Taxing Global Warming: Externalities and Dealing with Them

* TOMASZ KASPROWICZ

Free markets tend to provide optimal allocation of resources, but this outcome depends on a set of assumptions[1]. Of course, these assumptions are never fully met, but the distortions arising from deviations from optimal conditions are usually small and do not warrant intervention to correct them. This policy is confirmed by general higher effectiveness of free-market economies over centrally planned ones. This phenomenon was conclusively proven by the collapse of centrally planned economies of socialist countries when pitted against free-market-driven capitalist systems – which came as a surprise even to some western economists as late as 1984[2].

There are, however, cases when violations of conditions that are required for markets to function properly are so severe that we observe market failure. It is a situation when there are people willing to make transactions, but for some reason they cannot. This is clearly a highly inefficient outcome and may be caused, for example, by asymmetry of information between parties in transaction[3] and causes problems in healthcare market (like high prices and worse outcomes). The less regulated healthcare market in the United States performs far worse than the much more regulated market in Europe[4].

Yet another problem is posed by externalities. These arise in situations in which activities bring harm (or benefit) to the parties not directly involved in them. Vaccinations that build herd immunity create positive externalities because 'my decision to vaccinate' benefits society as a whole – in addition to my own benefit. Widely defined pollution (ranging from industrial waste to secondhand smoking) is the most commonly used example of a negative externality. The polluter benefits from polluting, but the community pays the price in terms of health outcomes or the quality of life.

In the case of positive externalities, people will do too little of the beneficial actions, as they do not accrue full benefits. In the case of negative externalities people do too much of the bad activity as they do not bear the full cost. In such a situation, the intervention may aim to bring the intensity of these activities to optimal levels.

One approach is *command and control* of outright banning or mandating certain behavior. Vaccine mandates or compulsory education are meant to create as many positive externalities as possible. On the other hand, some actions are considered indefensible and are thus outright banned

> SCIENTIFIC CONSENSUS FIRMLY SUPPORTS THE BLEAKER SCENARIOS

[1] Debreu, G. (1984) "Economic Theory in the Mathematical Mode", [in]: *The American Economic Review*, Vol. 74(3), pp. 267-278.

[2] Samuelson, P. A. (1989) *Economics*, New York: McGraw-Hill.

[3] Akerlof, G. A. (1978) "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism", [in]: *Uncertainty in Economics*, New York: Academic Press, pp. 235-251.

[4] https://www.healthsystemtracker.org/chart-collection/quality-u-s-healthcare-system-compare-countries/

– like burning trash in one's stove. In other cases, limits are imposed, or certain additional actions required (like installing filters or creating treatment plants). These systems have the inherent problem of setting the parameters right, as they are mostly arbitrary and politically driven. Therefore, one cannot be certain whether a given ban is not creating more harm than good in the end. In most cases, no outside verification of parameters is performed, and it is difficult to imagine how this might be done. Also, the circumstances may change. In the incoming winter, due to energy crisis, burning trash may be one of the few options remaining in order to avoid freezing for certain families. The dilemma is very real.

TAXATION OF EXTERNALITIES

The alternative to command-and-control systems is trying to transfer external benefits or costs back to perpetrators in monetary form. In case of positive externalities, subsidies are introduced to convince people to undertake more beneficial actions. For example, in order to make people more likely to vaccinate, the state provides various incentives: free vaccinations, lifting isolation requirements for vaccinated, and even a lottery for the vaccinated with significant winnings[5]. One of the arguments for free education also arises from the positive externalities argument. The goal is to transmit more of the benefits to decision-makers, so they engage in an optimal level of a given activity.

