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CLIMATE UNDER NEOLIBERALISM: THE EU EMISSIONS TRADING SYSTEM IN CRISIS-RIDDEN GREECE

by

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Abstract

Neoliberal capitalism has extended the use of markets instead of state intervention to address climate and energy issues. Carbon trading characteristically exemplifies the neoliberalization of climate policy. This paper discusses the workings of the European Union's Emissions Trading System (EU ETS) in crisis-ridden Greece. Beyond environmental effectiveness and distributional effects, the paper explores the interactions of EU ETS with crisis, austerity programs, energy poverty, and uneven development. Despite adjustments and changes, the EU ETS continues to indicate limited environmental effectiveness and unjust distributional effects. Moreover, by forging a centralized and inattentive neoliberal transition to a low-carbon economy for unequal EU partners like Greece, the EU ETS leads to additional disturbances and problems for the crisis-stricken Greek economy as a whole, its pauperized working people, and its energy and climate options to reduce emissions on its own potential, needs and priorities.

Key words: Political Economy, neoliberalism, climate change, EU Emissions Trading System, Greece

JEL Classification: B5, P1, Q5

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1. Introduction

The EU emissions trading system (EU ETS), the flagship of the EU climate policy, has been established under the influence of Neoliberalism. It was launched under the provision of the international flexible mechanisms of the Kyoto Protocol (KP) which attest the emergence of neoliberal thinking in climate issues.

Instituted by the Directive 2003/87/EC, the EU ETS established an integrated EU market for greenhouse gas (GHG) emissions permits. It was rationalized in terms of cost-effectiveness and flexibility to meet the GHGs reduction targets. The price of emissions allowances would provide polluters with incentives to invest in free- or low-carbon technologies and energy efficiency. The scheme was designed to run for two phases, phase 1 (2005-2007) and phase 2 (2008-2012), which coincided with the first commitment period of the KP. Predicated on the KP, the future of the EU ETS was critically conditioned by the endurance of the KP. However, efforts to reach a new, legally binding international climate agreement after 2012 failed in Copenhagen in 2009. UN negotiations, nevertheless, continued with the hope to reach a new agreement which would enter into force in 2020.[1]For the mid time (2013-2020), 38 developed countries, including the EU member states, agreed to participate in a second Kyoto period running from 2013 to 2020. The necessary amendments to the KP were adopted at the Doha conference in December 2012. A reduction of at least 18% from 1990 levels by 2020 was set as a target. The EU set a target of a 20% reduction from 1990 level; this was part of the "climate and energy package" (20-20-20) adopted in 2009.[2] The continuation of EU ETS in its third phase was enabled by these developments.

Greece, as a member of the EU, was obligated to transpose the 2003 ETS directive into the Greek Law. Greece, however, could adapt to the EU ETS scheme with mere difficulty. It was (and still is) a small, less developed country within the EU (consisted of fifteen members

[1]Albeit not the kind of agreement that many hoped, such an agreement was accomplished at the Paris conference in December 2015. Information on the Paris agreement and EU engagement can be found at https://ec.europa.eu/clima/policies/international/negotiations/paris_en, accessed June 20, 2018.

[2] The second KP applies to only around 14% of the world's emissions. See European Council "International Agreement on Climate Action" at http://www.consilium.europa.eu/en/policies/climate-change/international-agreements-climate-action/, accessed June 20, 2018.

at the time (EU-15)), with quite a different economic and energy system from that of the more developed member states. Based on data provided by OECD/IEA (2003), in 2001, when the ETS scheme was proposed, Greece had a gross domestic product (GDP) of 144.84 billion (1995) US dollars (accounting for only 1.5% of the total EU-15 GDP). The per capita GDP of Greece was 50.3% of the average per capita GDP of the EU-15. Moreover, the per capita final energy consumption of Greece was 65% of the per capita final energy consumption of EU-15 on average (OECD/IEA, 2003)[3]. These figures indicate the uneven development of Greece in the EU-15 and, consequently, its asymmetrical vulnerability to an economic crisis. With Greece's entry into the Eurozone in 2001, the country was exposed to risks posed by the unsound Eurozone architecture and by its increased incapacity to initiate independent national policies (Lapavitsas et al. 2010; Vlachou and Christou 1999; Vlachou, Theocarakis and Milonakis 2011).

The structure of the energy balance in Greece was critical for the application of the EU ETS. Significantly, primary energy production was heavily dependent on solid fuels (84% of the total in 2001), based mainly on lignite. Final energy consumption in Greece consisted mainly of oil (69.3%), which was imported, and of electricity (19.1%) in 2001. The use of natural gas in Greece was very limited both in primary production and in final energy consumption. For comparison, for the same year, final energy consumption in EU-15 was primarily composed of oil (50.3%), electricity (18.5%) and natural gas (22.6%)(OECD/IEA 2003).

Significantly, Greece was also heavily dependent on imports of energy which made its economy vulnerable to instabilities in the world energy market. In particular, the dependence of Greece on energy imports was overall 67.4% in 2003; it was higher for oil (96.1%) and for natural gas (98.8%) but significantly lower for solid fuels (4.7%). For comparison, the dependence on energy imports of EU-15 was overall 51.8% in 2003; it was higher for oil (79.2%) and for solid fuels (55.1%) but lower for natural gas (49.2%) (EC 2006: 30).

In short, when EU ETS was initiated, Greece was more vulnerable than the EU-15 on average in terms of the carbon content of its energy system, energy safety, and also in terms of economic growth and living standards. By 2016, Greece entered the eighth year of a deep

[3] Greece accounted for only 1.9% of the total final energy consumption of EU-15 in 2001, while Germany accounted for 23.0% and UK for 15.1% (OECD/IEA 2003). The energy intensity of the Greek economy (final energy consumption divided by the GDP) was higher than the average energy intensity in the EU-15 (OECD/IEA 2003).

economic crisis, implying that the second and the third phases of EU ETS run amidst a serious recession and harsh austerity programs which have accelerated the neoliberal transformation of Greek economy and its appropriation of nature (Konstantinidis and Vlachou 2017, 2018).

Building upon previous work (Vlachou 2002, 2005, 2014; Vlachou and Konstantinidis 2010, Vlachou and Pantelias 2017a, 2017b), in this paper, we investigate the workings of EU ETS in crisis-ridden Greece, from the standpoint of a critical political economy of the environment and energy, inspired by Marx (1976, 1991). The analysis grounds EU ETS in neoliberal capitalism, a class society, stirred by profit and propelled by competition at global scale, resulting in uneven development and ecological hazards. By focusing on the workings of EU ETS in Greece (with emphasis on the ongoing phase 3), we extend our previous critical understanding of the scheme by looking into its relations to crisis, austerity programs, energy poverty, and uneven development, as well as into its forging a centralized and inattentive (to national asymmetries) transition to a low-carbon economy for unequal EU partners. In the next section, we discuss nature and, in particular, climate under capitalism and its neoliberal transformation. In the third section, we discuss in brief the basic features of the EU ETS and the main results of its running in the first two periods are briefly mentioned. In the fourth section, we investigate the third phase of EU ETS in Greece, with a critical focus on the adjustments and the extensions of the scheme, and the compliance results for the years 2013-2016, highlighting distinct troubling outcomes in Greece. In the last section, some concluding remarks are offered.

2. Neoliberalism and Climate

Capitalist firms rely on natural resources and conditions for the production of value and surplus value (Resnick and Wolff 1987; Vlachou 2002, 2005). In particular, climate conditions sustain natural resources and conditions that are needed by capitalist firms in requisite quantities and qualities for their profit-making activities in contemporary capitalism. For capitalist production, access to high-quality supplies of natural resources or access to advantageous natural conditions may also confer advantage over competitors. This advantage becomes a source of revenues in the form of rent, which is part of the surplus value extracted by producing capitalists, and is appropriated by resource-owners or by producing capitalists as excess profits, if resource owners and capitalists are the same person (Harvey 1999; Vlachou 2002; Konstantinidis and Vlachou 2017).

Humans meet nature from the inside and use natural resources and conditions to satisfy their socially and historically determined needs (such as food or recreation). In particular, climate conditions sustain human life and, for that matter, they provide elements which are necessary for the reproduction of labor power bought as a commodity by capital. It follows that nature and climate, in particular, participate in the determination of the value of labor power for workers in capitalist firms (Marx 1976: 274-276; Vlachou 2002, 2005).

Following Marx, natural conditions enter the determination of value in capitalism, as the value of any commodity is shaped by regulating conditions of production: these are the average or generalized conditions of production in industry (Marx 1976: 129-130) and the least favorable natural conditions for primary sectors (Marx 1991: 779-797). Pollution, climate change and natural resources exhaustion, as well as measures to contain them, result in changes in costs of production, prices, profits and rents, albeit to variegated extents, and thus have economic ramifications for various actors (Vlachou 2002; 2005). Particularly, the increasing exhaustibility of fossil fuels and the intensification of global warming (GW), heavily related to the use of fossil fuels, are expected to have adverse effects on capitalist firms and working people which will (at least in part) register as increases in costs, values, and prices, resulting in changes in profits, rents, and wages (Vlachou 2002).

Various conflicts, tensions, and changes can be instigated between GHG emitters and various victims of GW because of the negative impacts of climate change. These multiple struggles give rise to national and international policies to mitigate GW. In particular, the inter-capitalist struggle or competition among capitals and the struggles taken up by the working and ecological movements play an important role in the shaping of environmental regulation (see also Vlachou 2004; Kenis and Lievens 2016). In the international arena, historical accountability for GW fuels the conflict over climate policy between developing countries and developed ones (Vlachou and Konstantinidis 2010; Schor 2015).

