The Ecological Footprint of Tourism

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A Case Study of the Greek Hotel Sector

By

Dimitrios A. Parpairis
and Dimitrios G. Lagos

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LIST OF ABBREVIATIONS

Apps	Applications
BCSD	Business Council for Sustainable Development
BPoA	Barbados Programme of Action
CAPEX	Capital Expenditure
CDM	Clean Development Mechanism
CES	Conventional Energy Sources
CSD	Commission on Sustainable Development
CSR	Corporate Social Responsibility
COP	Conference of the Parties
DJSI	Dow Jones Sustainability Index
EC	European Commission
EEA	European Environmental Agency
EEC	European Economic Community
EF	Ecological Footprint
EIA	Environmental Impact Assessment
EM	Electromechanical
EMAS	EU Eco-Management and Audit Scheme
EMS	Environmental Management System
EP	European Parliament
EQS	Equivalent Factors
ETC	European Travel Commission
EU	European Union
FDI	Foreign Direct Investments
GDP	Gross Domestic Product
GFN	Global Footprint Network
GHG	Green House Gas
GNTO	Greek National Tourism Organization
HCH	Hellenic Chamber of Hotels
HSA	Hellenic Statistical Authority
IEA	International Energy Agency
IEG	Integrated Energy Governance
IISD	International Institute of Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
IT	Information Technology

ITD	Information Technology Governance
IUCN	International Union for Conservation of Nature
JTM	Just Transition Mechanism
LPG	Liquefied Petroleum Gas
MPI	Migration Policy Institute
MSI	Mauritius Strategy of Implementation
NEEAC	National Environmental Education Advisory Council
NEF	New Energy Finance
NFA	National Footprint Accounts
NOAA	National Oceanic and Atmospheric Administration
OPEX	Operating Expenditure
PV	Photovoltaic
REG	Renewable Energy Governance
RES	Renewable Energy Sources
RET	Renewable Energy Technology
RUE	Rational Use of Energy
SA	Supplementary Accommodation
SDG	Sustainable Development Goal
SETE	Greek Tourism Confederation
SIDS	Small Island Developing States
TEF	Tourism Ecological Footprint
YF	Yield Factor
YPEKA	Hellenic Ministry of Environment, Energy and Climate Change
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNWTO	United Nations World Tourism Organization
WEF	World Economic Forum
WSSD	World Summit on Sustainable Development
WTTC	World Travel and Tourism Council
WWF	World Wildlife Fund

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PREFACE

This book is based on the theoretical and methodological research associated with the PhD Thesis: "The Contribution of Renewable Energy Sources to the Sustainable Tourism Development: Assessment of the Ecological Footprint within the Hellenic Hotel Sector" (Parpairis 2016). The referenced dissertation was executed under the supervision of the Department of Business Administration, instituted at the University of the Aegean.

The manuscript is designed to provide the reader with an introduction to the ecological footprint of tourism, through a contemporary research activity executed in Greece between the years 2011-2016, enhanced and updated with latest bibliography and references, such as books, scientific papers, journal articles, conference proceedings, institutional material, and websites, until its year of completion i.e. 2020.

In principle, the book is targeted at those who are engaged in, and are interested to actively learn about, the fusion of the energy and tourism sectors, under today's pressures exercised from global environmental and socioeconomic dynamics, mainly climate change and mass tourism, secondarily fiscal austerity, and only recently, the Covid-19 Pandemic.[1]

The study processes and investigates the application of the ecological footprint (EF) as a tool to measure environmental impact and sustainability in tourism hospitality operations i.e. hotels in Greece in our Case Study, within the Energy Transition Framework, and within the parallel development of the circular economy.

The purpose of this research relates to the assessment of the key components (variables) i.e. energy, water (aquatic: water consumption and wastewater), waste (solid) and land (territorial), that make up the EF within the tourism segment. This structured assessment is translated into the tourism ecological footprint (TEF).

Within this context, the scope of this research is to present the theoretical and methodological frameworks for assessing the TEF, and its components, within the Hellenic hotel sector, nationally and per accommodation typology (1* – 5* hotels) for the period 1990-2016, which has been extended from the original PhD dissertation research period (1990-2012).

[1] The 2020 Covid-19 pandemic effects are not considered in our research activity.

Initially, through the theoretical background, an introductory qualitative approach is carried out on the research object, and the methodological approaches of the EF and its components are registered distinctly.

