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EAERE Magazine

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EAERE
European Association of Environmental and Resource Economists

EAERE Magazine serves as an outlet for new research, projects, and other professional news, featuring articles that can contribute to recent policy discussions and developments in the field of environmental and natural resource economics. It is published quarterly in the Winter, Spring, Summer, and Fall. Contributions from the wider EAERE community, especially senior level researchers and practitioners, and EAERE Country Representatives, are included in the magazine.

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Dear EAERE friends and colleagues,

The other day I saw an advertisement for a T-shirt showing "*2020*" and then, borrowed from the evaluation schemes of Ebay, Yelp & Co., "☆☆☆☆☆*Very bad, cannot recommend.*" The T-Shirt is right; 2020 is bad. On the other hand, the T-Shirt itself is an attempt to make something good out of the crisis. The Corona crisis offers a chance for change, which I hope we can use.

In this issue, we want to address the question of what the Corona crisis could mean for the climate change crisis, for the suitability of environmental policy instruments and economic models. We start with an introduction by President **Christian Gollier**, Toulouse School of Economics, followed by an article from **Dallas Burtraw**, Resources for the Future, and **Åsa Löfgren**, University of Gothenburg, and an article from **Ilona M. Otto**, Potsdam Institute for Climate Impact Research.

We also want to do what we usually do in this Magazine; inform you about recent research in our field. A dream team of Norwegian economists have published an article in Science on how international climate policy could be improved with a supply-side climate treaty, and they present a summary of their findings in this issue.

Finally, we want to pay tribute to the fact that this year is not only the year of the Coronavirus but also the 30th anniversary of the EAERE. For this reason, we have articles by two former Presidents, **Domenico Siniscalco** and **Alistair Ulph** who tell us about the history of the Association and the field of environmental economics. I'd also like to use the opportunity to draw your attention, in case you missed it, to a very nice article in ERE by **Aart de Zeeuw** "The EAERE Celebrates Its 30th Anniversary" and the Obituary by **Anastasios Xepapadeas** and **Aart de Zeeuw** for one of the founding fathers of our field, **Karl-Göran Mäler**.

Enjoy reading!

Astrid Dannenberg

COVID-19, climate change, and the EAERE

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Christian Gollier *is an internationally renowned researcher in Decision Theory under Uncertainty and its applications in climate economics, finance, and cost-benefit analysis, with a special interest for long term (sustainable) effects. He is fellow of the Econometric Society, and won the Paul Samuelson Award for his 2001 MIT book "The Economics of Risk and Time". With Jean Tirole, he created the Toulouse School of Economics, where he serves as director (2007-2015 and 2017-). He is the president of the European Association of Environmental and Resource Economists (EAERE). He is one of the Lead Authors of the last two reports of the IPCC on climate change.*

The COVID-19 pandemic has hit us hard. Many people died, most of us were confined for a long period of time, the economic activity is down at an intensity never seen since World War II, implying huge reductions in employment and incomes. Public debt is on the rise, and public money will be even more scarce than in the past.

1. Impact of the COVID-19 on our profession

Some good things have emerged from this crisis. Teleworking and online meetings, seminars and conferences are among those innovations that have been key to manage the circumstances. EAERE annual conference is 100% online this year. As I write this note, I don't know how this experience will be felt by the members of the association, but I must say that I have great expectations about the outcomes of EAERE 2020! Being able to attend sessions from your home, escaping long travel times, saving the corresponding CO_2 emissions are important benefits of the online move. I believe that going online for meetings, seminars and conferences has been technically feasible for years. But our profession faced a coordination problem. The COVID-19 has solved this problem, and we will never go back to the ex-ante situation. It is true that we need to address some specific issues of online interactions, such as the absence of social events in online conferences, but I would be surprised if we would not be collectively able to find a solution within a few years. Learning by doing is at work here. Virtual reality is one promising solution, for example. I feel personally relieved by the anticipation of a wide reduction of the time I will spend in airplanes for the remainder of my career.

We are only starting to realize all the consequences of this online experience, for our teaching activities and for the structure of our profession. If hundreds of colleagues can attend one webinar in which I present my new paper, why would I continue to accept seminar invitations with 10 participants? I believe that in each subfield of economics and for each region of the world, one or two prominent webinar series will emerge. They will be complemented by departmental seminars at a frequency rate lower than what we have experienced over the last three decades. One issue is whether EAERE could sponsor such an environmental and resources economics webinar series in Europe. However, this new context clearly increases the risk of reinforcing the star system that exists in our profession. A similar problem arises for teaching programs.

2. Impact of the COVID-19 on the climate challenge

In the same vein, the COVID-19 crisis will at least have a beneficial effect in the short term since the fall in economic activity worldwide could lead to a 10% reduction in CO_2 emissions in 2020, an unprecedented achievement. Nevertheless, in Europe, this effect will be partially offset by the very significant drop observed on the EU-ETS market for tradable emission permits, as seen during the subprime and eurozone crises. In regions of the world where quantity targets are pursued with a permit market, recessions have little effect on emissions by the very construction of the system: the lower

demand for permits will be perfectly offset by the effect of this drop on the equilibrium price of CO_2 on the market. It's urgent to update these systems and take into account the current shock to avoid an economic recovery built on fossil fuels.

The current fall in the price of CO_2 in Europe is no policy justification. The virus has not altered the damage that our carbon dioxide will impose on future generations. There is therefore no reason to lower our guard on the war on global warming. We must continue to force industrialists to integrate this ecological damage into their decision-making process, and a price for carbon equal to the present value of the damage that this carbon causes continues to be imposed, with or without coronavirus. In view of the three current crises - a financial one, a European one and of course, a sanitary one - it is time for Europe to change its climate agenda. Instead of pursuing a target in terms of quantity (40% reduction in emissions by 2030 for example), the Union should set a target in terms of carbon price. A price starting at 50 euros per ton of CO_2, rising by 6% per year for the next 10 years, then 4% per year thereafter, seems desirable to me.