The state is called upon by social agencies to secure natural conditions and to mediate conflicting claims over natural resources. By performing various processes, the state, as we understand it, secures multiple conditions for the completion and renewal of the circuit of capital and, more generally, the reproduction of capitalism as a class society (Resnick and Wolff 1987; Vlachou and Maniatis 1999). The state may implement environmental regulation to discipline economic activity that generates damaging outcomes, such as climate change. The state can establish by-law command-and-control measures, emissions taxes, pollution permits and abatement subsidies (Vlachou 2005). It may also create the institutional framework and the financial support mechanisms to facilitate the transition from a high-carbon economy based on depleting fossil fuels, to a low carbon economy based on renewable energy. The direction of state climate and energy policies is largely an outcome of struggles waged by working people and capital and their relative strength over the access to global natural resources and conditions, at the national and international level (Vlachou 2004, 2014; Vlachou and Konstantinidis 2010; Kenis and Lievens 2016).

The appropriation of nature and natural conditions has been reshaped in the neoliberal phase of capitalism. Although variegated, neoliberal capitalism is a complex system of capitalist exploitation, i.e. surplus value extraction, with different ideological, economic and political aspects from those that prevailed after WWII. Despite differences in their explanations, the majority of Marxist scholars attribute the turn to neoliberalism to the crisis of the 1970s associated with slow-down in profits, stagflation and fiscal crises. Launched first in the U.K. and the USA, Neoliberalism spread globally through competition and the internalization of capital. Financial markets and, in particular, Washington institutions (the World Bank and IMF) played a major role in this process, by imposing neoliberal policies as conditionalities for aid or debt relief to countries close to default (Harvey 2006; Fine and Saad-Filho 2014; Konstantinidis and Vlachou 2017).

Standing on methodological individualism, neoliberals claim that the market offers an optimal mechanism for the coordination of individual economic activities, as well as solutions to various economic or environmental problems. The profound changes initiated in diverse economic processes are in part inspired by such ideological convictions. At the macroeconomic level, they privilege price stability over full employment goals, as well as the use of "free market" adjustments instead of macroeconomic state (fiscal or monetary) policies to achieve growth and stability. Neoliberal restructuring also includes the privatization of enterprises and resources that were previously state- or communally owned; the deregulation of economic activity, as shown, for example, by "liberalized" energy markets; and the commodification and deregulation of natural resources and conditions as shown by "free market environmentalism" (Konstantinidis and Vlachou 2017; Kenis and Lievens 2016). Neoliberalism also involves the increased internationalization of capital, exemplified by the increased abolition of obstacles to the free movement of capital across national borders. Its most pronounced new characteristic is the increased role of finance ('financialization'),that is the proliferation of financial markets and instruments and the increased presence of financial processes and imperatives in various aspects of economic and social reproduction. Within a changing competition context, pressured to pay high shareholder payouts and driven by short-term stock price movements, corporate management increasingly adopts cost-reducing methods (cutting wages and jobs), investments into financial operations and relocation of activity abroad (Konstantinidis and Vlachou 2017; Vlachou and Christou 1999; Fine 2006; Fine and Saad-Filho 2014).

Neoliberal rudiments, as described above, were inscribed in the formation of new European institutions such as the European Union (EU) and the Economic and Monetary Union (EMU). The Single European Act of 1986 and the Maastricht Treaty of 1992, leading to the single currency, targeted the completion of a single market through privatization and deregulation of input and output markets. Price stability was prioritized and is currently guarded via the rules of the Stability and Growth Pact and the statutes of the European Central Bank (ECB). As more competitive private capital from core European countries (mainly Germany and France) was the main beneficiary of such policies, these exacerbated the uneven development of Europe and the existing social division of labor between core (capital-intensive) Northern countries and periphery (labor-intensive) Southern countries. Given the uneven development of EU member-states, the lack of freedom for eurozone member states to conduct independent monetary and fiscal policy, coupled with the lack of a EU fiscal system and the inability of ECB to serve as a lender of last resort constitute aspects of a structurally-flawed EMU architecture that came, for instance, to haunt Greece during the crisis. The energy and climate undertakings and policies are also being neoliberalized within this EU context and are exposed to dangers and contradictions of neoliberal capitalism (Vlachou and Christou 1999; Lapavitsas et al 2010; Vlachou, Theocarakis, and Milonakis 2011; Konstantinidis and Vlachou 2017, 2018).

Under neoliberalism, nature is capitalized and commodified in new diverse ways. Neoliberalism "has included, and perhaps even depended upon, the incorporation of many new elements of nonhuman "nature" into the circuits of capital"— "most notably through extensive new forms of enclosures and dispossessions"—"and, conversely, the extension of market rationalities and techniques to environmental governance and politics" (McCarthy 2015: 4-5). Neoliberal capitalism has extended the use of markets, at the expense of state intervention, to address issues such as environmental pollution, climate change, and resource conservation (Lohmann 2006, 2015; Castree 2008a; Vlachou 2005). Market-oriented instruments such as emissions permits have been rationalized as the best means to achieve cost-efficiency in attaining environmental targets and to secure flexibility for polluting firms over compliance strategies (Vlachou 2005; Vlachou and Konstantinidis 2010; Konstantinidis and Vlachou 2017).

The use of markets means that neoliberal natures tend "to be divided into interchangeable "ecosystem service" units allowing aggregation, exchange and economic circulation" as Lohmann (2015: 8) observes.[4] Moreover, as the market mechanism can better operate under well-defined property rights according to mainstream economics, private property rights have been assigned to an increasing number of natural resources and conditions, such as the atmospheric commons. With increasing financialization, ecosystem commodities (with assigned private property rights) have been often highly financialized; the price of ecosystem titles is "generally fixed by the present and anticipated future revenues capitalized at the going rate of interest" (Harvey 1999: 276-277). These developments assert that neoliberalism is also an environmental and natural resource project, which affects social actors and the biophysical world in profound ways (McCarthy and Prudham 2004; Castree 2008a; 2008b; Vlachou and Konstantinidis 2010; Vlachou and Pantelias 2017a,b; Konstantinidis and Vlachou 2017).

The Kyoto Protocol of 1997 epitomizes the neoliberal dominance on climate analyses and policy. While preserving the conventional policy instruments, it adds new ones which come to play a key role in actual climate policy. In particular, Article 6 defines joint implementation (JI) of projects to reduce emissions in an Annex I party (an industrialized country with a Kyoto commitment), Article 12 establishes the clean development mechanism (CDM) for projects in non-Annex I countries (i.e. countries without national commitments), and Article 17 allows (Kyoto) emissions trading (KET) among Annex B parties (Annex B includes Annex I parties with emissions limitation targets). The stated rationale behind these policy options was to provide opportunities for Annex I parties to fulfill their commitments in a flexible, cost-effective way. Under the KET scheme, a legally binding limit was set on each Annex I party's emissions and emissions permits were issued based on this limit; the parties were allowed to trade the assigned amount of emissions (KET-AAUs) between them; KET is thus "a cap-and-trade system". Under the JI scheme, the investor country receives emissions reduction units (JI-ERUs) which can be used by it to fulfill its national limitation commitment; similarly, investing Annex I parties could use the certified emissions reductions units (CDM-CERs)

[4] For instance, "atmospheric circulation defined as an ecosystem service winds up being made up not only, for example, of molecules, but also of "molecule-equivalents (for example, 333 CO_2/8.8 CH_4/1 NO_2/0.06 CFC-11) that are collectively certified to be equally destabilizing to the climate and that can all be traded one for another to provide the "same" services to an "economy"" (Lohmann 2015: 8).

generated by CDM projects to comply with their national commitments. ERUs and CERs turned out in being traded in carbon markets as they were linked with the KET (Vlachou and Konstantinidis 2010). The Kyoto flexible mechanisms were particularly crucial for neoliberalizing conceptions and responses to climate change in advanced capitalist countries as well as in less developed ones.

A major driver in the shaping of the "innovative" instruments of the KP was capitalist competition at the world level.[5] Emitting companies have been engaged for years in promoting international emissions trading (ET) and in shaping its modalities. In 1991, the International Emissions Trading Association, a corporate lobby group, was set up under the auspices of the UN Conference on Trade and Development to investigate and promote ET. Several energy companies have chosen to initiate internal ET schemes so that "they would be well positioned to influence the policy as it develops and react to it as it is in place" (Hoffman 2004: 8). In particular, expertise gained by BP and Shell in the design of their intracompany ET schemes allowed them to assume advisory roles in developing the British and the EU ET schemes respectively (Hoffman 2004). The KET, linked in fact with the other flexible mechanisms, was directly and indirectly influenced by all these private initiatives of the energy companies aiming at securing their high profitability while complying with the Kyoto targets (Vlachou 2014).

