🏆 *reviewed paper*

Climate Urgency and Cities: Action and Reaction, Evidence and Reluctance

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1 ABSTRACT

The first section of the paper gives a brief critical overview of the situation of climate change strategies at the global level, from Kyoto to Paris, Madrid and Glasgow. It also discusses the measures taken by the European Union, and their level of implementation at selected member state and city levels. The impact of pressures groups such as extinction rebellion and the green movement are also examined, together with awareness raising actions such as films and documentaries demonstrating the tangible effects of man-made climate change.

The second section focuses on activists and environmentalists, their proposed solutions and selected proposed interventions in places which have been adversely affected by man-made climate change impacts, such as flooding or drought. It also briefly discusses the state of scientific knowledge and how it is dealt with by politicians, activists and climate change deniers.

The third section looks at the political evolution of climate change intervention at city level. It focuses on Madrid and London in the context of EU actions and respective national targets and examines the direction of travel of the two cities. It briefly synthesises the policies of lowering carbon emissions and proposed actions taken in 2008 in Madrid and London what actions have been taken between these dates and now and what effects they had on reducing carbon emissions, fuel consumption and air pollution. The paper finally compares these approaches with the current strategies for mitigating and adjusting to climate change in the latest city plans and offers critical comments.

Keywords: carbon emissions, green movement, policy, climate change, mitigation

2 BRIEF OVERVIEW OF CLIMATE CHANGE STRATEGIES AT GLOBAL AND EU LEVELS

Scientific evidence on climate change draws a complicated picture for the planet and the adoption of policy responses for this most important global phenomenon can only be global. It is difficult to be optimistic though about aligning national interests with a common global objective as they do not always coincide and are even opposed.

2.1 From Kyoto to Paris

The concern of scientists for human activity on the planet was visible at the Rio de Janeiro Summit in 1992. In parallel to the need to create sustainable environments, the urgency to reduce greenhouse gases (GHG) was one of the issues that led 194 countries, two observer states - Palestine and the Vatican City - and the European Union as a supranational body, to sign and ratify the United Nations Framework Convention on Climate Change (UNFCCC).

This convention assumed that global warming is a result of the increase of GHG in the atmosphere as a consequence of the formidable consumption of energy from fossil fuels. The convention promoted the implementation of an energy transition process towards the decarbonisation of national economies by using renewable energies to reduce these emissions produced by human activities.

The first annual follow-up meeting of the agreement, the Conferences of the Parties (COP) was held in Berlin in 1995, initiating a long process that, despite the difficulties, made it possible to reach various agreements, most notably in Kyoto in 1997 and Paris in 2019. The Kyoto Convention (COP 3) set the basis for the commitment on GHG emissions in industrialised countries and for the conditions of the carbon market.

The Paris Agreement (COP 15), which will replace the Kyoto Protocol from 2020, obliged countries to make cuts to their GHGs emissions so that the temperature of the planet does not to exceed 2ºC with respect to pre-industrial levels and, as far as possible, not exceed 1.5ºC. The Agreement also provided for periodic reviews of the results of the cut plans, the first in 2020, when targets would be set for 2030 and 2050, the final date for neutralising emissions.

ISBN 978-3-9504173-8-8 (CD), 978-3-9504173-9-5 (print)
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The regulation implementing these commitments was incorporated in Article 6, which refers to the trading of GHG emissions rights between countries and even between private companies belonging to the sectors obliged to make cuts, such as aviation companies. The treatment of accounting to avoid that the same right can exist in the balance sheet of two countries, as well as the terms of the inclusion of private companies in the market, was postponed for COP25.

2.2 From Madrid towards Glasgow

COP 25 was held in Madrid in December 2019 instead of the planned host Chile due to social unrest there in response to price increases of transport or fuels, similar to France, Iran and Ecuador.

The challenge facing COP25 was twofold: political and technical. It represented an opportunity to demonstrate the will of countries to avoid global warming and to complete the Paris Agreement by setting the criteria for implementing emissions markets postponed there due to disagreement between countries.

The summit took place among a dramatic lack of international leadership and weakening multilateralism to fight climate change. Trump had begun the process of getting the US out of the Paris Agreement, China showed no sign of cutting its greenhouse gases, Russia did not present a programme for reducing them, and the EU had failed to agree on a zero emissions target for 2050.

The conflicting position between national interests for the development of article 6 made the mission of COP 25 impossible. The reluctance of the major emitting countries to tighten up their plans for cuts - USA, China, Russia and India, together with Brazil, Australia and others where environmental concerns were not among their aspirations, prevented the adoption of the market rules proposed by the Paris Agreement.

The enormous investments that the transformations entail, the resistance of the economic and social sectors that would be affected in the short term and the lack of a supranational authority to guide the process and propose sanctions, highlighted the fragility of the international agreements. Even in the EU a difficult process was underway, due to the heavy dependence on coal of some countries, including Germany, and especially Poland, Hungary and the Czech Republic but ended in a compromise later.

Faced with the slowness of governments to address their adaptation and improvement plans and the lack of leadership among large emitting countries, other actors took the initiative. At COP25, the commitment of local and regional administrations to respect the agreement was achieved through effective and timely action plans. Likewise large companies showed their commitment by producing new products and services, generally related to the transport sector and urban services. The Spanish Group for Green Growth, which comprises almost 50 large companies, is firmly committed to the decarbonisation of the economy by incorporating available technology, thereby demonstrating the change in attitude of today's business world.

Agreement on changing the dominant production model by initiating an economically and socially viable transition was not achieved and the development of the content of the Paris Agreement postponed to COP26 scheduled in Glasgow in 2020.

3 FACTS, PLANS AND PEOPLE CONCERNING CLIMATE CHANGE AND ACTIONS UNDERTAKEN

3.1 What does science say?

Studies led by the IPCC - the Intergovernmental Panel on Climate Change, a group of experts that advises the United Nations- and other bodies linked to the UN warn that countries are not on track to meet the goals of the Paris Agreement. They must multiply by 5 their cut plans to achieve the 1.5º C target and by three for the 2ºC target. The concentration of GHGs in the atmosphere has not been reduced, they have only fallen during the crisis period (2008-2014) and in December 2019 they have increased by 1ºC and the forecast is that they will continue to increase until at least 2030. In this current situation it would be necessary to cut emissions by far more than 3 degrees foreseen in the current plans.

According to the World Meteorological Organisation, 2019 ended with maximum temperatures and carbon dioxide (CO2) emissions with 75% from fossil fuels. About half of the GHG go into the atmosphere, the rest into forests and the sea, which act as sinks. The acidification of the sea has increased by 26% since the beginning of the industrial era and extreme weather events, especially heat waves and storms, have increased.