On the other hand, the state may impose a tax on harmful actions in the amount equivalent to the harm done. These are known as 'Pigouvian taxes' and are likely the only taxes that improve how markets

> THE METHODS OF TAXING EMISSIONS ARE BASED ON TWO MAIN APPROACHES

operate instead of distorting them[6]. If applied correctly, the Pigouvian tax should bring down the level of harmful behavior to a market optimal level. This approach was applied to many phenomena, including obesity (sugar and fat taxes), nicotine, cannabis, and alcohol consumption (excise taxes). It is also quite common that rather a portion of proceeds from Pigouvian taxes is recirculated to the groups that are harmed by the actions taxed – for example, promoting healthy habits, addiction management, and environmental improvement. Still, the level of earmarking tends to be low[7].

The amount and method of imposing the tax is not trivial. Pigouvian taxes are superior when compared to the command-and-control approach, as they leave most of the decisions to the market and voluntary adjustment of behavior due to incentives. They also give the chance to improve how markets work – if they are set correctly. But that is a big 'if'. *If* the tax is too low, the market should work better than in its absence – but still sub-optimally. On the other hand, too large of a tax will create

[5] Law, A.C. et al. (2022) "Lottery-Based Incentives and COVID-19 Vaccination Rates in the US", [in]: *JAMA Intern Med*, Vol. 182(2), pp. 235–237. 2

[6] Kasprowicz, T (2001) "The Meaning of Taxation Effects of Various Taxes", [in]: *4liberty.eu Review*, No. 12.

[7] Cashin, C., Sparkes, S., and D. Bloom (2017) *Earmarking for Health: From Theory to Practice, Health Financing Working Paper*, No. 5.

perversions of its own – people will consume less than the optimal amount. The optimal value is the value of externalities, but it may be challenging to identify.

Firstly, the harm done by the same behavior in a different environment might be vastly different. Pollution in the middle of a city usually creates more costs than in desolate wilderness. Also, the size of the harm may change quite drastically over time and is prone to change frequently. Yet, the magnitude of the tax is still a political decision that cannot be adjusted on a daily basis, and which may be heavily distorted (whether intentionally or not). Moreover, attempts at imposing the flat tax may lead to perverse outcomes, and it is believed that the Pigouvian tax should be proportional to the level of the behavior one engages in[8].

TAXATION OF GREENHOUSE EMISSION

Emission of greenhouse gasses creates greenhouse effect, which threatens the stability of the global climate system. This, in turn, can have disastrous effects for human wellbeing. The exact size of the impact and, therefore, its valuation, is a subject of very intensive political debate where one side denies the problems, while the other shows catastrophic scenarios. As these are estimates, only time will tell which side is closer to the truth. However, scientific consensus firmly supports the bleaker scenarios. It seems that in order to maintain systemic stability, we need to maintain an increase in temperature under 1.5 ° Celsius[9].

[8] Carlton, D. W. and G.C. Loury (1980) "The Limitations of Pigouvian Taxes as a Long-Run Remedy for Externalities", [in]: *Quarterly Journal of Economics*, Vol. 95(3), pp. 559–566.

[9] IPCC (2019) *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems.*

> PRICING OF CARBON EMISSIONS IS OF UTMOST IMPORTANCE AND SPARKS CONTROVERSY

This crisis calls for radical cuts in greenhouse gas emissions (mainly CO2, but also methane, water vapor, among others) and their recapture and storage. In order to achieve this goal of net zero emissions for global energy, what is needed is not only a transformation focused on limiting the use of fossil fuels, but also stopping deforestation, limiting methane emissions from animal husbandry, and others. This is being achieved, for instance, via investments in technology in cleaner energy sources and production methods like artificial meat. Most of these technologies are still in their infancy and pose ecological problems of their own[10]. At the same time, they are at an economic disadvantage, partially because of negative externalities of burning fossil fuels not included in price. To correct for that, Pigouvian taxes are proposed or implemented.

The methods of taxing emissions are based on two main approaches. The most popular in Europe is an emission trading system.

[10] Khosroabadi, F., et al. (2021) "Analysis of Carbon Dioxide Capturing Technologies and Their Technology Developments", [in]: *Cleaner Engineering and Technology*, Vol. 5.