The reign of neoliberalism is evidenced in the current EU environmental and natural resource policies transposed into laws and applied as national policies in member states. In the negotiations preceding and following the adoption of the Kyoto Protocol, large GHG emitters (capitalist firms and industrialized EU countries) resisted the adoption of direct measures (e.g. mandated clean technologies) or an international harmonized carbon tax to reduce GHG emissions such as the proposed EU carbon tax (for a discussion, see Ikwue and Skea 1994). They favored instead market approaches such as an emissions trading system (Vlachou 2014). In the energy sector, heavily implicated for climate change, the achievement of an EU internal market has assumed high priority with the proclaimed goal to reduce the cost for energy commodities and to increase the competitiveness of firms located in EU (IEA 2014). Consequently, the completion of the EU internal energy market dictated the deregulation of the energy markets across member states and opened up the energy sector to private capital via the

[5] From a business perspective, it has been asserted that "the genius of these [carbon] markets is that, by turning units of pollution into units of property(allowances), they make it possible to allocate resources for pollution reduction where likely to have the greatest impact" (Bayon 2002: 63). Moreover, in a dynamic setting of capitalist competition, ET could allow for cost savings for capitals in the face of new, less costly, and more effective abatement technologies, improving the competitive position of innovating firms (Bayon 2002; Hoffman 2004).

privatizations of publicly-owned energy companies (Vlachou and Maniatis 1999; Konstantinidis and Vlachou 2017).

Shaped under the influence of intra-capitalist struggle, neoliberal EU energy and climate policies (carbon trading, "liberalized" energy markets, institutional changes and support mechanisms for highly-profitable renewable energy, etc.), tend to incorporate several elements of nonhuman nature into the circuits of capital. In particular, climate and energy issues are increasingly seen as an opportunity of change and growth, thus resulting into an 'early-mover advantage' when firms compete in international markets.[6] The policies for the transition to a low carbon economy might be an opportunity for growth for the highly-competitive industrial firms of USA and advanced EU countries (Vlachou 2004; Kenis and Lievens 2016). Germany, in particular, has set off to establish a competitive advantage in low-carbon technologies: in 2013, 752 companies and research organizations based in Germany filed 3,156 patents in low-carbon energy technologies, accounting for 48% of the EU total (EC 2017c: 20).[7] With respect to the competitiveness of its wind and solar energy, "Germany is performing well in the wind sector due to a comparative advantage in key components of the wind energy industry such as generating sets, gearboxes and power electronics. Germany is also performing well in the solar sector as indicated by the revealed comparative advantage indicator … This is due to a comparative advantage in the manufacturing of silicon and power electronics" (EC 2017c: 22).

However, a flourishing Germany, attracting financial capital from all over the EU and thus capable of financing its path to a low-carbon transition at a low financial cost, is the opposite side of struggling crisis-ridden southern EU countries, including Greece. Given the long-standing economic asymmetries among EU countries, the neoliberal energy and climate policies have a tendency to widen the uneven development of vulnerable EU economies, with negative implications for the environment, energy and natural resources as evidenced in Greece in recent years (Hadjimichalis 2014a; Konstantinidis and Vlachou 2017, 2018). Public debt was particularly crucial for extending neoliberal policies outside the global North. Less developed countries were forced under debt crisis to turn to the International Monetary Fund and the World Bank for loans in exchange for the adoption of structural adjustment programs,

[6] "Innovation offsets can not only lower the net cost of meeting environmental regulations, but can even lead to absolute advantages over firms in foreign countries not subject to similar regulations", according to Porter and van der Linde 1995: 98)
[7] 2013 is the most recent year for which complete patent statistics are available. The filed patents concentrated on sustainable transport (40%), followed by efficient systems (21%) and renewables (21%) (EC 2017c: 20).

creating favorable conditions for deregulation, market penetration and asset acquisitions in debtor countries (Harvey 2005; Varoufakis 2011; Swyngedouw 2005). These conclusions hold true for less developed countries within the EU as the case of crisis-ridden Greece exemplifies (Vlachou 2012; Hadjimichalis 2014a,b; Konstantinidis and Vlachou 2017, 2018). Dimensions of uneven development and inequality that have become central to climate policy are the differentiated responsibility and the unequal capacity to mitigate (when mitigation is costly), and an ethical right to development of the less developed countries (Vlachou and Konstantinidis 2010; Schor 2016).

The above theoretical framework helps us locate the EU ETS in crisis-ridden Greek economy within the neoliberal turn of capitalism, globally and EU-wide. Moreover, it helps illustrate how this major EU climate policy apparatus has accelerated the neoliberal restructuring of climate change management in EU and Greece, ongoing since the early 1990's, at the expense of working people and the unprivileged.

3. The basic design of the EU ETS

The EU ETS originates under the auspices of the KP. The KP established legally binding emissions reduction commitments of 5.2%, on average, from their 1990 level for the period 2008 to 2012 and for 38 developed countries (Annex I Parties). The European Union (EU) agreed to reduce its emissions by 8% on average. The Kyoto Protocol entered into force in February 2005. However, the US, the largest world-wide emitter of greenhouse gases at the time, did not ratify the KP. The EU established a joint commitment for its members and in 2002 reached the *Burden Sharing Agreement* which set different reduction targets for each member state. This agreement enabled the EU to take into account, albeit to a limited degree, differences in economic structures and reduction potentials of member states. As a result, less developed countries were permitted to increase their emissions. In particular, Portugal was allowed to increase its emissions compared to 1990 by 27%, Greece by 25%, Spain by 15%, and Ireland by 13%.[8] On the other hand, large emitters were assigned higher than average

[8] In the second Kyoto period (2013-2020), for the ETS sectors, a provision was included that a 10% of the total quantity of allowances to be auctioned in the EU-28 will be distributed to member states with low per capita income. Most of these members are former socialist countries in transition. See EC "Auctioning" at https://ec.europa.eu/clima/policies/ets/auctioning_en, accessed June 15, 2018.
For non-ETS sectors, the effort sharing provided lower reduction target and even permitted emissions increases for less developed countries in the EU-28. Greece, for instance, had an emissions limit of - 4%, Germany -14% and Portugal +1% in 2020 compared to 2005 emissions levels. See EC "Effort Sharing" at https://ec.europa.eu/clima/policies/effort_en#tab-0-0, accessed June 15, 2018.

reduction rates. For example, the reduction rate set for Germany was 21% and that for UK was 12.5 %.

To meet its commitments under the KP, the EU set up an emissions permits system. The EU ETS established an internal EU market for greenhouse gas (GHG) emissions allowances on arguments of efficiency and flexibility (European Commission 2003; Ellerman and Joskow 2008; Vlachou 2014; Berta, Gautherat, and Gun 2017). The scheme was first designed to run for two phases, (2005-2007) and (2008-2012), and was extended, albeit in an amended form, to a third phase in tandem with the Doha 2012 agreement instituting a second Kyoto period 2013-2020. Over the first two trading periods, the scheme initially covered only CO_2 emissions; however, limited extensions to other GHGs were introduced in phase 2. One allowance (EUA) gave the holder the right to emit one metric ton of CO_2 (tCO_2); provisions for transforming other GHG emissions into equivalent CO_2 emission units (tCO_2e) were included in the scheme from its outset.

In the EU ETS, it is the limit on the total number of allowances what creates scarcity in the carbon market. Member states issue emissions allowances (European Union allowances (EUAs)), which amount in total to the approved cap, and allocate them to participating plants. The participants can then engage in emissions allowances trading to fulfill their commitments in a cost-effective way. They can also use, albeit to a limited extent, CDM-CERs and JI-ERUs for compliance. In such a cap and trade system, an allowance to emit CO_2 or GHG is a "commodity" based on de facto property rights (although temporary ones) over Earth's capacity for carbon cycling (Lohmann 2009a,b; Vlachou 2014). Banking and borrowing of allowances were permitted only within the first phase and within the second one, but not between the first and the second trading periods. For the second and subsequent phases banking is allowed between periods but borrowing is not.

The ETS covered the emissions of large emitters from the power and heat industry and certain sectors of energy intensive industries. As of May 2008, the participating installations amounted to 11,186 plants. Important sectors such as transport and aviation (until 2012) were left out from the first two phases of the scheme. Allowances during phases 1 and 2 were mainly given free of charge (grandfathering) by the governments of the member states to the companies involved (European Commission 2003).[9] Member states were given discretion over

[9] In particular, Directive 2003/87/EC required that at least 95% of allowances for the period 2005-2007 and at least 90% of the allowances for the period 2008-2012 should be allocated for free. The remaining percentage of allowances could be auctioned (European Commission 2003).

the allowances allocation process. For each trading period member states designed National Allocation Plans (NAPs) which were submitted to the Commission for approval. NAPs determined the total level of ETS emissions, the allocation of emission allowances at the level of each installation in the country and the maximum amount of JI and CDM credits to be used for compliance.[10]

With respect to monitoring mechanisms, the ETS established a system of uniform national registries which connected with the Community Independent Transaction Log (CITL). Member states reported allocations and verified emissions at the installation level to the CITL. Facilities self-reported their emissions following the guidelines. The reports were verified by an independent verifier certified by the member state. Member states ensured compliance by deducting allowances from a firm's account at the national registry which were equal to the verified emissions of the firm. ETS has strict compliance provisions.[11]

By design EU ETS allowances were intended to become a financial instrument in order to increase the liquidity of the market. Market participants in the EU ETS can trade in emissions in the form of spot, futures or forwards, swaps, and options on futures.[12] The carbon futures and forward contracts hold promises to deliver carbon allowances or credits in a certain quantity, at a certain price, by a specified date (European Commission 2016a). As is the case with other derivatives, carbon derivatives derive their value from an underlying commodity/asset. In particular, carbon futures or forward contracts have as underlying either EUAs, CERs or ERUs, i.e., their value is linked to the expected future spot price of EUAs, CERs or ERUs (Daskalakis, Ibikunle, and Diaz-Rainey 2011; Berta, Gautherat, and Gun 2017). As financial instruments, carbon derivatives appear in the mainstream eyes as a singular, homogeneous instrument, engendering an abstract form of risk linked to the spot price of the underlying, which can be traded. Carbon derivatives markets then commodify a range of uncertainties (viewing them as risks) associated with emissions allowances or KP credits by

[10] The use of JI/CDM credits for compliance was limited by the supplementarity criterion of the KP. The supplementarity criterion was widely interpreted as requiring that at least half of the reduction implied by the country's assigned limit should be fulfilled by domestic action.