The massive fluctuations observed in the carbon price on the EU-ETS market are not desirable. Industrialists need predictability of future carbon prices to plan their energy transition, even if perfect predictability is impossible given the consequent uncertainties about how this transition will take place. In the immediate term, I support the solution of tinkering with the EU-ETS by adding a floor price of €30/tCO_2. This would create a hybrid system combining an emissions reduction target with a target for internalizing the value of climate damage.

As soon as this health crisis is over, it will be necessary to rethink European climate policy. The Green Deal that was being developed before the pandemic is probably doomed. The significant increase in sovereign debt in the Union and in the rest of the world will constrain public spending for a long time to come. The ability of states to subsidize the transition has diminished. Such action will have to be limited to financing the public infrastructure needed to coordinate private action, households and businesses. It must be honestly acknowledged that public support for private transition efforts is mortgaged. The Merkel-Macron-von der Leyen plan of a European loan to fund the energy transition is ambitious. It should be noticed however that the current version of the plan lacks coherence. If green investments are massively subsidized by public money, that will permanently depress the carbon price on the EU-ETS market. That will raise CO_2 emissions in non-subsidized sectors, neutralizing the net impact of the plan on EU emissions.

This reinforces the need to coordinate the myriad of these individual efforts through carbon pricing, with a price target for the next 30 years announced now. The credibility of this carbon price chronicle is crucial. Therefore, along with Jacques Delpla, director of the Asterion think tank, we recommend that this management be delegated to an independent body that we call the Central Carbon Bank (BCC).

This health crisis is being superimposed on an oil counter-shock of astonishing virulence. It is commonly presented as a concerted action by OPEC and Russia to annihilate marginal oil producers, particularly American shale oil. It can also be interpreted as a policy of oil countries to sell off their reserves before it is too late, i.e. before renewable energies overwhelm consumer countries. This "green paradox" requires a strong reaction from the latter, which should compensate for the drop in the price of fossil fuels on their soil by increasing the price of carbon. This justifies our proposal to raise the price of carbon to €50/tCO_2 or even more as of today. If we don't do this, we risk a strong return of gas and coal to the European energy mix.

The management of the COVID-19 crisis has shown that a strong political will combined with some social support by the population can lead to the victory against a potential catastrophe. Can we duplicate this winning strategy for climate change? I am quite pessimistic on this, because of the tragedy of the horizons. The corona lockdown was a sacrifice for the population, but it yielded almost immediate benefits

in terms of crushing the infection curves to limit the death toll within our frontiers. In the case of climate change, the benefits of our sacrifices will be felt by future generations. This vastly limits the political support to climate policies. Moreover, countries where coal is used to produce electricity know that they will bear a heavy burden of the transition cost if the carbon price in Europe goes beyond 30-35 euros per ton of CO_2. In the absence of a credible compensation scheme (that could be based on the new "Just Transition Fund"), these countries will block any attempt to increase the price of carbon on this continent. This is why we need a Plan B to manage our collective failure to implement Plan A, i.e., carbon pricing. This Plan A is supported by EAERE, as shown by its decision in 2019 to make public a Statement on carbon pricing. We will live for some years a period of carbon prices that will be much smaller than what would be necessary to attain the promised mitigation efforts. In one way or another, this Plan B will require an implicit carbon price and a strong cost-benefit expertise to evaluate the "command-and-control actions to mitigate emissions. EAERE should have a role to play in this complex post-COVID context.

Evolution of market design for emissions trading – economic theory meets real world

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Introduction

The theoretical advantages of carbon pricing are well-known to environmental economists. A carbon tax sets an explicit price on carbon emissions that provides an incentive to reduce emissions. Emissions markets like the EU ETS set a quantity limit on emissions and allow emissions rights (often termed "allowances") to be traded, which identifies a price. Both approaches assign a value to carbon emissions that causes polluters to account in their decision-making for the damages that accrue to society from carbon emissions. In a world with no uncertainty and full information, these two approaches yield the same marginal incentives that achieve equivalent cost-effective emissions reductions and social welfare.

Due to its theoretical advantages carbon pricing has strong advocates within the (foremost economic) research community (Baranzini et al 2017), but also many policy makers acknowledge that carbon pricing is the most cost-effective way to accomplish emissions reductions. Nonetheless, even as carbon pricing is increasingly implemented in practice in many countries (ICAP 2020), the scope of such policies is often too narrow, and prices remain too low to deliver on the objectives of the Paris Agreement (World Bank 2019). In this article we consider the institutional setting in which carbon pricing is introduced, including many preexisting standards and regulations. We describe the shortcomings of a conventional emissions trading program to incentivize significant emissions reductions in this setting. We explain how a trading program can be improved to amplify the effectiveness of existing regulations, and over time, evolve to strengthen the influence of the price signal it provides and improve the cost effectiveness of overall climate policy.