Moreover, a bottom-up analytical quantitative process is introduced, which calculates the footprint of each component separately, and the total TEF accordingly. We then compare the results with the total EF of the country (Greece) and draw important conclusions.

Additionally, benefiting from the referenced PhD Thesis field research (2015), amongst 1,252 registered 4* and 5* hotels in Greece, and in conjunction with the empirical results obtained from the case study, an analytical discussion and evaluation of results takes place, related to the ability of the TEF to be further exploited as an environmental and sustainability indicator.

Thus, the challenge generated from this research is to develop policies and measures driven by utilization of the EF, for enhancing sustainable tourism development within the frameworks of green energy transition and the circular economy.

Besides, the value of this contemporary approach is to present a measuring tool that can be utilized towards supporting hoteliers into achieving long-term mitigation of exogenous pressures:

a) tackling climate change at global, national, and local level, by achieving carbon neutrality (limiting GHG emissions); and
b) resisting the stresses exercised by the mass tourism model.

At the same time, the TEF measuring tool can be utilized as a short/medium-term support mechanism for an endogenous (local) adaptation process via the introduction and utilization of renewable energy sources (RES), technology (RET), and rational use of energy (RUE), i.e. translated into the wider framework of renewable energy governance (REG). Such an approach would enhance long term sustainability for the hospitality stakeholders, mainly hoteliers.

Furthermore, and within this context, the book concludes that it seems reasonable to expect significant benefits for the hotels, and subsequently for the environment, through actions associated with the TEF, such as reducing energy and water consumption, waste (solid and water) reduced landfill, and introducing bioclimatic concepts to decrease their land (territorial) footprint.

Finally, and within the digital innovation and circular economy frameworks, actions associated with the TEF, will provide hotel businesses with a solid basis towards promoting their social responsibility, enhancing

their competitive advantage, and boosting their growth potential, and finally, will allow them to take benefit from the available fiscal and tax incentives towards strengthening their balance sheet, growth potential, and sustainability development, under today's fluid socioeconomic environment.

Keywords: *Ecological Footprint, Sustainable Tourism Development, Climate Change, Mass Tourism, Renewable Energy Sources and Governance*.

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I would like to acknowledge Cambridge Scholars Publishing for the opportunity provided to publish this book, as well as the University of the Aegean for allowing me to practise this research activity as part of my Doctorate.

Writing this book was harder than I thought and more rewarding than I could have ever imagined. None of this would have been possible without the support of my family. I'm immensely grateful to them.

CHAPTER 1

INTRODUCTION TO THE ECOLOGICAL FOOTPRINT OF TOURISM (TEF)

The increase in global tourist traffic in recent years, and prior to the ongoing pandemic, i.e. 2015-2019 (UNWTO 2020a), coupled with the globalization of most human activities, have caused significant environmental impacts. These impacts are enhanced by the pressure exercised by climate change, which in some cases has managed to deplete resources (natural and anthropogenic), to such an extent that the continuation of the situation now even seems hostile to the sustainability of our planet's fragile resources and biodiversity.

One of the key tools proposed by various stakeholders for performing an environmental impact assessment (EIA) and its subsequent management, is the ecological footprint (EF), which, under certain conditions, can also be applied to the tourism industry; as the tourism ecological footprint (TEF). The ultimate goal would be to provide, through utilization of the EF, critical data, and effective support to tourism stakeholders, i.e. authorities, policy makers, legislators, institutions, businesses, society, and tourists, towards promoting tourism sustainability.

Overall, the EF records the organic production from the land which is needed to satisfy any human use, such as: a) food (cereals, fruits, vegetables, fish, etc.); b) timber (forests, etc.); c) the process of carbon dioxide absorption caused by the use of liquid and hydrocarbon fuels (mainly fossil fuels); and d) the space (land-territory) occupied by all types of buildings, plants, and structures (infrastructures, superstructures, networks, etc.). These parameters relate to the organic production generated from land, which inevitably creates conditions for the renewal of resources necessary to meet human needs.

As a matter of course, there are significant differences in the estimation of EF, from region to region, and from year to year, depending on local particularities and changing conditions. Indicative of EF variations is that biodiversity – with its specific characteristics and scale of reference from the individual to the wider world - should be taken into account directly, as

production and consumption processes change over time for most people or social entities, depending on: a) their needs; b) their ability to rationally and efficiently produce by using their technological developments; and c) their knowledge and innovative applications, but mainly in relation to d) the capacity offered by the given ecosystem (Ferguson 2001, 1-2).