> HIGHER PRICES OF CARBON-INTENSIVE GOODS WILL NOT BE A DETERRENT TO BUY THEM IF THEY ARE COMPENSATED BY DIRECT TRANSFERS

Planned emission levels in a given year is set as a limit or a 'cap', and companies that pollute are required to hold permits adequate to actual emission. They have to buy them from the state or are provided for free at the level of baseline pollution from previous years (grandfathered). From an economic point of view, the method of granting permissions is of little importance, but it may serve fiscal purposes if permits are sold. Grandfathering permits may, however, create perverse incentives of inflating emissions prior to introduction of the program, in order to secure greater allotment.

The ability to trade the permits between companies serves two purposes. Firstly, it gives incentives to reduce emissions as its freed-up permits can be sold giving extra profit. Since the cap is usually lowered each year the value of permits rises increasing the incentive. Secondly, the ability to trade allows the market to sort out where the emissions are most valuable as companies that are the best in converting emissions into economic value will be able to pay the most. This way, the cost of limiting the emissions is minimized. Such an approach allows markets to mitigate at least some problems with command-and-control systems. Cap level is still arbitrary and may be too low or to high given the situation, but at least we know that existing permits are allocated in the best way possible in industries covered by the system.

These systems mostly apply within countries, but the ability to reallocate permits between countries also exists. Under the Kyoto agreement, the trading of permits is not limited to companies, but also can be performed between countries. Such transfers provide optimization not only within countries, but also among countries, which gives further benefits in terms of pace and efficiency of the process. Each international transfer needs to be validated by the United Nations Convention on Climate Change and European Commission (if it takes place within EU).

The second approach is applying a tax to emissions of each ton of CO2 (or equivalence of other greenhouse gasses). This is a pure Pigouvian tax approach. Taxation of emissions of CO2 has existed for a long time, however, sometimes indirectly or only in some respects. For example, gasoline/kerosene is heavily taxed using an excise tax. Excise tax applied on electricity has similar properties assuming most of the electricity in a given country comes from burning fossil fuels. However, it is worth noting that the taxes that were applied to CO2 emissions were largely motivated by fiscal reasons and not the externalities argument, as they predate the time when the greenhouse effect was a point of active political debate.