The figures collected by the Global Carbon Project show that emissions are stagnating, but this is not enough to tackle the climatic crisis. In 2018 they grew by 2.1%, in 2017 by 1.5%. In 2019 by 0.6%, due to two factors: the fall in coal consumption in the USA and the European Union, linked to the increase in prices of this fuel, the fall in natural gas prices and overall economic slowdown. CO2 emissions in China are expected to increase by 2.6% and in India by 1.8%, while in the USA and the EU they are expected to fall by 1.7%.

According to the International Union of Public Transport (UITP), which unites more than 1,700 companies in the sector, only 35% of the countries that signed the Paris Agreement have included public transport strategies, even though experience shows that appropriate public transport systems demonstrate their effectiveness, displacing the use of private vehicles.

Globally, various pressure groups are studying global warming tipping points, points of no return and the change to positive feedback loops. The Climageddon Extinction Scenario is one of them.[1] Conversely the climate change deniers dismiss the imminent threat of climate change. Ten key ones are mentioned on the Before the Flood website[2] many of them connected with the fossil fuel industry and right wing media and political parties. The controversy between these camps was played out at the Davos 2020 meeting between President Trump and Greta Thunberg, the climate change activist where the mood of global leaders seem to have changed toward more attention to climate change.

3.2 What kind of plans?

It's impossible to think of decarbonised economies without tackling emissions cuts. At the moment, country-designed cutting plans are not sufficient to cope with the climate transition. Most political leaders do not act out of fear of social unrest since every transition has its victims. Climate agendas must help the most vulnerable sectors by adopting fair measures that accompany the losers. Politically, the energy transition cannot be at odds with economic growth, especially in developing countries.

A transformation of the economic and social model generates tensions and difficulties for vulnerable groups. Fossil fuel producing countries, whose fiscal revenues and GDP depend on this sector, run the risk of being trapped in the transition as they do not have the revenues to finance public policies. Conversely, for industrialised countries dependent on fossil fuels it is necessary to ensure transformation processes that accompany the economic and industrial reality of the affected areas.

Even the EU had not achieved consensus on a commitment to go carbon neutral by 2050 due to the reluctance of some countries until reaching a compromise position after COP25, exempting Poland from the 2050 zero carbon target. The European Green Deal's Investment Plan - the Sustainable Europe Investment Plan, SEIP - was presented on 14 January 2020 to start the transition to a green, competitive and inclusive climate-neutral economy. 1 trillion over the next decade will help unlock private funds through EU financial instruments, mainly the European Investment Bank. This bank, considered a "climate bank", will finance projects for the development of green energy and carbon capture and storage. A Just Transition Mechanism will provide financial and practical support to regions according to the degree of economic affection and transformation. Through the Just Transition Platform, the Commission will provide technical assistance to Member States and investors and ensure that affected communities, local authorities, social partners and non-governmental organisations are involved.

[1] Climageddon Extinction Scenario book. https://www.joboneforhumanity.org/climate_tipping_points
[2] Top Ten Climate Deniers https://www.beforetheflood.com/explore/the-deniers/top-10-climate-deniers/

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3.3 Public pressure

Citizen pressure is important for governments to take action and has played an important role at COP25: 800 organisations joined the parallel event, the Social Summit on Climate in Madrid. Thousands of people demonstrated to denounce the inaction of governments on climate change. Perhaps the most visible demonstrations globally have been organised by Extinction Rebellion with the cooperation of schools and young persons. Global environmental lobby Avaaz and many other NGOs are also achieving results.

Respected scientists are raising awareness with their TV documentaries. In the UK David Attenborough's Planet Earth TV programmes are widely viewed and his participation in public events such as the newly created Climate Change Citizens Assembly commissioned by 6 House of Commons select committees [3] to discuss how to meet the net zero carbon target by 2050 is influential.

Even if it is assumed that emissions are produced directly by everyone's activity, and indirectly by the energy consumed in the manufactured products used by everyone, the profile of environmental awareness and individual commitment has contradictory facets depending on the issue under consideration.

According to the European Commission, 93% of the population perceives warming as a serious problem. The survey carried out by the newspaper El País between 29 November and 4 December, in the middle of the COP25, refines the content of this global figure. The results indicate that 93.6% of the Spanish population recognise the existence of climate change; 59.5% consider that it is very urgent to take action, 31% that it is quite urgent; 65.1% are in favour of banning the use of gasoline and diesel cars and 53.4% would accept to pay special taxes (between 1 and 20 euros per month) to finance the fight against climate change. Reducing the consumption of animal proteins had less acceptance, despite Greenpeace pointing out that 14% of emissions come from intensive livestock farming.

4 POLITICAL EVOLUTION OF CLIMATE CHANGE INTERVENTION AT NATIONAL LEVEL: SPAIN & UK

This section looks at the political evolution of climate change intervention at national and city level. It focuses on Spain and the UK, and Madrid and London in the context of EU actions and examines the direction of travel of the two cities in respect to national targets. It briefly synthesises the policies of lowering carbon emissions and proposed actions taken in 2009 in Madrid and London, what actions have been taken between these dates and now and what effects they had on reducing carbon emissions, fuel consumption and air pollution.

It aims to critically evaluate progress or otherwise with climate change mitigation in Spain and the UK and in particular Madrid and London over the last ten years, in the context of other geo-political developments, such as trade wars and political upheavals in many parts of the world. Rising populism, often supporting climate doubters and protectionist trends also contributed to climate change challenges.

The climate change debate attracted prime political attention at global as well as national, city and even neighbourhood and individual level. The argument that actions undertaken by individual countries or cities were too negligible to make a difference and might hamper their competitiveness were countered by increasingly active pressure groups, often supported by very young persons who see their future at stake. Over the last ten years more countries and cities have not only set stringent targets for adverse impacts on climate change but taken action [4] to implement them at national and city level.

4.1 Climate change strategies and targets at national level in Spain and the UK

4.1.1 Population issue

Since 2009 many threats to climate change have not waned. Rapid urbanisation especially in the global South and relentless population growth are acerbating the climate change challenge. Although slowing down, population increases in both Spain and the UK (as well as in Madrid and London) are forecast to continue over the longer term and will add to their climate change pressures.