It is noted that today, and on a global scale, EF estimates reveal that the demand for human needs is ~1.7 times higher than the potential created from regenerated productive land. This estimate is also confirmed by the United Nations Global Footprint Network ('The Global Footprint Calculator') of about 200 countries, as the global community has already used its natural capital within a range of 1.69 times (GFN 2020) to 1.76 times (The World Counts 2020) more than mother-Earth can replenish.

Thus, we could argue that the EF can be considered as a mechanism for capturing the adverse environmental effects from all human activities, and at the same time, for assessing the demands of the planet's natural resource consumption by a given population. In other words, the EF can measure: a) the human resource consumption requirements, by determining the amount it obtains from nature in order to support the human economic needs, as well as; b) the quantity demanded for these needs, as recorded by an ecological account system that compares the bio-productive land that man requires for his needs with the bio-productive land offered in that particular geographic area.

The importance of the EF as a tool to measure biodiversity loss, has already been underlined, by the UN, by the World Wildlife Fund since the early 2000s, and up to the present day through contemporary calculation mechanisms, i.e. using online web calculators (WWF 2020a) and crucial reports (WWF 2002, 1-19, WWF 2020b, 1-83). Consequently, the EF could be defined as "the mechanism that can, under certain conditions, assess the impact of human actions on the earth's ecosystem" (Collins and Flynn 2015, 1-23).

In principle, the EF and subsequently the TEF, are identified based on four critical components (variables): energy, water (aquatic: water consumption and wastewater / sewage), waste (solid waste), and land (territorial). The assessment of these components is part of an established and more general methodological framework, used internationally, to assess the sustainability of a tourism product for a given region, in relation to the size of the tourism community and its resources.

This particular sustainability results from a detailed counting of the resources used by the tourism economy, combined with the standards set out in the model of the tourist unit (number of tourists, consumer goods, and services, to be used). In order to ascertain the extent and depth of the TEF

of a particular geographical area, as to the effects that determine it, a qualification choice was made by the authors for two critical and major exogenous variables, i.e. climate change and mass tourism, whose exercised pressures influence the TEF, and thus the sustainability of the tourism product of the area under consideration.

The assessment of the TEF, in accordance with the above assumptions, will then allow us to use it as an analytical tool, and as an ecological indicator of tourism, and thereby, safely approach the key objective of its integrated product management.

Moreover, it is assumed that, through the identification of the TEF, it is possible to balance all those features that constitute the sustainable management of tourism under certain conditions, within the context of renewable energy governance (Parpairis and Lagos 2013, 81-100), and through implementation of policies, strategies, and actions, related to the penetration and integration of renewable energy sources (RES), technology (RET), and rational use of energy (RUE), in the tourism energy mix. For example, and within the European continent, such an approach is fulfilled through a wider policy framework, i.e. "A European Green Deal" (EC 2019a and 2020a), related to the ongoing global energy transition, transformation, and security, ecosystem (IRENA 2020).

Such a balancing approach is presented methodically in Figure 1, following, which attempts to visualize the energy – tourism interaction nexus that is generated from the interplay of the energy and tourism branches at a top-down level, i.e. the exogenous long-term mitigation of pressure exercised from conventional models (energy[2] and mass tourism), with the green energy and tourism transition at a bottom-up level i.e. endogenous short-term adaptation to renewable energy governance and alternative and special forms of tourism.

Consequently, the EF constitutes the measuring tool that "forces" both economic sectors and their activities, through stakeholders' leverage, interaction, and correlation, towards the path of sustainability, by leveraging strengths, weaknesses, opportunities, and threats.

As such, it has been chosen to test the above assumption with a specific case study exercised in Greece, one of the leading tourist destinations globally, the main objective of which is the methodological determination of the tourism EF in the Hellenic hotel sector, in relation to the category of accommodation, i.e. 1* – 5* hotels. The quantitative assessment can draw conclusions regarding the intended leverage of hotels with the energy transition, transformation, and security ecosystem, towards reducing their TEF.

[2] Energy produced from conventional forms i.e. fossil fuels.

Moreover, it will attempt to ascertain, in conjunction with the executed field research (Parpairis 2016, 255-264), the impact that, eventually, the introduction and use of RES, RET and RUE, through the wider framework of renewable energy governance, can have on the sustainability of hotel businesses, and generally towards the sustainability of the tourism industry itself.