The problem of low prices

Policy makers have nearly three decades of experience using cap and trade to address emissions of sulfur dioxide and nitrogen oxides, and more recently carbon dioxide. At the outset of each of these programs, a prominent concern—especially of industry—has been that prices might spike to unacceptable levels. Experience has been the opposite; allowance prices in emissions markets have been lower than anticipated in every market, often falling in real terms (Burtraw and Keyes 2018). For example, in the EU ETS the price of allowances has oscillated at levels insufficient to drive investments that would achieve the desired energy transformation. In 2005, inexperience with environmental markets caused prices in the EU to rise at first. The increase in electricity prices coupled with free allocation of emis-

sions allowances resulted in windfall profits for electricity generators. Then, in 2007 prices fell precipitously. This "pilot phase" of the EU program was followed by multiple reforms aimed at strengthening the market, but until late 2017 prices remained much lower than most observers expected or felt necessary to achieve the EU's long-run goals. The implementation of various reforms in 2018 led to a sharp and prolonged increase in prices that appears to have affected emissions outcomes (Agora Energiewende and Sandbag 2020). However, prices remain too low to drive investments in the industrial sector, and measures to protect against international competition have suppressed the pass-through of allowance prices to product prices in industry, leaving largely unrealized any influence of an embedded carbon price in the consumption of industrial goods. Recently, in the shadow of the COVID-19 crisis, prices have fluctuated again.

Ultimately, low prices for emissions allowances are the result of reduced demand for emissions allowances with a cap that fails to adjust. Reduced demand may be a sign of program success, especially where the carbon price has driven innovation and investments. Secular economic events including changes in fuel prices and overall economic activity can also reduce demand. Another prominent explanation is the role that regulations such as energy efficiency standards play in driving down emissions. Often this is reinforced by intentional reinvestment of carbon auction revenues to promote energy efficiency and low carbon technology. These factors work together to reduce demand for allowances, which suppresses the allowance price.

But wait…. Shouldn't low prices be a good thing? These lower-than-expected prices pose several problems and challenges, and paradoxically, this outcome of low prices presents a significant threat to the success of emissions markets.

An important problem with a weak carbon price is that it does not provide enough incentive to invest in new technology and innovation activities to reach long-term climate targets. It also undermines public confidence in emissions trading as an effective climate policy, which further encourages the development of other policies and regulations. Implemented in an uncoordinated way, a portfolio of overlapping policies risks transmitting a disparate array of implicit carbon prices that reflect a wide range of varying resource costs to reduce carbon emissions, imparting inefficiency and raising the cost of climate policy. The low allowance prices in the carbon market inaccurately signal to policymakers that costs are quite low, because the costs of overlapping policies are usually hidden; the regulator is also likely to miss many cost-effective opportunities for reducing emissions in the short term, which carbon pricing would be expected to identify. In addition, environmental advocates, who may be distrustful of economic approaches to environmental regulation at the outset, see a failure to incentivize innovation.

These policy interactions are represented in what's called "the waterbed effect." An emissions cap behaves like a waterbed—if you push emissions down in one place emissions go up somewhere else. Emissions that are regulated under the cap might go down because of a technical advance, secular changes in the economy, or other regulations that affect the emitting facilities. Under the waterbed effect, if the cap fails to adjust, these factors including other policies or actions aimed to reduce emissions have no effect on total emissions, an outcome that offends many. However, they affect the demand for emissions allowances, which causes allowance prices to fall.

Next we turn to some examples of how the design of emissions trading markets can be revised to reduce the volatility of allowances prices and strengthen the price signal.

Revising the design of emissions markets

The factors that place downward pressure on allowance demand and prices endure in all settings with carbon markets. When these factors become prominent and affect the allowance market, one can hope that regulators would adjust the program perhaps by reducing allowance supply to support the allowance price. Such an administrative intervention is always avail-

able, but exercising this option is time consuming, uncertain, and politically trying. Alternatively, one can look for a market design that will automatically adjust allowance supply. This is evident indirectly in the market stability reserve in the EU ETS through the provision to invalidate a substantial portion of allowances in the reserve beginning in 2023. While this reform is encouraging, it is also complicated and unpredictable for market participants.

A more direct and transparent mechanism would be a minimum price, or reserve price, below which allowances would not be sold in the auction. This feature supports the carbon price by restricting supply if the demand of allowances in the auction is insufficient to sell the available supply at a price at or above the reserve price. A price floor has been discussed previously in the EU ETS but not adopted based on concerns about its legality under the assertion that it would set the price in the market, but this concern has been powerfully challenged (Fischer et al. 2020). The auction reserve price does not set a price in the market; instead, it sets a minimum price in which additional allowances from the government will be made available. Indeed, the price could fall below the reserve price between auctions or if no allowances sell in the auction.

An auction reserve price is implemented in the North American carbon markets. In the Regional Greenhouse Gas Initiative and the California-Quebec carbon market, at some time auction prices have fallen to the reserve price level, causing some allowances not to sell in the auction and the market supply to be constrained automatically, which subsequently caused the market price to rise above the price floor. This feature is credited with the success and durability of these programs. In 2021 the Regional Greenhouse Gas Initiative will innovate further by introducing an additional price step providing a higher minimum price, above the price floor, for 10 percent of the allowances. This design is intended to accommodate the ambitions of subsidiary state-level policies that implement complementary regulations aimed at the same facilities and intending to accelerate emissions reductions from sources covered also by the regional emissions cap.

Uncertainty is a two-edged sword, however. Because unpredictable factors could cause the allowance price to rise precipitously, these programs make available additional allowances at a higher price step (figure 1). The consequence is a schedule of allowance supply that responds to the market price, much like one observes in other commodity markets.