[11] A fine of 100 euros per excess metric ton of CO_2 equivalent (CO_2e) is set for a non-compliant company. For the first trading period the fine was lowered to 40 euros per metric ton of CO_2 equivalent to give time to the installations to adapt. To the extent that fines are much higher than the allowance prices, the ETS scheme can stimulate emissions mitigation.

[12] In the first two periods, spot trading represented a relatively small volume of transactions while derivatives trading represented the lion's share of transactions.

abstracting from concrete uncertainties engendered by various specific conditions and relations (see also Lohmann 2009a; Vlachou and Pantelias 2017a,b).

Carbon derivatives are distinguished by the way they are traded in the market in over-the-counter (OTC) derivatives and exchange-traded derivatives (ETD). The former are subject to counter-party risk and are largely unregulated, while the latter reduce the risks of default through the use of the central counterparty and are regulated under financial market rules which have been lately amended (European Commission 2014 c, d, e; 2016a).[13]

EU ETS allowances have been hurriedly developed to a major financial instrument. Moreover, following financial practices, carbon derivatives have started to give rise to various financial innovations (e.g. complex securitized carbon products). Secondary markets were also developed in credits. Issues on carbon market oversight thus become critical (Lohmann 2009a; Friends of the Earth 2009; World Bank 2010; Berta, Gautherat, and Gun 2017; Vlachou and Pantelias 2017a,b).[14]

The results from the running of EU ETS for the first two periods are reported and evaluated in previous work, at the EU level in Vlachou 2014; Vlachou and Pantelias 2017a,b, and for Greece in Vlachou (2017). Due to space limitations, we offer here only the major outcomes. The majority of allowances were freely allocated, raising serious equity issues. Due to limited auctioning, non-regulated power companies were able to appropriate 'windfall' profits. Allowances surplus emerge due mainly to, among other reasons, failed projections, economic crisis and financial speculative trading, and the use of significant amounts of CERs and ERUs. When the amounts of CERs and ERUs are added to the (free and auctioned) allocated EUAs (and EUAAs), the actual total surplus of allowances increases reaching 1,903 $MtCO_2$ and accounted for 18% of total allocation (free and auctioned allowances) in EU-27 in 2018-2012 (Vlachou 2017).[15] This surplus could be banked for future use.

[13] However, under MiFID (Markets in Financial Instruments Directive), "spot transactions are not currently subject to equivalent rules at the EU level and are not supervised" (European Commission 2016a: 69); in the revised MiFID, or MiFID II, which applies since January 3,2018, spot trading was defined as a financial instrument (Vlachou and Pantelias 2017b). Auctions are carried out through auctions platforms, governed by the EU ETS auctioning regulation (1030/2010).

[14] Secondary CERs market transactions, for instance, provided insurance to final buyers (mainly EU ETS installations with annual compliance obligations) by transferring under-delivery risk to intermediaries which take on this risk in exchange for a premium over primary market prices.

[15] In *The State of the European Carbon Market in 2012,* the EC estimated the surplus at the start of Phase 3 to be around 1.5 to 2 billion allowances (European Commission 2012; see also World Bank 2013: 42).

Carbon prices were low and volatile and so constitute poor incentives for investments in free- or low-carbon technologies and energy efficiency. For instance, investments in renewable energy were encouraged by generous support mechanisms and not by the carbon market. The ETS compliance costs were passed-through to electricity prices, creating issues in the competitiveness of power-intensive firms and negative distributional effects for the working people. Discretion for member states over cap-setting and allocation increased complexity, and subsequently administrative and transactions costs, and also raised competitiveness issues. Several of these problems were addressed first by limited adjustments of the ETS scheme for phase 2 implementation and second by the revision of the scheme to be applied for the 2013-2020 (third) period.

4. The Third Trading Period (2013-2016) and its results

4.1 Amendments in the EU ETS and compliance results

The EC made an effort to correct several pitfalls of the EU ETS for phase 3 in a proposal to amend it made in January 2008 as part of an integrated package of three proposals for implementing measures for the EU's objectives on climate change and energy. The overall target set for the EU was a reduction in GHG emissions of at least 20% from 1990 levels by 2020. At the same time the EU committed to increase the share of renewable energy in overall EU energy consumption to 20% by 2020 and to increase energy efficiency by 20% (European Commission 2009: 63).

Following consultation and debate, the amendment of the EU ETS, published as Directive 2009/29/EC, applies to phase 3 (2013-2020) of the scheme (European Commission 2009; Ellerman, Marcantonini, and Zaklan 2016). The amended directive sets for the EU ETS an EU-wide target of 21% emissions reduction in 2020 compared to 2005. The most important changes in the scheme are the following: (1) the adoption of a single EU-wide cap declining at 1.74 percent per year; (2) the enlargement of scope: a number of new industries (e.g. aluminium and ammonia producers, bulk organic chemicals, carbon capture and storage)[16] and two further gases (nitrous oxide and perfluorocarbons) are included; (3) the adoption of auctioning as the basic principle for allocation, to be mainly applied as rule to the electric utility sector in 2013, with limited exceptions, and to be gradually introduced for the remaining industrial sectors by

[16] The inclusion of aviation emissions starting in 2012 was implemented through a separate directive.

2027 at a rate depending on the degree to which the sector is exposed to risk of carbon leakage; (4) free allocation for industrial sectors based on centrally determined benchmarks and risk-exposure lists of sectors; (5) limitations on the use of offsets, combined nevertheless with enabling provisions for linking the scheme with other GHG cap-and-trade systems, not included in the preceding KP framework; and (6) the distribution of the revenues from auctioning to member states to be largely based on the allocation of ‘auction rights’ determined by the country’s share in the total (2005) verified emissions or the average of the 2005-2007 period, whichever is the highest (Vlachou and Pantelias 2017a,b).

It is estimated by the EC that during phase 3 around at least 57% of allowances will be auctioned and the remaining 43% will be handed out for free.[17] Based on auctions revenues, the NER300 funding program for innovative low-carbon energy demonstration projects was established for the third phase.[18]The program is conceived as an important stimulus for the demonstration of carbon capture and storage (CCS) and innovative renewable energy (RES) technologies on a commercial scale within the EU.

The first results from phase 3 continued to be disturbing. In 2013 there was a surplus amounting to 8.9% percent of total allowances issued (free allowances and auctioned ones) , including NER300 auctions. Monthly average spot price of EUA was quite low ranging between a low of €3.44 (May 2013) and a high level of €5.21 (January 2013), according to the European Energy Exchange (Vlachou and Pantelias 2017a).

As a result, and after long prior discussions, the EC moved into implementing *back-loading* of auctions in the first quarter of 2014, following the EC regulation (EU) No. 176/2014, in an effort to rebalance supply and demand. Back-loading was designed to postpone the auctioning of 900 million allowances to reduce the surplus in the short run. The volume of allowances to be auctioned will be reduced by 400 million in 2014, 300 million in 2015, and by 200 million in 2016; the auction volume will be increased by 300 million in 2019 and by 600 million in 2020 (European Commission 2014b).[19]

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[17] European Commission, *Auctioning*, https://ec.europa.eu/clima/policies/ets/auctioning_en. Accessed July 20, 2018.

[18] It is so called because it is funded from the sale of 300 million emission allowances from the New Entrants' Reserve (NER). Information on NER300 is available at https://ec.europa.eu/clima/policies/lowcarbon/ner300_en, accessed June 15,2018

[19] However, it was later decided that the 900 million allowances that were back-loaded in 2014-2016 will be transferred to the market stability reserve rather than auctioned in 2019-2020. See “market stability reserve” at https://ec.europa.eu/clima/policies/ets/reform_en, visited June 10, 2018.

The European Commission had also taken action to set up a more permanent mechanism to correct market imbalances. It proposed the *market stability reserve* (MSR) to inaugurate at the beginning of the next trading period, in 2021. According to the design, allowances are deducted from the amount to be auctioned on the basis of certain rules and are placed in the MSR. Alternatively, allowances may be released from the reserve and auctioned. Therefore, the creation of the MRS does not change the number of free allowances. Likewise, it does not affect the total quantity (the cap) of allowances across the EU. A decision was reached by the European Parliament and the Council on October 6, 2015 which stipulates that the MRS will start operating from January 1, 2019, which brings forward its start by two years compared to the originally proposed schedule (European Parliament and the Council 2015; EC 2014a).[20]

Based on official data from the EC on verified emissions and compliance by EU ETS installations for the years 2013-2016 (last modified 15 June 2017), we have calculated the verified emissions and the total allocated allowances (which is the sum of freely allocated allowances and auctioned or sold allowances by governments, including auctions under NER300) of all stationary installations and aviation for each of the EU-28 countries and the three EEA-EFTA countries[21] for the years of 2013-2016. At the aggregate level, verified emissions declined between 2013 and 2016 by 7.7% while allocated allowances declined even more (by 26.2%).

