling prospects.

The largest and the cheapest oil reserves to produce are located in the Arab Gulf region and Russia and not in the hands of the IOCs. Instead, they are controlled by NOCs and governments who can self-finance the whole operation from reserves to pipelines.

Conclusions

Despite incessant efforts by environmental activists and divestment campaigners to keep oil underground, oil will continue to drive the global economy throughout the 21st century and probably far beyond.

It is possible that one sinister reason behind the calls for global energy transition and keeping oil underground is to prevent the Arab world, Venezuela and Russia from enhancing their geopolitical and economic influence over the global economy and tightening their grip on global oil reserves in coming years with the continued use of oil.

Still, the last barrels of oil will come from the Arab world, Venezuela and Russia with the very last barrel produced most probably coming from Iraq.

Footnotes

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Oil and Gas Under Attack at COP26

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As the COP26 climate summit in Glasgow wraps up, the oil and gas industries are once again the villains of the piece (coal of course is already beyond the pale). On the eve of the summit, Royal Dutch Shell's CEO stated that the company would be absent from the climate talks after being told it would not be welcome. Teenage climate icon Greta Thunberg, whose utterances have repeatedly gone viral on social media over the past two weeks, tweeted "I don't know about you, but I sure am not comfortable with having some of the world's biggest villains influencing & dictating the fate of the world."

Just prior to the start of the Glasgow summit, the US House Oversight Committee chair Carolyn Maloney accused ExxonMobil in the US of "lying" about climate change since the 1970s "like the tobacco executives were (about smoking and the link to cancer)". According to Maloney and other critics of the company, it had for years "raised doubts about climate change", as in 1997 when its then-CEO Lee Raymond said the "case for global warming is far from airtight" and that scientific evidence was "inconclusive." Evidently Ms. Maloney is unaware that even the highly qualified climate scientist Steven Koonin, undersecretary for science at the U.S. Department of Energy in the Obama administration, finds that Mr. Raymond had it exactly right. In his recently-published book "Unsettled" which offers an authoritative survey of the scientific literature, Koonin concludes that climate science is indeed far from "settled" and climate alarmism is unwarranted.

The Western oil majors have long been being accused of being like tobacco lobby of the 1970s.Now they ask for time to "transition" out of the fossil fuels to grow their renewable energy business. But for non-Western state-owned oil producers, over which activist shareholders and dearbonaization-focused Western governments have little influence, the special ire expressed by various commentators is remarkable. Among the group of oil producers, Saudi serves as a lightning rod.

Greenpeace expressed "grave concern" at "moves by the Saudi government to cripple the COP26 climate talks in Glasgow". The NGO accused the Saudi government of being "smart, strategic and utterly cynical", pushing back on including the 1.5^0C goal -- an arbitrary limit that seems to have taken a life of its own -- at the talks. Greenpeace says that the Saudis behaved as an arsonist at the talks, they "light matches, drop them, start fires and walk away".

But beyond the hyperbole, even seasoned observers of oil markets seem to have taken to criticizing the Saudis. A recent Bloomberg column accused Saudi energy minister Prince Abdulaziz Bin Salman of "delivering a masterclass in gaslighting" when he argued that the roots of the current energy crisis can be found in the decades of anti-oil policies adopted by the developed countries. "Gas-lighting", to remind ourselves, refers to psychological manipulation over an extended period of time that causes victims to question the validity of their own perception, leading to confusion and a dependency on the perpetrator. That is a serious charge indeed.

The article goes on to accuse Saudi Aramco, the state-owned oil company, of ignoring the world's biggest consumers' requests to increase oil supply. It continues, "despite what Prince Abdulaziz would have you believe, OPEC+ exists to look after the interests of its members, nobody else." You would have thought that sovereign governments and their national oil companies are tasked with representing the interests of their citizens. The effrontery of the argument that oil producers should decide on their supply and pricing decisions on the basis of their customers' views rather than on the laws of demand and supply and maximizing profits is astonishing.

Adam Smith, the founding sage of the discipline, famously observed, "It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own self-interest. We address ourselves not to their humanity but to their self-love, and never talk to them of our own necessities, but of their advantages." One might ask what were customers' views when oil prices collapsed in mid-2014 and led to massive fiscal imbalances and a dire economic growth outlook for oil producers?

In a recent TV interview, Harold Hamm – the famous US oil and gas entrepreneur and lead player in the "fracking revolution" that catapulted the country to its position as the world's leading oil and gas producer – was asked about the Western criticism on the industry apparent at COP26. The TV host asked him, "do you feel like Custer" (referring to American cavalry commander who led his men and himself to death at the Battle of Little Bighorn in 1876)? His response: "this (Biden) administration does not understand Economics 101…and has it all backwards". Mr. Hamm was referring to the Biden's executive actions since attaining office, ranging from the revoked permit for the Keystone XL pipeline, suspended oil leasing in Alaska to the halting of permits to drill in oil and gas leases on federal lands. But perhaps it wasn't so much an ignorance of economics as much as the perceived political benefits of hewing to the Democratic party's environmental constituency.

In another TV interview on November 6th, US Energy Secretary Jennifer Granholm threw her head back and laughed when asked if there was a plan to bring down gasoline prices – now at 7-year highs, having increased by 60% in the past year. She apparently found the question hilarious and and said: "would that I had the magic wand on this…Oil is a global market. It is controlled by a cartel. That cartel is called OPEC, and they made a decision yesterday that they were not going

to increase beyond what they were already planning." There was no recognition of the contradiction in castigating the OPEC+ oil producers group for refusing to ramp up oil exports beyond its scheduled monthly increases while the Biden administration is doing its best to hobble domestic oil and gas production.

In his latest response to high gasoline prices, a barometer of US presidential popularity, President Biden has asked the Federal Trade Commission to examine the role of oil companies in illegally causing high gasoline prices. In response, the American Petroleum Institute said "Rather than launching investigations on markets that are regulated and closely monitored on a daily basis or pleading with OPEC to increase supply, we should be encouraging the safe and responsible development of American-made oil and natural gas."

As countries emerge from the covid lockdowns, oil demand is surging. According to BP, global oil demand has now bounced back above 100 million barrels a day, a level that marked the peak seen before the pandemic. October gasoline sales in India reached an all-time high -- 8.3% higher than in October 2019 -- as covid cases diminish, the economy recovers and mobility increases. While the country "promises" net zero carbon emissions 50 years hence (in 2070) to COP26 host Prime Minister Boris Johnson's evident delight, it is also busy planning the start of multiple new refinery construction projects driven by economic growth and concomitant oil demand.

While the Saudi government has announced large investments in renewable energy to the approbation of the climate activists, the state oil company Aramco forecasts continued global oil demand growth for the foreseeable future and will boost its oil production capacity to 13 million barrels per day (bpd) by 2027 from 12 million bpd now. Other producers that plan significant production capacity increases include the UAE, Iraq, Guyana and Brazil. As the developing countries undergo economic recovery from the covid pandemic, veteran oil analyst David Blackmon states baldly, "forget about peak oil (demand), we haven't even reached peak coal (demand) yet".

While the vilification of the oil industry continues apace in the West, it is clear that for the developing countries, accounting for 80% of the global population, "nationally determined contributions" to constrain carbon emissions at annual climate summits will not override their legitimate aspirations for poverty alleviation and better standards of living for their citizens. This higher order imperative depends on a baseload of reliable and affordable fossil fuel supplies. As willing buyers, oil-short developing countries will continue to have durable and mutually-beneficial partnerships with oil producers. Oil companies committed to the "energy transition" and governments overly focused on decarbonization in the West play little or no role in this equation.

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Regional and Municipal Levels – the Central Arenas of the Energy Transition in Germany

BY JOSEF GOCHERMANN

Abstract

The energy transition can be mapped on four levels. While industry and the state should act on the national and international level, most of the energy transition is taking place at the regional and municipal levels. Here the small-scale and decentralized nature of the new energy world is reflected, where customized individual solutions are created.

Characteristics of the new energy world

The energy transition is much more than just replacing fossil fuels and uranium with renewable energies. The 4th industrial revolution is fundamentally changing the energy world. The new energy world will be essentially characterized by

- decentralized, distributed structures,
- regenerative energies, and
- intelligent systems.

It is true that there will continue to be large structures, such as offshore wind farms, large photovoltaic plants in sunny countries, international distribution grids, or cross-border hydrogen infrastructure. The new energy world, on the other hand, will be characterized by many small-scale, on-site solutions: decentralized energy supply in urban neighborhoods, individual energy generation through photovoltaics and windmills, community energy systems in business parks, and the interconnection of decentralized systems to virtual power plants, smart grids, and much more.

The large structures are already dominated by large companies and concerns. They have embraced the energy transition and are driving the generation of electricity from renewable sources, the replacement of fossil energy in industrial processes and the hydrogen infrastructure [2].

However, these large-scale industrial structures require a different market-economy framework and different regulatory regimes than the newly emerging small-scale and decentralized structures. Nevertheless, the energy transition is still considered as a whole, which leads to conflicts and contradictions.

The four action levels of the energy transmission

The high complexity and diversity of the fields of action is a great challenge for many actors in the energy world and also for politics and citizens. The elements are interconnected in many ways and influence each other, which often seems to lead to contradictions and oppositions. The difficulty in understanding this complexity is often the reason for a skeptical or negative attitude towards the energy transition.

This complexity can be reduced if the energy transition is not viewed as a whole, but if it is mapped on four levels: *international*, *national*, *regional* and *individual* (see Figure 1) [3].

Responsibility for action at the various levels should lie with different bodies. Municipal utilities, local authorities and public transport operators know what the framework conditions and requirements are at their regional level. Companies and private house-

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Level	*Change*	*Characteristics*	*Fields of action*
International	**Change of responsibility**	• Energy as a global common good • International energy partnerships • Congruent energy and foreign policy	• Global networking to reduce greenhouse gases • Technology dissemination • International hydrogen economy • Capital / financing systems
National	**Energy and technology change**	• Renewable energies instead of fossil fuels and uranium • Electrification of the systems • Large wind and solar parks • Control of power distribution	• Expansion of more solar and wind parks • Compensation of volatilities / flexible grid control • Technology promotion • National hydrogen economy
Regional	**Paradigm change**	• Decentralization • Distributed systems • Intelligent systems • Transparency of energy systems • Regional actors • Citizen involvement/participation	• Energy availability • Balancing supply and demand • Regional multidirectional actor networks • SMEs as market participants • Urban district supply • Mobility concepts
Individual	**Change of attitude**	• Solar and wind energy as a public good • Prosumer / self-sufficiency • Energy value defined by availability • Individual responsibility • Conscious use of energy / experiencing energy	• Strengthening decentralized structures and forms of organization • Energy platforms • Small-scale energy partnerships • Rediscovering energy as a production factor

Figure 1: The four levels of the energy transition, the characteristics of the respective change and the fields of action (Gochermann 2021).

holds want to and should determine for themselves how they deal with energy. And policymakers must set framework conditions at the national level, coordinate technologies at a higher level and reach international agreements. As long as one stays on one level, there is usually no conflict.

It becomes problematic when you move across levels: when large national energy companies want to control energy all the way into the home, when municipal utilities or regional players act on the national or even international stage, or when the state wants to regulate all the way down to the individual level. The energy transition in Germany threatens to be stifled in over-regulation by the state, in too detailed thinking and in the definition of individual regulations and individual exceptions. In organizational theory, this is called over-organization.