[3] https://www.ft.com/content/7288bfd6-3fb6-11ea-a047-eae9bd51ceba
Financial Times, 25 January 2020. Burning questions at first UK climate change citizen assembly in Birmingham 24-26 January 2020. https://www.climateassembly.uk/?gclid=EAIaIQobChMIxsDXmOmj5wIVAbDtCh2EMgP5EAAYASAAEgLYCPD_BwE

[4] E.g Finland and Helsinki in particular

'Is State'	Spain	UK	Madrid	London
Population (2009 paper) % migrants & ethnic population	46,157,822 (2008) 5,268,762 (2008)	60,975,000 (2007 est) 6.3 million (2004 est)	3.273.006 (2008) 571,864 (2008)	7.56 million (2007) [13% UK] 162,000 [2.14%] [39% of E&W] 8,787 million (2016)
Population (2020 latest stats) Forecasts	47,100,396 *2019) -11% by 2050	66,436,000 (2018 est ONS)	3,266,126 (2019)	9.3 million (2020 est) * 10.8 m (2041)**
GVA (gross value added, workplace basis) (2009 paper) GVA per capita (2009 paper)	GDP PPP 1.378 trillion US$ (2008 est.) GDP PPP per capita $34,600 (2008 est.)	GDP PPP 2.231 trillion US$ (2008) 1.358 trillion £ GDP PPP per capita 36,600 US$ (2008)	114,906,801 (2006) 30,094 (2006)	£ 251 billion (2007) [21% of UK total] = 66% above UK average but 3rd deprived region
GVA (2020 latest stats) GVA per capita		GDP PPP 2.925 trillion US$ (2017 est) GDP PPP per capita US$ 44.300 (2017 est)	GDP 140,608,809 € (2018) GDP per capita 43,722 € (2018)	GVA (2015) £ 378. 4 billion GVA per capita £ 43,629

Comparative Table: population and GDP Spain – UK, Madrid – London. Sources: Madrid: National Institute of Statistics, List of Inhabitants, Madrid City Town, Madrid Institute of Statistics of the Community of Madrid. London: * CIA World Factbook, London: Government statistics and inventories. ** Draft London Plan, 2017, London Mayor's Transport Policy 2018.

4.1.2 Decarbonisation strategies

In 2009,[5] Spain and the UK were among the leading countries to take positive actions towards their climate change problems and chose to play a global role, arguably because they were aware of their high pollution levels owing to their prolific energy consumption.

	Spain	Spain	UK	UK
overall energy consumption in mt/ktp oil equivalent/pa	147 *(2007)*	3, 261 ktp (2017)	240 *(2001)*	*143 (2018)*
overall CO2 emission in mt/kt CO2 equivalent/pa	330,497 (2004) 349m230 (2017)	10.769 kt CO2 (2017)	587,261 (2004)	364 (2017) 373.2 (2017)*

Comparative Table. Is-state: national - city energy consumption and CO2 emissions (2009 – 2019). Sources: Spain: National Greenhouse Gas Inventory Report 2019. Ministry for Ecological Transition; Madrid Energy Balance of the Municipality of Madrid, Report 2017, Madrid City Hall. UK: Climate Change Committee 2019, Carbon Brief (190204), 2017 UK Greenhouse gas emissions, final figures, statistical release, national statistics, DBEIS 2019

Spain and the UK set stringent targets for CO2 emission reductions, allocated funds for mitigation and adaptation, and acted on what was in their direct control, e.g. improving energy efficiency of their own buildings and decarbonising their transport vehicle fleet, besides awareness raising campaigns to change consumer behaviour. Ten years on, the effects of these measures are real and both countries as well as their capitals remain committed to a carbon neutral future by 2050. Although the target to reach zero carbon emissions by 2050 was agreed by COP25 in Madrid in 2019, it has been adopted by the EU in 2019 (albeit without Poland), as well as by both Spain and the UK, and London in 2017 [6] (labour) and Madrid in 2019 [7] (socialist).

National level	Spain *(base 1990)* *2009 is state*	Spain (base 1990) *2020 is state*	UK *(base 1990) 2009 is state**	UK (base 1990) *2020 is state*	EU (base 1990)
	- 37 % by 2012	-17% by 2020	- 20% by 2010	- 43% by 2020**	
		-20% GHG by 2030	- 26% by 2020	- 51% by 2025***	
		-90% GHG by 2050	- 60% by 2025	- 57% by 2030****	-40% GHG by 2030 new aim = 55% by 2030
		target: 100% non-renewables by 2050 70% by 2030	- 80% by 2050	- 100% by 2050*****	-100% by 2050 (2019 - except Poland) 20% renewable energy by 2020

Comparative Table: National CO2 emission reduction targets (2009 – 2019). Sources: Spain: National Integrated Energy and Climate Plan, 2021-2030, (2919); CarbonBrief, Euractiv 2018. UK: * Climate Change Act 2008. **3rd carbon budget 2018-22; ***4th carbon budget-2023-2027; **** 5th carbon budget 2028-2032; ***** update Climate Change Act (in 2019)

[5] Compare current situation with that in 2009. Judith Ryser & Teresa Franchini. Towards Low Carbon Cities: Madrid and London, Isocarp congress 2009.

[6] London Environment Strategy, GLA 2017

[7] In September 2019 the government of Madrid reached a political consensus on the climate emergency, which was rejected by the extreme right.

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Since 2009 the policies for CO2 reductions per sector have evolved and changed, influenced in part by the results of measures achieved as well as by the various sectoral lobbies. At state level, the commitment to overall CO2 emissions reductions remains firm, as well as the commitment to act on own estates and transport fleets. However, the pressures on other sectors by lobbies have impacted on targets and measures.

4.2 Spain: current situation

The challenge of climate change for Spain is particularly challenging, due to its geographical position and socio-economic conditions. While the planet increased its global temperature by 1.1ºC since the pre-industrial period, in Spain the temperature has risen by 1.7ºC.[8] 70% of Spain's surface area is at risk of desertification, and the coasts of the Mediterranean, the Balearic archipelago and the Canary Islands are especially vulnerable to rising sea levels.

The report "Climate Emergency in Spain", prepared by the Spanish Sustainability Observatory for COP25, details the effects of climate change in the country at present, which in brief are:

- the country's average temperature increased by 1.57 ºC in just 57 years, rising from an average of 14.0 ºC between 1970-1979 to 15.7 ºC between 2010-2019
- the average temperature in the provincial capitals has increased by one degree in the last 30 years. In some cities such as Madrid, Barcelona and Alicante the increase is more than 2 ºC
- the current summer is 5 weeks longer than at the beginning of the 1980s
- the surface temperature of the Mediterranean has increased by 0.34ºC per decade since the beginning of the 1980s
- the increase in the level of the Mediterranean is estimated at 3.4 mm per year from 1993 to 2017
- the increase of CO2 concentration in the atmosphere is 1.9 ppm per year since 1984
- 33 of the 52 glaciers that existed in 1850 have disappeared, most of them after 1980
- the effects on biodiversity are reflected, among other phenomena, in the distribution of species and migrations, in changes of habitats, behaviour and food
- GHG emissions fell by 2.3%, but increased by more than 15% in 2018 since 1990. Spain is the EU country that has increased its GHG emissions the most since 1990: in 27 years they have increased by 17.9% while in Europe as a whole they have decreased by 23.5%
- the ten dirtiest companies release 62% of the fixed emissions and 25% of those of the whole country
- in certain areas there have been unprecedented levels of rainfall in the last 100 years and floods have caused losses in the millions
- the last decade has seen more, larger, more intense and longer heat waves than in previous decades
- the longest, most extensive and lowest temperature cold waves were recorded in the 1980s and only one in the early the 2000s
- in 2019, 80,000 hectares of forest were burnt[9]

The solution before the damage becomes irreversible is to achieve climate neutrality by 2050, as scientists have been advocating since the 1970s.