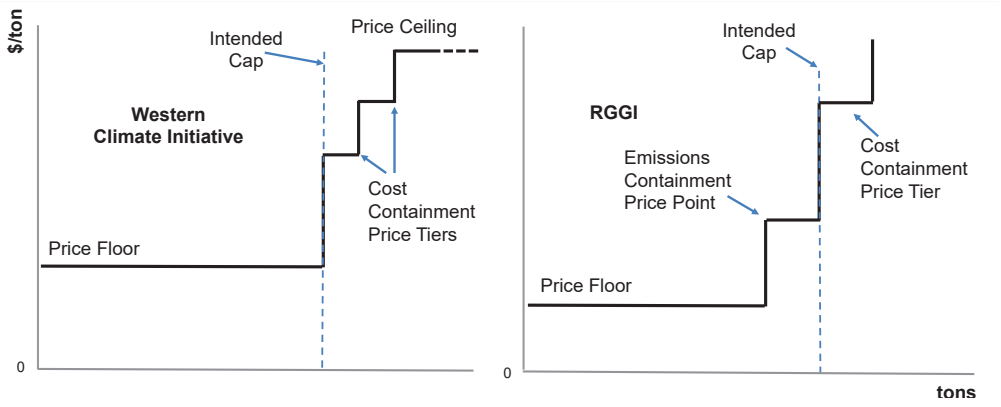

Figure 1. How the supply of emissions allowances in the North American carbon markets respond to market prices (after 2021). Adapted from Burtraw (2020).

Concluding remarks

Low prices on emissions markets give rise to several challenges and potential problems. Given the institutional setting of emissions markets (such as too generous emissions caps, and pre-existing regulations and standards); it is also likely that low carbon prices on emission markets will endure. In light of this, we describe how emission markets, by introducing an auction reserve price, can be revised to more effectively adjust the allowance supply to support the carbon price. Most importantly, such an adjustment mechanism can amplify the effectiveness of existing regulations and improve the cost effectiveness of overall climate policy over time.

The early years of the EU ETS provided stark evidence of persistently low allowance prices that influenced the North American programs to include a price floor in their market design. The European emissions market has so far chosen a more indirect way to strengthen the allowance price by adjusting the supply of allowances through the market stability reserve. However, it is abundantly clear in all of the existing carbon markets that the allowance price needs support to drive investments necessary to decarbonize the whole economy, including more challenging sectors (such as steel, cement, and aluminum). This has sparked a large interest from both policy makers and researchers to think about policies that can complement the incentives provided by emissions markets, such as for example flexible performance standards (Löfgren et al 2020; Fischer 2019), and carbon contracts-for-difference (Sartor & Bataille, 2019; Neuhoff et al 2019).

As environmental economists, we have an important role to play in reconciling economic theory with the use of carbon pricing in practice. Political considerations and companion policies influence carbon pricing in the real world. By acknowledging that it is impossible to disentangle the institutional setting from the policy itself, we believe that environmental economists will be able to offer more useful policy advice as well as increase the trust in economic approaches as a tool for environmental regulation.

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Social tipping points and abrupt system changes

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Ilona Otto *is a newly appointed Professor in Societal Impacts of Climate Change at the Wegener Center for Climate and Global Change, University of Graz. She leads a new research group focusing on Social Complexity and System Transformation. The group's ambition is to use complex science theory and novel research methods to analyse social dynamic processes and interventions that are likely to spark rapid social changes necessary to radically transform the interactions of human societies with nature and ecosystem services in the next 30 years.*

Irrespective of the health issues, the coronavirus pandemic that we are currently experiencing demonstrates that rapid and radical responses of governments and business, as well as rapid lifestyle changes, are possible. Suddenly, we've found we are able to adjust personal habits and routines (e.g. not shaking hands), change travel plans (e.g. give up on holidays abroad), and adjust business practices (e.g. move meetings online, allow working from home). Have these actions affected GDP growth and generated economic costs? Yes, of course! Is it a problem? There are concerns, but the majority of citizens and media perceives such changes as necessary, and even desired, in order to reduce the risks.

In this context, I am asking myself what went wrong with climate action? We have now had over 30 years of international negotiations and government conferences, accompanied by NGO involvement, large levels of funds transferred to all kind of programs and actions all around the world, numerous citizen and youth protests, and the production of terabytes of data and thousands of scientific papers. Have these actions managed to push the World-Earth System onto a new sustainability trajectory? The answer is "no" and, to date, the only time global greenhouse gas emissions have actually substantially reduced is as an unintended result of the coronavirus pandemic and the lockdown measures. Some sources report global greenhouse gas emissions plunged by as much as 17% in April. This is the largest decline since WW2. However, without massive structural changes, the emissions are expected to rise again as soon as the lockdown measures are released. Experts warn we have only six months to change the course of the climate crisis and prevent a post-lockdown rebound effect.

There are five important points that I want to make here:

1. Non-linear changes in human societies are possible and observed. Sometimes the pace of change increases and this can be devastating, leading to crises and wars, but these dynamics can also be imperfectly controlled and navigated. Catastrophes might act as "windows of opportunity" that force us to change our mental models and motivate engagement in reflective processes that might lead to sharp breaks from the existing procedures and policies. In my recent study published in PNAS my co-authors I discuss how contagious processes of rapidly spreading technologies, behaviours, and social norms could lead to a structural reorganization at the whole system level (Otto et. al. 2020). However, commonly used models in economics, as well as Integrated Assessment Models, are unable to either reproduce or estimate the likelihood of such non-linear dynamics. Economics in general, and resource economics in particular, need better theory and tools.

2. Radical and rapid government and organizational responses are possible. We need politicians and global leaders, who have the courage to set and follow ambitious targets, to address the challenges global societies are dealing with. It is important that such global vision and targets are based on science and ethical

principles and their achievement is supported by scientific tools and methods.

3. Risk perception is very important. Global society sometimes behaves like a herd, but often people come together, cooperate, and support each other. This happens particularly if the perceived risk is high, if people feel they have agency in the system, and they feel their choices matter. Fear, however, can lead to destruction and panic. More research is needed into what makes us perceive some risks as being more tangible than others, and how this knowledge could be used in addressing global environmental problems.