In its 2018 report on the "Coordination and management of the implementation of the energy transition in Germany" the German Federal Court of Audit sharply criticized such over-organization. According to the report, the tasks of the energy turnaround are spread across four departments with 38 units and almost 300 employees in the Federal Ministry of Economics alone, plus around 400 employees in subordinate authorities [4]. The Federal Audit Office doubted the control function of the 26 laws and 32 ordinances that regulated the generation, storage, transmission, distribution and consumption of energy "in some cases with a high degree of detail."

Energy transition takes place at the regional level

Politicians in Germany, and certainly in other industrialized countries, still assume that the energy transition has to happen at the national level. From the perspective of the Ministry of Economics, energy policy is still primarily industrial policy. They only think in terms of large industrial structures, large power lines and regulation of the system.

However, only part of the energy transition is taking place at the national level. It is essentially an energy and technology transformation. The switch from coal and uranium to renewables is indeed a national task. The phase-out of nuclear energy and also of coal were important national decisions in Germany. But regulating how and where distributed and volatile renewables develop and how they are integrated into the system cannot be controlled by a ministry.

The main level at which the energy transition is taking place is the regional level. Until now, it was purely a distribution level for energy suppliers, including the necessary infrastructure. Municipal utilities and energy supply companies *supplied* the end users with electricity, gas and heat.

Today, the regional level is already the playing field on which the energy transition is being driven forward. And it will be even more so in the future with increasing decentralization, distributed systems, and the multitude of new players. There are a wide variety of players on the playing field: cities and municipalities, municipal utilities and public transport companies, citizens' energy cooperatives and medium-sized companies, neighborhood operators and regional energy companies, and many more. In addition, there are all the actors at the individual level who either use energy or want to produce it and feed it into the grid. The coordination between all these actors can only take place at the regional level. This is where the picture of the new energy world is shaped.

Ultimately, it is a question of regional services of general interest, but not as a supply obligation of a few companies, as has been up to now. Regional services of general interest in the energy sector mean connecting the individual and regional levels in the sense of platforms and creating the conditions for dynamic exchange and cooperation.

Completely new tasks and opportunities are emerging for regional municipal utilities and energy companies. They are no longer pure suppliers, but rather the moderators of the networked energy world. They provide the platforms, ensure the availability of energy through flexible balancing, and adapt the necessary concepts to the respective regions.

Municipal utilities as infrastructure service providers

The municipal utility Wuppertaler Stadtwerke (WSW) is more than just a distribution network operator and energy supplier. The WSW group of companies has the character of a concern and, in addition to WSW Energie & Wasser AG, also includes the local transport division WSW Mobil GmbH and the waste management company Abfallwirtschaftsgesellschaft mbH. According to CEO Markus Hilkenbach, the orientation is that of a local infrastructure service provider.

The aim is to organize services relating to public utilities in such a way that customers can purchase everything with a single customer number. Be it electricity, gas or heat, energy services, but also the mobility offers [5]. In the future, comprehensive services will be offered in the areas of network and distribution, smart city, telecommunications, intelligent systems and platform economy, as well as waste disposal. Linking all these offerings enables the formation of a "municipal nucleus" that represents a genuine unique selling proposition.

District development and sector coupling

Municipal utilities can also take a leading role in sector coupling at the municipal level. Wuppertaler Stadtwerke (WSW) has long been intensively pursuing the topics of neighborhood development, heat transition and mobility transition. Together with the University of Wuppertal, WSW is involved, for example, in the Arrenberg climate quarter [6], where new approaches of living together have been tested for over 25 years - far beyond questions of energy use. In a research project, hundreds of apartments in a densely populated, historic working-class neighborhood were equipped with smart meters. One goal was to study tenants' willingness to shift their own energy use patterns in "sync" with the volatile supply of renewables. The results are

impressive. By load shifting alone, significant CO_2 savings were realized in the households.

The publicly funded "Wuppertal Model", which closes the chain from waste incineration and the generation of heat and electricity, through the local production of hydrogen, to the refueling of the company's own hydrogen buses, acts beyond the country's borders as a blueprint for comparable projects in Germany, but also in Canada.

Shaping the urban heat transition

In cities, there is considerable local heat potential, such as commercial waste heat, wastewater heat, geothermal heat, solar energy and, depending on the location, river water heat. According to the Institute for Ecological Economy Research (IÖW) in Berlin, municipalities should definitely tap into this potential. In the medium term, this could reduce the demand for gas for heating. It would be efficient and cost-effective to tap the potential not only where it occurs, but as comprehensively as possible. In most cases, this would only be possible with a cross-building district approach [7].

In 2019, the management consultancy Ernst & Young (EY) conducted a study on heating sales in which around 600 private customers were asked about their needs and experiences with decentralized heating solutions, as well as their relationships with energy suppliers and other participants active in the heating market [8]. In contrast to the electricity market, the heating market has always been characterized by its decentralized nature, as the transport of heat is much more lossy than electricity. The heating market is characterized by a large number of suppliers offering a wide range of additional services in addition to the spectrum of generation technologies described above. However, only very few providers cover this total scope of technologies and services for all customer groups. The majority of market players, mostly smaller craft enterprises, limit themselves to a selected number of technologies and services.

Regional concepts - energieland2050

The majority of renewable energy generation facilities in Germany are located in rural areas. For thirty years now, rural areas have been a pioneer in renewables. The Steinfurt district in the Münsterland region of northwestern Germany, approx. 450,000 inhabitants, has been committed to climate protection for more than 20 years. It is one of the few counties that has its own office for climate protection and sustainability.

In addition to the municipal district activities, a network has been formed in the district of Steinfurt over the last 15 years in which more than 80 companies and all 24 municipalities want to promote climate protection. In the meantime, these activities have been brought together in an association, the *energieland2050* [9]. In 2050, according to the objective, the district wants to be energy self-sufficient and independent. To achieve this, the consumption of energy is to be reduced by 50 percent. The potential of renewable energies is to be fully exploited, and the volume of wind power is to be at least maintained by re-powering the old plants [10]. The first large wind farm in Germany was built in the mid-1990s in the municipality of Schöppingen - in the district of Steinfurt [3, p. 222]. Today the share of renewable energies in electricity consumption in the Steinfurt district is almost 70 percent. There are 21 wind farms in the region, and around 4,000 citizens

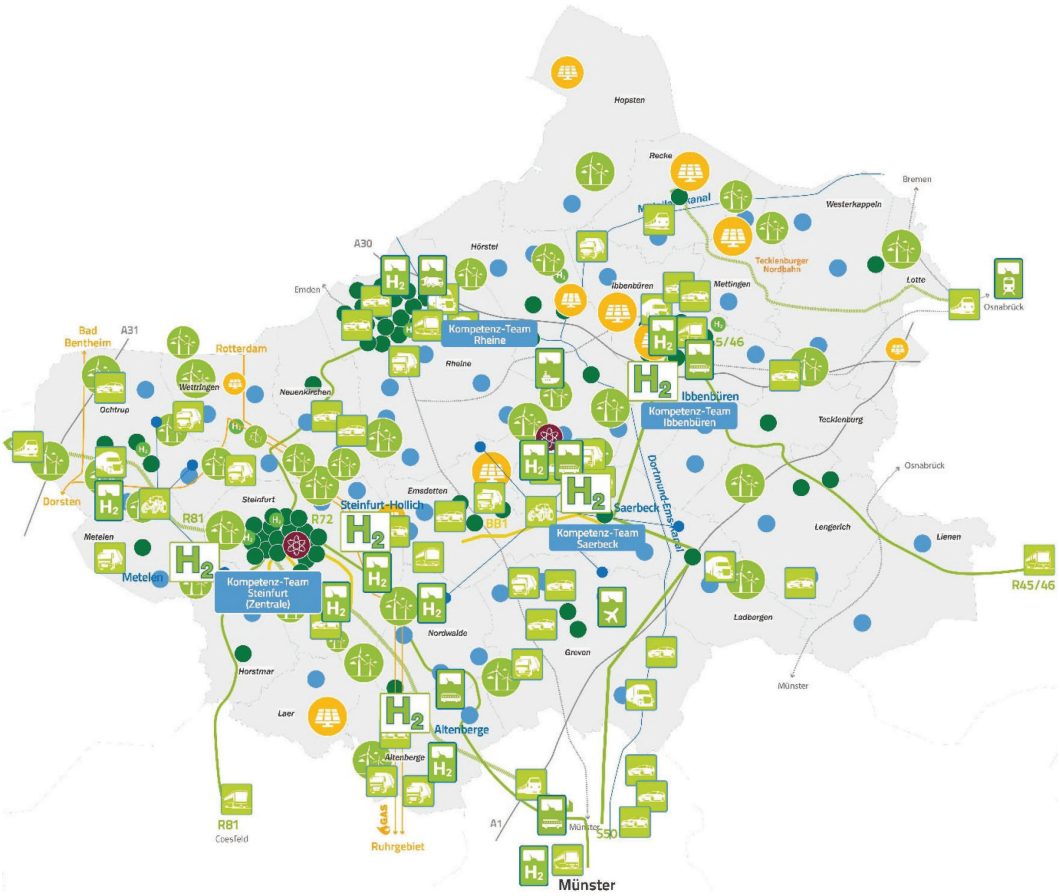

Figure 2: HYMAT hydrogen competence center in the Steinfurt district. Map of producers, users, actors and the infrastructure for hydrogen production and use (source: Steinfurt county [11], with kind permission).

participate in the citizen wind farms in the Steinfurt district [9].

The regional energy transition is supported by a broad network: the wind farm operators anchored in the region, the companies, the banks, the seven municipal utilities, the communities and, last but not least, the citizens as "prosumers" - together they want to generate themselves what they consume locally. As a result, more and more money (investments, energy expenditures, business taxes, etc.) remains locally with the trades, the investors, the municipalities, and the people. Here, the network idea of the new energy world is already fully lived. According to the head of energieland2050, Silke Wesselmann, this also includes a certain self-sufficiency mentality [10]. The goal of self-sufficiency would be "widely supported." Here we find an important element of the new energy world: acceptance.

Of course, the district of Steinfurt is also at the forefront when it comes to hydrogen. Based on the activities of the energieland2050 association, the people of Steinfurt are working to establish the hydrogen competence center HYMAT-Energy [11]. A total of 32 measures with 130 individual measures were developed in a detailed concept. The basic approach is that the green hydrogen comes from the region's renewables and is also used there. By 2030, the aim is to have built up a corresponding hydrogen infrastructure with electrolysers and hydrogen filling stations.

Municipal mobility

With 165,000 inhabitants, the city of Osnabrück is one of the three centers in northwestern Germany besides Münster and Oldenburg. Stadtwerke Osnabrück (municipal utility) is also responsible for operating local public transport and has repeatedly attracted attention for years with pioneering projects. They want to develop from a pure public transport operator into a complete mobility service provider for the people in the region [12].

The aim is to combine new offerings based on new forms of propulsion in a smart and sustainable way, emphasizes mobility board member Stephan Rolfes. And this in an environment of increasing flexibility, individuality and independence. Stadtwerke Osnabrück is therefore focusing on an environmental network with an electrically powered and well-developed bus network as its backbone and a multi-stage digitization strategy for the simple and intelligent use of all services [12].

In the first year, a total of 35 buses were on the road electrically and emission-free. The ultra-modern vehicles in the classy "We drive electricity" MetroBus design now dominate the cityscape of Osnabrück. This system is supplemented by feeder and pick-up buses in rural and suburban areas, small shuttle buses that can be ordered via app. An expanded public transport system based on demand, consisting of scheduled and on-demand services, forms the backbone of the environmental network. In addition, there are collaborative offerings such as car, ride and bike sharing. [12].