4.2.1 National Strategies: from Kyoto to the “climate emergency" declaration

As a result of the Kyoto Protocol Agreement, Spain committed itself to limiting the increase in its emissions to 15%. The path that began in 1997 developed irregularly, associated with the political will of successive governments and the economic fluctuations of the national and international scene.

In 2004 the European Commission sent the first air quality warning to Spain - along with Austria, France, Germany, Ireland, Italy, Luxembourg, Portugal and the United Kingdom - urging it to intensify its efforts to reduce air pollution, particularly in their urban areas.

[8] according to the Spanish Meteorological Agency in December 2019
[9] "Climate Emergency in Spain", prepared by the Sustainability Observatory for COP25.

The actions adopted during the socialist government's term of office (2004-2011) were numerous, including the promotion of renewable energies and the approval of a wide range of legal instruments: National Plan for Adaptation to Climate Change 2006, Technical Building Code 2006, Spanish Air Quality Strategy 2007, Spanish Strategy for Climate Change and Clean Energy, Horizon 2007-2012-2020, derived from the Spanish Strategy for Sustainable Development 2007, Plan for Urgent Measures, Action Plan E4 2008-2012, Renewable Energy Plan 2005-2010, National Emission Rights Plan 2008-2012.

The inactivity of the subsequent conservative government (2012-2018) in environmental matters was limited, since the measures of the National Air Quality and Atmosphere Protection Plan 2013-2016 did not give the expected results and the concentrations of the main pollutants continued to increase, while the next Plan for the period 2017-2019 was not executed. During these years, affected by the severe economic crisis that devastated the country's productive base, the lack of support for renewable energies, the maintenance of coal-fired power stations and the scant attention paid to reducing polluting vehicles exemplify the absence of political interest in global warming. Faced with inaction by the central government, actions were taken by some city and regional governments. One of the main environmental organisations, Ecologistas en Acción (Ecologists in Action), highlights the dismantling of a good part of the existing environmental legislation between 2011 and 2015 - Coastal Law, Forestry Law - and the blocking of initiatives by other groups, which have prevented significant advances in environmental protection.

The results of these actions were insufficient and during these almost 20 years, the Kyoto Protocol ended up being fulfilled due to the purchase of emission rights from surplus countries and the sharp fall in emissions due to the economic crisis. Even so, Spain was warned by Brussels on numerous occasions about air quality, especially in Madrid and Barcelona, where nitrogen dioxide (NO2) limits had been exceeded for almost a decade.

According to the European Environment Agency, Spain was the European Union country where greenhouse gas emissions grew the most in absolute terms between 1990 and 2017. During this period, they increased by 51.7 million tonnes, which is 17.9%. This figure contrasts with the EU as a whole, which reduced its emissions by 23.5% in those 27 years while GDP grew by 58%.

For the socialist government elected in 2018, the climate change problem became a state issue. The creation of the Ministry for Ecological Transition (MITECO) in the same year was intended to meet the objectives set by the EU for the 2050 horizon.

The 2017 data provided by the National Greenhouse Gas Inventory Report, 2019 edition, prepared by MITECO, confirmed the seriousness of the situation: total GEI emissions amounted to 340,230.88 kilotons of CO2, which represented +4.24% compared to 2016, +17.9% compared to the base year 1990 and -23% compared to 2005. The sectors with the highest level of emissions were transport (26%), electricity generation (20%), industrial activities (19%) and agriculture (12%). The main reductions were in the commercial and residential sector (-3.3 %) and in the use of fluorinated gases (-17.2 %). Emissions covered by the Emissions Trading Scheme (40.1 % of total) increased by +10.3 % compared to the previous year.

This situation was slightly reversed in 2018. According to data provided by the National Statistics Institute (INE), GHG emissions fell by 2.3% over the previous year, making it the fourth lowest level in the last ten years.

4.2.2 National Strategies: from Kyoto to the “climate emergency" declaration

Spain officially declared a climate emergency in the country on 21 January 2020, in line with the approach taken by other countries - Ireland, Canada, France, Austria, Argentina, Malta, Bangladesh and Andorra - and many cities and regions. The fight against climate change as one of the main objectives of political action of the socialist government established in 2018.

This initiative will implement 30 lines of action, some of which are priorities:

-drafting of the climate change and energy transition act to guarantee the country's decarbonisation by 2050, using a 100% renewable electrical system, emission-neutral vehicles and a non-polluting agricultural system

-drafting of the second national adaptation plan, including the national climate observation system and the development of impact indicators

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-creation of the citizens' assembly on climate change, a participation mechanism that strengthens cross-cutting and equal representation of the civilian population

-promotion of productive transformation, to encourage the transformation of the industrial model and the service sector through just transition agreements, to favour the sustainability of economic activities and the creation of quality jobs

This initiative affects many aspects: circular economy, sustainable tourism, demographic challenge, fight against desertification, waste treatment, sustainable mobility, financing of public transport, establishment of low emission areas in municipalities with more than 50,000 inhabitants, improvement of forestry activity, increase of protected marine areas, rural development, protection of biodiversity, opportunities for energy transition and generation of green jobs.

The Climate Change Act includes investment of more than 200 billion euros for the decade 2020-2030. The first step will be to draw up a National Sustainable Finance Action Plan and a programme for the issue of green bonds by the Public Treasury. The fiscal policy will integrate the climate change variable by generating a "green taxation" that will set dissuasive taxes and fiscal incentives to drive the transformation of the productive sector. Subsidies and tax benefits for energy products of fossil origin will be eliminated, except in cases justified by social or technological reasons, and no applications for exploration, research permits or concessions for the exploitation of hydrocarbons or fracking activities will be authorised. This is the beginning of a new path at state level, the results will be seen during the march.

4.3 United Kingdom: current situation

In the UK, more extreme weather conditions since 2009, fiercer storms, recurrent flooding, hotter and drier summers and coast erosions have risen public awareness of climate change and its impact on people's wellbeing. Consumer movements have started to demand more action from commerce and industry to curb adverse effects. Among public requests are to reduce the use of plastic in packaging, inbuilt redundancy in products, lower meat and dairy product consumption and curbing travel by air and by car, while turning more to cycling and walking.