4. Due to the connectivity and complexity of global systems, the likelihood of pandemics or other crises cascading through global trade networks, financial systems, or patterns of human mobility is high. In addition, global crises of varying natures are likely to become more frequent in the future and many of them are likely to be driven by ecological pressures including climate change. Society has to learn how to cope with systemic risks and uncertainties or perhaps we need to understand how to restructure and rewrite our global society to make it more resilient to future shocks. Many governments have announced massive post-coronavirus recovery subsidies. The International Energy Agency estimates these might reach $9tn. Such funds should be spent very wisely and support projects, infrastructure development, and business activities that increase the long-term resilience of our human civilization. This can be achieved only if we respect planetary boundaries. We currently have a unique opportunity which we should not waste.

5. We cannot afford to shy away from global inequalities. Resilient societies are societies that create and maintain public goods including a health care system accessible to everyone, and an education system that provides equal opportunities for children and young people. Crises tend to hit the underprivileged harder than other social groups. Social tensions and dissatisfaction cascade to all spheres of life and extend beyond national borders. Populist and nationalist movements capitalize on these tendencies and feed on them. Global inequalities have been constantly rising over the last 30 years and in many cases the wealth and privileges of the few were created at the expense of the environment and the weakest social groups. This trend must be reversed and governments must undertake substantial tax reforms, and improve redistributive and natural resource management policies.

Finally, we need a paradigm change in economics and social sciences in general. New approaches that would go beyond the rational choice and equilibrium paradigms are needed. They should be able to explain and demonstrate system evolution pathways, system transitions, tipping points, and tipping interventions. They should include human agents who operate under the conditions of resource scarcity, information cacophony, and conflicting interests, and take decisions in the presence of high risk and uncertainty. Dear EAERE members, your expertise is needed more than ever and it is just so exciting to be in this field.

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Arguments for a new supply-side climate treaty

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The Paris Agreement can be strengthened if fossil fuel-producing countries agree on a plan for leaving oil, gas and coal deposits permanently in the ground.

To reach the Paris Agreement's goal of keeping global warming well below 2 degrees, large parts of the world's deposits of oil, gas and coal must remain unexploited. But who will take responsibility for capping the extraction? And which deposits should be selected for permanent *in situ* conservation?

In an article that we published in *Science* last summer, we present key economic mechanisms in support of the suggestion that fossil fuel producing countries establish a new international climate agreement limiting the supply of such fuels. This could complement the Paris Agreement, which is based on demand-side measures.

Such a producer treaty will i) enhance the impact of the Paris Agreement in the presence of free riders; ii) stimulate investments in climate friendly technology; iii) act as insurance against a failed Paris Agreement, and iv) reduce the resistance against climate action among fossil fuel producers.

Less carbon leakage

The Paris Agreement seeks to reduce the emission of greenhouse gases. In-

struments designed to achieve this goal, like CO_2 taxes, reduce the demand for fossil fuels and thereby lower the international fossil fuel prices. However, this leads to so-called carbon leakage: lower prices lead to increased use of fossil fuels in countries that free ride by not implementing demand-side measures.

A group of countries attempting to prevent climate change must acknowledge this effect. By reducing their *supply* of fossil fuels, they will contribute to higher global fuel prices. By reducing both their own demand (in accordance with the Paris Agreement) and their own supply of fossil fuel, these countries can eliminate changes in international fuel prices and thereby prevent carbon leakage. The cost-efficient mix of supply-side and demand-side policies for the group depends on how supply and demand for fossil fuels among free riders respond to changes in fossil fuel prices.

Stimulating investments in green technology

A producer treaty will raise the expected future prices of fossil fuels, also in countries without their own climate policy. This makes it more profitable for private investors to invest in climate friendly technologies.

A producer treaty might thus contribute to virtuous circle: increased investments in green technology lower the costs of tomorrow's climate friendly society, enhancing thereby the realism of such a society – which in turn strengthens the prospects that green investments will in effect be profitable.

Insurance against a failed Paris Agreement

If the Paris Agreement turns out to be successful in preventing excessive climate change, then a producer treaty will be superfluous. In this case, future international fossil fuel prices will be low due to low demands. This undermines the profitability of extracting fossil fuels and ensures that a sufficient amount of resources will remain in the ground. However, this will also make the producer treaty inexpensive: Deposits pledged to remain untouched will turn out to be unprofitable anyway, at least if selected in a cost-effective manner. A producer treaty might even avoid waste by preventing exploration, development and extraction of deposits that end up being unprofitable, but which would have been undertaken by investors with feeble beliefs in effective future climate policies.

If, on the other hand, the Paris Agreement turns out to be a failure, then a producer treaty is essential in preventing uncontrolled climate change. In this case, the treaty will impose real costs on producers with deposits that the treaty has earmarked for conservation. But it will also provide considerable – probably much greater – benefits in terms of a more stable global climate.

In this manner, a producer treaty will ensure against a failed Paris Agreement. If the Paris Agreement succeeds, then the producer treaty is superfluous and inexpensive. If the Paris Agreement fails, then the producer treaty will temper the serious effects of continued impotent demand-side climate policies.

Bringing producers on the team

A successful Paris Agreement will reduce the value of resources that are still in the ground. Hence, it is not surprising that big producers of oil, gas and coal have been among the most strident opponents of the agreement.

However, it would benefit producers as a group to complement the Paris Agreement with a treaty that limits fossil fuel supply. Why? Producers will of course lose on deposits that will remain untouched – something that will happen also with a successful Paris Agreement – but gain on the fossil fuel that are nonetheless produced since fuel prices will be higher. From this perspective a producer treaty is similar to OPEC, although comprising coal and gas as well as oil, and having a different underlying objective. Groups that traditionally have worked

against climate policies might therefore be expected to support a producer treaty.