Smart Cities

A city's energy management will look completely different than it has in the past. There will no longer be the one utility that supplies and distributes energy. New, truly municipal solutions are required. Shared responsibility for dealing with energy will become obvious, especially in cities. Here lies a core of a new energy society.

But the real challenge of smart cities is far more than just an energy issue. In the smart cities of the future - and in some metropolises this has already begun - many areas will be interlinked. Smart buildings, digital building information management (BIM), smart transportation technology, electro mobility and charging infrastructure, intelligent administration, digital communication - the city of the future is a business model that can be mapped, simulated and analyzed digitally.

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Rate Setting for an Electrified World

BY JACKIE NOCK

Abstract

Electrification to meet decarbonization goals is a significant new risk facing regulators and utilities. This paper identifies potential changes to regulatory rate setting processes that could help lower the cost of electrification, including addressing regulatory siloes, aligning utility employee incentives, competitive pricing (such as rate discounting), and congestion pricing.

INTRODUCTION

Utility regulation has been designed since the 1950s to address the natural monopoly position of energy utilities – to protect the public from potential monopolistic behaviour on the part of a public utility while ensuring the continued quality of utility service.

This continues to be an important goal, but is this the only problem that regulators should address?

Professor Malcolm Sparrow states in his book 'Fundamentals of Regulatory Design':

> *Regulatory agencies exist primarily to control risks to society. …*
>
> *The programs, or course, were designed as solutions to the set of risks that existed at the time the programs were created, and may be successful in achieving their design purpose. But major programs, once created, tend to ossify over time, and lack the flexibility to cover the shifting landscape of risks.*

Professor Sparrow encourages all regulatory agencies to allocate resources to 'problem-centric' work in order to identify new risks that might not be addressed by existing programs. The regulator can then evaluate each new risk to determine if it should allocate resources to address it.

This paper puts forward a new risk that was not around when regulatory programs were established – electrification to meet decarbonization goals. It then suggests changes to existing programs (with a focus on rate setting) that may be needed to address this new risk.

This paper assumes the regulator has determined that supporting electrification of transportation, buildings and industrial processes is both within the regulator's mandate and in the public interest. and that the regulator is starting the process of updating regulatory programs to support a cost-effective and equitable transition.

This paper is not intended to demonstrate that electrification is a new risk for all regulators, or that it is the only new risk that existing programs may not address (for example, cybersecurity and extreme weather are other new risks), or that the suggested changes are the optimal approaches.

Instead, the purpose of this paper is to serve as an illustrative case study to show potential outcomes that could result from an increased focus on 'problem-centric' work.

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NEW RISK: ELECTRIFICATION

Multiple studies have identified that electrification of buildings (along with transportation and many industrial end-uses), combined with decarbonization of power generation, is critical to achieving deep decarbonization goals. (Billimoria, 2018; Davis, 2021)

This creates a new risk for regulators as electrification impacts natural gas utilities, electric utilities, and their customers.

For example, if utility rates and programs discourage customers from fuel switching to electricity when they are replacing their existing gas equipment, this could increase the cost of the clean energy transition.

If poorly planned, electrification could also result in the cost of the gas network and the more expensive clean gas substitutes being borne by those least able to exit the gas network (such as low-income customers and renters). It could also result in unnecessarily high electric costs (or reduced reliability) to serve the new uncertain load.

NEW RATE SETTING APPROACHES

This paper identifies four changes to regulatory approaches that could be used to lower the cost of electrification to meet decarbonization goals, with a focus on rate setting:

1. Address regulatory silos (between gas and electric filings)
2. Align utility employee incentives (bonuses)
3. Competitive pricing (gaining new electrification load)
4. Congestion pricing (integrating electrification load)

This paper is not intended to include all the changes that may be needed (such as long-term planning), but merely be a starting point for discussion.

1. Address Regulatory Silos

Regulatory processes are still generally structured around the 1950s monopoly utility 'problem definition', with regulators generally agnostic regarding customer fuel choices. Gas and electric utilities file their rate design applications separately and they are reviewed independently from one another.

However, when making investment decisions (such as replacing heating equipment) customers compare

offerings from the gas and electric utility – which can include utility retail rates, energy efficiency incentives and extension policy. Where electrification is the lowest cost way for society to achieve emission reduction targets, shouldn't the pricing signals utilities send support this outcome (or at least not discourage it)?

This may seem like an obvious approach to customers (who may expect that regulators are doing this already) but it is not an approach generally used by regulators due to the siloed nature of regulatory proceedings.

To address this, regulators could move from the existing siloed approach - where gas and electric utility rate design, energy efficiency and extension policies are reviewed separately from each other - to a holistic view.

Utility revenue requirement applications would still be undertaken separately, with total rates/revenues set to allow a fair return for the utility and fair cost recovery between customer classes. However, when it comes to rate design, energy efficiency programs and extension policies, the regulator would combine all these gas and electric filings. The regulator would then review this bundled filing from the perspective of the end use customer by looking at the service being provided, such as:

- transportation,
- building heating/cooling and
- industrial processes

This would allow the regulator to identify whether, for each service, electrification is a likely outcome of the clean energy transition. If yes, the regulator could then determine whether existing gas and electric pricing signals discourage electrification (and so could increase the cost of the energy transition), and if so, propose changes to address them.

For example, for buildings the regulator may determine that energy efficiency programs encouraging customers to invest in gas equipment are not in the public interest, or that utility contributions under its extension policy should be reduced or removed where there is concern that the customer will not be there for the economic life of the utility asset.

This approach could also support better visibility into the size of the potential electrification load. It could then help start a discussion into how electric utilities can cost-effectively serve this load, and how to equitably address gas utility rate impacts resulting from a loss of load.

Transportation also requires a holistic approach as the electric service provided to any one transportation customer can occur at many different metered locations. Specifically, while the majority of a customer's electric vehicle (EV) charging occurs at home, EV owners also make use of public EV charging stations at their workplaces and when travelling longer distances.

The starting point for a review of residential electric transportation rates would therefore be an amalgamation of the revenues from public EV charging stations and home charging (in addition to EV incentive programs offered by the utility). Residential bills do not typically separate out EV charging from other services, however estimations could be made.

Under this approach, even if revenues from public EV charging stations do not recover their costs, they could be considered fair overall if total transportation revenues recover total costs.

2. Align Utility Employee Incentives

The decarbonization of the energy sector can have a significant impact on gas and electric utilities, and their customers. We will need talented utility employees to bring their best ideas forward to ensure an efficient and just transition. Is there more regulators can do to support this?

Electric and gas utilities are generally regulated under cost-of-service regulation, where the utility's allowed income is directly linked to the size of the investments made by the utility (referred to as 'rate base').

Electric utilities under cost-of-service regulation therefore do not have a clear financial incentive to propose time-of-use rates that reduce the need for supply-side investments. A gas utility would also have no incentive to design rates that encourage electrification. In both cases, these actions would reduce the utility's rate base and so decrease their allowed income.

Strides have been made in many jurisdictions to address this disincentive through alternative forms of regulation, such as performance-based regulation. However, it can be difficult to fully remove the incentive to invest in supply-side assets.

This paper proposes an additional tool that regulators could consider. It starts with the recognition that there is more than one way to incentivize a service provider. Consider restaurants – you pay the bill at the end of the meal, but also tip your server. The same approach could be considered for utilities.

Instead of only using broad brush tools to incent the utility, regulators could expand their toolbox to include an additional incentive that is specifically used to fund utility employee bonuses.

Critics could argue that this will result in an additional cost to customers, over and above the amount the utility is already allowed to earn on its rate base. However, this could be a relatively low-cost way of mitigating the bias towards supply-side investments, and so result in lower costs to customers overall.

There could also be a concern of regulatory overreach - regulators do not typically micromanage utility employee incentive programs. However, this option provides utility employees with an opportunity to increase their earnings, while preserving the ability of the shareholder to earn a fair return on existing assets. It could also mitigate shareholder stranded asset risk by discouraging unnecessary supply-side investments. Utilities may therefore not be opposed to this proposal.

In addition, the UK regulator, Ofgem, already uses a similar 'employee bonus' approach. Ofgem asks utilities to demonstrate how they intend to align the structure of pay and reward within the organisation to the delivery of their business plan commitments. (Ofgem, 2018)

Electric Utilities

For electric utilities, the incentive pool could be tied to achieving electrification targets and cost-effectively integrating the new load. This could encourage staff to bring forward innovative ideas that might not otherwise have been supported within their organization.

For example, many gas and electric utilities already have energy efficiency staff who have a great understanding of their customers' energy uses. If these staff were given bonuses (linked to electrification targets) and pricing flexibility, this could significantly accelerate electrification.

If bonuses were also provided for initiatives that cost effectively integrate this new load (for example, using 'smart grid' solutions), these could have further benefits for customers.

Gas Utilities

For gas utilities, managing a transition away from natural gas will require all of the expertise and skill of the gas utility's employees. There will need to be a strategy in place to ensure the costs of the energy transition are not borne by those least able to afford it and that the safety/reliability of the gas system is not compromised.

However, under cost-of-service regulation, the utility is instead incented to grow the rate base. It could also be discouraged from requesting mitigation approaches (such as accelerated depreciation) as this reduces the utility rate base. Instead, it may propose exit fees which could delay electrification and so increase the costs of the transition.

The problem here is not with the gas utility, but with the regulatory incentive structure it is working under. The best way to address it is to fix the incentives.

An incentive pool for gas utility employee bonuses could link bonuses to specific action items, such as developing and implementing a plan to support strategic pruning of the gas network, equitable cost recovery of existing assets, and an employee retention strategy to ensure safety and reliability is not compromised during the transition. The regulator may also want to include an incentive pool linked to reducing methane leaks and helping customers electrify.

The regulator's ability to 'find important problems and fix them' can be significantly enhanced if we ensure that the utility executive management and supporting staff are incentivized to do the same.

3. Competitive Pricing

Regulators have traditionally been agnostic about customers' fuel choices and so rate designs (other than bypass rates) did not consider customers' competitive options.

However, where electrification is the least societal cost option, shouldn't regulators also ensure that (to the extent possible) it is the least priced?

Bonbright, author of 'The Principles of Public Utility Rates' (Bonbright, 1988) and often considered the father of rate design, addressed a similar issue.

In the 1980s telecom utilities were facing competitive pressure. Bonbright (p. 592) stated that when there is competition in the market, the *least-cost provider should be the least-priced supplier*.

To achieve this outcome, for rate designs the variable charge for natural gas costs might be increased relative to the fixed charge, while for electricity rates the opposite could occur.

The electric utility could also discount its rates to obtain this new load. Bonbright (p. 620) provides pricing principles for utilities seeking to attract/retain load in a competitive environment:

> *Prices should be allowed to be set with incremental cost at the minimum. At the maximum, prices for regulated services should be set at standalone cost. Prices that are set at levels between those two economic benchmarks will not involve cross subsidy. Within these bounds, considerable pricing flexibility should be allowed*.

This approach could allow the electric utility to obtain new profitable load that it would not otherwise be able to obtain under the regulated tariff. It should therefore benefit all customers (some contribution to fixed costs being better than none).

For larger customers, this could result in a move from standardized tariffs to negotiated contracts, and for residential and commercial customers it could result in discounted rate options for customers switching to EVs or heat pumps.

There could also be areas where electrification is considered the lowest cost option from a societal perspective, but where the electric price (even when set at incremental cost) is still too high to incent the customer to fuel switch. An example could be large industrial customers where a significant investment in new transmission infrastructure is needed.