Besides aiming at carbon neutrality by 2050, the UK has upgraded several sectoral targets as regards climate change since 2009. In 2019, UK renewable energy targets were updated to 20% by 2020, up from 15% from base line 2008 and the Climate Change Committee advised for 30%-45% renewables by 2030. However, this includes a large % of nuclear energy which needs new generation plant, while nuclear waste issues are not addressed. The transport GHG and CO2 emission targets were also updated.

sector	1990	2000	2010	2015	2020	2025	2030	2035
agriculture	58.9	54.8	48.6	49.1	46.6	44.8	44.4	44.3
residential	80.1	88.7	87.5	66.3	66.4	67.3	71.3	74.9
transport	121.9	126.7	120.1	120.0	116.4	112.2	109.1	107.6
en supply	277.9	220.9	206.7	144.1	86.0	67.7	74.0	76.0
business	114.4	116.2	94.8	84.6	75.9	66.4	59.7	57.2
industry	60.0	27.1	12.7	12.7	10.0	9.4	9.0	8.8
waste m	66.6	62.7	31.7	18.2	13.7	12.0	11.0	10.5
public	13.5	12.1	9.7	8.1	7.0	6.9	7.5	7.9
land forest	5.7	0.5	-5.8	-7.4	-1.2	-9.0	-6.8	-5.3
total	799.0	709.7	605.9	495.7	410.9	377.6	379.2	382.0

UK Greenhouse gas emissions by selected source, MtCO2e (2019). Total net GHG emissions. Source UK NECP, 2019 (p 99), Updated Energy and Emissions Projections 2017. https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017

However, despite UK targets for transportation air pollution reductions road traffic increased in Great Britain from 255 billion miles travelled in 1990 to 328 billion miles in 2018, an increase of 29%. While total fuel used for road transport in the UK remained relatively stable from 1990 to 2017 diesel use overtook petrol use in 2005. Greenhouse gases increased and made up 21% of UK total GHG emissions in 2017 while those from other sources had decreased. Nevertheless, due to more stringent exhaust emission limits, the most damaging pollutants to health decreased (CO, particulate matter, NOx), but in 2018 only 0.5% of all licensed vehicles were ultra-low emission vehicles. [10]

[10] In-Depth Q&A, the UK climate change projections 2018, CarbonBrief 190917, https://www.carbonbrief.org/in-depth-qa-the-uk-climate-projections-2018

It should be noted that changes of consumer behaviour had some impact on the government, together with the latest Climate Change Scenarios for the UK (UKCP18) which show that the trend to drier summers and hotter wetter winters in increasing, together with sea level rises. The government has introduced some measures toward some of these requests and updated its climate change related legislation generally.

4.3.1 Legal position

The main updates of UK legislation and strategies since 2009 are:

- the UK's Integrated National Energy and Climate Plan, 2019 (NECP)
- the National Planning Policy Framework, updated in 2019 (NPPF)
- the Energy Act, 2011
- UK Building Regulations Part L, 2013
- Clean Air Strategy 2019
- Lean Growth Strategy
- Climate Change Scenarios, UKCIP 02, 09 and 18
- UK 5 Carbon Budgets (latest 2028-2032, -57% by 2030, 1,950 MtCO2e).

Some competences related to climate change are devolved to the UK nations, Scotland, Northern Ireland and Wales. Despite new national legislation and recent government interventions, pressures on industry and commerce as well as on farming remain moderate. This points to a growing discrepancy between political objectives and changing wishes of the population as awareness of the climate change stress has entered the social media and public debate. An illustration of this are the disruptive demonstrations of Extinction Rebellion which were tolerated by the inconvenienced public but are under threat to be outlawed in London, despite the civil right enshrined in UK legislation to demonstrate peacefully. The frailty of climate change measures remains a crucial issue as they are subjected to sudden reversals when opposing executive political powers obtain majorities at state and city level.

5 POLITICAL EVOLUTION OF CLIMATE CHANGE INTERVENTION AT CITY LEVEL: MADRID AND LONDON

A defining issue is that implementation of state legislation and measures is bound to take place at lower levels: in regions and cities, by civic pressure groups and even individuals. Moreover, climate change issues range across traditional functional sectors and their respective competences. This points to the need of horizontal and vertical cooperation rather than confrontation driven by political self-interest which hampers progress also at global level. Furthermore, Implementation tends to stand a better chance with genuine devolution of operational competences and related budgets.

5.1 Madrid

Madrid is aware that the prevention of climate change is one of its main challenges, since the conditions of its geographical location aggravate the effects of emissions produced by urban activities and give rise to periods of dangerous levels of contaminants.

5.1.1 Air pollution

The city of Madrid adopted the first Ordinance on air pollution control in 1968. In 1978 the Automatic Pollution Monitoring and Control Network was created and in 1982 the Atmospheric Sanitation Plan was drawn up, leading to the first emissions inventory. The incorporation of Spain into the EU in 1986 meant the transposition of Directive 80/779/EC and the setting up of the reference framework for air quality assessment. The city council's actions in this respect in the 1990s focused basically on the replacement of coal-fired boilers.

The high level of air pollution recorded in the first decade of 2000 led to the approval of the Local Air Quality Strategy 2006-2010. Its action programme addressed several aspects - transport, fixed sources of pollutant emissions, urban waste - and even the need to act against climate change in response to the Kyoto Protocol. While the plan succeeded in reducing pollution levels, the Air Quality Plan 2011-2015 recognised the difficulties of meeting the targets set by the EU, in particular those produced by urban traffic which

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accounted for 65% of NOx emissions in 2009. The main objectives of this plan were to discourage and restrict the use of private motorised vehicles and to promote public transport and alternative modes of mobility. The most relevant urban development action was the delimitation of a Low Emission Zone in the city centre, a proposal that was never implemented. The actions were limited to the pedestrianisation and tempering of some streets and the delimitation of four Residential Priority Areas in which access to non-resident vehicles was restricted.

In parallel to these measures, critical air conditions at certain times of the year due to a combination of meteorological factors and pollution levels, led to the adoption in 2016 of the Protocol of measures to be taken during episodes of high nitrogen dioxide pollution, activated since then every December, with the exception of 2019.

Nevertheless, these measures were not sufficient to meet the objectives of national and European legislation despite successive EU warnings. The left-wing municipal government which took office in 2015 drew up Plan A, proposing a set of measures organised into four lines of action: sustainable mobility, urban regeneration, adaptation to climate change and citizen awareness-raising.

5.1.2 Territorial and design measures

The most outstanding action of Plan A was the delimitation of the Central Zero Emissions Area, 472 hectares free of vehicles and with new spaces for pedestrians, bicycles and public transport. This measure included the reform of the main access roads to the city centre, especially the Gran Via. Despite the fierce reaction of the political opposition party, previously in municipal power, and certain social factions which were reluctant to eliminate vehicle traffic, the proposal was carried out between 2017 and 2018. The implementation of Madrid Central and the reform of the Gran Vía not only meant the reduction of pollution levels in the city centre but also the most important urban transformation developed by the city council during the last decades.