Importers of oil, coal and gas will instead be losers by having to face higher international fuel prices. Many producer countries are rich, while many importer countries are poor, leading on the face of it to unwanted distributional consequences. However, resistance from resource exporters might partly explain why decades of negotiations have not produced a sufficiently stringent international climate agreement. Bringing fossil fuel producers on the team through a supply-side treaty might be preferred even by poor resource-importing countries that would otherwise be severely affected by climate change, if the relevant counterfactual is ineffective demand-side policies that lead to uncontrolled climate change.

Practical steps towards supply-side climate policies

A supply-side treaty will be more effective if participation is wide. Full participation is, however, no prerequisite for the advantages that we have sketched above.

As a first step, rich, well-organized fossil fuel-producing countries with ambitions for effective climate policies could announce moratoria on fossil fuel exploration in areas under their jurisdiction. For example, countries that control the Arctic could stop exploration in this sensitive region.

As a next step, these countries could invite all fossil fuel producers to prepare supply-side pledges, in the form of moratoria for exploration and extraction of some of their resources, combined with a cap for maximum yearly future extraction from their remaining deposits.

Like demand-side measures, supply-side policies will also face resistance, such as from fossil fuel-importing countries and corporations that rely heavily on such fuels. Nevertheless, the fact that demand- and supply-side policies distribute costs and benefits differently indicates that global climate policies might be facilitated if both approaches are applied in tandem.

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EAERE: past and future

Domenico Siniscalco
Morgan Stanley

Domenico Siniscalco *has been Managing Director and Vice Chairman at Morgan Stanley since 2006. He is Country Head of Italy and Head of Government Coverage EMEA. From September 2001 to July 2004 Domenico was Director General of the Italian Treasury, then became Italian Minister of Economy & Finance (July 2004 to September 2005). In this capacity he was also a member of the Eurogroup of the European Council of Economy and Finance Ministers, member of the G7/G8, and Governor of the IMF. Domenico has been a Board member of the Grosvenor Group in London, he sits in the Board of HEC (Paris) and has been member of the Board of Eni, Telecom Italia and other companies. He is Chairman of Fondazione Luigi Einaudi (Torino), Chairman of the Scientific Advisory Board of Fondazione Eni Enrico Mattei (Milano) and Chairman of the Council for the United States and Italy.*

Many academic disciplines, as they gain momentum, typically create a professional association. Environmental and resource economics in Europe was in that situation in 1990. The history of the discipline dated back to Thomas Malthus and to the seminal contributions of Pigou and Coase. The Club of Rome had published an impactful report on Limits to Growth in 1972. But only in the late 1980s, the discipline began to involve a big group of scholars and it started interacting with the general and political debate, propelled by pressures coming from media, policy and the real world. After many years of relative neglect for environmental issues, the stars were finally aligning for a true take off of environmental and resource economics.

In that intellectual and political movement, in 1990, the University of Venice organized the first European conference of Environmental and Resource Economists, to the credit of Ignazio Musu. Some two hundred economists from Europe and the US came to Ca'Dolfin to present their work and mostly to exchange ideas and create a new network. They were coming from different backgrounds: public economics, development, agriculture, as well as industrial organization and business. An important group was coming from the Nordic countries, but important economists from the Netherlands, France, the UK, Ireland, Germany, and Italy were present too. Most participants had never met before.

Given the success of the meeting and the enthusiasm of participants, the organizers, and notably Ignazio Musu, Henk Folmer, Rüdiger Pehtig and Karl-Göran Mäler, plus a number of younger economists, decided to create the European Association of Environmental and Resource Economics (EAERE), which mirrored the US Association of Environmental and Resource Economics (AERE), founded in 1979 in Boulder, Colorado. Like AERE, the EAERE was built on three main pillars: i) the annual conference, ii) a journal and iii) a summer school to nurture the profession. During the Second annual Conference, in Stockholm in 1991, the bylaws were approved and the candidates for president were announced and subsequently elected. The first President was Henk Folmer, from Wageningen Agricultural University. At the very beginning there were about 100 members. In a few years the membership grew to 300 and is now roughly 1000, with a good gender, geographic and background diversity. Outstanding members of the Association in the early years were Karl-Göran Mäler, Rüdiger Pehtig, Franck Convery, Ignazio Musu, Anastasios Xepapadeas, Aaart De Zeeuw, and Scott Barrett. I became chairman of the Association in 1996-7. Carlo Carraro, with whom I wrote my best papers in the economics of environment, was Chairman in 2018-19. In 1994, EAERE and Fondazione Mattei organized the first World Conference of Environmental and resource economists, in Venice. The meeting inaugurated the contacts between international associations..

The making of a discipline

In 1990, I was a young economist, with a fresh PhD in economics from Cambridge and a chair of Economics in the Uni-

versity of Torino. At the end of 1989, I had become the first director at Fondazione Mattei, set up by Franco Reviglio, then President of ENI, and we had decided to focus the new institution on environment and natural resources.

At the time, traditional topics of environmental economics were pretty wide: from renewable and non-renewable resources, to valuation of environmental assets and accounting, to market-based instruments in environmental policy. Newer topics were emerging too, ranging from intertemporal issues, with the notion of sustainable development, to international and global issues, such as acid rain, the protection of the ozone layer and climate change. This latter topic was really challenging from the analytical viewpoint: it was one dimension of human development; it had an inter-generational dimension; it was a global externality.

Some topics, related to poverty and access to resources, such as water, waste or urbanization, required a multidisciplinary approach. In general, to address all the environmental issues, economic tools need to be integrated with natural sciences, sociology, political economy, engineering and technology. Intrinsically, the environmental topics required a true multi-disciplinary approach.