In these cases, government may want to provide funding to 'bridge the gap' or put in place codes/standards to require the customer to fuel switch. This approach ensures that the cost of electrification to meet decarbonization objectives is not disproportionately borne by electric utility ratepayers.

4. Congestion Pricing

A key issue with electrification is how to efficiently integrate this new load.

One option is to use time-of-use pricing to encourage customers to shift load away from peak periods. A question for rate design analysts then becomes how to set the peak/off-peak pricing differential.

Bonbright (p. 511) states that the peak/off-peak differential should reflect the utility's marginal costs. However, this is easier said than done given the lumpy (and regional) nature of network investments. In addition, customers do not always respond efficiently to efficient pricing signals.

Utilities could easily end up in a circular situation of designing rates with only a small peak/off-peak differential on the basis that the customer response will be too small to defer network costs.

The experience of Orion (an electricity distribution network located in New Zealand) is illustrative of an alternative approach to setting the peak/off-peak differential. This is referred to as congestion pricing.

Around 1990 Orion was facing a congested network and so put in place pricing signals to encourage customers to shift to off-peak periods. Orion describes its approach as follows:

> Like roads, electricity networks have 'rush hours' where loading levels peak and capacity is fully utilized.
>
> Orion's rush hours typically occur on cold winter mornings when residential load coincides with the start of the business day, and again on cold evenings when people arrive home from work and turn on their lights, heaters, and cook their evening meal. ...
>
> One solution to cope with these relatively short periods of high loading is to expand our network's capacity - much like making roads bigger to handle more traffic. But this is very expensive, especially given that the additional capacity is not needed 98% of the time, and would mean price increases.
>
> We think it makes better sense to promote other cheaper options, such as load management, where we reduce the electrical load on our network during periods of peak demand. We can do this by heating hot water cylinders at off-peak times, and through pricing that encourages off-peak electricity use.

Orion's peak/off-peak differential for residential and small commercial customers is around 3:1, and by 2010 this resulted in a reduction of peak demand of around 10% (with direct load control contributing an additional 10%). This resulted in a significant cost benefits for all customers.

Orion did not base its peak/off-peak differential on a marginal costing study. Instead, Orion's approach was based on the differential needed to elicit an efficient customer response.

This is consistent with Bonbright's (p. 383) efficiency rate design principle:

> *Discourage the wasteful use of public utility services while promoting all use that is economically justified.*

The congestion rate would still have to be evaluated against all the rate design principles (Bonbright, p. 383), but at least a rate design that could defer the need for new supply-side investment would be evaluated. Additional rate design considerations are described below (AUEB, 1996):

> *Before making a change in [rate] design, the Board would need to be satisfied, on the basis of clear and convincing evidence, that greater efficiencies or cost savings would accrue to the benefit of [customers] overall. The Board would also need to be satisfied that the magnitude of the changes to affected parties are acceptable and that benefits in the broad public interest would result. The Board would also look for transitional measures designed to manage such changes.*

In addition, as an important impact of pricing occurs when customers are replacing their plant, congestion pricing may need to be put in place well in advance of the actual need for demand response in order to defer the network investment.

CONCLUSION

Professor Sparrow encourages all regulatory agencies to allocate resources to 'problem-centric' work to identify and address new risks.

There are significant new risks facing the energy industry that were not around when existing regulatory processes were first designed. For example, electrification of transportation, buildings, and industrial processes to meet decarbonization goals can have a significant impact on utilities and their customers.

This paper aims to highlight the need for allocating regulatory resources to 'problem-centric' work by identifying potential changes to existing regulatory rate setting processes that could help lower the cost of electrification.

Professor Sparrow notes that 'problem-centric' work can be both difficult and intellectually challenging, but by working together (and with sufficient resources) we should be able to provide good solutions and great pathways going forward.

Disclaimer

This paper was prepared by Jackie Nock in her personal capacity. Views, thoughts, and opinions expressed in this paper belong solely to the author and not to the author's employer.

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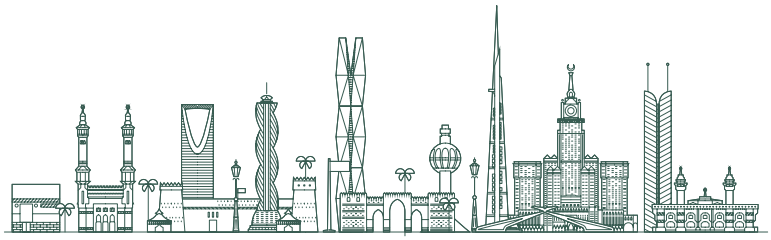
44th IAEE INTERNATIONAL CONFERENCE
Riyadh, Saudi Arabia
4-8 February 2023



Call For Papers

Pathways to a Clean, Stable, and Sustainable Energy Future

The Saudi Association for Energy Economics (SAEE) and the King Abdullah Petroleum Studies and Research Center (KAPSARC) are hosting the 44th International Conference of the International Association for Energy Economics (IAEE) on February 4-8, 2023, in Riyadh, Saudi Arabia.

Conference Overview

Tackling climate change while ensuring a just, reliable and clean energy transition has been at the forefront of global challenges. The onset of COVID-19 has further exacerbated the challenge of meeting climate targets. The 2021 United Nations Climate Change Conference (COP26) urged further actions by Parties to reduce their carbon dioxide (CO2) emissions by 2030 so that the world could reach net-zero emissions by 2050. As the world slowly recovers from the aftermath of the pandemic, millions of people still lack access to affordable, reliable, and sustainable energy and clean cooking. The 44th IAEE conference will highlight the interdependence of clean, stable, and sustainable energy trajectories. In addition, recent developments in energy markets will be discussed.

This will be the first time that the IAEE has held its international conference in the Middle East and North Africa(MENA)region, one that, for the past two decades, has supplied the world with more than 40% of its oil and gas needs. The region's hydrocarbon production potential and cost advantages will affect and be affected by the pattern and speed of the global energy transition.

The 44th IAEE International Conference will provide an opportunity for government officials, institutional leaders, academics, and corporate leaders to meet, exchange views and address timely and relevant issues facing the energy sector.

Program Structure

The program will feature keynotes, workshops, plenaries and concurrent sessions. These will include Hydrogen and Circular Carbon Economy (CCE) Workshops. The following Energy Plenaries are planned:

- Economy and Energy Diversification in MENA
- Energy, Development, and Climate Change
- Energy Transition and Pathways
- Investment and Financing
- Mobility and Technology
- Efficiency and Industrial Competitiveness
- Energy Volatility, Security, and Access

The program also features a tour and dinner at a world heritage site, dinner at the National Museum featuring Arabian prehistory, history, culture, and art as well as optional technical tours.

Call for Papers

Concurrent session presenters must submit an abstract that briefly describes their research or case study. Along with the overview, it must include the background and potential significance of their research, its methodology, results, conclusions, and references (if any). All abstracts must conform to the structure outlined in the abstract template. Abstracts are limited to no more than two pages in length and must be submitted online no later than September 9, 2022.

IAEE International Association for ENERGY ECONOMICS

KAPSARC
مركز الملك عبدالله للدراسات والبحوث البترولية
King Abdullah Petroleum Studies and Research Center

جمعية اقتصاديات الطاقة
Saudi Association for Energy Economics

Important Dates

Abstract submission deadline: **September 9, 2022**

Notification of abstract acceptance: **October 21, 2022**

Submission of full paper and registration: **December 2, 2022**

Conference starts: **Saturday, February 4, 2023**

Non-Exhaustive Topics for Papers

- Energy, development, and climate change
- CCUS methods and solutions
- Circular Carbon Economy (CCE)
- The role of hydrogen in the energy transition
- Economics and geopolitics of oil and natural gas
- Challenges facing the power sector in MENA
- MENA economic and energy diversification
- Impact of energy price volatility on supply security and investment
- The role of oil and gas in the energy transition
- Energy sector investment and financing
- The role of energy efficiency in the transition
- Renewables opportunities and challenges
- Energy and the transport sector
- Energy and emissions modeling
- Energy poverty and Sustainable Development Goals (SDGs)
- COVID-19 and energy
- Energy and industrial competitiveness

Conference Venue

The 44th IAEE International Conference will be held on the King Abdullah Petroleum Studies and Research Center (KAPSARC) campus in Riyadh, Saudi Arabia. The international airport and hotels are just a short distance away from KAPSARC's award-winning campus, designed by the noted architect Zaha Hadid.

Who Should Attend?

The conference is intended for a broad range of individuals interested in energy matters, including:

- Business leaders and consultants
- Practitioners, academics, and scholars in the fields of energy, natural resources, or environmental economics
- Policymakers and government officials, international institutions, and regulatory agencies
- Energy and environmental analysts working for local authorities, development agencies, consumer bodies, and non-government organizations (NGOs)

Student Events

Students may, in addition to submitting an abstract, submit a paper for consideration in the IAEE Best Student Paper Award Competition.

Best Student Paper deadline: **October 7, 2022**

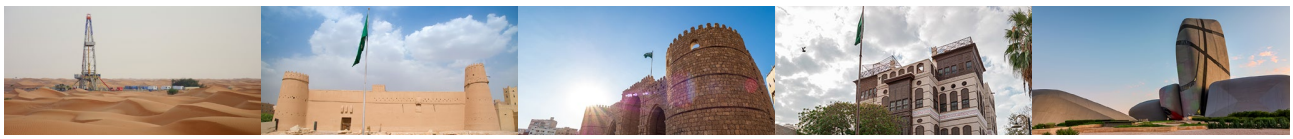
Best Student Paper notice: **November 7, 2022**

Students are encouraged to participate in the Student Poster Session.

For more information, please contact iaee2023@saudi-aee.sa

Complimentary Registration

The conference organizers are pleased to offer complimentary registration to attend the 44th IAEE International conference in Riyadh, Saudi Arabia. This offer extends to all speakers and attendees.



Not All Carbon is Created equal, so Let's Tax Extravagant Emissions More

BY PHILIPPE BENOIT

Abstract

Climate taxes traditionally apply a uniform price for emissions, but emissions result differing types of underlying activities. Some meet critical basic human needs, while others serve highly discretionary extravagant lifestyles. This article proposes a tax on the extravagant carbon emissions of the wealthy to serve climate and equity considerations.

Everyone emits, but the rich emit more

Everyone generates greenhouse gas emissions, from the richest to the poorest. Fossil fuel consumption and their accompanying emissions are part of the livelihoods of millions of working-class families in the United States and around the world (e.g., in cars and two-wheel vehicles, or for residential heating). Even the world's poorest households generate some GHG emissions, notably in cooking.

The rich, however, generate substantially more emissions per person than the middle class or poorer families. As previously analyzed by Oxfam, the world's richest 1 percent emit about 50 tons of carbon dioxide (CO_2) per capita, 30 times more than the poorest 50 percent and 175 times that of the poorest 10 percent.[1] In the United States, the richest 10 percent emit over five times more per capita than the bottom 50 percent and about three times the national average. In China, the richest 5 percent emit almost four times the national average.[2]

This higher level of emissions flows from a more carbon rich consumption lifestyle, much of which is not accessible to middle-class or poorer households. For example, a first-class airplane trip from Washington to Paris is estimated to account for the equivalent of 1.82 tons of carbon dioxide, which is more than four times the same trip in economy class[3] and nearly 10 percent of the annual U.S. per capita GHG emissions. There are other high-carbon luxury products limited to the rich, such as high-end sports cars, super-yachts, multiple large residences, and private jet travel.