Total verified emissions for 2013-2016 amounted to 7,501.8 $MtCO_2$. Total allocated allowances amounted to 6,882.8 $MtCO_2$, 55 percent of which was freely allocated and the remaining 45 percent was auctioned. There is an overall shortage of 619 $MtCO_2$, i.e. 8.3% of verified emissions. In the years 2014-2016, due to back-loading, auctions by governments were reduced by 900 million tCO_2. In the absence of back-loading, a surplus would have appeared, amounting to 3.8% of verified emissions for 2013-2016.

The figure 1 presents the freely allocated and auctioned allowances, and verified emissions at the country level for the period 2013-2016. Despite the back-loading, several countries (including economies-in-transition) experience a surplus.

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[20] Moreover, as part of a proposal to revise the ETS for phase 4 (2021-2030) in July 2015, the EC proposed to reduce the cap by 2.2% per year, instead of the current 1.74%. The revised EU ETS directive (Directive (EU) 2018/410), which entered into force on April 8, 2018, institutes the proposed cap reduction from 2021 onwards. See EC "Revision for phase 4" at https://ec.europa.eu/clima/policies/ets/revision_en#tab-0-0, accessed June 27, 2018.

[21] The three EEA-EFTA countries are Iceland, Liechtenstein and Norway.

[Insert Figure 1]

With respect to CERs and ERUs, in Phase 3 credits cannot be surrendered directly for compliance; they must be first exchanged for EUAs and then surrendered for compliance. According to the EC, "although the exact quantity of international credit entitlements over phase 2 and 3 (2008-2020) will partially depend on the quantity of future verified emissions, market analysts estimate that it will amount to approximately 1.6 billion credits.[22] As of June 2017, the total number of international credits used or exchanged amounts to 1.48 billion, accounting for over 90% of the estimate for the allowed maximum"(EC 2017b: 21). Participants in the EU ETS used 1.058 billion tons of international credits in phase 2 (2008-2012).[23] This implies that 0.422 billion tons of international credits have been used or exchanged since the initiation of Phase 3 up to June 2017.[24] CERs constitute 54.6% of the total credits used or exchanged and ERUs the remaining 45.3%. A high percentage of CERs (71.1%) originated in China, while 76.9% of ERUs originated in Ukraine (EC 2017b: 40).

With reference to Greece, total verified emissions for 2013-16 amounted to 213.7 $MtCO_2$, accounting for 2.9% of the overall verified emissions of EU ETS installations in EU-28 and the three EEA-EFTA countries. Total allocated allowances amounted to 172.6 $MtCO_2$, 35.3 percent of which was freely allocated and the remaining 64.7 percent was auctioned. The limited share of freely allocated allowances is justified by the significant share of fossil-fueled electricity generation plants in emissions from ETS installations.[25] Comparing verified emissions to the aggregate of freely allocated and auctioned allowances, Greece experienced an overall shortage of 41.2 $MtCO_2$ amounting to 19.3% of verified emissions for the period 2013-2016.

With respect to sectoral ETS performance in Greece, Table 1 presents the freely allocated and verified allowances by sector in Greece based on data extracted from the EUTL database at the installation level for the period 2013-2016. Combustion of fuels accounted for 74.8% of total verified emissions of stationary installations. PPC alone accounted for 68.1% of

[22] Öko-Institut (2012: 38), for instance, estimates the total entitlement for the use of CDM and JI credits to 1,622 million for 2008-2020. For Greece, it provides only estimates of the entitlement for the use of CDM and JI credits for existing installations in Greece which amount to 36 million for 2008-2020 (Öko-Institut 2012: 36); this figure excludes entitlements to new entrants in phase 2 and 3 and to aviation in Greece.

[23] See also https://ec.europa.eu/clima/policies/ets/credits_en, accessed June 15, 2018.

[24] This is compatible with the evidence provided by EC (2017b) that until June 30, 2017, 423.16 million of credits have been used or exchanged in Phase 3.

[25] As part of the back-loading, the auctioned allowances decreased from 36 $MtCO_2$ in 2013 to 22.3 $MtCO_2$ in 2014; they were increased to 25.2 $MtCO_2$ in 2015 and to 28.1 $MtCO_2$ in 2016.(European Environment Agency: on-line dataset: "ETS_Database_v24" - last modified 15 June 2017, authors calculations)

total verified emissions of stationary installations. The non-combustion sectors accounted for 25.2% of total verified emissions of stationary installations. Among these sectors, high levels of verified emissions are observed in the production of cement clinker and in refining of mineral oil. Starting participation in the ETS in 2012, aviation accounted for almost 1.6% of total verified emissions from ETS liable operators in the country.

[insert Table 1]

On a year-by-year basis, verified emissions from stationary installations were decreasing in the period 2013-2016, mainly as a result of the severe economic crisis in the country. From a level of 58.6 MtCO_2 in 2013, they dropped to 46.3 MtCO_2 in 2016 (a 20.9% decline). The decline in the combustion of fuels activity was considerable: its verified emissions dropped from a level of 45.7 MtCO_2 in 2013 to 32.5 MtCO_2 in 2016 (a decline of 28.9%).

With respect to PPC (the major power company), its verified emissions dropped from a level of 41.3 MtCO_2 in 2013 to 28.4 MtCO_2 in 2016 (a decline of 31.2%). This outcome reflects the impact of crisis and austerity programs in the form of reduced demand as well as the impact of priority dispatching for RES power plants (a support mechanism for RES). Given the small amount of free allowances allocated to PPC[26], the company had to buy allowances for compliance (including CERs and ERUs exchanged for EUAs) amounting to 142.8 MtCO_2 for the period 2013-2016. Taking into consideration that all Greek installations had to buy EUAs amounting to 152.7 MtCO_2 in total, PPC is *the* major Greek player in the EU carbon market.

With respect to non-combustion industrial installations, the verified emissions from oil refineries increased by 9.4% between 2013 and 2016. However, overall freely allocated allowances were lower than verified emissions by 4.7 MtCO_2 in the refineries. With respect to the other industrial sectors, the freely allocated allowances were higher than verified emissions for the 2013 -2016 period in the production of cement clinker, iron and steel, non-ferrous metals, lime, ceramics, ammonia; these sectors experienced a surplus of free allocated

[26] These few free allowances correspond to thermal power generation for district heating by PPC using the provision of the 10a article of the ETS Directive.

allowances. This over-allocation of free allowances in industrial sectors captures the impact of crisis and that of the harsh austerity programs on these sectors.[27]

Overall, the freely allocated allowances to stationary installations amounted to 58.6 $MtCO_2$ while their verified emissions amounted to 210.2 $MtCO_2$; consequently they had to buy for compliance allowances amounted to 151.6 $MtCO_2$. The aviation sector in Greece verified 3.5 $MtCO_2$ of emissions while it received free allowances for 2.4 $MtCO_2$; it had to buy for compliance allowances amounted to 1.1 $MtCO_2$ (see Table 1).

With respect to CERs and ERUs exchanged for EUAs for 2013-2016, we were able to collect data only for PPC, kindly provided upon request. CERs/ERUs bought for compliance for 2013-2016 amounted to 4.43 $MtCO_2$ (3.1% of allowances surrendered by PPC) at a total cost of €30 million. However, it should be mentioned that, based on data provided above, PPC accounted for 93.5% of the overall shortage of free allowances in Greece, meaning that PPC's purchases of CERs and ERUs is a good approximation of the total international credits used for compliance by Greece.

Auctioning is the default method for allocating allowances in Phase 3. Two auction platforms are in place. The EC and 25 member states, including Greece, have appointed the European Energy Exchange (EEX) in Leipzig as their common auction platform. Germany, Poland and the United Kingdom decided to opt out of the common platform and appoint their own auction platform; Germany appointed EEX while the UK appointed ICE Futures Europe in London as its auction platform, respectively. Poland contracted EEX, in its capacity as common auction platform, to auction on its behalf pending the listing of an opt-out auction platform.

We have drawn prices of EUA for 2013-2016 from auctions conducted by the common platform (EEX). Figure 2 presents the auction spot prices derived from EEX for auctions of EUAs made for EU countries using EEX as the common platform. According to EC (2016b: 5), for stationary installations, the average auction clearing price for EUAs was €4.43 in 2013, €5.90 in 2014, €7.62 in 2015, and €5.26 in 2016. Despite back-loading, EUA prices are still quite low to work as catalyst for the transition to a low-carbon economy, as hoped by the

[27] For a discussion of the Greek crisis and the impact of austerity programs see Vlachou (2012) and Konstantinidis and Vlachou (2017, 2018).

designers of the scheme. They kept rising in 2014 and 2015 but they dropped and oscillated a lot in 2016.

[Insert figure 2]

It is stipulated in the revised EU ETS directive that at least 50 % of auctioning revenues should be used by member states for climate and energy related purposes. Since 2014, member states are requested to report annually on the amounts and use of the revenues generated. Over the period 2013-2016, nearly € 15.8 billion from the auctioning were collected by member states.[28] Due to space limitations, analysis of the use of auction revenues by member states for the first years of Phase 3 can be found in EC (2017a).

4.2 Evaluating the third phase with attention to its distinct outcomes in Greece

Several evaluations of phase 3 are emerging (see, for instance, Ellerman, Marcantonini, and Zalkan 2016; Vlachou and Pantelias 2017a,b). Critical assessments start with the insufficient target. It is argued that a reduction of at least 40 % in 2020, compared to 1990 levels, was needed; such a target has been set by the EU in "the 2030 energy and climate framework", and it is to be achieved by 2030.[29] Tighter caps, however, are challenged on competitiveness grounds as a strong global climate agreement is still wanting. The Paris agreement signed in 2015, on the one hand, lacks legally binding reduction targets[30] and, on the other hand, encounters the withdrawal of the US since US President Donald Trump announced on June 1, 2017, that the U.S. would cease all participation in it. On the front of environmental effectiveness, ETS was also challenged by over-allocation and surpluses experienced in the period 2 which continue to haunt phase 3, albeit reduced; they were kept in check through the decreasing cap and the back-loading.