"New environmental issues" were clearly a dimension of economic and demographic development. For the first time, the Brundtland commission, the Rio the Janeiro Conference, and the Kyoto conference in 1997 attracted the heads of State to discuss and negotiate around the environmental topics, mostly related to climate change. The creation of the Intergovernmental Panel on Climate Change, which won the Nobel Peace Prize in 2007, institutionalized the role of science and the multidisciplinary approach in the policy debate around climate change.

As I said in the introduction, the stars were aligning and environmental economics entered a phase of tumultuous growth. The discipline grew as a network of people and research centers. The main hubs were the Bejier Institute at the Swedish Royal Academy of Sciences, the University of Toulouse, Siegel and the Max Planck Institute in Germany, Fondazione Mattei in Milan and Venice, UCD in Dublin, Cyprus, and the University of Krakow which gave rise to a Polish chapter of the association.

Interaction with policy making was crucial particularly around carbon taxation and global agreements against climate change. The effort at the time was also to attract the best economists in the world to work on the relevant topics. I vividly remember that at a conference in Siena, a paper I had written with Carlo Carraro on global agreement against climate change had Ken Arrow as a discussant: a real challenge! At the time we also established permanent relations with the US, with RFF, the Brookings, Stanford, NBER, where we were able to organize weeks on environmental economics. Dedicated sessions have also been organized every year at the annual conferences of the European Economic Association. The policy outreach was wide: from Africa to China.

In all this effort, my cooperation with Carlo Carraro and Alessandro Lanza proved to be essential. And the common mind and trust with many friends was equally important.

At the third annual conference of EAERE in Krakow, 1992, the Polish friends hand-produced the water-colour picture which depicts a rainbow falling in the sea, which immediately was adopted as the logo of EAERE. Maybe I am becoming nostalgic, but I hope that logo will never be changed!

To understand the more recent developments of the environmental subjects one should analyze the journals and the main conference programs. But there is no need for data to support the notion that environmental economics consistently developed a multi-disciplinary approach, with a diverse, research based and inclusive approach. I believe this approach proved to be a pig positive to retain a relationship with the real world and to survive a period of extreme specialization in economics which

proved to be sterile and led to some crisis. Against this background, I believe that IPCC and EAERE proved to be crucial in keeping the discipline on a fruitful track.

The future of the discipline

Over the years, environmental economics was gradually converging to climate change, to later discover in practice a theoretical result: coalitions that involve all countries in the protection of the global environment are impossible, due to the structure of externalities. Only recently, the discipline is expanding again to a wider set of topics with diverse research tools: technology, demography, public economics, finance, etc. Environmental topics are highest on the agenda of policy makers and in the public debate. Financial markets widely trade ESG bonds (environment, social and governance) and SDG securities. Today I believe sustainable development is resting on three main pillars: consumer preferences; technology; and capital. The real fundamentals in economic theory!

In 2020, the COVID-19 pandemic is reshaping our way of living and working in a deep way and is posing new challenges to environmental economics. In five months, most countries went through a wave of technological and organizational progress which is probably here to stay. Epidemiological and environmental issues seem to be related in many ways. How to integrate the economic recovery with climate change. How to implement a new Green Deal in the EU recovery plan. And the new way of living and working will also influence our Association through technology. This latter and more limited topic is worth exploring, and so is the impact of COVID-19 on research and higher education. As of today, predicting such trends and changes on the evolution of research and education is probably too early. But I trust that the structure of our association and its interdisciplinary nature will provide unique perspectives on the topic.

Indeed, EAERE is made up of economists that come from many different methodological backgrounds and they are able to interact with other disciplines in many areas: science, technology, demography, finance and ecology. These characteristics of the association, which are necessarily linked to the topic addressed by environmental economics, are crucial to ensure close links to the real world, and create a very fruitful debate to address the topics and challenges of the future.

Before and after – how EAERE transformed our discipline

Alistair Ulph

Alistair Ulph *graduated from the University of Glasgow in 1968 and the University of Oxford in 1970. After spells at Oxford University, Stirling University and Australian National University he joined Southampton University in 1979, becoming Professor of Economics in 1985. He was Deputy Vice-Chancellor at Southampton University from 1995-2001, and moved to the University of Manchester in 2003 as Vice-President and Dean of Humanities. He retired in 2010, becoming a part-time Research Professor in Economics. He was elected Fellow of the Royal Society of Arts in 1999, President of EAERE 2000-2001 and is an EAERE Fellow.*

My academic career as an environmental and resource economist before retirement in 2010 spanned 40 years, 20 prior to EAERE's first conference and 20 after, and in this article I want to give a sense of how different the two eras were.

My interest in environmental and resource economics began in my postgraduate years in Oxford in the late 1960s, when I wrote a thesis on the economics of the mining industry, starting from Hotelling's classic paper on the economics of exhaustible resources. The topic remained one of my interests during the 1970's, when there was a lot of public interest in the issue arising from the OPEC oil price shocks and concerns about the long-term sustainability of economic growth. During a spell as research fellow in the mid-70s at the Centre for Resource and Environmental Studies at the Australian National University I worked on theoretical models of imperfect competition with exhaustible resources, empirical work on estimating the demand for energy in the Australian manufacturing sector, using what were then relatively new flexible functional forms, and some valuation work on the benefits of one of Australia's national parks. I also got involved in policy issues, such as the design of systems for taxing resource rents, of obvious relevance to Australia.

In 1979 I returned to the UK to take up a post at the University of Southampton. The post was one of very few then earmarked as being in the field of environmental and resource economics. It was the post vacated by David Pearce when he left Southampton for a chair at the University of Aberdeen, then the hub of the UK offshore oil-industry. I continued working on empirical models of imperfect competition and the oil market (with funding from BP), and models of energy demand, funded by the Department of Energy. I also got involved in projects related to climate change, such as assessing the effectiveness of a carbon tax and evaluating the costs of sea level rise in the south of England.