The first action of the conservative government that won the municipal elections of May 2019 was to eliminate Madrid Central due to its alleged lack of effectiveness, allowing vehicles to enter the area again. The intervention of Ecologistas en Accion, Greenpeace and the Plataforma en Defensa de Madrid Central (Platform in Defence of Madrid Central) led to the Madrid courts alleging health and environmental reasons for not eliminating the entry of vehicles into the capital's low-emission area.

5.1.3 Revision of GHG emission targets

The proposal of 2019 includes the design of a specific plan and initiatives, political as well as economic, to guarantee the progressive reduction of greenhouse gases in order to reach zero net balance no later than 2040 and, if possible, before 2035.

The response to this legal setback was the presentation in January 2020 of a new plan that will replace the current one: Madrid 360. The new plan aims to be the tool with which Madrid city council will definitively comply with the air quality limits established in Directive 2008/50/EC of the European Parliament and of the European Council of 21 May 2008. It intends to reduce nitrogen oxide emissions by 15% more than what was proposed in Plan A, as it provides for a 20% reduction in NOx by 2023.

5.1.4 New measures

One of the most unique measures included in Madrid 360 will be the pedestrianisation of the Puerta del Sol square and its surroundings with the aim of turning it into a true zero emissions zone. Another flagship measure is the Zero Line, zero emissions and zero cost for users, formed by two bus lines to move across the Centre district. In addition, another low emission perimeter line is proposed around the Central district, for a fee. All the buses of the Municipal Transport Company will also be renewed, incorporating electric vehicles.

With regard to traffic restrictions, they will depend on the environmental marking of each vehicle and no non-resident may park on the surface. Unlike the previous plan, vehicles belonging to shopkeepers in the area and those occupied by more than two people will be allowed to circulate freely, a measure that has already been contested by environmental groups that are committed to the total elimination of traffic. To facilitate the decarbonisation of the city, economic aid is planned to replace polluting vehicles with technologically advanced ones.

It is hoped that the actions taken by the new administration will fulfil their mission, since at the end of 2019 the Madrid City Council, in line with the EU, declared a climate emergency.

5.2 London

Over recent years, the Greater London Assembly and the Mayor of London have acquired a number of new competences, but only few related to climate change issues, and their tax and fund raising powers remain very limited and tend to be ultimately under the control of central government.

5.2.1 London climate change strategies and targets under changing governance

Regarding London's environmental policy, the political position of climate change has altered in London since the inception of its own government, Greater London Assembly and directly elected Mayor in 2000. The fist mayor of Greater London Ken Livingstone (labour, 2000-2008) had a very progressive approach to the environment. He had commissioned scientific studies and projection methods to establish London's is state and what targets and measures were needed to curb environmental pollution.

This was not least due to his lobbying that under the Greater London Authority Act 2007 the mayor has a new statutory duty to contribute towards the mitigation of, or adaptation to, climate change in the UK and to produce statutory strategies for climate change mitigation and energy and for adaptation to climate change in London. In 2008 this included retrofitting existing buildings which contributed 73% of CO2 emissions and make fuller use of Combined Cooling Heat and Power (CCHP) technologies. [11]

The subsequent mayor Boris Johnson (conservative, 2008-2016) had other priorities but did not alter the environmental policies of the previous London Plan significantly. He did not rock the ecology boat because it was in his political interest, not for reasons of continuity. Reaping the fruits of the Olympics to London brought to London by the previous mayor gave him greater political gains.

The current mayor Sadiq Khan (labour, 2016-2020) continues to support climate change mitigation actions but with a less firm approach as his priority is with social housing provision (which is not happening though, due to the structure of the neo-liberal housing market system in the UK, the vested interests of land owners and property investors, including unchallenged global ones and lack of mayoral competence in this field).

5.2.2 The new Draft London Plan 2017 and updates

Mayor Sadiq Khan considers his "Replacement Plan" as different from its predecessors with its declared focus on sustainable development. Climate change holds a modest role in the mayor's concept of "Good Growth" - socially and economically inclusive and environmentally sustainable - which is underpinning his new statutory draft London Plan 2019. Policy GG6, "Increasing efficiency and resilience", seeks to improve energy efficiency, support move towards a low carbon circular economy, contribute to London becoming a zero carbon city by 2050 and ensure that buildings and infrastructure are designed to adapt to a changing climate.

His broad environmental goals, climate change targets and actions are laid down separately in non-statutory documents: The London Environment Strategy, 2017[12] (for public consultation), The Climate Action Plan, 2018[13] where the overall CO2 reduction target is set at 40% to be reached between 2018-2022, 50% between 2023-2027 and 199% by 2050 and the Zero Carbon London, A 1.5C Compatible Plan, with its amendments in December 2018.

In 2014, London's GHG emissions were estimated at around 38 MtCO2e, 7% of UK's total emissions. They have fallen by 26% since 1990, largely due to reduced gas consumption and decarbonisation of the national electricity grid. In 2014 35% of emissions were estimated generated from homes, 42% from workplaces, and 23% from transport. Measures will include retrofitting existing buildings and higher insulation standards for new build. The London Environmental Strategy shows how reaching the 2050 is expected to be achieved through combined electricity and gas grid decarbonisation and local action, the latter subject to funding.

[11] London Mayor's Climate Change Action Plan 2007
https://www.iema.net/news/2016/01/08/Mayor-unveils-London-Climate-Change-Action-Plan/
[12] Mayor of London, London Environment Strategy, Draft for public consultation, August 2017
[13] Mayor of London, 1.5C Climate Action Plan, GLA 2018, amended December 2018.

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London electricity demand accounts for almost half of total CO2 emissions which are decreasing with increasing use of renewable electricity generation (25% of total UK generation, to reach 59% by 2030 included nuclear energy). Unfortunately, no similar actions are taken to decarbonise gas which amounts to about half of total energy consumption in London, contributing 30% of London's total GHG emissions.

Energy consumption is to be reduced by reaching 15% of renewable district energy supply by 2030. Measures are local zero emission zones and increasing numbers of ULEZ (Ultra-Low Emission Zones), zero emissions of own car fleet by 2025, of heavy vehicles by 2030 and of buses by 2037. As regards buildings all new building should be zero carbon by 2019, and minimum energy performance standards introduced in all rented properties. Smart meters should be installed in every home by 2020 and lofts and cavity walls insulated by 2020, as well as gas boilers replaced by high efficiency models. By 2030 there should be wide deployment of low carbon heating like heat pumps. London carbon budgets show the required energy efficiency levels for housing, non-domestic and transport to meet these targets.

London produced 18 mt of waste in 2015 (3.1 mt household is 17%, 5.0 mt commercial industrial is 28%; 9.7 construction demolition excavation is 54%). Direct GHG emissions from waste represent 2% of London's total. Only 52% is recycled and the target is to increase recycling to 65%, reduce food waste by 20% by 2025 as well as single use packaging waste and to generate low carbon energy from residual waste, leaving very little to landfill. This is estimated to save 101,000 t of CO2 in 2021, 169,000 t by 2025, and 535,000 tCO2e by 2031.