Looking forward, several factors point to the potential for a greater amount of high-carbon luxury activities. Notably, the number of high-wealth individuals is project to grow, with the number of millionaires worldwide increasing from 56 million to 84 million by 2025.[4] Moreover, market forces and technological innovation have the potential to create new ways for the rich to emit through novel and elite products and services that target the high-end market.

Emissions result from different activities with different "inherent" values (i.e., utility)

As I and others have previously written,[5] in considering how to price and tax GHG emissions, it is pertinent to consider what activity has generated the gas. For example, some have pointed to the difference between emissions relating to subsistence as opposed to luxury activities.[6] This "subsistence/luxury" categorization can be extended to better reflect the consumption patterns seen in advanced economies and, notably, increasingly in emerging economies where emissions are growing. Under this perspective, the distinction is less between what the poorest of the poor require for subsistence versus luxury items, but more generally what the growing middle classes[7] and rising working classes[8] across the developing world require versus the more extravagant activities of the rich.

Accordingly, this article categorizes emissions based on four types of underlying consumption activities: (i) for basic needs, such as food and shelter; (ii) for basic income generation (such as commuting to work); (iii) for basic leisure (e.g., to go to the movies); and (iv) for discretionary extravagant activities (such as super-yachts). Similarly, the utility of the corresponding emissions also varies, arguably diminishing across these four groupings (as illustrated by Figure 1).

A tradition of uniform carbon tax rates

While the utility of the underlying consumption activity will differ, the common approach for carbon tax proposals is to use a uniform tax rate. Three types of factors are typically considered in establishing the appropriate rate: the social cost of carbon, the desired targeted level of emissions reductions, and the amount of revenues to be raised.[9] In large part because the impact of a ton of CO_2 is essentially uniform, irrespective of where it is emitted and by whom, much of the discourse on carbon pricing applies a similarly uniform charge per unit of emission.

But is it appropriate to tax a kilogram of CO_2 emitted by a poor villager in South Asia in cooking to feed their family at the same rate as a kilogram of CO_2 emitted on a European highway by a sportscar travelling at 150 miles per hour? Yes, there is an accepted rationale (at times drawing from Pigouvian theory) that the price/tax should be the same, in large part because the climate impact of the kilogram of CO_2 is the same.

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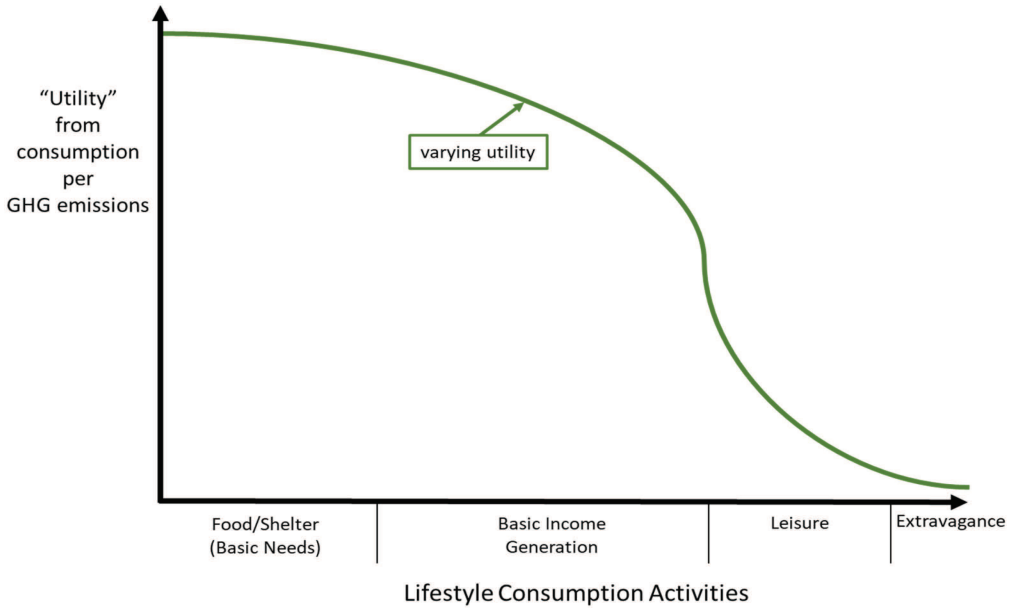

Figure 1: Different carbon emitting consumption activities have differing "utilities"
Source: Author's depiction

A differentiated carbon tax regime targeting extravagant activities

But is a uniform rate the most appropriate structure in designing a carbon taxing regime?[10] The argument can be made that the emissions from these several types of activities should be taxed differently as a function of their utility. This article proposes a tax targeting specifically extravagant luxury emissions (a "carbon extravagance tax") – a targeting justified in part by the capacity of the rich to pay this tax, their access to lower carbon alternatives and, importantly, the detrimental societal impact of using up our common carbon budget for highly discretionary extravagant activities (see Box 1).

Box 1: Extravagant emissions deplete our shrinking common carbon budget

Extravagant and other emissions and their projected impact on climate are raising greater concern because of the rapidly shrinking carbon budget. Two factors are increasing the rate of reduction in this carbon budget. The first is the continuing and increasing amount of actual emissions which are using up the budget. The second is the lowered level of the budget target itself as recognition rises regarding the need for more ambitious temperature goals.

Carbon constitutes, in simplified terms, a "zero-sum" game.[11] We all share a common CO_2 budget estimated at 1,065 $GtCO_2$ if we want to limit global temperature increase to 2°C.[12] Under the more ambitious 1.5°C target that is gaining traction in many discussions, this budget drops to a mere 315 $GtCO_2$,[13] a reduction of 70% in allowable CO_2 emissions. By extrapolation, the carbon budget for the "well below 2°C" target of Article 2 of the Paris Agreement[14] would sit somewhere between these two figures.

In contrast to the dynamics of economic wealth where luxury expenditures can produce jobs and incomes for poorer working-class families, when it comes to the climate, the more carbon that the rich emit for extravagant activities, the less room there is for others to emit for basic needs and other purposes. This dynamic may justify a special and burdensome carbon tax on luxury/extravagant emissions designed to dissuade the class of related underlying activities.

What might a "carbon extravagance tax" look like

At its core, the proposed carbon extravagance tax would apply to products and services that are both luxury items and generate substantial emissions, such as high-end sportscars powered with internal combustion engines. In contrast, the tax would not target either the expensive "non-emitting" Tesla electric cars (albeit, a high-end luxury good, but one that might be referred to as "conspicuous consumption with a conscience") or the working/middle class staple Ford pickup truck.[15] It could be imposed at the time of purchase (e.g., in the manner of a traditional sales tax), periodically (e.g., annually for the registration of a high-carbon luxury vehicle) or based on use (e.g., a special berthing charge for super-yachts). The tax could be deployed on a stand-alone basis (potentially as the first step in a broader carbon pricing initiative) or as a complement to a traditional carbon tax (as illustrated in Figure 2).

The revenues raised by the carbon extravagance tax can be used like those from a traditional carbon tax; for example, to finance research and development into low-carbon solutions, to provide general budgetary support, or redistributed to taxpayers (particularly poorer ones, as described later).

Impacts on Emissions, Revenues and Innovation; and Challenges

The carbon extravagance tax could support several important policy goals simultaneously, albeit with limited impact in various respects, especially regarding direct impacts on emissions and revenues.

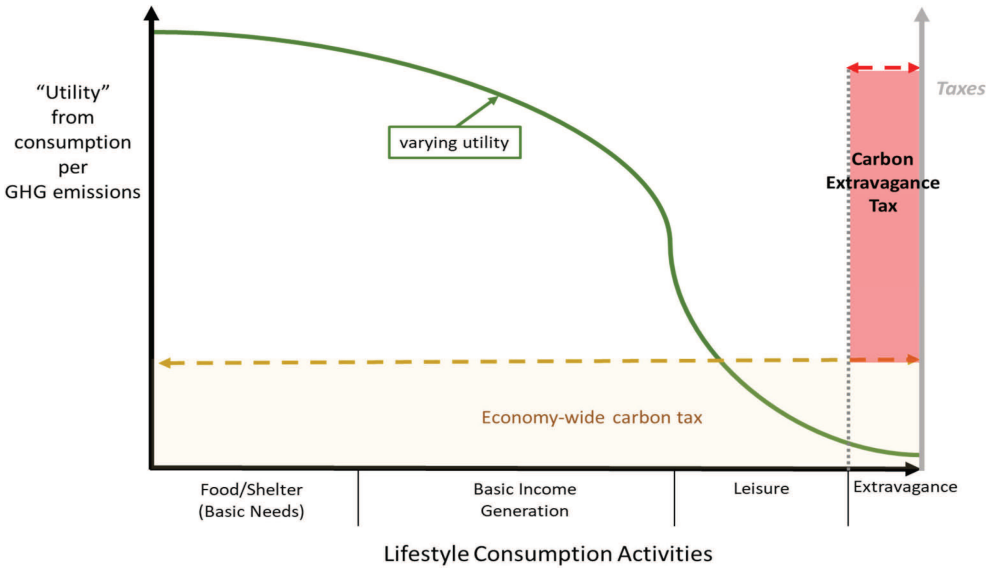

Figure 2: The "carbon extravagance tax" (illustrative)
Source: Based on Author's depiction in Ethics and International Affairs[16]

The tax could operate to reduce the appeal and related emissions of specified luxury carbon-intensive products and services through two distinct dynamics. First, through the price-effect itself. Second, potentially from a negative connotation attached to a tax on extravagance (which, to the contrary, might generate an appeal for some). However, its overall impact on emissions is likely to be small in absolute terms. Similarly, the amount of revenues generated is likely to be small.

Significantly, the carbon extravagance tax could potentially spur low-carbon innovation in high-end products by promoting manufacturers looking to provide untaxed alternatives to their elite clients or looking to strengthen their own branding on sustainability issues. This low-carbon innovation in high-end products could potentially result in a larger impact if it leads to advancements in the bigger and more modestly priced midlevel and discount consumer markets. Moreover, low-carbon innovation in the high-end market might even generate a demand for low carbon alternatives in broader markets (which some argue might be the eventual real climate benefit in Tesla's marketing of high-end vehicles).

The tax would present various challenges. For example, luxury taxes have faced design and implementation issues regarding the choice of covered products (including objections from targeted industries), rates and enforcement. Carbon tax regimes raise concerns about unfair competition and carbon leakage from jurisdictions that do not impose a similar tax. There is a body of experience and expertise to draw from to address these issues. But the challenges for the carbon extravagance tax may well be difficult to overcome, especially given the limited nature of the anticipated direct benefits.

Equity Considerations

The proposed carbon extravagance tax is, however, in many respects more about signaling and indirect impacts. Many of these would be felt with regard to equity considerations.

There has been a great deal of discussion about carbon taxes[17] in part because they are often viewed as an economically efficient climate tool. But there have also been concerns about their disproportionate impact on poorer and middle-income households -- in other words, that they constitute a regressive tax. This is in part due to the fact that poorer families generally spend a larger share of their income on gasoline and other items typically subject to a carbon tax.[18] Although there are ways to counter this regressive impact (for example, by redistributing the revenues[19] or with higher rates for high-end products),[20] the typical carbon tax remains burdened by its regressive characteristics. It was this concern about a disproportionate impact on the working class that helped fuel the yellow vest demonstrations which rocked France several years ago when a carbon gasoline tax was proposed. [21]

In contrast, the proposed carbon extravagance tax is progressive as it is paid essentially only by the wealthy and, by extension, has a greater proportional impact on their higher incomes. It thereby helps promote equity within the climate context and more broadly in the economy. It also sends an important message that discretionary extravagant activities should carry a higher price than carbon consumption related to meeting basic needs or even basic leisure activities. Moreover, the progressive nature of the carbon extravagance tax can be enhanced if the revenues are used to benefit poorer families, directly through distribution programs or indirectly either by funding health or other social services for the poor or, alternatively, by supporting the development of low-carbon products for poorer families.