> ONE BIG PROBLEM WITH CARBON TAXES (AS WITH ANY TAXES) IS THAT THEY CAN BE AVOIDED

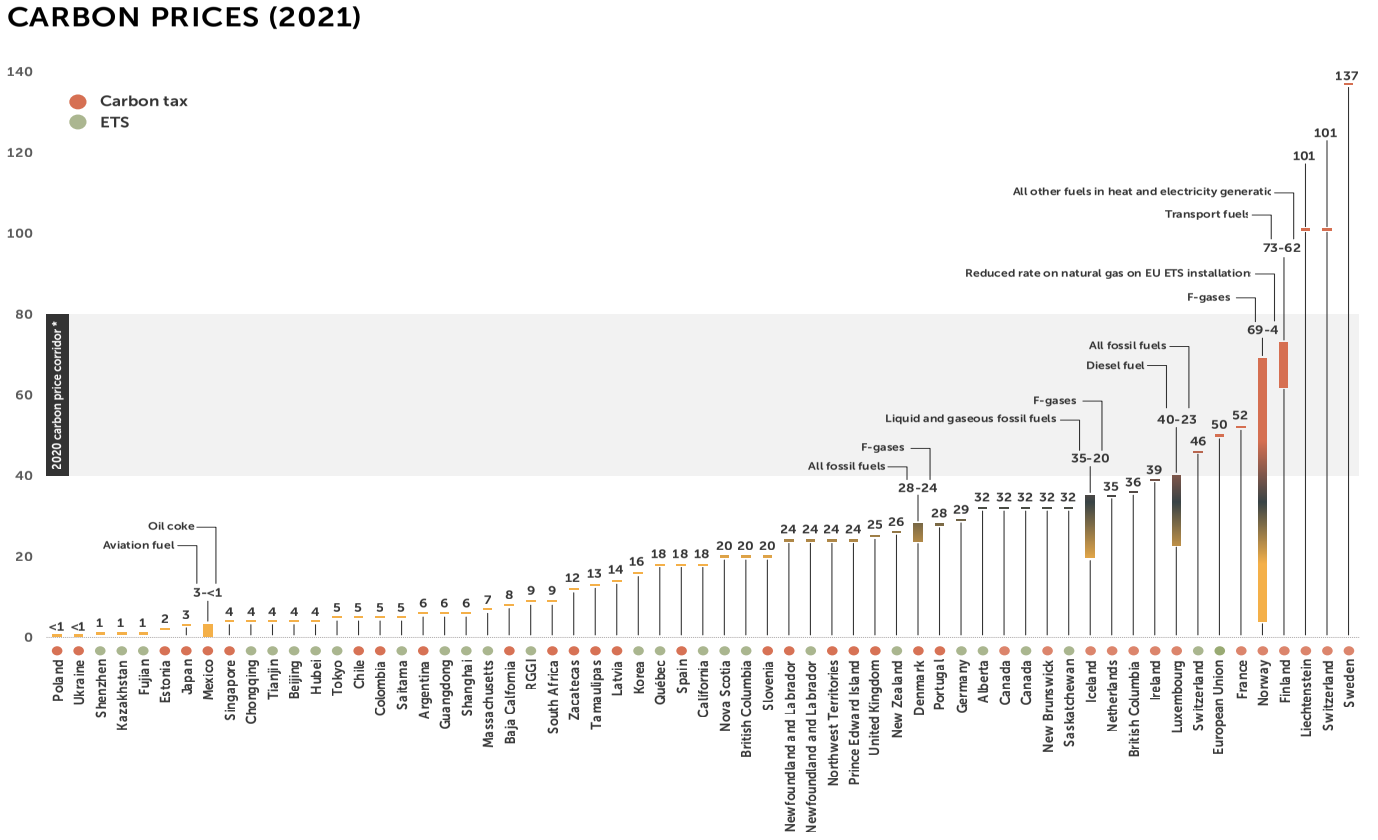
These two methods of limiting emissions by taxation have certain asymmetric properties, despite the fact that both rely on the market to alleviate at least some of the problems with arbitrary state intervention. Permit trading is a system where the cap is set at an arbitrary level, but the value of emission is market determined (given the cap). In the case of carbon taxes, the government decides the rate, whereas the market decides about the levels of emissions given the tax. Both approaches have their downsides. The 'cap and trade' system allows to manage the level of emissions quite accurately, but in case of recession or a technological breakthrough, the price of emissions may fall dramatically and discourage from pursuing more reduction. This was observed during the 2008 recession, when the permit price plummeted. Carbon tax, on the other hand, gives an unpredictable level of emissions and it is difficult to caliber it properly to attain a desired outcome, given the goals.

There also exists a 'mixed hybrid cap' as well as trade models that are imposing price caps (the state is always offering more

Figure 1: EU carbon permit price history

Source: https://tradingeconomics.com/commodity/carbon

Figure 2: Carbon prices as of April 1, 2021



Source: The World Bank (2021) State and Trends of Carbon Pricing 2021

> IN ORDER TO ACHIEVE EMISSION GOALS (AND, EVENTUALLY, ZERO NET EMISSION) CARBON EMISSIONS MUST BE OFFSET

permissions at a cap price) and price floors (one cannot trade below the floor) that tries to address some of the problems. The price floor keeps the incentive to limit emissions even during economic downturns, while the price cap is a way to prevent choking the economy by a fixed emission cap.