A number of policies consolidated in Chapter 9 "Sustainable Infrastructure" contribute to the mayor's commitment to London becoming a zero-carbon city by 2050. They are: [14]

Policy SI1 improving air quality, Policy SI2: minimising greenhouse gas emissions, Policy SI3 energy infrastructure, Policy SI4 Managing heat risk, Policy SI7 Reducing waste and supporting the circular economy.

[14] Policy SI1 improving air quality
Reference to Air Quality Focus Areas. Large developments should use Air Quality Positive approach, and others should be Air Quality Neutral, and comply with the Non Road Mobile Machinery Low Emission Zone (reduce emissions from demolition and construction). Air Quality Assessments -AQAs should be submitted with new developments. Onsite reduction is preferable but offsite equivalent provision is possible. Measures to reach Air Quality Positive could include with low or zero emission heating and energy, improvement of public transport, walking and cycling infrastructure, avoid street canyons which prevent effective dispersion of pollutants, use sensors. See GLA's LAEI: the London Atmospheric Emissions Inventory. See also Air Quality Focus Aras (AQFA) map, 2017. Key performance indicators and measures: air quality. Positive trend in approved referable development applications demonstrating that they meet at least air quality neutral standard for emissions (based on a rolling average).
Policy SI2: minimising greenhouse gas emissions
A major development should be net zero carbon (reducing CO2 emissions from construction and operation, minimise annual and peak energy demand. Major developments should include besides an Environmental Impact Assessment a detailed energy strategy to demonstrate how the zero carbon target will be met within the framework of the energy hierarchy (see diagram: reduce energy use, clean through energy efficiency, green through renewable energy, offset) and be monitored, re energy performance. A minimum of 35% of on-site reduction beyond building regulations 2013 part L is expected (10% for residential, 15% non-residential through energy efficiency measures). London Boroughs to use BREEAM measures and targets in local plans.
BUT in lieu: cash to borough carbon offsite fund and/or offsite alternative proposals are possible but should be minimal by using carbon offset price mechanism. Maximise onsite electricity and heat production (using solar, photovoltaic, thermal, innovative building materials, smart technology. More in London Environment Strategy.
Policy SI3 energy infrastructure
Produce energy masterplans for large scale developments (establishing most effective energy supply options)
Development plans should identify suitable sites for necessary energy infrastructure requirements and upgrades of existing ones.
Large scale developments within heat network priority areas should have a communal heating system following the heating hierarchy (e.g. decentralised heat pumps, heat from zero emission sources, fuel cells, low temperature networks, low emission CHP, low NOx gas boilers, secondary heat sources, connected to existing heat networks where feasible, facilitate new connections.
See map heat network priority areas. Increase use of renewable energy sources and CHP.
Policy SI4 Managing heat risk
Developments should minimise internal heat gain and impact on urban heat islands, reduce potential overheating and reliance on air conditioning.
Policy SI7 Reducing waste and supporting the circular economy
Increase recycling and reuse, produce low carbo energy from waste (65% by 2030 from municipal waste, 95% by 2020 from construction and excavation waste). But waste bags are littering London streets inordinately which are a health hazard, an environmental pollution risk and an image problem.

5.2.3 Sustainable transportation policies and GHG emission reductions

GHG emissions from transport were around 8.6 MtCO23 per her in 2914. They aim is to reduce it to 1.5 MtCO2e a year by 2050. The Mayor's Transport Strategy aims to reduce CO2 emissions from road, rail and shipping by 72% by 2041. Aviation which contributes 2,5% of GHG in London (around 950,000 tVO2e per year) and curbing them appears difficult. Heathrow expansion is likely to increase them by 1/3.

The mayor's key London transport strategy is that 80% of all trips in London will be made on foot, by cycle or using public transport by 2041. Towards this aim he has developed a walking action plan, a cycling action plan.

London's congestion charge was conceived by the first London mayor and implemented. The next conservative mayor revoked the planned extension of the congestion zone in central London (in the richest borough), while the current labour mayor introduced ULEZ, Ultra low Emissions Zones in central London in 2018 and plans to extend them to the outer ring road (North and South circular) In 2011, the congestion charge cut CO2 emissions by 16% (100,00 t) = -1% of London's total road traffic in 2011. Half was due to 75,000 fewer vehicle daily, and half to remaining traffic experiencing less congestion. [15] Since then, car traffic has increased again in the congestion charge area but no monitoring data is available. ULEZ has reduced emissions of nitrogen oxides (NOx) by some 29% in January 2020 since its inception in April 2019.

The London Plans put more emphasis on cycling, A hire cycle infrastructure was provided with sponsorship from banks. Cycle superhighways were constructed across London and are planned to extend to outer London. Where lanes were established it is estimated that cycling has increased by up to 53%. Total daily distances cycled have reached 4 km in 2018-2019. [16] Car pool companies obtained licenses to operate in London. Charging infrastructure was gradually provided for electric cars but the uptake is slow and the charging facilities considered insufficient and too slow. Walking is advocated but facilities are hampered by prioritising traffic flows, although they average only 11 miles in central London during rush hours and idling engines are a pollution problem. The cycle highways have attracted or catered for increasing numbers of cyclists (commuters) in London, but the reason for this increase may also be extensive commuter train strikes and steep fair rises of rail and regional and local transport. The aim of the current mayor is to shift transport modes toward cycling, walking and public transport.

In the London Mayor's Transport Policy 2018 the target of mode share is in 2041: 20% car, taxi, private hire vehicle - 80% walking, cycling, public transport for 33 million day trips, from 2015: 37% car, taxi, private hire vehicle - 63% walking, cycling, public transport for 26.7 million day trips

5.2.4 Energy strategy, consumption reduction targets and energy efficiency measures

The London Energy and Greenhouse Gas Inventory (LEGGI) presents the factual situation of energy consumption and level of carbonisation of London for all sectors (homes, workplaces and transportation from 2008 to 2017.[17]

London's energy consumption was 134,653 GW in 2017 in total (54,829 GW domestic, 47.727 GW industrial and commercial, 32,098 GW transport). This compares with 149.388 GW in total in 2009 (63,462 domestic, 54,413 industrial and commercial, 32,479 GW transport). [18] London's CO2 emissions from energy use were 30.3 mt, a 30% reduction on 1990 levels, and a 40% reduction since peak emissions in 2000. This is despite an increase of population by nearly 30% since 1990. London's per capita emissions are estimated at 3.4 t of CO2e in 2017, down from 3.5 of CO2e in 2019.