Therefore, the qualitative and quantitative conclusions generated from this research activity, compared with the theoretical and empirical background, allow us to highlight the necessity to design and implement new, visionary, endogenous, and integrated, tourism models, which can provide long-term solutions against the emerging pathogens, uncertainties, and malfunctions of tourism activity today.

Within this context, it seems realistic to expect substantial benefits for the hotels, and hence for the wider socioeconomic environment, through actions associated with the utilization of the TEF as an environmental and sustainability indicator. Such actions would be concentrated on reducing energy dependence, water consumption, wastewater, and solid waste going to landfill, as well as introducing architectural bioclimatic (eco-designing, heating, cooling, ventilating, thermal insulation, lighting, shading, and material ideas) and innovative infrastructure concepts (EMS, smart grids, smart meters, etc.), to decrease their land (territorial) footprint.

Thus, associated hoteliers' actions would provide a long-term sustainable basis for solidifying their social responsibility, enhancing their competitive advantage, boosting their growth potential, and finally, taking benefit from the available fiscal and tax incentives, strengthening their balance sheet, and their sustainability, in today's socioeconomic and pandemic crisis.

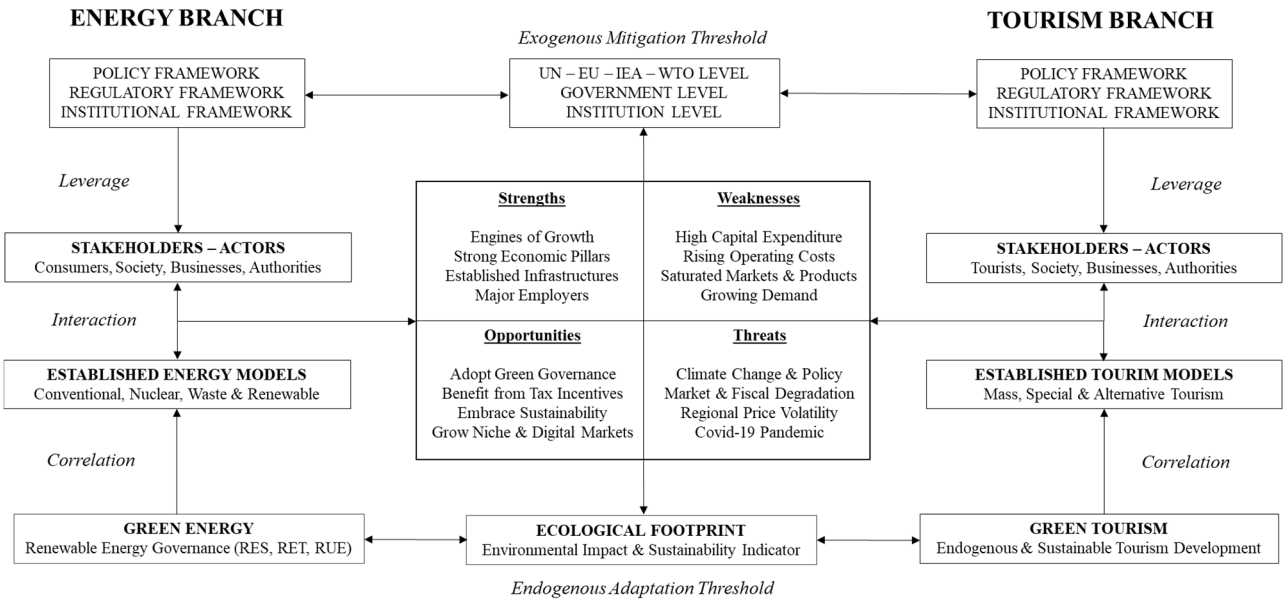

Figure 1: Energy – Tourism Interaction Nexus

CHAPTER 2

THE CONCEPTUAL FRAMEWORK OF CLIMATE CHANGE AND SUSTAINABLE TOURISM DEVELOPMENT

2.1 Introduction

The main objective of this Chapter is to present the conceptual framework of climate change and sustainable development, within the context of tourism. Moreover, the interaction and relationship between climate change and tourism will be introduced, as well as the parameters of sustainability in tourism operations through the introduction and exploitation of renewable energy sources (RES), technology (RET), and the rational use of energy (RUE), all of them within the specific concept of renewable energy governance (REG).