Low and volatile carbon prices provided little incentive for investment in emissions reduction projects. The introduction of a price floor has not been really considered at the level of EU as a means to stabilize prices. However, in October 2017, the Dutch government announced its intention to introduce a carbon price floor for ETS electricity plants. The carbon

[28] This information is provided by EC at https://ec.europa.eu/clima/policies/ets/auctioning_en, accessed May 20, 2018

[29]See https://ec.europa.eu/clima/policies/strategies/2030_en, accessed June 30, 2018.

[30] See, for instance, Harvey F., "Paris climate change deal too weak to help poor, critics warn" available at https://www.theguardian.com/environment/2015/dec/14/paris-climate-change-deal-cop21-oxfam-actionaid, accessed June 30, 2018.

price floor is pictured to be €18/tCO_2 in 2020, increasing to €43/tCO_2 in 2030. The idea is that if EUA prices are lower than the carbon floor price, the ETS power plants will be obliged to pay a tax to bridge the difference between the two, while meeting, at the same time, their compliance obligations (World Bank 2018: 48).

Auctioning deprives unregulated private electricity companies of windfall profits (rents) that they used to earn in phase 1 and 2 by passing on the market price of the freely allocated allowances (as opportunity cost), through marginal cost pricing. Auctioning, nevertheless, increases the cost of ETS installations and, consequently, the prices of their product; as a result, they resist it, if they compete in international markets where rivals do not face carbon restrictions. When auctioning increases the price of electricity, it leads to subsequent distributional and competitive impacts on the buyers. On the other hand, the use of revenues from auctioning for climate and energy-related purposes will become an issue of conflict over various competing undertakings, with class and social implications (Vlachou 2014).

In addition, several distinct effects originated from the application of ETS in Greece, for 2013-2016 when the country was in deep recession. In phase 3, there have been significant cost implications for the electricity sector, compared to limited ones in phase 2. Electricity prices in Greece are regulated. Since the free allocation of EUAs to power production is eliminated (with a few exceptions) in phase 3, the Greek government decided to incorporate the cost of EU ETS in the price offers of production units in the day-ahead wholesale electricity market for real-time dispatching, as part of the variable cost of electricity (which is conceptually the base of these price offers). Following a proposal by Regulatory Energy Agency (RAE) and a consultation process, RAE reached the decision 643/2011 on the methodology for including the cost of EUAs and credits in the price offers for the day-ahead dispatching (DAS) of power plants (Greek Government Gazette 2011). Full implementation was to start from 1-1-2013; there would be a transitional stage from 1-6-2011 to 31-12-2012 for which the cost of the EU ETS would refer to EUAs and credits bought in case of shortages. Apparently, this pass-through became critical since 2013 when auctioning became the default allocation.

Based on data kindly provided by PPC upon request, we find that PPC bought 143 million of allowances (including exchanged CERs and ERUs for EUAs) for compliance at a total cost of €896.7 million for the period 2013-2016. Based on the same data, we calculated the average cost of compliance to ETS for PPC per MWh produced by thermal power plants for the years 2013-2016, which is presented in Table 2. We compare it to the average system marginal price (SMP) of the wholesale power market which was drawn from reports published by RAE (2016, 2017). SMP corresponds in concept to the short-run marginal cost (i.e. the marginal operating cost); in practice, it is the bid of the costliest plant needed to be put in operation to meet demand.[31] The average cost of compliance to ETS for PPC per MWh produced by thermal power plants for the years 2013-2016 ranges from 12.2% to 19.4% of the SMP in the wholesale electricity market.

[Insert Table 2]

As the ETS compliance cost is being transferred to electricity buyers, that is to firms and households, negative implications for the competitiveness of Greek firms and for the real income of Greek households follow. This cost transfer raised resistance from businesses as it tends to exacerbate long-standing differences in competitiveness between Greek firms and their counterparts in more advanced EU countries, deepening the uneven capitalist development of Greece within the EU (Vlachou 2012). Not surprisingly, however, pressures from business over competitiveness issues were also exerted in other EU countries, including highly competitive ones, in view of carbon leakage. As a result, such fears were partially eased by using a provision in the revised EU ETS Directive (2009/29/EC, Article 10a). To a considerable extent[32], power price increases due to indirect EU ETS costs are being reimbursed to industrial firms vulnerable to carbon leakage risks, using national financial resources, after the approval of the EC. In 2017, this practice was taking place in 10 EU countries, including UK, Germany, Spain, Netherlands and Belgium's region Fladders (EC 2017b).[33]

In 2014, the government of Greece also established a state-aid scheme for the 2013-2020 period to compensate the electricity-intensive firms which are mainly situated in the production or the processes of ferrous and non-ferrous metals, production of secondary

[31] "The Greek wholesale electricity market is based on a pure day ahead mandatory pool mechanism. Generators, auto-producers and importers must state an offer price for each hour of the following day for their available capacity to supply electricity to the system. Currently a cap of EUR 300/MWh applies to all generators' offers. At the same time, all buyers of electricity; retailers, exporters pumped storage hydro and self- supplied consumers must submit demand declarations for each hour of the following day but they do not submit price based offers. The day ahead market clears on an hourly basis according to a system marginal price (SMP), corresponding to the economic offer of the block lastly accepted in the economic merit order to meet demand."(RAE 2017: 44).

[32]The maximum aid intensity, defined as the percentage of eligible costs according to which the maximum amount of state-aid is computed, was set at 85 % of the eligible costs incurred in 2013, 2014 and 2015, 80 % of the eligible costs incurred in 2016, 2017 and 2018 and 75 % of the eligible costs incurred in 2019 and 2020. (Source: EC 2014f,: 4; Government Gazette 2014: 38376).

[33] For a critique from a Green MEP, who largely is in favor of EU ETS, see P. Eriksson (2016).

aluminum, and production of bulk chemicals, following the approval of the EC (EC 2014f). The necessary funds for this aid come from Greece's revenues from the auctions of allowances, and are managed by LAGHE (Operator of the Electricity Market in Greece).[34]

According to EC (2017b: 16), the approved ceiling of the indirect carbon cost compensation for Greece was €160 million for the years 2015-2018, i.e. an annual average of €40 million. Greece's auction revenues (excluding aviation allowances) for 2016, for instance, were €147 million. This means that approximately 27% of Greece's auction revenues (excluding aviation allowances) were reimbursed in 2016 as compensation for indirect EU ETS costs (included in power prices) to industrial firms vulnerable to carbon leakage. This support extends *beyond* the free allocated allowances to them for the same reason, although the latter were not fully used as the allowances surplus indicates. It should be reminded that auctions revenues were earmarked, albeit on a voluntary base, for funding climate and energy initiatives aiming at reducing GHG emissions domestically (EC 2017b). Now they are in part granted as additional support to industrial ETS installations to protect their international competitiveness. We should not, however, miss the uneven development aspect of this state-aid scheme. Hard-hit by the crisis and in need of liquidity, Greek industrial firms fiercely resisted any cost increases in order to survive international competition. To their detriment, carbon cost compensation was demanded by and granted to their counterparts in Germany ("the locomotive of EU") and in other EU countries so that Greek firms are expected to further slide down the ladder of uneven development.

On the other hand, households were afflicted by energy poverty due to increased electricity prices, in part caused by EU ETS compliance costs, in the midst of crisis and harsh austerity programs. Besides the ETS cost, households disproportionally shoulder the cost of the hasty and ill-designed RES advance into electricity generation. Strikingly, official evaluations admit that the penetration of RES into power generation was not stimulated by carbon prices, as was initially promulgated, but was the result of generous support measures for RES (such as generous fit-in-tariff (FIT), priority dispatching and long-term contracts for power purchase) both at the level of EU and in Greece (IEA 2014; RAE 2016). These support measures, combined with reductions in the investment cost of RES, made the entry of private investors into RES quite profitable.[35] As a result, the target of 2,200MW of cumulative

[34]The annual budget for aid will fluctuate with CO_2 price and was estimated to be between EUR 14 million with a CO_2 price of 5 EUR/ton to EUR 20 million with a CO_2 price of 7.5 EUR/ton (EC 2014f: 2).

[35] According to IEA report (2017: 108)"The PV sector has attracted high interest from investors due to the favorable FiT programme, reduction of PV capital expenditure, and adoption of different policy measures for

photovoltaic generation capacity for 2020 was achieved as early as 2013.[36] Since such an overshooting was not unique to Greece as other EU countries reached the 2020 target quite early (IEA 2014), it indicates a poor design of EU-wide PV/RES policy.

The generous RES support system in Greece, administer through a special account[37], was poorly financed at first by a RES tax. Later on, it inescapably encountered further financial problems as a result of inadequate power sales revenues due to reduced demand and accumulated unpaid electricity bills.[38] These developments resulted in delayed payments to private RES producers and in an accumulated RES special account deficit, which peaked at around € 550 million in 2013. The Greek government was forced to reduce the support measures (i.e. reduce feed-in prices). In addition, it initiated the following methods to balance out the RES deficit by the end of 2017: introduced a special charge which suppliers had to pay starting from the last trimester of 2016; used the revenues from the lignite levy of €2 per MWh; increased the RES duty (established now as a special RES levy with the acronym ETMEAR) on final consumers; and channeled part of the revenues from auctions of EUA to the RES account (IEA 2014 ; IEA 2017, 101, 105,106; RAE 2016; Vlachou 2017).