PRICING THE EMISSIONS

Current estimates of the social cost of carbon emissions are set at USD 3,000 per ton of CO2[11], while the IPCC suggests the price of USD 135-5500 in 2030 in order to keep the temperature increase below 1.5 ° Celsius limit[12]. At the same time, policy recommendations are at the level of USD50-200, whereas the actual prices set can be as low as USD 10 in China, and above USD 100 in only three jurisdictions[13]. This difference reflects a huge uncertainty around the estimates of the actual value of externalities associated with emissions. As future costs are impossible to objectively verify and the current outlays are potentially significant, the pricing of carbon emissions is of utmost importance and sparks controversy. The problems with setting the price of carbon are not trivial – instead, they are heavily politicized as one of the main dividing factors in today's polarized political environment, with mostly the right wing dismissing the problem, whereas the left is creating catastrophic scenarios.

When discussing carbon taxes, it is also important to take into consideration the flip side of the process. Taxing carbon can create a significant revenue stream and managing it might be as important in emission reduction as taxation itself. Such revenues could be used for research and adoption of clean technologies or carbon capture subsidies for prosumers. It is also proposed that it might be used to decrease the digressive nature of the carbon tax, as it burdens poorer households[14]. This, however, threatens to a certain degree the effect that the taxation might have on emissions. Higher prices of carbon-intensive goods will not be a deterrent to buy them if they are compensated by direct transfers.

CARBON LEAKAGE AND CARBON TARIFFS

One big problem with carbon taxes (as with any taxes) is that they can be avoided. Certain ways of doing that are actually beneficial and may lead to improving efficiency, changing technology to a cleaner one, or

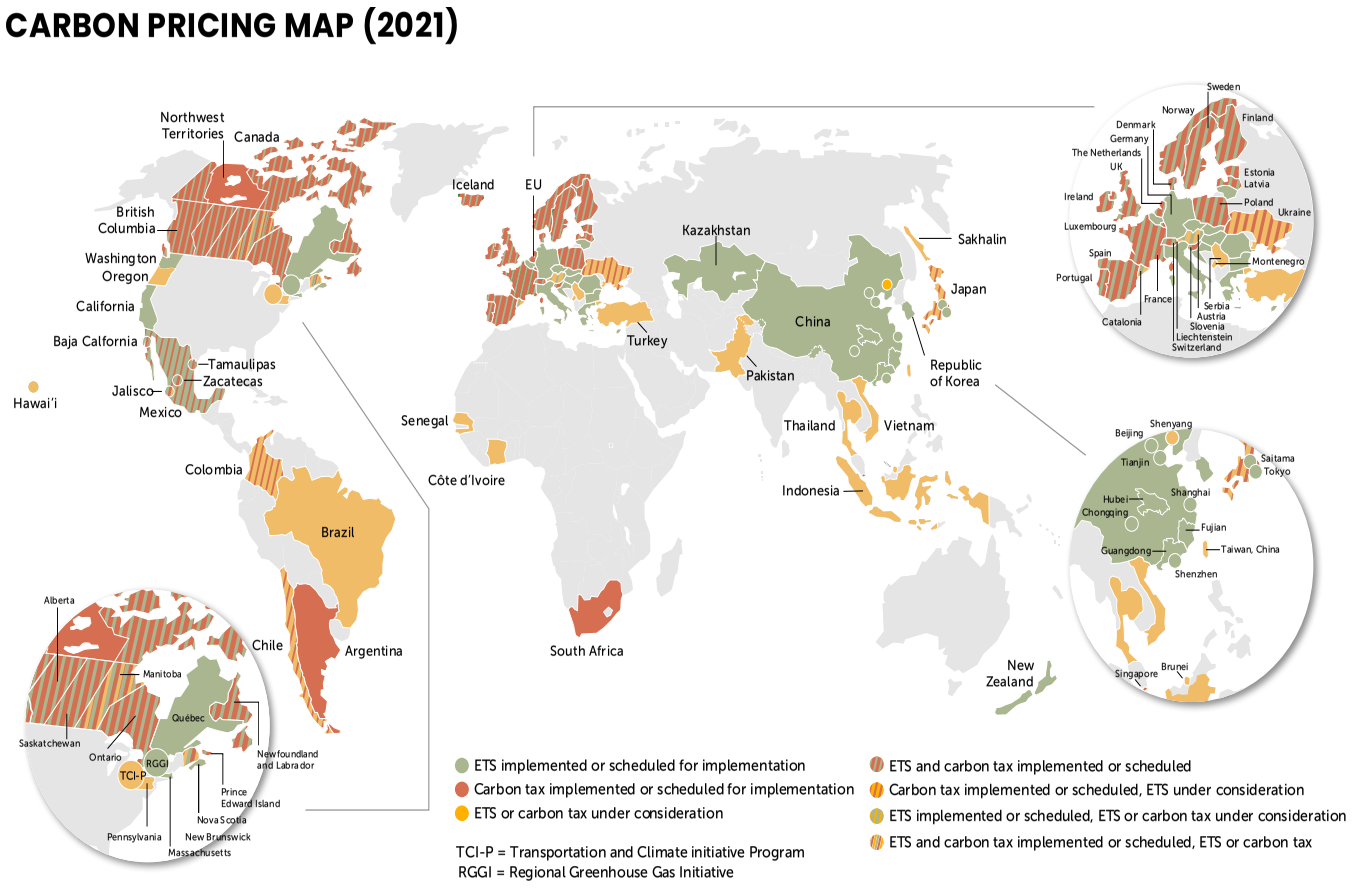
[11] Kikstra, J.S. et al. (2021) "The Social Cost of Carbon Dioxide under Climate-Economy Feedbacks and Temperature Variability", [in]: *Environmental Research Letters*, Vol. 16(9).