2.2 The Relationship Between Climate Change and Tourism

Tourism and climate change are related in many ways, and in a complex manner. Their interaction is wide, deep, and multiplex, since tourism depends, directly and in the long-term, on climate, and indirectly, on natural resources and biodiversity (ecosystems). At the same time, weather conditions are considered as a critical differentiator for tourism in the short term. Part of the radical changes and risks generated through climate change (heatwaves, drought, migration, biodiversity, degradation, etc.), are associated today with tourism, and are naturally linked to the greenhouse gas (GHG) emissions which are generated by tourism operations (hotels, travel, infrastructure, networks, etc.) on a wide scale (Becken & Hay 2007, 116-143).

Already, the criticality of climate change to the planet, and on humans, is mainly reflected in the temperature change that has occurred significantly in recent years, hitting record numbers since statistics were

first kept. The associated effects on tourism were first registered during the 1st International Conference on Climate Change and Tourism, which was held in Tunisia in 2003 (Jones 2003, 45-46), as well as by many researchers and scholars dealing with the effects of climate change on the sustainability of the tourism sector, and parallel economic activities that are linked to tourism, e.g. agriculture, wineries, etc. (Cook and Wolkovich 2016, 1-6),

Consequently, local (endogenous), national, and international (exogenous), tourism policies, have been increasingly influenced by the necessity to manage the associated risk as a result of the pressure exercised by climate change. Such policies are implemented through 'green' legislation, initiatives, and agreements.

Hence, the energy parameter within tourism operations comes to the forefront, when debating climate change and the strategies, policies, and actions needed, to mitigate its consequences on the tourism sector, since the reduction in GHG emissions, generated from energy needs, is the main issue to be addressed.

According to the recent predictions related to the sustainable growth of tourism (WTTC 2020), the number of tourists on a worldwide scale is expected to reach 1.8 billion/year by 2030, accompanied by a further 15.6 billion/year in domestic tourist arrivals.

Furthermore, based on the UK-based website report, "Carbon Brief" (Dune 2018), tourism on a world-wide scale accounted for 8% of GHG emissions (2009-2013), making the sector even a bigger polluter than the construction industry. Moreover, based on the latest UN report (UNWTO 2019a), by the year 2030, tourism transport-related carbon dioxide (CO_2) emissions will grow by 25% on 2016 levels, representing a CO_2 emissions growth of 5.3% of all man-made emissions.

Under such growth circumstances, and predictions of future tourism activity, it has become critical that the tourism sector begins its green transformation towards reducing GHG emissions, and contributing to the Paris Agreement (see below) and the associated UN Sustainable Development Goal 13, related to actions associated with tackling climate change (UN 2015a).

Looking back, and as is well known, the ongoing effort to resolve problems from the use of energy, especially electricity, has strongly and decisively marked the course of man and society. Thus, the interest of the global community has justifiably shifted since the mid 90s, starting with the Third Conference of the Parties (COP3), in Kyoto Japan (UN 1997a), towards tackling the greenhouse effect, and subsequently addressing climate change phenomena that directly affect energy consumption, and which require global mobilization to control.

The international effort is now focused on developing common frameworks that balance both the key growth sectors, and the different priorities of the stakeholders that determine them, as levels of growth, prosperity, and consumer patterns, vary widely between developing countries, as opposed to those of the developed world. This was initially underlined during the Twelfth Session of the Conference of the Parties (COP12), which took place in Nairobi, Kenya (UN 2006).

An indication of the inability of the common frameworks to be accepted by all countries on our planet was the refusal of 43 'small' countries to sign the 'suicide agreement' on climate - as they called it - during the Fourteenth Session of the Conference of the Parties (COP14), which took place in Poznan, Poland (UN 2008), considering it unable to prevent their imminent disappearance from the map, as they were threatened by rising ocean levels due to climate change.

Characteristic of the critical situation is the fact that the objective of the Paris World Conference on climate change i.e. the Paris Agreement (UN 2015b), related to the Twenty-first Session of the Conference of the Parties (COP21), was the agreement of the countries to take measures to limit global warming caused by climate change by just 1.5 degrees Celsius, compared to pre-industrial levels and not to reach 2.0 degrees, as the EU had initially suggested. In line with the 1.5-point target, industrialized and developed states would need to reduce GHG emissions, by 40% by 2020, compared to 1990 levels, and by 95% by 2050.