The ill-designed RES policy and the ETS compliance cost thus resulted, after all, in increased levies and charges on electricity consumed by the working people who have already faced harsh wage cuts or, even worse, have lost their jobs, as it is substantiated by the high unemployment rate in the country (Vlachou 2012; Konstantinidis and Vlachou 2017, 2018). In addition, the costs of energy-poverty relieving measures initiated by the government were pass-through to final consumers via electricity bills. For instance, a social residential tariff was initiated by the government since the beginning of 2011 for vulnerable customers to combat energy poverty. In 2015, 608,714 residential customers with a total consumption of 2,236,691 MWh joined this program (RAE 2016: 71). The cost of this program is not assumed by the state budget but, instead, is being passed through to the electricity bills to the final customers

streamlining of the licensing procedure (exemptions for the obligation of obtaining certain licenses for smaller installations)".

[36] As a result, during the period 2012-2014, the licensing of new PV installations were suspended; moreover, few PV systems were installed since 2014 due to lower compensation prices established. The FIT program closed on December 2015. A new support program was introduced in August 2016 (applicable in January 2016), with the objective, however, to gradually integrate RES into the electricity market so that RES generation would start slowly competing with conventional power generation (IEA 2017: 103).

[37] Its cost peaked at €2 billion in 2013 and was reduced to around €1.7billion per year in 2014 and 2015 (IEA 2017: 105).

[38] For PPC, provisions for bad debt amounted to €950.4 million in 2015, representing 16.6% of its total revenues in 2015 (PPC 2016: 36-37). Being a state-regulated firm, PPC initiated adaptable debt settlements of accumulated electricity debt with its customers, instead of disconnecting the service.

(as a cross subsidy between consumers). Social discontent over electricity bills has been mounting with increasing power as economic depression escalates. This is evidenced in the complaints received by RAE.[39]

Another negative aspect of the application of ill-designed ETS scheme and RES policy in the time of crisis in Greece is their impact on the economic performance of PPC, the production mix of which was heavily dependent on lignite. Due to decreases in electricity demand, RES enhancement and the EU ETS cost, low-cost lignite generation capacity became increasingly unused, with a negative impact on PPC's revenues, profitability and its ability to service its debt payments, while in the process of being privatized, set as an austerity program requirement (IEA 2017: 65; PPC 2016; Konstantinidis and Vlachou 2018). In particular, generation from lignite–fired plants was reduced from 33.2 TWh in 2008 to 17.1 TWh in 2016 (i.e. a 48.5% reduction), while net installed lignite-generation capacity was reduced by 18.6% (see RAE 2009, 2017).[40]

All the above indicate that the burden of ETS cost and RES enhancement is greatly shouldered by the working people in Greece, who are being harshly pauperized by the severe austerity programs. This is clearly a class-biased and unfair design and product of climate and energy policy. At the same time, this policy tends to discredit the use of ETS and RES in the eyes of the many in Greece; it definitely creates social grievances against such deep-rooted class transitions to a low-carbon economy. The narrative of the green growth as a way of exiting the crisis and of paving the path to future ecologically sustainable prosperity has the ring of a fairy tale to working people in today's crisis-ridden Greece. The ongoing appropriation of nature in Greece is an emblematic case of repressive neoliberal restructuring of Greek capitalist economy (see also Konstantinidis and Vlachou 2017, 2018).

5. Concluding remarks

Despite adjustments and changes, the EU ETS has been characterized by limited environmental effectiveness and unjust distributional effects. Allowances surpluses led to low and volatile

[39] It is reported that "the continuous economic crisis makes consumers more concerned on increasing bill expanses. In addition a standard energy bill especially the electricity bill contains many different charges and levies…" (RAE 2016: 74).

[40] Net installed lignite-generation capacity was reduced from 4808,1 MW in 2008 to 3912 MW in 2016 due to a decommissioning of 913 MW of lignite capacity in 2010-16 (RAE 2009, 2017; IEA 2017: 66). These figures indicate a sharp decline (36.7%) in capacity utilization (our calculations).

carbon prices which do not provide incentives for investments needed for a transition to a low-carbon economy, disproving the expectations of carbon market supporters and designers. Deeply grounded in neoliberal capitalism, the EU ETS was further challenged by the economic crisis through increased allowances surpluses, price volatility and financial risks (see also Lohmann 2009a,b, 2015; Berta, Gautherat, and Gun 2017; Vlachou and Pantelias 2017a,b).

Moreover, the application of EU ETS in Greece in times of crisis revealed the inflexibility of the ETS architecture (and EU climate policy, for that matter) to economic shocks in cases of structural asymmetries in the energy and economic systems of member states. Significantly, it also revealed the structural inability of Greece, as an EU member, to build its own path to a low carbon economy, taking into account its serious limitations and possibilities at the time. Heavily dependent on fossil fuels generation, when hit by a severe crisis, Greece could not adjust in a unilateral national mode to asymmetrical crisis circumstances. The EU architecture at all levels, including climate and energy, proves to leave unevenly developed countries like Greece without real choice in tailoring climate policies such as the ETS (or energy policy such RES enhancement) to its own needs, priorities, and timetables. This major implication of our critical investigation is also reached in a mainstream study by the IEA (2017: 94): "All climate and energy policies originate from EU initiatives or obligations. This results in two main risks, which could lead to additional challenges for the Greek energy system and its economy as a whole. First, without a long-term national climate policy strategy, it is difficult to balance and optimize different options to reduce GHG emissions and to specify instruments according to the long-term potential and needs of Greece. Second, Greece should be better prepared to cope with potential future technical, social, or economic developments, as well as any possible future obligations that may arise from EU or other international commitments." In other terms, locked in the unequal capitalist development within the EU, Greece has to follow EU-wide neoliberal climate and energy policies designed under the influence of the dominant class interests in the EU, no matter their troubling impacts (see also Vlachou 2012, Konstantinidis and Vlachou 2017, 2018).

These remarks emerge powerful from the application of EU ETS in its third phase. In the midst of deep recession, Greece should have been able to make, for instance, a greater use of its low-cost lignite generation in the short- and medium-run, and comply with reduction obligations over a longer time-period. Moreover, given the high surpluses of non-combustion sectors, Greece as a country could have used them to counterbalance, albeit to a limited extent, emissions released by a greater use of lignite generation. By gradually phasing-out lignite generation would have been a cost-effective way to meet emissions reduction target at the country level in time of crisis. While reducing GHG emissions according to its own priorities, the country could save scare financial resources, especially in the power sector, for stimulating economic growth and relieving energy poverty; avoid the deterioration of economic position of the indebted PPC and the hasty devaluation of its (indigenous) lignite-fired capacity; and gain the time needed to build its own, socially-constructed (hopefully socialist but probably capitalist) path to economic recovery towards a low carbon economy. However, the EU architecture at all levels, including climate and energy, proves to leave unevenly developed countries like Greece without real choice for even a capitalist road of sustainable development.

An extensive restructuring of the existing energy system, production, transport and other social systems is needed for climate sustainability in Greece. This restructuring, however, should take into account Greece's intense need to exit the severe crisis and so its limited means, along with workable timetables. From the standpoint of the working people and the unprivileged in Greece, ecological/climate sustainability needs to be combined with a socialist transformation of Greek society in which a collective and non-exploitative organization of production will prevail. Despite the disappointment and disenchantment, as part of the recently failed struggles of the Greek people opposing austerity programs against dominant national and EU business interests and also as part of the giving up of the socialist vision by the present left-wing (by origination but not by doing) administration, a strong radical collective subjectivity could emerge as people draw their own conclusions - hopefully close to a new ecosocialist vision shaped by the lessons learnt, including those from the neoliberal climate policies originated by EU.