I mention all this because throughout the 1970s and 1980s much of my research, like that of most environmental and resource economists, was focussed on work with colleagues in my own department. In those years, environmental and resource economics was a rather niche area in which only a small number of UK economics departments had anyone working in the field. I also did research in labour economics and industrial economics, and it was more usual to be asked to give seminars in those fields than in environmental and resource economics.

The position was much the same in other European countries. There were two main ways of meeting and interacting with other environmental and resource economists outside the UK. One was by presenting papers at large general economics conferences, such as the annual meetings of the European Econometric Society, where they might have a particular session on a topic in environmental and resource economics. It was at such meetings that I first met Michael Hoel and Cees Withagen, for example. The second route to meeting other environmental and resource economists was to be invited to give a seminar or attend a small specialist conference organised by

European universities where there were similar small groups of people interested in the field. It was by this route that I first met Aart de Zeeuw, Rüdiger Pehtig and Karl-Göran Mäler, for example.

It was with considerable interest, therefore, that I attended the inaugural conference of the European Association of Environmental and Resource Economists in Venice in April 1990. By today's standard it was relatively small conference, with about 200 attendees, but it brought about significant and rapid change. As I've said, no single European country had the concentration of environmental and resource economists to justify setting up such an organisation, but at the European level it worked. The annual conference of EAERE quickly became a key conference to attend. This greatly enhanced the opportunities for collaborative research funding and joint publication across different European countries. It also made it easier to compare regulatory systems across different European countries, to learn what worked and what did not. As a small example, in the 20 years after 1990 compared to the 20 years before 1990 the number book chapters I published doubled and about 90% were in books with non-UK European editors compared to less than 25% before 1990.

In 1999 I was elected to be President of EAERE for 2000-2001, and I also organised the 2001 Conference in Southampton. By this time the membership had grown to about 360, with a further 110 AERE Secondary members. There were three main issues I sought to tackle while I was President. First, a feature of the way the Council was elected in the early years of EAERE, as laid down in the original constitution adopted in 1992, was that the whole Council was elected to serve for 2 years and then an entirely new Council was elected. The Secretary-General also changed at that time, and was usually a colleague of the incoming President. To get some idea of the issues being addressed by the Council, there would be an informal briefing of the incoming President by the outgoing President, in my case by Aart de Zeeuw, which I much appreciated. However, this did not seem a sensible way to develop longer-term strategies for EAERE. Therefore, I got the agreement of the General Assemblies in 2000 and 2001 to change the statutes of EAERE so that there was more rotation (it was constitutionally necessary to get this agreed by two successive General Assemblies). There were three aspects to the change. The first change was that in any two-year period, the then President would serve alongside the outgoing President and the incoming President, meaning that an individual elected President would serve for six years on Council. The rationale was to give the individual time to learn about the key strategic issues facing EAERE before taking up post as President, and then, after two years in post, to pass on the experience learned to the successor. The second change was that the four other elected members of Council would serve for four years, with overlapping periods of office, so every 2 years the two longest serving members of Council step down and are replaced by 2 newly elected members of Council. These changes were designed to strike a balance between refreshing Council with new thinking while maintaining some organisational stability and memory. The final aspect of this change was to appoint a permanent Secretary-General, Monica Eberle.

The second issue I sought to address was the organisation of the Summer School for PhD students. This had been an important part of what EAERE provided for the community since its founding, but by 2000 there had been some years when the Summer School did not run, because it had not been possible to secure funding for the summer school. Part of the reason was that EAERE provided little financial support for running the Summer School. I believed this was an important aspect of the benefits that EAERE provided, allowing PhD students to interact with a wider range of expert lecturers and other PhD students than they might meet in their home institution. Therefore in 2000 I organised the Summer School, held in Venice, and got agreement that EAERE would provide some financial support for the Summer School, (now up to 10,000 Euros), to help organisers raise other funds. This financial support for

the Summer School meant there had to be a modest increase in the membership fee.

The third challenge I sought to address as President related to the journal, Environmental and Resource Economics, linked to EAERE. Concerns were regularly expressed in the General Assembly about the subscription rate charged by Kluwer (later Springer) for the journal. This was part of a more general concern by learned societies and university libraries about the cost of journals published by commercial publishers. Indeed, there were some strong feelings amongst some EAERE members that EAERE should set up its own journal, like some other learned societies did. It was at this time that Ian Bateman took over from Kerry Turner as Editor of EARE. So, it seemed timely to renegotiate the relationship between EAERE and Kluwer. I started the process, which carried on into the period of my successor, Klaus Conrad, and we succeeded in getting a number of concessions from Kluwer.

In the subsequent 18 years, EAERE has continued to flourish and now has about three times the membership it had when I was President, and the annual conference has doubled in size. This reflects the more important fact that environmental and resource economics is now a critical part of the European agenda of economists in universities, government, NGOs, consultancies and business, and EAERE has played an important part in that evolution. It was a privilege to have played a small part in that journey.

EAERE
European Association
of Environmental and
Resource Economists

The European Association of Environmental and Resource Economists (EAERE) is an international scientific association which aims are:
_to contribute to the development and application of environmental and resource economics as a science in Europe;
_to encourage and improve communication between teachers, researchers and students in environmental and resource economics in different European countries;
_to develop and encourage the cooperation between university level teaching institutions and research institutions in Europe.
Founded in 1990, EAERE has approximately 1200 members in over 60 countries from Europe and beyond, from academic institutions, the public sector, and the private industry. Interests span from traditional economics, agricultural economics, forestry, and natural resource economics.
Membership is open to individuals who by their profession, training and/or function are involved in environmental and resource economics as a science, and to institutions which operate in fields connected with the aims of the Association.

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