However, it seems very unlikely that the global community would be able to accept a common climate policy with commitments that are differently approached by rich and poor countries. For example, while rich northern countries (i.e. the US, Canada, and Scandinavian countries), were doing their best to tackle the pollutant problem, these countries are considered the least polluting ones. On the other hand, oil-rich countries (North African, Middle East and Gulf countries) were the champions of inertia, with an exceedingly high contribution to the atmospheric charge on pollutants, caused by the almost exclusive use of fossil fuel energy, which they themselves produced.

Yet, the fact that significant progress on convergence is finally being observed in international conditions, following the Paris Agreement, should not be ignored.

From the first UN conference in Berlin (COP1 1995), then in Geneva (COP2 1996), Kyoto (COP3 1997), Buenos Aires (COP4 1998), Bonn (COP5 1999), Hague-Bonn (COP6 2000-2001), Marrakesh (COP7 2001), New Delhi (COP8 2002), Milan (COP9 2003), Buenos Aires (COP10 2004), Montreal (COP11 2005), Nairobi (COP12 2006), Bali (COP13 2007), Poznan

(COP14 2008), Copenhagen (COP15 2009), Cancun (COP16 2010), Durban (COP17 2011), Doha (COP18 2012), Warsaw (COP19 2013), Lima (COP20 2014), Paris (COP21 2015), Marrakech (COP22 2016), Bonn (COP23 2017), Katowice (COP24 2018), till the latest COP25 in Madrid[3] (UN 2019), and in conjunction with the successive intermediate protocols already adopted, there appears to be a significant understanding of the need for immediate action in order to manage both the greenhouse effect and the consequent climate change, in a more commonly accepted and sustainable way, as agreed and elaborated in the Paris World Conference.

Moreover, the stakeholders' understanding of climate change and the critical actions necessary to be adopted, will be the focus of the much anticipated COP26, (postponed due to the Covid-19 pandemic), which will take place in Glasgow, in November 2021 (UN 2020).

The original idea behind the past COPs, based on the plan to tackle the previous target, was the so-called Pollution Trading System, whereby stakeholders (i.e. countries, businesses, organizations, etc.), could buy pollution rights over others who would pay to continue to pollute. This process was elaborated at the UN's Earth Summit which took place in Rio de Janeiro (UN 1992), when 160 countries agreed the UN Framework Convention on Climate Change (UNFCCC).

However, as it turned out, it was not accompanied by a substantial contribution to help solve the greenhouse effect problem. This particular system of trading in pollutants, as it initially worked, was as follows:

- Polluting industries would be required to buy licenses for most, if not all, of their pollutant emissions each year.
- If they produced more pollutants than the permits they had, they would have to buy more.
- If they emitted less, they could sell the extra licenses to companies that had exceeded their limits.
- Apart from that, there was another, undeniable goal, to increase the price of electricity for end consumers so that they too have an incentive to save energy.

The lessons learned from the first period were then elaborated, both in the EU and in other countries, as a next phase of the UN's Pollution Trading System, i.e. the Clean Development Mechanism[4] (CDM 1997), in an effort to broaden its scope and correct its mistakes. However, the system

[3] Under the Presidency from the Chilean Government.

[4] Clean Development Mechanism: "The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets".

that eventually emerged and was incorporated into the Kyoto Protocol, was far from the original goal.

Thus, it finally appeared that the common goal embraced by the global community, of clean development through an integrated energy (IEG) and climate policy, by setting quantifiable targets (Fischer and Geden 2013, 1-15) towards tackling the greenhouse effect, and thus answering climate change, could be difficult, and long to achieve.

Still, today this looks like a one-way street in order to eventually bring about the sought-after reversal of environmental deterioration of important indicators aimed at preventing the complete biodiversity collapse of the planet, as many researchers and studies suggest is likely to happen if the global community stays inactive.

Thus, collective agreements are necessary at a global, national, and local level, in order to solve the two major problems of our time:

1. The greenhouse effect (GHG emissions), and consequently its impact on climate change, and
2. Socioeconomic (and not only) global and national austerity, and migration crisis.

On the first axis (GHG emissions), the world is already taking decisive steps addressing the issue (see below). On the second axis (socioeconomic), much is to be done, considering also the ongoing and upcoming tragic consequences that the current Covid-19 pandemic has instigated.