[12] de Coninck, H. et al. (2018) "Chapter 4: Strengthening and Implementing the Global Response", [in]: *IPCC SR15*, pp. 313–443.

[13] https://www.globalelr.com/2021/08/chinas-national-ets-launches-trading/

[14] Ravigné, E., Ghersi, F., and F. Nadaud (2022) "Is a Fair Energy Transition Possible? Evidence from the French Low-Carbon Strategy", [in]: *Ecological Economics*, Vol. 196.

Figure 3: Carbon tax adoption



Source World Bank (2021) State and Trends of Carbon Pricing 2021

> IT IS ESTIMATED THAT ABOUT 6 GIGATONS OF CO_2 WILL HAVE TO BE CAPTURED GLOBALLY PER YEAR BY 2050

reducing overconsumption and waste. But as carbon taxes are neither universal nor equal, there is room for geographical arbitrage.

A lack of low carbon taxes give states that are not implementing them an advantage in attracting high-emission industry. As CO2 moves freely in the atmosphere, the net result of such a transfer might be negative due to more transportation of products needed and the possibility of using even dirtier (but cheaper) technologies than originally applied[15].

This fact is often cited by the opposition to emission regulation. The parties that oppose limiting emissions claim that applying carbon tax brings no overall benefits, as global emissions remain unchanged (even if they fall in one country) or even grow, while the economy of the host country is hurt by the industry moving out. This argument is not without its merits and requires addressing[16].

One attempt to limit carbon leakage are carbon tariffs. The tariff would be applied to imports of emission-generating goods manufactured in the countries that does not adopt carbon taxing (or adopts lighter versions of the regime). This is supposed to level the competitive field and discourage moving the production out of the countries implementing carbon taxes. In 2021, the European Union proposed such a mechanism, called the 'carbon border adjustment mechanism' (CBAM). It is not exactly a tariff per se, but rather a requirement to buy permission in case you import goods from outside of the EU – just as if they were manufactured inside the European Union. The permits are generated outside of the cap, but at the price mirroring the price of permissions on the market. This mechanism shall apply to iron and steel, cement, fertilizer, aluminum, and electricity generation, and will be potentially extended to other goods. The mechanism shall be initially operational in 2025 and cover all sectors by 2030[17].