Given these factors, formulating a carbon extravagance tax might help to overcome some of the populist reservations and resistance to carbon pricing as a climate tool. The targeting of this carbon tax at the rich would also help address (albeit, minimally) societal economic inequality along the lines of a wealth tax and might even operate as a climate complement to a wealth tax. It might, however, also generate intense objections from some quarters precisely because it targets wealthier households.

There are other tools which can serve both climate and inequality considerations. For example, exempting low-carbon assets under a wealth tax regime might help advance climate-friendly investments. However, one advantage of the proposed carbon extravagance tax over other tools in advancing climate and equity issues simultaneously is that, by its very name and terms, it targets some of the carbon excesses available to only the wealthy.

Conclusion

A carbon extravagance tax is worth considering. It can help somewhat to reduce emissions, raise some revenues and stimulate low-carbon innovation. But more importantly, it sends a message about preserving some of the diminishing carbon budget for the less privileged, thereby also addressing climate justice and broader inequalities. Indeed, as politicians consider issues of inequality and equity, and debate the relative merits of a wealth or other taxes targeted at the ultra-wealthy, it may be useful to inject into those conversations the potential to deploy a climate tool with a similar orientation. A carbon extravagance tax may be worth considering.

Footnotes

[1] Oxfam, Extreme Carbon Inequality, Oxfam Media Briefing, December 2, 2015, https://www-cdn.oxfam.org/s3fs-public/file_attachments/mb-extreme-carbon-inequality-021215-en.pdf.

[2] See "Guide to Chinese Climate Policy 2019", D. Sandalow, Columbia University Center on Global Energy Policy (CGEP), at p. 105 (https://energypolicy.columbia.edu/research/report/guide-chinese-climate-policy).

[3] Flight Carbon footprint calculator, https://calculator.carbonfootprint.com/calculator.aspx?tab=3.

[4] "Global Wealth Report 2021", Credit Suisse, June 2021 (https://www.credit-suisse.com/about-us/en/reports-research/global-wealth-report.html).

[5] See earlier essay on a luxury carbon tax by P. Benoit, "A luxury carbon tax to address climate change and inequality: not all carbon is created equal", March 2020, Ethics & International Affairs, https://www.ethicsandinternationalaffairs.org/2020/a-luxury-carbon-tax-to-address-climate-change-and-inequality-not-all-carbon-is-created-equal/.

[6] Henry Shue, "Subsistence protection and mitigation ambition: Necessities, economic and climatic", The British Journal of Politics and International Relations, 2019, Vol. 21 (2) 251-262, https://www.researchgate.net/publication/331217421_Subsistence_protection_and_mitigation_ambition_Necessities_economic_and_climatic.

[7] Homi Kharas, "The Unprecedented Expansion of the Global Middle Class: An Update." The Brookings Institution. Global Economy and Development Working Paper 100 (2017) https://www.brookings.edu/wp-content/uploads/2017/02/global_20170228_global-middle-class.pdf.

[8] N. Birdsall, N. Lustig and C. Meyer, "The Strugglers: The New Poor in Latin America?" Center for Global Development (2013). https://www.cgdev.org/sites/default/files/new-poor-latin-america_1.pdf.

[9] See, for example, N. Kaufman and P. Marsters descriptions in "What you need to know about a federal carbon tax in the United States", https://energypolicy.columbia.edu/what-you-need-know-about-federal-carbon-tax-united-states.

[10] Differentiated pricing has been considered in other circumstances. See, e.g., Antoine d'Autume, Katheline Schubert and Cees Withagen, "Should the carbon price be the same in all countries", Journal of Public Economic Theory, Wiley 2016, 10.1111/jpet.12162, https://halshs.archives-ouvertes.fr/halshs-01300261/document.

[11] The carbon budget could potentially increase if technologies that take CO2 out of the atmosphere (such as direct air capture) can be developed in the future at scale and at reasonable cost. For the time being, however, we are essentially limited to our existing carbon budget.

[12] Mercator Research Institute on Global Commons and Climate Change, https://www.mcc-berlin.net/en/research/co2-budget.html.

[13] Ibid.

[14] Paris Agreement, https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

[15] Heightened fuel economy standards can be used to encourage car manufacturers to lower the emissions of these vehicles.

[16] P. Benoit (2020).

[17] See, e.g., F. Funke and L. Mattauch, "Why Is Carbon Pricing in Some Countries More Successful Than in Others?," August 10, 2018, in Our World in Data, https://ourworldindata.org/carbon-pricing-popular.

[18] Carbon taxes can be levied in different ways. For example, they can be imposed on producers/suppliers (e.g., of gasoline) who then pass it on to their customers (through higher prices) or they can be levied directly on consumers at the point of sale (e.g., added at the pump).

[19] See, e.g., N. Kaufman (2019).

[20] See, e.g., description of France's car tax in "Tax regime applicable to electric vehicles: your advantages in 2019", Beev, https://beev.co/fiscalite/fiscalite-des-vehicules-electriques/.

[21] See, for example, Alissa Rubin and Somini Sengupta, "'Yellow Vest' Protests Shake France. Here's the lesson for Climate Change," December 6, 2018, The New York Times, https://www.nytimes.com/2018/12/06/world/europe/france-fuel-carbon-tax.html.

Solar Sharing Economy or "My Home is My Power Plant"? Profiling Collective and Individual Solar Prosumers in Southern Switzerland

BY ALESSANDRA MOTZ, BEATRICE PETROVICH, STEFAN GAHRENS, AND ROLF WÜSTENHAGEN

Abstract

Increasingly energy policies aim to bring the consumers to the centre of the energy transition. One popular approach is for homeowners and renters in single- and multi-family houses to become solar prosumers. A consumer survey in Switzerland sheds light on the early movers leading the shift towards decentralised energy production.

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Citizen solar power for a just and speedy energy transition

As several other countries in Europe and in the world, Switzerland is facing the two-fold challenge of dramatically curbing greenhouse gas emissions while ensuring a secure and affordable energy supply to its consumers. In the case of Switzerland, the government has pledged to cut emissions by 50% by 2030 (NDC 2020) and reach net zero by 2050 (Swiss Federal Office of Energy 2018).

The restructuring of the energy and electricity systems implied by the Swiss Energy Strategy 2050 requires, among other things, a massive increase in renewable-based generation capacities (Swiss Federal Office of Energy 2018). The involvement of citizens is increasingly important to meet the medium- and long-term renewable generation targets for many reasons. Firstly, citizens' involvement enables key decentralized solutions for renewable generation and climate mitigation, such as solar energy on buildings. Building-scale solar PV systems can not only reduce the climate footprint of buildings, a sector which makes up for a third of Swiss carbon emissions (Federal Office for the Environment 2021), but can also power clean electric mobility (SolarPowerEurope 2019). Further, the participation of citizens in renewable energy investment decisions may help extending the benefits of the energy transition to all consumption segments, including individuals and families with a lower income. Procedural and distributional justice, i.e. a fair decision process and benefit sharing, foster social acceptance of new renewable energy infrastructure and climate policies (Gross 2007, Wolsink 2007). This is particularly important in the case of Switzerland, where the long-standing tradition of national, cantonal, and local referenda makes citizens' consensus of paramount importance to any long-term transition process.

This article provides an insight into the role of households in contributing to renewable energy targets, and what their contribution may be in the next few years. Using survey data, we analyse the adoption of building-scale solar photovoltaic (PV) panels among the residents in Canton Ticino, the southernmost and sunniest region of Switzerland. In particular, we focus on market segments whose potential contribution is still untapped: tenants and homeowners living in multi-family houses. We profile the early adopters of solar solutions for single family houses (SFH) and multi-family houses (MFH). Identifying the "early movers" is relevant for policymakers and solar marketers, as early adopters can speed up the adoption of the technology through spill over and peer effects. In fact, their observable behaviour can increase confidence in the innovative solutions via word of mouth and social learning (Baranzini et al. 2017), or can activate the need to comply with a social norm (Curtius et al. 2018). These mechanisms foster innovation adoption in the rest of the population (such as the so called "late majority").

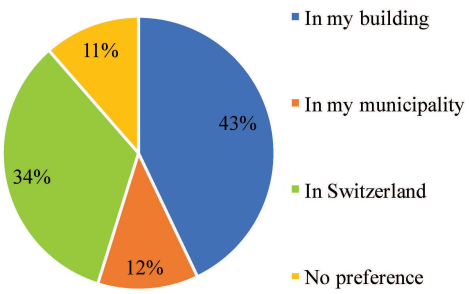
Please in my backyard (PIMBY)

Our analysis of solar adoption in SFHs and MFHs is based on an on-line survey distributed in Canton Ticino, Switzerland, between September and November 2021 in cooperation with four local electricity suppliers (O-FPE 2021)[1]. Around 30'000 households received the invitation to fill in the survey and 2'299 respondents validly completed it, yielding a response rate of 7.6%. While it is not fully representative, the final sample reasonably reflects the local population in terms of education and income.

The origin of the electricity they consume is important for a vast majority of the respondents (89% of the sample, Chart 1). Survey responses suggest indeed a strong preference for very local electricity: 43% of their respondents state they would like to consume electricity generated in the building where they live, and 12% would appreciate electricity generated within their municipality. In both cases, the respondents state they would be ready to accept a price increase of around 10% as compared to actual prices. The preference for electricity generated in the own building is only slightly

higher among homeowners (46%) than tenants (40%). This suggests that a good share of households might be willing to support the shift to the renewable energy supply of buildings.

Chart 1 – Preferred origin of the own electricity supply in Canton Ticino (% of respondents)



Diffusion of solar among tenants and homeowners

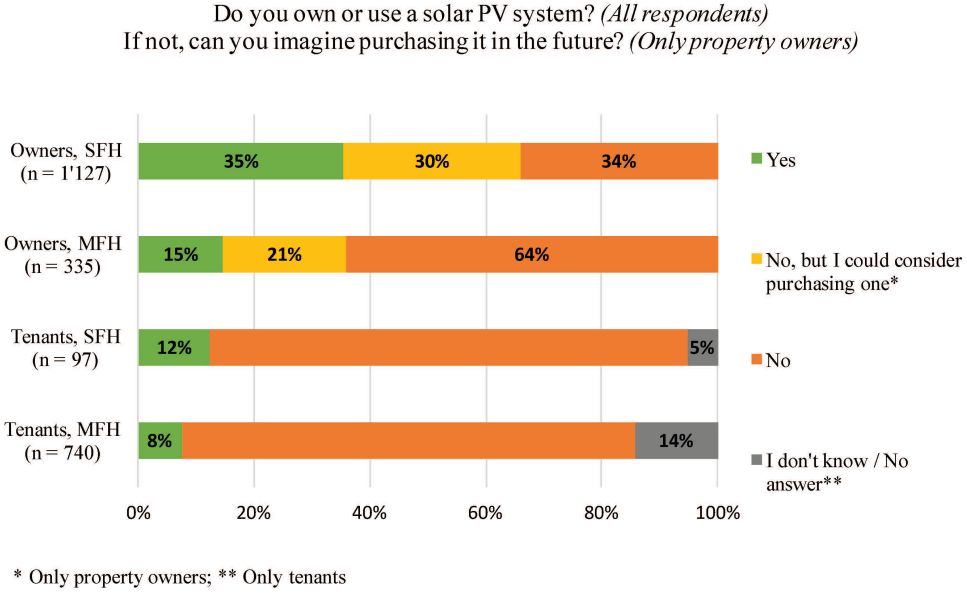
Despite the clear preference for local electricity generated in one's building, only 22.5% of the respondents state that they already own or use PV. The consumption of distributed solar electricity is more common among households in single-family houses (SFH, 34%) than in multi-family houses (MFH, 10%). Moreover, property owners are more likely than tenants to own and use solar, no matter whether they live in a SFH or MFH: homeowners living in SFH are almost three times as likely to have PV as tenants living in the same kind of dwelling (35% vs. 12%, Chart 2), and apartment owners living in MFH are twice as likely to have PV as tenants in the same housing solution (15% vs 8%). Homeowners also declare a relatively high interest in purchasing PV, with 30% of those living in SFH and 21% of those living in MFH considering the purchase in the next few years.