London's energy strategy includes measures to reduce electricity consumption,[19] decentralise energy generation, decrease fossil fuel use and increase renewable energy use. Energy consumption has indeed declined in London since 2009, but for various reasons and efficiency measures are among them. The Draft London Plan is poor in is-state data on energy consumption, CO2 emissions, energy status of building stock, etc. not least because sources of information are fragmented and often privatised. This may pose a problem

[15] . source: C40 Cities, 111103. https://www.c40.org/case_studies/londons-congestion-charge-cuts-co2-emissions-by-16

[16] Evening Standard, 180701. Cycling in London at record levels.

[17] LEGGI, London Energy and Greenhouse Gas Inventory.2008-2017 https://data.london.gov.uk/dataset/leggi

[18] Source LEGGI, https://data.london.gov.uk/dataset/leggi

[19] London's electricity consumption in 2013 was 39,337 GWh (source: London Environmental Strategy, 2018 GLA), as opposed to 14.000 kt oil equivalent (see 2009 table).

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for proper monitoring of the effectiveness of the targets. Natural gas consumption has decreased in London by 25% since 2000, according to the London Energy and Greenhouse Gas Inventory (LEGGI).

A key problem with all these targets is that the Greater London administration does not have the competence of implementing most of them and has to rely on the London Boroughs to act upon their own housing stock and transport fleet, and mainly on the private sector which owns and supplies the bulk of London's built environment. Nevertheless, the Mayor of London has competences over a number of specialised agencies: Transport for London, the London Development Agency (Olympic site), the London Fire and Emergency Planning Authority, the Metropolitan Police. He can influence their operational actions directly and make them lower adverse effects on climate change in the Framework of the London Plan. The London Plan has also certain powers to influence the London Boroughs, through guidance toward lowering adverse climate change impacts and reducing GHG emissions. The key actions focus on transportation, retrofitting existing building stock and standards for new build.

It has to be stressed that targets are not reality, and measures to implement them are of the essence at all levels. Monitoring results show that most of these targets are not met within the prescribed timeframe. Nevertheless setting targets it useful to mobilise public opinion and change behaviour.

Overall, the current mayor has adopted the 2050 zero carbon target for London in 2016 and laid down implementation objectives in his Draft London Plan. Quite a few actions can be undertaken by the Greater London Authority itself and the agencies under the Mayor, in particular Transport for London, but the majority of its targets will need to be pursued by lower tier authorities, the London Boroughs and the private sector which owns the energy utilities and some transportation networks in London.

However, while targets have been made more ambitious, their realisation lags behind when measured at interim periods which would require increasingly stringent actions to achieve a carbon neutral state in 2050. It means also more efforts to reach consensus and cooperation from all stakeholders who will weigh up how achieving these targets will affect their habits, living standards and aspirations against saving them and the planet from climate crisis.

6 CONCLUSIONS

Environmental concerns are not new and have evolved over time. A major wave of environmental awareness occurred in California in the 1960s, followed and sustained elsewhere. The language was different then. Activists talked about environmental protection, ecological footprint reduction and balancing the eco-system. In the 1970s the Gaia hypothesis (Earth System Science in the USA) of perpetual conditions for life became popular. [20]

The discussion shifted to global warming in the 1980s and to climate change in the 1990s. Greenhouse gas emissions from energy production and use were already mentioned as harmful in the 1950s and NASA studied their evolution from the 1970s to today. Global warming became a political issue with governments which were setting targets and promising action. In the 21st century the discussion moved to the green economy combined more recently with the circular economy. In 2020, climate change gained political and market attention at the World Economic Forum in Davos. Safe on the benefits of trees, little consensus transpired on a way forward though. The UN was and remains actively involved in curbing adverse climate change effects, but as a voluntary intergovernmental agency it has little power over global action.

At national level, politicians have more control over their commitments and actions than international agencies. Both Spain and the UK have signed up to the Paris Agreement, and introduced a target of zero carbon emissions by 2050. Moreover, they have introduced strategies for practical measures to achieve these goals.

Implementation however is mainly in the hands of lower tier administrations and in market economies in those of the private sector, besides individual behaviour change. Clearly, operational interventions are mainly carried out by regional and city governments and private industry. Community groups and individuals also play a role by both realising local schemes and exercising pressure as consumers which can influence industry and commerce. Indeed, large corporations have started to rethink their attitudes and even take measures toward climate change concerns, while some investors have moved their assets out of fossil

[20] James Lovelock. Gaia, a new look at life on earth, 1979, Oxford Landmark Science.

fuels. Company accounting standards for climate related risks and a price on carbon may accelerate that, although many firms still resort just to 'greenwash'.

Looking back at two decades of climate change and its responses in Spain and Madrid and the UK and London, what are the lessons to be learnt? A number of overarching issues seem to emerge from the empirical data and the changing debate on the future of the planet.

6.1 Climate change targets

Ambitious climate change targets have been set at both the state and city levels, but their materialisation seems very unlikely. So the question is, should their decision makers abandon targets or reduce them to more doable levels or should they tag their visions high as an incentive for others to follow?

Despite tangible effects of climate change any consensus on what goals to adopt and what actions to undertake seems to be difficult to achieve both at city and national level, and even more so by the international community at global level.

A major impediment to climate change mitigation and adaptation which by nature are long term is the political system with its short term cycles and its often abrupt swings between opposite parties. In this complex game key players make their moves at their convenience, but subject to specific rules: the international level dependent on national interests, the European Union as guarantor of collective compliance, the nation states dependent on the economy and the political constellations, the municipalities dependent on votes, and civil society according to their beliefs and prejudices. Moreover, at all levels the players are divided between those who believe that the planet has reached its limits and those who let others make the sacrifices.

6.2 Political power swings

The paper corroborates that every democratically elected swing of political power tends to reverse previous directions of travel and seriously undermine long term progress of combating adverse effects of climate change, despite some efforts at both national and local levels of future proofing such actions. Only a multiparty adoption of remedial objectives stands a chance of realisation. Similar differences of opinion permeate the private market and sometimes civil society, in particular opposing protagonists of the circular green economy to those who believe in purely technological fixes which would enable them to continue with business as usual.

6.3 Actions by civil society

Increasing consumer pressure for sustainable products and services may influence the corporate world, but dependence on energy and fear of declining living standards may overrule such change also among consumers. International 'green' pressure groups requesting sustainable alternatives to current practices and their detrimental impact on global warming, as well as local communities which undertake measures to curb global warming may draw attention of the media but do not command the necessary critical mass to enforce radical change. Not surprisingly in a world where global corporations are often more powerful and wealthy than sovereign countries even in representative democracies the electorate does not necessarily obtain actions to mitigate greenhouse gas emissions promised in political manifestos.

6.4 Who is leading climate change action of the future?

The question remains of where the combat against global warming is going from here, and who will be responsible to lead it in the future? The last word ought to remain with the very young who will have to live with the consequences of the rapid march to global warming. The deserve all the support of those who try to understand the phenomenon and are searching for practical solutions.

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