This idea (so far applicable to the EU) is also politically controversial – but mostly on the international scene. Developing countries that were benefiting from arbitrage (mainly China) due to carbon leakage find the carbon tariffs to be a kind of trade protectionism and are threatening with retaliation via trade wars. The stance of the United States is also somewhat fluid, as it varies between opposition and joining the mechanism (together with Canada and the United Kingdom), as the EU plan will eventually cover

[15] Barker, T. et al. (2007) "11.7.2 Carbon leakage", [in]: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, eds. B. Metz et al., Cambridge and New York: Cambridge University Press.

[16] Marcu, A. (2013) "Carbon Leakage: An Overview, [in]: *CEPS Special Report*, No. 79.

[17] European Commission (2021) *Carbon Border Adjustment Mechanism: Questions and Answers.* Available [online]: https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661

> CARBON CAPTURE AND REDUCTION TECHNOLOGIES ARE NEW AND STILL EXPENSIVE

USD 17 billion of US exports[18]. It is also doubtful whether such tariffs are compatible with the WTO rules[19]. Expansive interpretation of the GATT Border Adjustment Taxes may be a solution to this conundrum, but it remains legally doubtful[20].

In order to address these doubts and take into account the needs of the developing countries, there is a proposal to recirculate the funds obtained back into the exporter countries and investing them in green transformation there[21]. This strategy includes investments in renewable energy sources and green technologies. Such an approach would double the impact of tariffs on emission reduction.

CARBON OFFSET

Some industries require fossil fuels at the current level of technology, and it is not feasible to phase them out. These include such vital activities as cement production or steelmaking. In order to achieve emission goals (and, eventually, zero net emission) carbon emissions must be offset.

Carbon offset can be roughly divided into two types: *negative emission technologies* and *reduction in emissions*.

Negative emission technologies (NET) are a catch phrase covering all sorts of technologies that allow to capture carbon from the atmosphere and is, in principle, opposite to emission. NET can be grouped into several categories:

- **carbon capture and storage** – technologies that chemically bind CO2 that can then be stored underground or recycled into other processes;
- **enhanced weathering** – a process that accelerates natural carbon removal trough weathering of rocks;
- **forestation including reforestation**;
- **biochar** – storing carbon in soil in stable form after pyrolysis of organic matter;
- **ocean fertilization** – increasing biomass of ocean;
- **soil carbon sequestration** – increasing the amount of carbon stored in topsoil.

[18] https://www.scientificamerican.com/article/how-the-u-s-is-preparing-for-europes-carbon-tariffs/

[19] According to the WTO's *General Agreement on Tariffs and Trade* (1947), note 19, art. 1, "*[A]ny advantage, [favor], privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties*".

[20] https://harvardlawreview.org/2022/04/the-promise-and-perils-of-carbon-tariffs/

[21] Strand, J. (2020). *Supporting Carbon Tax Implementation in Developing Countries through Results-Based Payments for Emissions Reductions*, Policy Research Working Paper, No. 9443.

Taking into consideration that emission reduction is progressing too slow to keep climate stability alone, geoengineering and carbon capture technologies are required as a temporary or permanent elements in maintaining said stability. It is estimated that about 6 gigatons of CO2 will have to be captured globally per year by 2050[22].

On the other hand, emission reduction concerns technologies that allow for a faster decrease in quantity or change of the quality of greenhouse gasses. The most well-known is, of course, the use of renewable energy sources and increasing energy efficiency. However, there are technologies that seem more exotic – like methane collection and combustion. Methane from agricultural activities or landfills is captured and burned. Resulting CO2 is far less damaging than methane. The same applies to other chemical agents which may have greenhouse contribution many times greater than CO2. These include hydrofluorocarbons and perfluorocarbons, which can be rather easily captured at an emission site and destroyed.

If the emissions create negative externalities and should be taxed, then the activities that are capturing carbon create positive externalities – and thus should be subsidized. Projects creating carbon offset that is accredited by the United Nations Framework Convention on Climate Change are linked with the emission trading system – either under the Kyoto Protocol or the EU Emission Trading Scheme[23].