Although the diffusion of PV is higher among homeowners than among tenants, renters also hold a very positive attitude towards solar PV systems installed on their roofs. 83% declare indeed they would be ready to back the project of installing a solar PV system on the common roof, and 71% state they would even try to convince their neighbours to approve the plan (Chart 3). 76% of the tenants living in MFH think, moreover, that the households living in a MFH should not have the right to oppose the installation of PV panels on the common roof, as long as the electricity bill does not increase, whereas only 7% think that each household should have a veto right.

A portrait of solar prosumers in single and multi-family houses

Depending on the living situation, citizens can contribute differently to the uptake of solar in residential buildings. Those citizens owning and living in a SFH can turn their home into their own power plant by installing a solar PV system on their roof or façade. We name them the "individual solar prosumers", as they produce and consume their own electricity at the same location. As shown above, as of 2021, in the sunniest region of

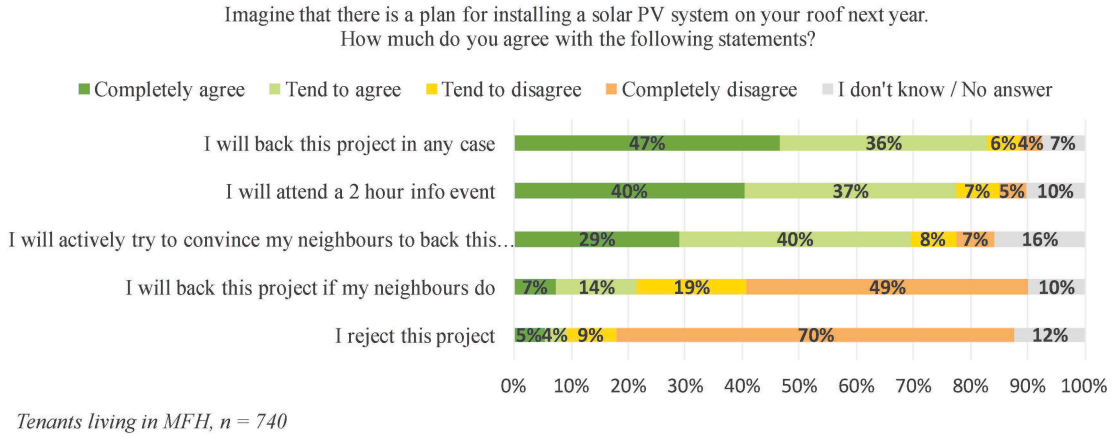
Chart 2 – Ownership and use of distributed solar PV system in Canton Ticino, by housing solution (% respondents)



* Only property owners; ** Only tenants

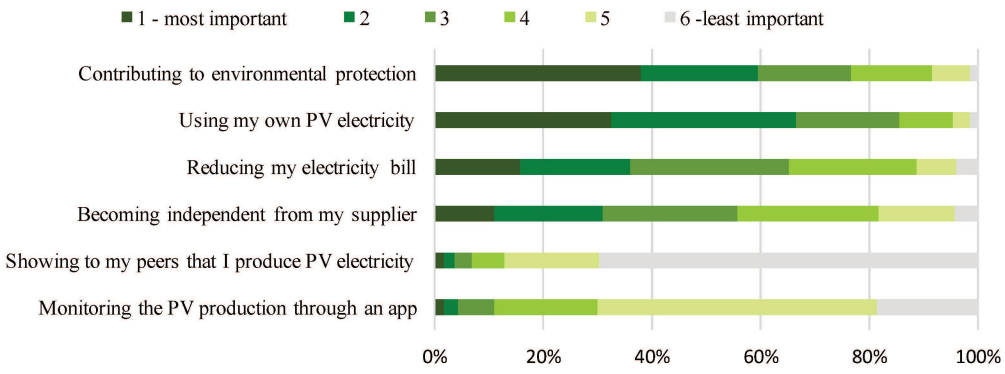
Note: In the questionnaire we asked two different questions to owners and tenants, namely "Do you own or can you imagine owning a solar PV system?" and "As a tenant, do you use a solar PV system?" (text translated from Italian).

Chart 3 – Tenants' interest in a solar PV system on the common roof (% respondents)



Tenants living in MFH, n = 740

Chart 4– Ranking of reasons to invest in a solar PV system for homeowners (% respondents)



(n = 863; homeowners living in MFH or SFH who have a solar PV system or are interested in purchasing one)

Switzerland, individual solar prosumers are already a reality: about a third of the SFH owners in our sample own or use a solar PV system (Chart 2). When asked about the main reasons to invest in PVs, the homeowners mention their desire to contribute to environmental protection, increase self-sufficiency (consuming their own electricity), and reduce their electricity bill (Chart 4).

Citizens inhabiting MFHs could contribute to the uptake of solar in residential buildings by participating in a building-scale "collective self-consumption scheme". In such a scheme the production of solar PV system located on the common roof is sold to all the MFH residents. We name citizens living in MFHs who actively support a common roof solar PV system as "collective solar prosumers". We take as a proxy of active support the stated willingness to convince their own neighbours to support the project of a solar system on the common roof of an MFH.

Individual and collective solar prosumers display stronger environmental concern and are less reluctant to try out new technologies than others (Table 1). However, while individual solar prosumers tend to be slightly richer (higher income and more assets) than other SFH owners, collective solar prosumers are not necessarily richer or poorer than other citizens living in MFHs.

Table 1 – Profiling individual and collective solar prosumers in Canton Ticino

Relevant demographic or behavioural profiles	Homeowners living inSFH			Apartment owners living in MFHs			Tenants living in MFHs			Variable range
	With PVs **Individual solar prosumers**	Without PVs	p-value*	Willing to convince neighbours **Collective solar prosumers**	NOT willing to convince neighbours	p-value*	Willing to convince neighbours **Collective solar prosumers**	NOT willing to convince neighbours	p-value*	
Wealth measure 1: Gross monthly household income	**4.41**	**4.10**	**p<.01**	4.29	4.29	p=0.96	3.39	3.61	p=0.06	1 to 6 (3: from 4.501 CHF to 6'000 CHF; 4 from 6'001 to 9'000 CHF)
Wealth measure 2: Net household assets	**3.48**	**3.14**	**p<.01**	3.41	3.36	p=0.81	2.39	2.28	p=0.29	1 to 6 (2: from 10'001 CHF to 100'000 CHF; 3: from 100'001 CHF to 500'000 CHF)
Environmental concern measure: % of respondents who think that the speed of the energy transition in Switzerland is too slow	**69.0%**	**51.9%**	**p<.01**	57.3%	46.3%	p=0.08	**62.3%**	**41.2%**	**p<0.01**	Dummy: 0 (no), 1 (yes)
Technical affinity measure: Reluctant to try new technologies	**3.6**	**3.5**	**p=0.02**	**3.6**	**3.4**	**p=0.03**	**3.5**	**3.2**	**p<0.01**	1 (completely agree) to 4 (completely disagree)
Collectivism measure 1: Happy to share things with neigbours	2.1	2.1	p=0.48	**2.2**	**2.5**	**p=0.01**	**2.1**	**2.4**	**p<0.01**	1 (completely agree) to 4 (completely disagree)
Collectivism measure 2: Happy to use shared mobility	2.7	2.8	p=0.45	**2.5**	**3.0**	**p<0.01,**	**2.3**	**2.7**	**p<0.01**	1 (completely agree) to 4 (completely disagree)
Trust measure: Tends to trust people	2.2	2.1	p=0.67	**2.2**	**2.5**	**p<0.01**	**2.2**	**2.5**	**p<0.01**	1 (completely agree) to 4 (completely disagree)
EV ownership or interest % of respondents who own an electric car or are interest in purchasing one	**64%**	**44%**	**p<.01**	54%	43%	p=0.12	**51%**	**36%**	**p=0.005**	Dummy: 0 (no), 1 (yes)
n	*400*	*727*		*253*	*82*		*514*	*226*		

* p-value refers to a mean or proportion difference test between the subgroups.

** p-value refers to a mean or proportion difference test between the subgroups.*

Three other characteristics distinguish collective solar prosumers. Firstly, they display a higher collectivist attitude than other citizens living in MFHs. The collectivist attitude or "societal interest value orientation" is defined as a preference for being a member of the group rather than apart from the group (Erdem et al. 2006). More collectivist individuals are more likely to be happy to share things with neighbours and use shared mobility services. Secondly, collective solar prosumers tend to display a stronger general sense of trust in other people. A sense of trust is needed to achieve a high acceptance and willingness to participate in projects that share energy among a group of people: in this setting one member's consumption of the common solar kWh makes those units unavailable to others. A sense of mutual trust can mitigate the perceived risk of conflicts over the use of the common electricity production. Thirdly, collective solar prosumers are more likely to own or being interested in an electric vehicle than other MFH inhabitants. Stronger support for solar could be triggered by interest in inhouse electric charging.

Policy implications and conclusions

The inclusion of citizens in the renewable energy investment decisions is regarded as a cornerstone of a just and speedy energy transition. Citizen involvement enables key solutions for decentralized renewable energy generation, in particular the shift to renewable electricity supply of existing buildings. Depending on whether citizens own or rent their dwelling and on whether they reside in single- or multi-family houses, they can contribute differently to the uptake of solar in residential buildings. Single-family house owners can install a solar PV system on their roof or façade; they turn their home into their own power plant and become "individual solar prosumers". As shown above, as of 2021, in the sunniest region of Switzerland, individual solar prosumers are not a niche anymore: based on survey data, about a third of our respondents owning an SFH already own or use a solar PV system. They tend to be wealthier, more environmentally concerned and less reluctant to try out new technologies than other SFH owners. In the same region, citizens who live in a MFH are significantly less likely to consume solar electricity produced in the building where they live. We identify an untapped potential for solar on MFHs since many MFH inhabitants display a strong preference for locally generated electricity. Solar promotion policies and marketing strategy could specifically target this promising segment, potentially exploiting local ambassadors. We identify a group of MFH residents who can become local ambassadors for solar PV investments on MFHs: the "collective solar prosumers". They care about the environment, are already familiar with sharing services (e.g. mobility) and products with their neighbours or other people, and are not necessarily richer than other citizens living in MFHs. This finding suggests that solar systems on MFHs' roofs may help include households with different income levels in the energy transition. The portrait of collective solar prosumers suggests high potential for solar on MFHs in contexts where trust and relationships between neighbours are already strong (e.g. cooperative housing). As the collective solar prosumers are more likely to own an electric vehicle than other MFH inhabitants, we suggest that the diffusion of electric vehicles is an opportunity to promote and find acceptance for solar PV on MFH.