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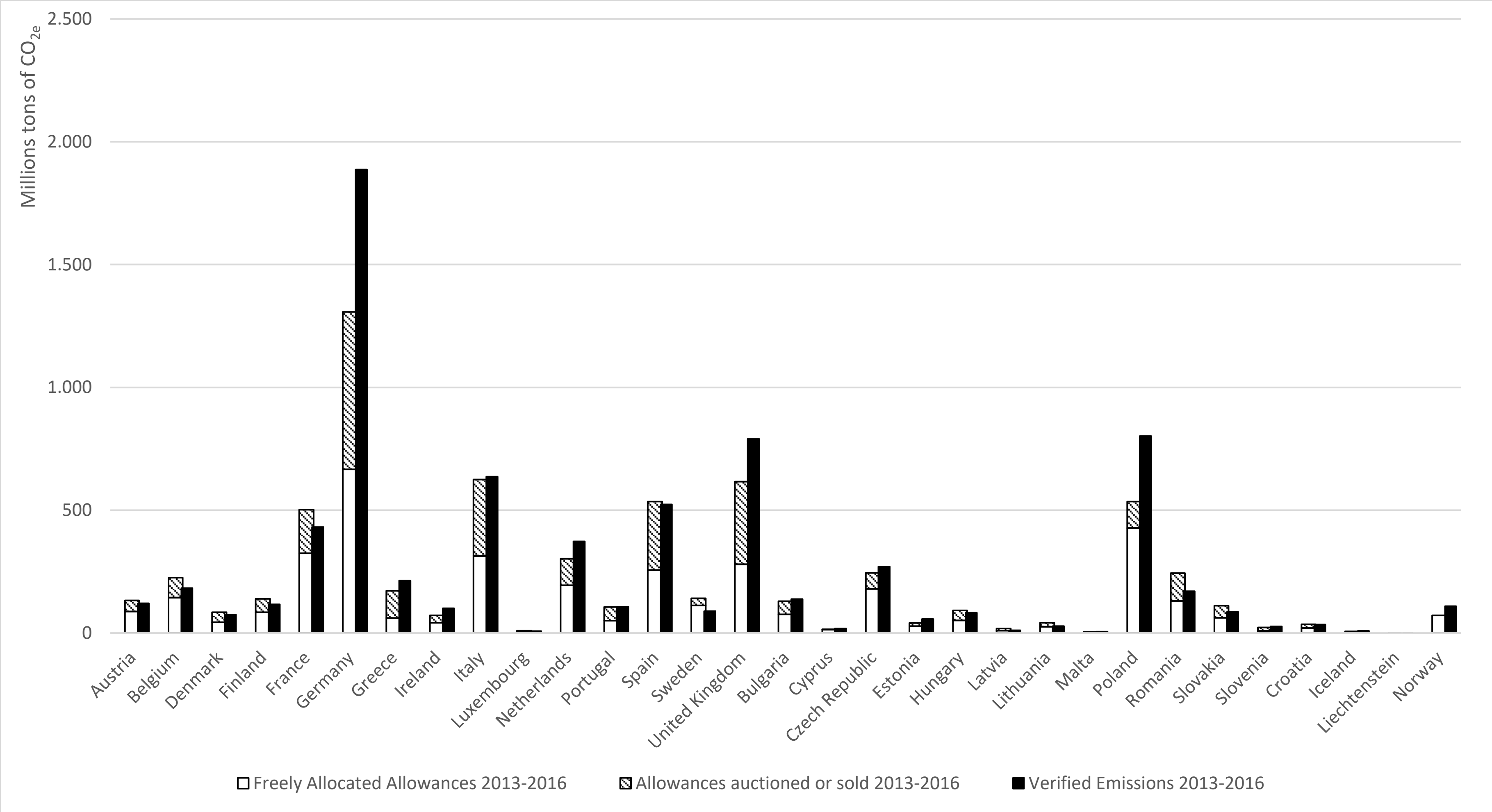
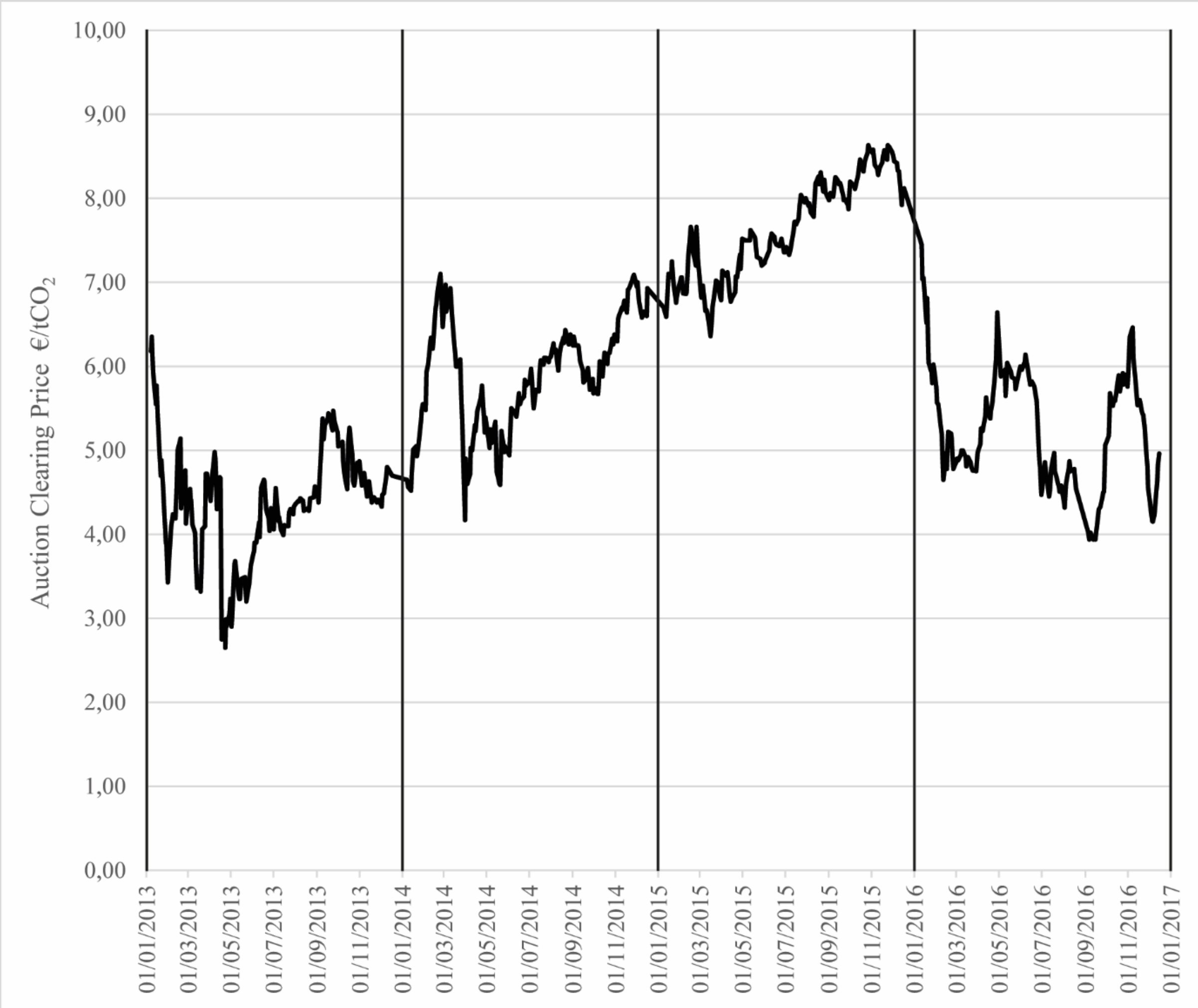
Figure 1. Freely allocated allowances, auctioned or sold allowances by government, and verified emissions by country in the EU ETS for the years 2013-2016.



Source: European Environment Agency, on-line data: "EU ETS data from EUTL": ETS_Database_v24
Unit: Million metric tons of CO_2 equivalent.

Figure 2. Price of EU allowances (EUA) in spot primary market auctions in the Common Platform (EEX), 2013-2016.



Source: European Energy Exchange (EEX), EUA Primary Market Auction Report: Emission Spot Primary Market Auction Report 2013, 2014,2015,2016.

Table 1. Freely Allocated Allowances and Verified Emissions per sector in Greece, 2013-2016 (in metric tons of CO_{2e}).

Activity	Freely Allocated Allowances	Verified Emissions	Verified - Allocated Emissions	Verified Emissions (% of total verified emissions of stationary installations)
Combustion of fuels (1+2)	5.14	157.14	152.01	74.8%
1. Large Energy producers				
1.1 Public Power Company	0.39	143.24	142.85	68.1%
1.2 Main Private Electricity Producers (Natural Gas)	2.83	12.08	9.25	5.7%
2. Other	1.92	1.83	-0.09	0.9%
Refining of mineral oil	17.68	22.42	4.74	10.7%
Production or processing of ferrous metals	2.96	3.26	0.30	1.6%
Production or processing of non-ferrous metals	0.10	0.09	-0.01	0.0%
Production of secondary aluminium	0.32	0.35	0.04	0.2%
Production of pig iron or steel	0.67	0.44	-0.23	0.2%
Production of cement clinker	27.81	23.48	-4.34	11.2%
Production of lime, or calcination of dolomite/magnesite	2.48	1.91	-0.57	0.9%
Manufacture of glass	0.15	0.19	0.04	0.1%
Manufacture of ceramics	0.61	0.27	-0.33	0.1%
Production of pulp	0.00	0.00	0.00	0.0%
Production of paper or cardboard	0.37	0.43	0.07	0.2%
Production of ammonia	0.26	0.17	-0.09	0.1%
Manufacture of mineral wool	0.02	0.02	0.00	0.0%
Production of bulk chemicals	0.00	0.00	0.00	0.0%
Total Stationary Installations	58.58	210.18	151.60	100%
Aviation	2.44	3.55	1.11	n.a
TOTAL	61.02	213.73	152.71	n.a

Source: European Union Transaction Log (EU ETL), online database, last accessed 27.06.2017.

Table 2. The cost of ETS compliance for PPC, 2013-2016.

	2013	**2014**	**2015**	**2016**
1. Allowances/credits bought (in million tons of CO_2e)	41.29	39.01	34.21	28.34
2. Average cost of allowances/credits weighted by volume (euro/tn of CO_2e)	6.03	5.61	7.37	6.23
3. Total cost of compliance (million euro)	248.80	219.00	252.23	176.67
4. The cost of compliance per MWh of thermal power production (euro/MWh)	8.02	7.03	8.88	7.05
5. Average System Marginal Price (SMP) (euro/MWh)	41.47	57.56	51.93	42.85
6. Cost of compliance as a share of SMP(%)	19.4%	12.2%	17.1%	16.5%

Source:

1. Calculations for 1-4 were based on data kindly provided by Public Power Corporation S.A. (PPC) upon request.
2. Data on SMP: Regulatory Authority for Energy (RAE) - National Report for the European Commission 2016; National Report 2017.