> THE TOPIC OF GLOBAL WARMING BECAME HIGHLY POLITICIZED

Carbon capture and reduction technologies are new and still expensive. For one, they are energy extensive (and, hence, require a renewable energy source to stay net-emission negative) and cost USD 750 per ton of CO2 stored, which is much lower than the price of emissions, as mentioned earlier. The costs are falling, and newer technologies promise the range of cost to be at the level of USD 100-200 per ton. Clearly, this is still high, but it is already approaching acceptable levels[24].

The problem of carbon offset technologies is that many types of offsets are difficult to verify, whereas the quality of certification methods is questionable[25]. Moreover, the parties engaged in these schemes specify parameters that are the most beneficial for them – for instance, inflating past emissions, comparing targets with the worst-case scenario, and not the most likely scenario. Some activists claim that carbon offset technologies give misleading feelings that not much will change as we will offset all of the emissions somehow.

[22] Fuss, S. et al. (2018) "Negative Emissions –Part 2: Costs, Potentials and Side Effects", [in]: *Environmental Research Letters*, Vol. 13(6).

[23] UNFCCC (1997) *Kyoto Protocol*. Available [online]: http://unfccc. int/kyoto_protocol/items/2830. php

[24] https://policyexchange.org.uk/four-negative-emission-technologies-nets-that-could-get-us-to-net-zero/

[25] Morgan, J. (2021) "Offsetting Is a Dangerous Climate Lie", [in]: www.illuminem.com. Available [online]: https://illuminem.com/illuminemvoices/6f8f62e0-ba48-41e9-b690-723930d9a23e

This phenomenon slows down the actual required transformation[26].

CONCLUSIONS

The topic of global warming became highly politicized. Powerful and numerous groups depend on extracting and burning fossil fuels[27]. These include energy companies and their workers, mining companies, and even entire nations dependent on energy exports (like Saudi Arabia or Russia). Yet, it seems that the sense of imminent existential threat has settled in, and many countries are willing to tackle the problem. Taxation of emissions is one of the most popular approaches, but carbon taxes and tariffs make for a highly controversial political topic. The largest polluters approach the idea of carbon taxation and tariffs either partially (the United States) or very cautiously (China). The difficult story of ratifying the Kyoto and Paris agreements allows only for cautious optimism.

The European Union is the leader in setting ambitious goals in emission reduction – however, at a risk to its economy due to carbon leakage. This policy still enjoys popular support, despite political forces questioning global warming altogether. The test to these sentiments will come soon, with an energy crisis in the winter of 2022, which might bring popularity to fringe, extreme parties. Still, carbon taxes are proposed as the most optimal tool from the economic point of view to achieve emission targets. However, the application of carbon taxes is still limited, so we cannot be convinced of its actual effectiveness.

Taxing the emissions correctly is a challenging task. On the one hand, there is the issue of setting the parameters right. Europeans need reduction quick, but it cannot lead to the collapse of our economy while doing it. Also, we want the reduction to be of a global nature – not just shifting it around the globe. This is the role of carbon tariffs that is currently being discussed.

The discussion concerning the taxation usually omits the ways tax revenues are spent, which is no less important in reducing emissions. Pooling the revenues seems to be the worst approach, whereas redirecting it into green transformation domestically and internationally appears to be the most efficient use of the money. One must remember that the lowest hanging fruits are usually in developing countries, so spending the money in the form of foreign direct investment (or even foreign help) might be the best way to move forward. It may also ease the opposition to carbon tariffs, which are badly needed in order to limit carbon leakage.

*

TOMASZ KASPROWICZ

Vice-President of the Res Publica Foundation. Managing partner of Gemini, an IT company specializing in business process automation. Editor at Liberte! and Res Publica Nowa

[26] Smith, K. (2007) *The Carbon Neutral Myth: Offset Indulgences for Your Climate Sins*, Amsterdam: Transnational Institute.

[27] https://www.politico.eu/article/europe-emissions-climate-change-lobbying-war/