Footnotes

[1] The survey replicates the annual Consumer Barometer of Renewable Energies conducted by the University of St.Gallen since 2011 (www.kuba.iwoe.unisg.ch).

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International Association for ENERGY ECONOMICS

IAEE/Affiliate Master Calendar of Events

(Note: IAEE Cornerstone Conferences are in boxes)

Date	Event and Event Title	Location	Supporting Organizations(s)	Contact
2022				
March 2-3	*2nd MENA IAEE Symposium Combined with 5th Annual Derasat Forum*	Kingdom of Bahrain	IAEE	David Williams iaee@iaee.org
July 31-August 3	43rd IAEE International Conference *Mapping the Global Energy Future: Voyage in Unchartered Territory*	Tokyo, Japan	IEEJ/IAEE	Yukari Yamashita https://iaee2022.org/
September 21–24	17th IAEE European Conference *The Future of Global Energy Systems*	Athens, Greece	HAEE/IAEE	Spiros Papaefthimiou http://haee.gr/
November 20–22	8th Latin American Energy Economics Conference	Bogota, Colombia.	ALADEE	Gerardo Rabinovich grenerg@gmail.com
2023				
February 4-9	44th IAEE International Conference *Energy Market Transformation in a Globalized World*	Saudi Arabia	SAEE/IAEE	Majid Al-Moneef moneefma@gmail.com
Postponed to 2023 Dates TBA	18th IAEE European Conference *The Global Energy Transition: Toward Decarbonization*	Milan, Italy	AIEE/IAEE	G. Battista Zorzoli https://www.aiee.it/
2024				
June 23-26	45th IAEE International Conference *Overcoming the Energy Challenge*	Istanbul, Turkey	TRAEE/IAEE	Gurkan Kumbaroglu http://www.traee.org/
2025				
Postponed to 2025 Dates TBA	46th IAEE International Conference *Title TBA*	Paris, France	FAEE/IAEE	Christophe Bonnery https://www.faee.fr
2026				
May-June	47th IAEE International Conference *Forces of Change in Energy: Evolution, Disruption or Stability*	New Orleans	USAEE	Peter Balash www.usaee.org

Calendar

08-09 March 2022, SPE Workshop: Production Optimisation in Gas and Oil Assets, 8-9 March 2022, The Netherlands at Leonardo Royal Hotel Den Haag Promenade, 1 Van Stolkweg, Den Haag, Zuid-Holland, 2585 JL, Netherlands. Contact: Email: kdunn@spe.org URL: http://go.evvnt.com/911491-0?pid=204

08-09 March 2022, Future of Utilities: Smart Energy 2022 | 8-9 March | The Tower Hotel, London at The Tower Hotel, Saint Katharine's Way, London, England, E1W 1LD, United Kingdom. Contact: Email: sfox@marketforcelive.com URL: http://go.evvnt.com/1000776-0?pid=204

09-22 March 2022, Power Purchase Agreement at Live Online Course. Contact: Phone: +6563250215, Email: abigail@infocusinternational.com URL: https://www.infocusinternational.com/ppa-online

15-17 March 2022, Materials Technology Advances - Growth Enablers for Oilfield Applications and Energy Transition at Leonardo Royal Hotel Den Haag Promenade, 1 Van Stolkweg, Den Haag, Zuid-Holland, 2585 JL, Netherlands. Contact: Email: kdunn@spe.org URL: http://go.evvnt.com/915879-0?pid=204

15-16 March 2022, Reuters Events: US Offshore Wind 2022 at Hynes Convention Center, 900 Boylston Street, Boston, Massachusetts, 02115, United States. Contact: Email: megane.holl@thomsonreuters.com URL: https://go.evvnt.com/947561-0?pid=204

21-22 March 2022, Future of Utilities: Water 2022 | 21-22 March | Hilton Tower Bridge, London at Hilton London Tower Bridge, 5 Tooley Street, London, England, SE1 2BY, United Kingdom. Contact: Email: sfox@marketforcelive.com URL: http://go.evvnt.com/1000789-0?pid=204

21-25 March 2022, Reuters Events: Utility Transition 2022 at Online. Contact: Email: owen.rolt@thomsonreuters.com URL: http://go.evvnt.com/945609-0?pid=204

22-23 March 2022, SPE Workshop: Well Integrity in a Changing World, 22 - 23 March 2022, The Netherlands at Leonardo Royal Hotel Den Haag Promenade, 1 Van Stolkweg, Den Haag, Zuid-Holland, 2585 JL, Netherlands. Contact: Email: vrcarril@spe.org URL: https://go.evvnt.com/909171-0?pid=204

04-05 April 2022, SMi's 11th Annual Smart Water Systems Conference at Copthorne Tara Hotel London Kensington, Scarsdale Place, London, England, W8 5SY, United Kingdom. Contact: Phone: 02078276154, Email: ngaloria@smi-online.co.uk URL: http://go.evvnt.com/959381-3?pid=204

20-21 April 2022, Global Summit on Renewable Energy and Resources at United States. Contact: Phone: 0133354000, Email: renewableenergymeet2022@gmail.com URL: https://www.meetingsint.com/conferences/renewable-energy

27-27 April 2022, SPE Norway Subsurface Conference | 27 April 2022, Bergen, Norway at Quality Hotel Edvard Grieg, 50 Sandsliåsen, Ytrebygda, Vestland, 5254, Norway. Contact: Email: kdunn@spe.org URL: http://go.evvnt.com/991142-0?pid=204

11-13 May 2022, Power2Drive Europe at Messe München, Germany. Contact: Email: info@powertodrive.de URL: https://www.powertodrive.de

11-13 May 2022, ees Europe at Messe München, Germany. Contact: Email: info@ees-europe.com URL: https://www.ees-europe.com/start

11-13 May 2022, Intersolar Europe at Messe München, Germany. Contact: Email: info@intersolar.de URL: https://www.intersolar.de/start

23-24 May 2022, 8th International Symposium on Environment and Energy Finance Issues (ISEFI-2022) at Paris, France. Contact: URL: https://isefi.sciencesconf.org

May 31 - June 01 2022, SPE Workshop: Digital Transform & Thrive in Turbulent Times at Imperial Riding School Renaissance Vienna Hotel, 60 Ungargasse, Wien, 1030, Austria. Contact: Email: vrcarril@spe.org URL: https://go.evvnt.com/929106-0?pid=204

08-09 June 2022, Plastic Waste Free World Conference and Expo North America at Cobb Galleria Centre, 2 Galleria Parkway Southeast, Atlanta, Georgia, 30339, United States. Contact: Phone: 014047378307, Email: peter@trans-globalevents.com URL: https://go.evvnt.com/994470-0?pid=204

08-09 June 2022, The Greener Manufacturing Show North America, June 8-9 2022, Atlanta, USA at Cobb Galleria Centre, 2 Galleria Parkway Southeast, Atlanta, Georgia, 30339, United States. Contact: Phone: 0014047378307, Email: peter@trans-globalevents.com URL: http://go.evvnt.com/994569-0?pid=204

08-09 June 2022, Reuters Events: Hydrogen 2022 at Hotel Novotel Amsterdam City, 10 Europaboulevard, Amsterdam, Noord-Holland, 1083 AD, Netherlands. Contact: Email: luke.brett@thomsonreuters.com URL: https://go.evvnt.com/974507-0?pid=204

14-16 June 2022, Carbon Capture Technology Conference & Expo North America at George R. Brown Convention Center, 1001 Avenida De Las Americas, Houston, Texas, 77010, United States. Contact: Phone: 14047378307, Email: charlie.brandon@trans-globalevents.com URL: https://go.evvnt.com/994469-0?pid=204

14-16 June 2022, Hydrogen Technology Conference and Expo North America at George R. Brown Convention Center, 1001 Avenida De Las Americas, Houston, Texas, 77010, United States. Contact: Phone: 0014047378307, Email: charlie.brandon@trans-globalevents.com URL: http://go.evvnt.com/994468-0?pid=204

14-15 June 2022, Reuters Events: Global Energy Transition 2022 at New York Marriott at the Brooklyn Bridge, 333 Adams Street, Brooklyn, New York, 11201, United States. Contact: Email: owen.rolt@thomsonreuters.com URL: https://go.evvnt.com/960770-0?pid=204

14-16 June 2022, Materials Technology Advances – Growth Enablers for Oilfield Applications and Energy Transition at Leonardo Royal Hotel Den Haag Promenade, 1 Van Stolkweg, Den Haag, Zuid-Holland, 2585 JL, Netherlands. Contact: Email: vrcarril@spe.org URL: https://go.evvnt.com/915879-0?pid=204

21-22 June 2022, Utility Scale Solar & Wind North America 2022 at The Westin Galleria Dallas, 13340 Dallas Parkway, Dallas, Texas, 75240, United States. Contact: Email: Leonel.LamReis@thomsonreuters.com URL: https://go.evvnt.com/985805-2?pid=204

28-30 June 2022, 2022 National Energy & Utility Affordability Coalition Annual Conference at New Orleans Marriott. Contact: Phone: 202-838-8375, URL: http://neuac.org

18-19 July 2022, Reuters Events: US Offshore Wind 2022 at Hynes Convention Center, 900 Boylston Street, Boston, Massachusetts, 02115, United States. Contact: Email: Diana.Dropol@thomsonreuters.com URL: https://go.evvnt.com/947561-0?pid=204

July 31 - August 03 2022, 43rd IAEE International Conference - Mapping the Global Energy Future: Voyage in UnchanteredTerritory at Tokyo, Japan. Contact: URL: www.iaee2022.org

02-02 August 2022, X International Academic Symposium: Green opportunities for the energy sector at Barcelona. Contact: Email: ieb.simposium@ub.edu URL: https://ieb.ub.edu/ca/event/x-international-academic-symposium-green-opportunities-for-the-energy-sector/

02-02 August 2022, X International Academic Symposium: Green Opportunities for the Energy Sector at Barcelona. Contact: Email: ieb.simposium@ub.edu URL: https://ieb.ub.edu/ca/inicio/catedra-de-sostenibilidad-energetica/

06-07 September 2022, SPE Workshop: Well Integrity in a Changing World, 6-7 September 2022, The Netherlands at Leonardo Royal Hotel Den Haag Promenade, 1 Van Stolkweg, Den Haag, Zuid-Holland, 2585 JL, Netherlands. Contact: Email: vrcarril@spe.org URL: https://go.evvnt.com/909171-0?pid=204

12-13 September 2022, 8th Annual IOT in Oil & Gas Conference at Hilton Americas-Houston, 1600 Lamar Street, Houston, Texas, 77010, United States. Contact: Phone: 18558694260, Email: symon.rubens@energyconferencenetwork.com URL: https://go.evvnt.com/1018143-2?pid=204

21-24 September 2022, 17th IAEE European Conference: The Future of Global Energy Systems at Athens, Greece. Contact: URL: www.haee.gr

22-22 September 2022, World Energy Storage Day at Virtual. Contact: Phone: India, Email: dsalunkhe@ces-ltd.com URL: www.energystorageday.org

05-08 February 2023, 44th IAEE International Conference: Energy Market Transformation in a Globalized World at Riyadh, Saudi Arabia. Contact: Email: moneefma@gmail.com URL: www.iaee.org

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