Among the most important joint actions to address GHG emissions and climate change, proposed at international, European, and national level, are those related to the introduction of renewable energy sources (RES), technology (RET), and rational use of energy (RUE), on a large scale, in order to move to a certain extent and to replace, as far as possible, the traditional, but very polluting, methods of generating electricity through the exploitation of fossil fuels.

Within the aforementioned proposed context, the fusion, and subsequent interaction, between renewable energy and the socioeconomic environment, with the associated complexities and challenges, has been excellently addressed by the notion of renewable energy governance, (REG) (Michalena and Hills 2013, 387-397).

Clearly, through REG, the synergy of the various production techniques and sources becomes necessary, as RESs are not always capable of meeting in an efficient and exclusive way, the needs for continuous flow of energy irrespective of weather conditions or other critical variables.

It thus becomes evident that the development of RESs, the degree of their penetration into the production process, and their decisive contribution to the fight against key indicators of environmental degradation, require parallel actions, to:

- Alter the consumption pattern of society;
- Differentiate construction and infrastructure techniques and methods;
- Introduce innovative and digital energy saving management tools, tech, grids, etc.; and
- Change the energy strategy as a whole, as well as by sector (i.e. tourism), towards accomplishing sustainable development through the Clean Energy Transition process (IEA 2020).

These specific and parallel actions are of particular importance, as international research shows that many countries around the world adopt green policy and growth principles. In the EU, and through the context of the Green New Deal, the Just Transition Mechanism (JTM), has been put in motion as a critical tool to ensure that the transition towards a climate-neutral economy takes place by the year 2030.

The JTM provides EU member states with affected regions i.e. Greece (at Megalopolis and Ptolemais prefectures, where most of the lignite exploitation takes place), with support directed towards mobilizing €150 billion over a period of seven years (2021-2027), to alleviate the socio-economic impact of the ongoing energy transition from fossil-fuels (lignite and HFO in the case of Greece) to RES and RET (EC 2019b).

Moreover, and as an example of initiatives taken at a local level, and on a local scale, but with international magnitude, the Cleantech Open Global Ideas[5] competition (IDGC 2015), which took place in Athens, Greece, can be considered as a corresponding action of global interest. The final competition for innovation, and in particular, in the field of clean technology, also focused on green development issues, as well as those related to the EF, i.e. air, water and waste, energy efficiency, renewable energy, green buildings, smart power, and transportation.

[5] The competition was realized from the Industry Disruptors – Game Changers non-profit/non-governmental organization, which was founded to promote entrepreneurship in Greece, South East Europe, and the East Med.

According to the UN's Intergovernmental Panel on Climate Change research, and latest report (IPCC 2018),[6] there are also green economy initiatives, according to which three main pillars dominate:

1. Integration of services offered by nature into financial calculations;
2. Production of green jobs; and
3. Use of financial tools that will give the direction of green options to the market.

Further to the findings of various studies, it is estimated that the current rate of global warming is already bringing Earth's climate closer to the tipping points of the climate system, which, if not overcome, are likely to bring about catastrophic changes in climate, economy, and the society. Climate change is already causing 'desertification and deforestation' on a global land scale almost as large as Europe's, which exacerbates climate conditions across the globe, and undermines any potential strategy or/and legislative policy proposed towards protecting the environment.

The UN's suggested climate action is primarily aimed at limiting global warming, which may limit, or even modify, the production and consumption processes of human activities, which are solely responsible for raising the global temperature. Today, the climate change impact, caused by the anthropogenic GHG emissions, is researched by governmental organizations including NASA: "which includes the development of a transdisciplinary framework to analyze complex interactions among biophysical and socio-economic processes" (NASA 2020).

According to the latest 2020 analysis by the US National Oceanic and Atmospheric Administration, there is concern about the pace of climate change, as it was found that: "2019 was the second-warmest year on record, Earth's global average surface temperature was 1.71°F (0.95°C) above the 20th century average in 2019, and moreover, 9 of the 10 warmest years on record have occurred since 2005" (NOAA 2020).

Likewise, according to the latest World Bank data, the observed uneven geographic growth and prosperity, which is also strongly influenced by climate change, has the first consequences of mass migration, and the burst of poverty and violence with religious, ideological, factional cover, in essence, is "humanitarian survival" (World Bank 2020):

[6] The IPCC special report: "relates to the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty".