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Barcelona Societat

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Journal on social knowledge and analysis

December 2020

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Ajuntament de Barcelona

Presentation

Laura Pérez
Major of Social Rights, Global Justice, Feminisms and LGTBI Area

The Coid-19 pandemic is a crisis of crises. It's a health emergency that has caused a profound economic and social crisis, and the WHO has warned that the destruction of the environment and globalisation contribute to the spread of viruses like the one that causes Covid-19. Therefore, the health emergency should not lead us to overlook the climate emergency, as the two are closely linked. Overcoming the pandemic and its economic and social effects is the most urgent task for governments across the globe, but the climate emergency continues to be the greatest challenge faced by humankind. The scientific evidence is overwhelming. In Catalonia, the average temperature has risen by 1.6ºC since 1950, and will increase at a much faster rate over the coming decades if we don't cut greenhouse gas emissions. The group of experts from the United Nations who have been studying climate change for decades have warned us that we must achieve zero emissions by 2050, in order to keep the increase in global temperature by the end of the century at 1.5ºC, a rise that would have a serious impact on the climate, but nevertheless one that could be controlled by putting adaptation measures in place.

Almost all serious political actors now agree on the need for an ecological transition, particularly because of the awareness-raising work carried out by ecological organisations from the global movement for climate justice which has emerged in recent years. Now we have to decide on the direction of this transition, who will win and who will lose out in this far-reaching process of transformation. The climate crisis has a greater impact on women and people on low incomes (both on a global scale and within each country), precisely those who are responsible for emitting fewer greenhouse gases. Given this injustice, there is a need to construct an ecological transition that incorporates social justice and a gender perspective. And this is where cities have an important role to play.

This issue of *Barcelona Societat* aims to contribute to this task, with a series of reflections on the various aspects of the links between the climate crisis and inequalities, and offering concrete examples of fair and just ecological transition policies which combine the efforts to reduce greenhouse gas emissions and the protection of social rights. Barcelona, with tools that have been constructed collaboratively such as the Climate Plan and the Climate Emergency Declaration, is spearheading these policies. The ongoing *Pla Calor* (Heat Plan) involves a series of different initiatives where the ecological is combined with a social and gender perspective, including mobility policies aimed at cutting the pollution which is so harmful to health, the climate shelter network, energy advice points, housing renovation policies and initiatives aimed at transforming schools.

The crisis caused by Covid-19 has hit us hard, but it has also forced us to rethink many things that we have taken for granted. It has highlighted the importance of care work, our own vulnerability, the need for stronger neighbourhood and community networks, etc. Let's use this moment of

collective reflection to push ahead with the great transformation that is needed within our societies over the coming decades: the ecological transition that incorporates a social and gender perspective. This issue of *Barcelona Societat* offers a modest contribution, from a municipal perspective, to the collective reflection this transformation demands.

Foreword

Bru Laín and **Albert Sales**

A few months ago, when we started preparing this issue 27 of the journal *Barcelona Societat* which you now have in your hands, we were using a working title that referred to the "climate change"-"cities" relationship between these two concepts. It was at that point that one of the journal's contributors very cleverly suggested making a change to the title. The idea, she said, was not just to highlight the fact a climate "change" was taking place but also to point out that this change was now a real "emergency". And she was absolutely right. This change is a real emergency, both in terms of the giddying speed in which climate, biodiversity, resource depletion and other changes are taking place as well as the scale of these changes, and the extent of their current and future consequences on large swathes of the population all over the planet. It was clear that the problem or matter we were dealing with, and which we had to identify, related not just to the change taking place but to a genuine emergency.

Likewise, we thought it appropriate to point out from this issue's title that this emergency is not limited to a particular or single dimension but must be seen as a diverse, heterogeneous, complex and plural phenomenon. Therefore, we should not talk about a climate emergency but rather about "climate emergencies". Using the plural helped us identify the problem in its true dimension, that is, a diverse one: the emergencies take different dimensions with different consequences when we talking about the diversity of flora and fauna, the effects on people's health, the changes to atmospheric patterns, water quality, the reduction in biodiversity, air pollution and so on.

Besides their consequences on plant and animal life and on the planet's natural resources in general, the climate emergencies also have very specific effects in terms of their impact on the population, on people. Again, it is worth pointing out that the climate emergencies have very varied consequences on people, on their health and well-being, the quality of their housing, their cognitive performance or their financial situation, to name but a few dimensions of the problem. In this issue of *Barcelona Societat,* we felt it was important to focus on the general effects relating to social justice, in particular those aspects or dimensions relating to issues of gender, social exclusion and poverty in the context of the city.

Accordingly, it begins with an opinion piece that focuses the debate on a new approach when addressing the economic aspects or dimensions of ecology. Ecology and politics cannot be separated from each other, so what the classics traditionally labelled as "political economy" must now be reformulated as "political ecology". We thus move from a more general and conceptual reflection to more empirical and applied research. This is why the next article uses ten indicators to explore the socio-ecological functioning of the metropolitan area. Precipitation and temperature, land uses, the state of vegetation, the effects of fires, the state of biodiversity and the rivers, and energy consumption are some of the indicators that are key to understanding environmental health and the situation in this area, as well as, therefore, our ability to intervene.

On the basis of this diagnosis, we also wanted to look at the role of cities, particularly Barcelona, as major consumers of resources (such as food, water or energy) that produce large amounts of waste and are therefore responsible for a significant part of the climate emergencies. In that sense, cities become large urban concentrations which, by definition, are environmentally unsustainable unless bold and comprehensive policies are adopted that are geared towards ruralisation, in terms of economic activity and also how they operate socially.

If we maintain there are many climate emergencies and that they have many effects, we have to highlight one of their main consequences on one of the key aspects of social justice, namely, energy insecurity. Likewise, we must also take into account the depth of this insecurity and the form it takes. Doing this exercise makes us realise that the current business and energy consumption model is not only unsustainable from an ecological point of view but also that its consequences are very different, depending on which social group we are talking about. These days, energy insecurity mainly affects women in Barcelona, so any proposals for overcoming it must inevitably be based on an eco-feminist perspective.

The climate emergency has traditionally been tackled by central governments or supranational bodies. It has therefore been framed in national or global policies, multilateral agreements, and so on. But cities also play a key role in addressing these climate emergencies and that has been the subject of much less discussion. Consequently, in this issue of the journal, we also reflect on their social impact in the urban context, including institutional architecture and urban public policies, and also provide some key elements for discussing how to conceptualise vulnerability, resilience, mitigation and adapting the urban fabric to the current and future consequences of climate change. We think about how cities suffering effects of their own are, at the same time, key players and leading players in the fight against the climate emergencies.

If we talk about the social justice-related aspects of the climate crisis, we must take energy policy into account as one of the great drivers of social equity or inequity. We therefore propose that we reflect on how to work towards guaranteeing the right to energy and what role can be played by different authorities, such as local government, and different sectors, such as the social and cooperative sectors. Highlighting the role of these players necessarily involves re-conceptualising the place and role of public administration. So we invite you to consider the fight against inequalities as a task that relates not just to social policies but also to energy policy. What is the relationship – if there is one – between energy policy and social policy?

This reflection leads us to review the role played by what are known as the "councils of change" in the latest stage of the political cycle, which started in 2015. Madrid, Barcelona, Cádiz and La Coruña city councils, to name but a few, have achieved many of the climate and transitional public policy goals they set themselves. In spite of this, they too must be the subject of a critical analysis regarding the scope of this government action that puts the emphasis on the limitations, obstacles or limits at municipal level encountered by these city councils. We therefore ask ourselves, from the Gramscian perspective, what the limits of municipal policy are as regards the fight against the climate emergency so that we can draw some useful lessons that can be applied in future political cycles.

Barcelona Societat always includes a space dedicated to analysing specific experiences which require detailed reflection due to their unique nature. In that regard, we wanted to focus on "Health in the streets" project which assesses the environmental and health effects of the superblock programme in three city neighbourhoods: Poblenou, Sant Antoni and Horta. The assessment was carried out using both quantitative and qualitative methods to calculate this impact, which has generally been seen as very positive. In addition, we have also dedicated a space to reflecting on urban mobility, relating it to the dynamics and use of transport by women and their relationship with health and sustainability. On average, women use public transport more than men, so it is in their mobility patterns that new proposals for making urban mobility more sustainable and reducing its impact on health must be explored. Thirdly, we wanted to analyse the policy on energy advice points, which were set up a few years ago and provide an important service to city households and

consumers. Finally, we present and analyse "Blue, Green & Grey: Adapting Schools to Climate Change", a project co-financed by the European Commission's Urban Innovative Actions programme that proposes actions in eleven schools with measures relating to nature, water and architecture. The aim of the project is to improve the children's quality of life, as well as for their immediate surroundings and local residents, by promoting open uses for the school playgrounds.

As the variety of articles in this issue of *Barcelona Societat* shows, there are many climate emergencies, and they are complex and far-reaching. At the same time, so are their effects and consequences which, as a general rule, tend to be deeper and more severe for women as a whole and, in general, for the most vulnerable populations. The reflections and proposals for the future aimed at mitigating and redressing the climate crisis must therefore start from the reality of these groups. We hope that reading this issue of the journal will make a valuable contribution to that.
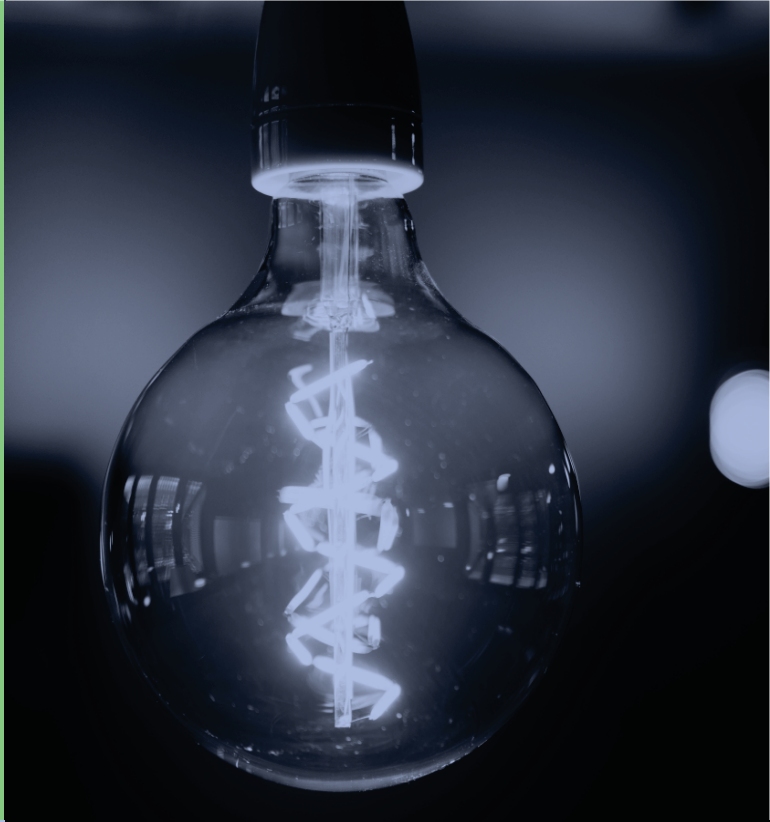
Take stand

From Ecological Economics to Political Ecology

Joan Martinez Alier
(ICTA, UAB)

Ecological economics studies conflicts between environmental sustainability and economic growth. Industrial economy is not circular, but entropic. Therefore, economy seeks new natural resources at the "frontiers of extraction". Usually, there are poor or indigenous people in these places. There are, therefore, many "ecological-distributive conflicts" which are studied by the political ecology and registered by the Atlas of Environmental Justice (www.ejatlas.org). Various social values (economic, cultural, ecological) appear in these conflicts.

I have worked for 45 years since the 1970s on two related subjects: ecological economics and political ecology. Ecological economics criticises conventional economics because economics focuses on markets and prices and not on the use of energy and materials in the economy, the "social metabolism". Political ecology in turn studies "ecological distribution conflicts". I emphasise "ecological" because conflicts on pollution or land or water grabbing cannot be translated only into lost money values. There are other values in dispute.

I helped to forge ecological economics in the 1980s, together with Herman Daly, AnnMari Johnsson, Bob Costanza and others. We followed in the steps of Nicholas Georgescu-Roegen, K. W. Kapp, Kenneth Boulding, all historical figures of proto-ecological economics, as before them Patrick Geddes, Frederick Soddy, Otto Neurath.

In the 1980s, some of us in ecological economics came from ecology (like H. T. Odum) and some were dissident economists. We criticised the attempts to show that there was no contradiction between economic growth and environmental sustainability, as in the term "sustainable development" of the Brundtland Commission of 1987 (precisely the year when I published my book *Ecological Economics: energy, environment and society*). Even now the United Nations insists in the Sustainable Development Goals (SDG) or Agenda 2030 on the idea that economic growth is compatible with environmental sustainability, as in SDG Goal no. 8. We criticise this (Menton et al 2020, in the journal *Sustainability Science*). We oppose "green economic growth" and "sustainable development" because they do not exist. The ecological viewpoint implies less economic growth, and indeed some "degrowth" leading to a "steady state" as Heman Daly proposed already in the 1970s.

Economic growth meant from the beginning of capitalism the destruction of biodiversity and human lives in the sugar and cotton slave plantations in the Americas, and a bit later in the thermo-industrial revolution, the burning of coal, oil and gas. All of this is not properly accounted for by economists. We need to look at reality in physical and social terms, not in chrematistic terms.

Chrematistics was a notion coined by Aristotle, defined as the part of the economy dealing with money, markets and prices. There is another part of the real economy – the care of young and older people, and the services from nature, the soil (that we pave over and whose fertility we undermine), the water cycle that we interrupt and pollute, the air that we make unbreathable.

The field of study of "ecological economics" did not exist with this explicit name before the mid-1980s. I had published in Catalan a book on the topic (anticipating the 1987 longer book in English), and it was reviewed by Luis Urteaga in *Documents d'Anàlisi Geogràfica*, 7, 1985, pp. 193-205, with the title "La economía ecológica de Martinez Alier". In 1987, a meeting was organised in Barcelona where the first ecological economists decided to create a journal and a society with the new name of Ecological Economics. Economic journalist Manuel Estapé wrote an article on this meeting in the main local newspaper, La Vanguardia (4 October 1987), with the title "First Conference of Economics of Ecology". He interviewed me and also Bob Costanza, Bruce Hannon and Roefie Hueting, three of 39 participants who included Herman Daly, Silvio Funtowicz, Jerry Ravetz, Martin O'Connor, Mario Giampietro, Richard Norgaard, Charles Perrings, Thomas Zylicz, AnnMari Jansson, etc., the nucleus of what became the International Society for Ecological Economics. This is explained in my book of memoirs "*Demà serà un altre dia. Una vida fent economía ecològica i ecología política".*

Critiques from ecological economics were not only against conventional economics but also against Marxist economics because, although Marx and Engels understood that the economy implied a changing "social metabolism" (flows of energy and materials), they did not analyse this in detail and refused to believe in limits to the economy once the "productive forces" would be released from their fetters by changes in the capitalist relations of production. "Growth of the productive forces" meant (in physical language) destroying the exhaustible stocks of fossil fuels formed geologically by photosynthesis millions of years ago and also, as known since the late 19th century, changing the composition of the atmosphere.

Concepts that I helped to disseminate are "sustainable economic *degrowth*" together with Giorgos Kallis, François Schneider, Federico Demaria and the whole group in Barcelona since 2010 calling themselves Research & Degrowth; ecological economics, with the International Society for Ecological Economics and its branches in Europe, Latin America and India which I supported from their births between 1987 and 1997; and then the "environmentalism of the poor and the indigenous" or *ecologismo popular* since 1990 (together with Ramachandra Guha and others). The journal *Ecologia Política* was launched in Barcelona with Anna Monjo of Editorial Icaria and with economist James O'Connor. Reaching 60 issues in 2021, it has been successful mainly in Latin America in explaining the movements of the environmentalism of the poor and the indigenous. I see that now there is an incipient vogue for calling these movements "subaltern environmentalism", why not? The term will be understood in India by social historians, and by Gramscians in Europe and elsewhere although Gramsci himself did not write on environmentalism.

So, I claim to be intellectually both a Zadist in Europe and a Zapatista in Mexico because Zapata in the Mexican revolution of 1910 asked for *Tierra y Libertad* meaning that land (and water) should remain as commons, against privatisation by industrial sugar mills in Morelos. Not yet being an environmentalist, Zapata was already practising the environmentalism of the poor and the indigenous. Livelihood and freedom were not to depend on the capitalist abundance promised by President Porfirio Diaz, on the contrary. I am also a Mariateguista because Mariátegui at one point (already dead) was accused of being a Narodnik, as a supporter in the Andes of the indigenous commons against the *hacendados*, and I am myself an ecological neo-Narodnik currently writing what is likely to be the last book of my life entitled *Land, Water, Air and Freedom* on the international movement for environmental justice, based on the EJAtlas[1], to be published in 2022.

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1. It can be accessed at: www.ejatlas.org

Covid 19, the GDP and the debt economy

The health crisis linked to the Covid-19 pandemic is causing a huge economic crisis. But we don't know if it will last long. It can be transient; the market economy is going to restart anyway. What has happened is not "degrowth by design", it is an accident. It is not planned "sustainable degrowth" by political consensus in order to avoid climate agroecology increases by 10%, that's fine. We can take advantage of this crisis to develop local agroecology. The current crisis also allows us to talk about the benefits of a decrease in travel change and biodiversity loss, to improve the quality of city air, to support care of needed people by public expenditure, to decrease mobility, to disinvest from fossil fuels, advertising, military industries.

This moment has allowed us to think and to preach some ideas with more political courage. For example, anybody can now agree that we should forget GDP and macroeconomic accounting. If GDP falls by 10%, it does not matter provided that the unemployed are supported. It's real life that's important. If public health drops by 10%, that is terrible. But if it increases, that's fine. If less people travel, especially by air, this is all right. There is a growing international movement, *Stay Grounded*, which has been around for several years already.

Our goal should not be a growing economy again to pay off our debts. There are in fact lots of unpaid debts. For example, companies do not pay for their ecological liabilities. There are conspicuous international cases such as Chevron Texaco in Ecuador, Shell in Nigeria. Nor do the world's rich pay their debts from their excessive carbon dioxide emissions causing climate change. While ecological debts are not repaid, why should economic debts be paid? Even when people starve to death, should they pay the economic debts?

The priority is to forget about GDP. Instead of saying "GDP is going to fall by 10%, that's terrible," we should say "we will no longer count things with GDP"." Keynesians say we need 3% or 4% growth to achieve full employment. But we can only reach those numbers with more oil, gas and coal burning. That is no longer possible. The economy must no longer grow, people must live.

The second priority is to renegotiate debts. Countries such as Ecuador, Argentina or many African countries have a lot of economic debts. They're all mental, on paper or on a computer. These countries are really creditors of large ecological and social debts. Economic debts can be negotiated away. In 1953, West Germany did not pay the debt created by Adolf Hitler. In recent years low inflation that has made it difficult to repay debts. We should not have profit-making private banks but only public savings banks unconcerned about making profits, and credit unions or cooperatives.

I think that the obsession with the GDP comes in part because public debt is given as a percentage of GDP. For example, the Italian state has a debt of 14 months of GDP. And debts are what drives the capitalist system and disciplines wage labour, they force the obligation to export cheap raw materials (see Argentina), they impose the great discipline of mortgages, etc. Ten years ago there was a big scam in Catalonia and parts of Spain against relatively poor people who bought flats, mortgaged them, paid for them almost whole, and some of them are still being evicted for not paying the full amounts including the accumulated debts. Some were immigrants from Colombia, from Ecuador, Peru, I know one or two of them. The obsession with GDP is the obsession with continuous rolling of the debt wheel and living out of interest. It is not the only time in our history that metaphysical inventions or *dispositifs* have been deployed to discipline people – for example, "If you ignore us and commit mortal sins, you will go to hell." This is why Varoufakis and other victims of *Debtocracy* sometimes mention the "financial Inquisition".

Covid-19 has also helped the idea of a universal basic income for all people between the ages of 18 and 65. This is a policy that does not originate in ecological economics or in the Degrowth movement but most of us support it. In Spain, the progressive government of the Spanish Socialist Workers' Party (PSOE) and Unidas Podemos (UP) is creating a "minimum vital income" in 2020. Podemos started talking about a universal income about five years ago. Now that they have entered a coalition government in a subaltern position, they are forced to back down. This

minimum income only affects some people. This requires more bureaucracy: who can have it and who can't? A universal income would be universal, everybody with a DNI or NIE would get it. It would have a good effect on people's mental and physical well-being. Women would be more independent of their husbands or fathers by having their own income. And it would also have a good effect on the labour market. For example, people could work three or four days instead of working five days a week because they would have extra an income of €400 or €500 per month from the basic universal income. They would travel less to work, would be more relaxed, they could do other things. Just as we have a right to health or school, we need to create a human right to a universal income. This would change a lot in the capitalist system.

We are wrong if we believe that GDP measures production, and that we must increase GDP to pay back debts. They say: "we must get indebted to be able to spend more money to get out of the crisis, and then we must increase GDP (in monetary terms, of course) to pay back debts". An infernal wheel because what we call "production" is largely destruction related to the mining, transport and combustion of oil, gas and coal. Pierre Charbonnier writes in *Abondance et Liberté* that we must put an end to "productionism". I think now is time to abolish the GDP, to replace it with social and physical indicators.

Polluting industries can be shut down overnight as we have already done it during confinement. Car factories started making artificial respirators. In the same way, we could convert industry into the manufacturing of more necessary things. For example, in Europe, we do not need to build new housing, because there are enough square metres of buildings and second homes. We could redistribute everything in another way. Advertising is not needed, military industries should be drastically reduced even if this creates wage-unemployment. Hence the need for a universal basic income, so that people are not forced to work for wages in damaging occupations. But urban regeneration is needed, cleaning up old industrial sites. We must think about agricultural regeneration instead of cars and motorways.

Covid 19 allows a discussion of new policies. The first is to forget about GDP. The second is to renegotiate debts. The third is a universal basic income. Let us seize this moment to 1) Stop counting Gross Domestic Product, use physical and social indicators to decide whether we are improving or worsening. Never talk about GDP again, ever again. 2) Internal redistribution, a basic universal income (rather than dreaming that wage employment will arrive for all thanks to economic growth). 3) International redistribution, enough of ecologically unequal trade and also start recognising the ecological debt of the rich. 4) Disassociate the real economy from the payment of many financial debts, not to go back to the *Debtocracy* of 2008. 5) Less travel by people and also of goods. 6) More local agroecology, more ecological urbanism. All this guided by democratic debates about how to impose some prohibitions and how to change taxes. It is not easy to raise taxes on fossil fuels, if you see what happened in France with the *gilets jaunes*. Now, I think finally everyone admits climate change exists.

The Covid-19 pandemic has been a good opportunity for remembering other pandemics, those coming to America after 1492 and causing a total demographic catastrophe, as also the Black Plague in Europe (and in Catalonia, of course) and their influence on the peasant wars of the end of feudalism that I myself had often explained in class. Particularly the 1918 flu, which is the closest. The first few weeks of confinement I remembered and learned more about the history of pandemics than I did in my entire life. We have all learnt about epidemiology and demography. The historical demography of America is part of our history as Europeans, and is not taught enough in schools. Leon Portilla, in *La Visión de los Vencidos*, explains that in Tenochtitlan, in Mexico, the Spaniards won because smallpox arrived, which they called Hueyzáhuatl. In 1992, the Fifth Centenary of the "discovery" was celebrated. With Verena Stolcke in 1990 we brought Alfred Crosby and Noble David Cook to Barcelona, great historians of the demographic catastrophes in America after 1492 due to lack of immunity and other reasons. No newspaper mentioned them, now they would be more successful. It seems that with this pandemic we are all equally vulnerable. Are all human beings initially equally lacking immunity from this virus? I don't know. It seems that

the pandemic will last a couple of years, back and forth, with excess mortality over the usual level that will not reach by far 1 percent.

After the flu of 1918-19 came the Charleston and the 1920s, economic growth, the crisis of 1929, the fascisms, the Spanish war of 1936-39, Francoism and World War II, also Japan's terrible war in China. Humans don't need any viruses to make disasters. I am impressed by the possible similarity now with the major pandemic of 1918, the "Spanish flu" that did not come from Spain. Many people died in that pandemic. But it was not like the Black Plague of the Middle Ages, or the diseases imported by the "Conquest" in Latin America in the 16th century. It will probably be less with the Covid-19 pandemic. But it can finally help confirm the global population peak. The population is not going to grow indefinitely.

The environmentalism of the poor and the indigenous
In 2002 I published a book called *The Environmentalism of the Poor. Ecological conflicts and valuation*. The subtitle that I wanted was: Ecological distribution conflicts and languages of valuation. It was too long[2]. In this book, I presented three currents in environmental movements. The first is the "cult of wildlife." Conservationists propose that part of the land should go to industry and another part, 10, 15 or 20%, should be preserved for wildlife. It's a minority of environmentalists that promote national parks. This current was born in the United States in the 19th century and developed in Europe in the 20th century. The second trend is "eco-efficiency", with slogans such as the "green new deal", sustainable development, the "circular economy", "dematerialisation of the economy": many euphemisms for arguing that economic growth and ecology are compatible. It is a very active trend within the United Nations, social-democratic governments, the Chinese Communist Party and the European Commission.

Finally, the third current is that of environmental justice and the environmentalism of the poor. For example, the Zadists against the airport of Notre-Dame-des-Landes: people who defend the land against privatisation. In my book, I talked about the poor but I should have talked more about Indigenous peoples. Worldwide, 370 to 500 million self-identify as such. They live often in the frontiers of commodity extraction: in the Arctic, the Amazon, Africa, central India, the Andes, where there is coal, copper or iron mining, or oil or gas extraction. They are at the forefront of the fight against "extractivism". "Commodity extraction frontiers" is a concept from historian Jason Moore thinking of the Europeans who arrived in America after 1500 in Potosí in Upper Peru to extract silver to make luxury goods or to trade with China, and a bit later in the Caribbean where other Europeans grabbed the land, imported slaves to produce sugar which was very useful for feeding workers during the Industrial Revolution. These frontiers of extraction (and also of waste disposal) are constantly being pushed back: today they are in the Arctic, in the Amazon where there are also groups like the *Achuar* people protesting against oil companies. These people are not members of Greenpeace or Friends of the Earth, they are environmentalists in their own way and claim their rights to land, water and air. Our economy in Europe is based on cheap imports of raw materials and energy. This is why political ecologists in South America complain against "extractivism" with Maristella Svampa, Eduardo Gudynas, Alberto Acosta.

Political ecology studies environmental conflicts. Which values are deployed in such conflicts? For example, an indigenous people can claim the value for livelihood of a mountain for its supply of water, wood, seeds or medicinal plants. They can also argue that the mountain is sacred. On the other hand, there is the language of monetary valuation of the environment, which allows compensation in cash for environmental damage. Conventional economists try to impose this chrematistic language. However, we ecological economists say that there are incommensurable values, it's impossible to reduce all values to a single measurement unit. Economists talk about the economy merely as chrematistics. But Aristotle also spoke of the oikonomia, which has to do with the conditions of life. There is a double meaning to the word "economy". Marx, Frederick Soddy,

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2. In the end, the subtitle was "Ecological conflicts and valuation", although the one I preferred was "Ecological distribution conflicts and languages of valuation".

Karl Polanyi, Herman Daly and I have all emphasised the difference between chrematistics and the real economy.

In my book of 2002, I also talked about "feminist neo-malthusianism" referring to a movement in France, also in Catalonia (studied by Eduard Masjuan) and elsewhere in Europe, the US, parts of Latin America 120 years ago. It was a movement particularly strong in France. The *grève des ventres* was an expression forged by Marie Huot, a feminist activist. When shall we reach the "demographic peak"? Shall we reach 10 billion people or will we stop growing before that? Depopulation is going to be a major research topic in the coming decades. I welcome this. In Europe more than a century ago, women and men decided to have less children, and later also in many other places such as, for instance, in Southern India. A rapidly declining growth rate of the world's human population is a good trend. Perhaps the peak will be in 2050, before reaching 9.5 billion. Remember that in the 20th century population increased from 1.5 billion to 6 billion. The curve is flattening, it needs to be flattened more.

Pierre Charbonnier: against "productionism"

My book *The Environmentalism of the Poor* was published in several languages, and finally in 2014 in French as *L'ecologisme des pauvres. Une étude des conflits environnementaux dans le monde*. It was well received, including a long critique by philosopher Pierre Charbonnier who was then in his early 30s[3].

His own book of 2020 on Western political philosophy, *Abondance et Liberté*, is very good indeed. We could be at the beginning of a new era in which ecological economics and political ecology will be the main themes of a new political philosophy. I like that very much. He praises the theory of popular environmentalism or environmentalism of the poor and indigenous people, and our Atlas of Environmental Justice. His main thesis is that from the 17th century until now the political philosophy and political economy of Grotius, Locke, the Physiocrats, the Liberals (Adam Smith), Marx and the Socialists, Karl Polanyi, the Keynesians and the Neo-Liberals all somehow realised that economic abundance depended on access to land, to colonies and slave labour, hydraulic energy, the steam engine and later coal, oil and gas , but did not put the study of social metabolism (energy and material flows) at the heart of political and economic analysis. Abundance allowed freedom (of some), and those who were not yet free would become so in a future of abundance. Political philosophers and political economists put physical realities at the background, not at the forefront of politics.

So much so that climate change caused by the burning of coal that has been well known since 1896 with Svante Arrhenius did not lead to any political reaction until the 1980s. Almost one hundred years passed without political reaction. In the 20th century, burning coal increased sevenfold, and oil and gas increased much more. Until 2020, it continues to increase and therefore there are more CO_2 emissions. We have not reached peak CO_2 emissions (at least until 2020) and much less peak concentration of CO_2 in the atmosphere. There is talk about climate change at international meetings; almost nothing is done. The concentration of CO_2 in the atmosphere was 300 ppm in 1900, 360 in 1990 and now 412 ppm en route to 450ppm by 2050, perhaps 500 ppm by 2100. The pandemic and confinements of 2020 will not be reflected in this curve, which is called the Keeling curve. The Keeling curve must be flattened (Graph 1).

Pierre Charbonnier's question is whether climate change and in general political ecology (and the physical indicators established by human ecologists and ecological economists on Material and Energy Flows, the HANPP) will now enter into the demands of trade unions and political party programmes as central themes. Charbonnier thinks that the leftists and the diverse environmentalist fellow-travellers (I call them the Zadistas and Zapatistas) should become protagonists of this political change. They will put ecological economics (instead of conventional economics), political ecology, public health, agroecology and food, housing, at the heart of politic.

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3. http://www.unsam.edu.ar/ojs/index.php/conhist/article/view/267

They will stop talking about GDP, economic growth, repayment of financial debts, austerity vs. Keynesianism, as the main topics of politics. They will insist on the political relevance of social and ecological indicators. Economists must withdraw from the public arena and be replaced by ecologists, public health and agroecology experts, and by environmental urban and regional planners.

Graph 1. The Keeling curve, reading on May 26, 2018. Carbon dioxide concentration at Mauna Loa Observatory

411.89 ppm

November 12, 2020

Carbon dioxide concentration at Mauna Loa Observatory
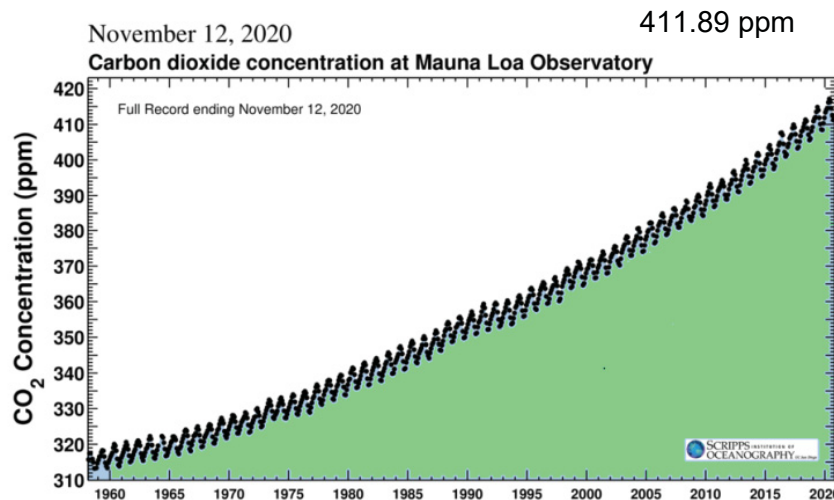
Note: Full Record ending May 26, 2018

In universities, economists should study human ecology in the first semester, and then they should study social history and the societies which have existed without markets (based on reciprocity and redistribution) in the second semester, and only then would they be allowed to study markets and prices. And when they go into macroeconomics and the calculation of GDP, they should be taught that GDP should be abolished, and learn about an ecological macroeconomics without growth. They should also be taught about "ecologically unequal exchange". Pierre Charbonnier highlights this as a leverage point for applying other economic measurement parameters. He wonders how it is possible for standard economists still to propose David Ricardo's theory of international trade. On the other hand, Marxists talked about unequal exchange of working hours but not unequal exchanges also in hectares, in energy units and tons of materials, in pollution loads and in water "incorporated" into exported raw materials. These are calculations we have proposed with Alf Hornborg and others for 25 years. There is a new economic-social history measuring these unequal exchanges and their effects. One example, Brazil exports 400 million tons of iron a year, there are disasters like Mariana, Brumadinho: hundreds of deaths and major ecological damage when iron mine waste deposits break down (*presas de jales* as they say in Mexico, *diques de relaves* in South America). Brazil exports much iron ore at a cheap price, and it does a lot of damage locally. There are protests of the environmentalism of the poor and the indigenous that started on a smaller scale in colonial times in Potosí, Zacatecas and Minas Gerais.

These are national and international "ecological distribution conflicts". They should be discussed and brought into politics. But as Pierre Charbonnier argues, we must go beyond this; after 150 years of socialist ideas about the distribution of goods (and evils) "produced" by the economy (based on coal, oil and gas, and cheap raw materials) it is necessary for ecological socialists to wonder what "production" means as measured in GDP. And what do the expressions used in Marxist language, "development of productive forces" and "the accumulation of capital" mean? Burning fossil fuels is not "accumulating" anything physical, it is dissipating energy and producing climate change (accumulating in any case CO_2 in the atmosphere), and also making money that allows more money to be earned, but not actually "accumulating" energy. And if we burn agro-fuels, we eliminate other species that lose places to live. We do not accumulate anything or develop any productive force.

The EJAtlas at ICTA UAB and the world movement for environmental justice
The industrial economy is not circular, it is entropic. Therefore, it requires new supplies of energy and materials extracted from the "commodity frontiers". It also produces polluting waste. Therefore, ecological distribution conflicts arise.

Figure 1. The first page of the EJAtlas. Conflicts are coded by colour

The Atlas of Environmental Justice is an online inventory of such ecological distribution conflicts based on scholarly and activist knowledge. It started in 2012 and reached 3150 entries by May 2020, allowing new work in the field of comparative, statistical political ecology. We add one or two conflicts daily, they are conflicts born of projects that harm people and the environment. They also produce kilowatt-hours, or tons of soybeans, etc. Those evils and those goods cannot be measured in the same units. We make such conflicts more visible (often involving deaths, sometimes successfully stopping projects, etc.) by putting them in the EJAtlas. Some are historical and others from today (Figure 1). Academically, we do comparative, statistical political ecology. And we give a little help to the global movement for environmental justice. In the north, we must repent from our colonialism and racism. For example, the 2015 Paris Agreement on climate change did not promise enough reductions and, worse, it has a No Liability clause: rich countries are not legally responsible for the climate change we have produced with our excessive CO_2 emissions. Extractive companies also practice this principle of no-liability at local level, e.g. Chevron-Texaco in Ecuador, Shell in Nigeria.

The EJAtlas classifies such conflicts in 10 main categories: nuclear energy, biomass, fossil fuels and climate justice, mining, infrastructures (such as motorways, airports), industry, biodiversity conservation, water, waste management, tourism. The EJAtlas from the ICTA - UAB is becoming well known around the world. Each entry contains a description, sources of information, and many codified variables. It is directed by Leah Temper and me, coordinated by Daniela Del Bene, and it has had hundreds of collaborators. The EJAtlas is used for research but also for university teaching in environmental social sciences and in business economics and management. It is a unique instrument co-produced with and supporting environmental movements. It allows for comparative analyses on the social actors involved in the conflicts and their forms of mobilisation, and on the behaviour of private or public companies. Research can focus on countries or regions but also on cross-cultural topics such as copper mining, sand mining, eucalyptus or oil palm plantations, dams, incinerators and other methods of waste disposal, coal-fired power plants, gas fracking, nuclear reactors, CAFOs (concentrated animal feeding operations). Cross-cultural analyses are done also on the cultural expressions (slogans, banners, murals, documentaries) of the conflicts gathered in the EJAtlas. The wealth of research coming from the EJAtlas contributes to give an affirmative answer to the question: Is there a global environmental justice movement?

In Catalonia, the EJAtlas has collected a few conflicts only and I shall explain why. This is a world atlas. There is one person in Catalonia for approximately every thousand people in the world. The

EJAtlas is concerned with the proportion between population and number of cases in the EJAtlas. We shall add soon two cases in Catalonia clearly missing still: the asbestos pollution in Cerdanyola by the Uralita factory (delayed working-class environmentalism) and the anti-nuclear movement of the 1970s in Ascó and Vandellós (Tarragona), reaching then about two cases per million inhabitants. The registered cases are: GM maize (in Lleida and Aragon); Tourism (in Vall Fosca, Pyrenees); Coal power plant, and later waste incinerator (Cercs); MAP - high voltage electric line from France; Pork industry; Potassium mining (Llobregat River); Bullfighting, prohibition of; Asphalt factory at Ateneu 9 Barris (Barcelona, Fig. 4); Waste burning at Lafarge cement factory (Montcada i Reixach); Midcat - gas pipelines industrial pollution Ercros (Flix); Water transfer (Ebro River).

It would be easy to add other cases by consensus among environmental groups and activists, and collect not the 14 but the 25 most relevant environmental conflicts in Catalonia, reaching over 3 relevant conflicts per million inhabitants. This abundance of conflicts is also true for the world as a whole. Local researchers in political ecology and environmental history would be able to collect twenty or thirty thousand relevant environmental conflicts. The EJAtlas is thus a limited sample of only 3,150 cases (May 2020), but a good sample that might grow to 5,000 by 2024 with improved geographical and thematic coverage.

Imatge 1. The Ateneu Popular Nou Barris occupies the space of an asphalt plant (owned by Barcelona City Council) dismantled in 1977 by direct action by neighbours carrying banners: "Save our lungs - Get the asphalt plant out"

Source: EJAtlas.

My main occupation is to cooperate with a team of researchers at ICTA UAB on the EJAtlas. We are producing articles which are recognised internationally. Here I briefly describe the last two. One (in the journal Global Environmental Change, July 2020) is called "Environmental Conflicts and Defenders", it analyses the repression against environmental defenders[4], co-authored by Arnim Scheidel, Daniela Del Bene, Juan Liu, Grettel Navas, Sara Mingorría, Federico Demaria, Sofía Avila, Brototi Roy, Irmak Ertör, Leah Temper, all of us living in or around Barcelona in 2020.

There is a world movement for environmental justice, composed of a myriad of local movements against fossil fuel extraction, open cast mining, tree plantations, hydropower dams and other extractive industries, and also against waste disposal in the form of incineration or dumps. This is the environmentalism of the poor and the indigenous. It took the name "environmental justice" in Southern United States in the 1980s, from movements against the unjust, disproportionate socio-environmental impacts in areas predominantly inhabited by Black, Hispanic and Indigenous populations. We continue to use the words "environmental justice" in this sense.

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4. https://doi.org/10.1016/j.gloenvcha.2020.102104

The bulk of the information on this movement comes from activists rather than academics. Activists such as OCMAL in Latin America (Observatorio de Conflictos Mineros) started to make maps of conflicts, also OIlwatch and other organisations born in the 1980s and 1990s. Another civil society organisation, Global Witness (and not a UN department or an academic organisation), provides yearly figures and the names of environmental defenders killed defending the environment and their livelihoods. The world movement for environmental justice operates so far at the margins of the international meetings (COPs) and the Panels (IPCC, IPBES) which occupy central spaces of information and propose public policies.

This July 2020 article in Global Environmental Change is inspired by such grassroots movements across the world, and it aspires to support them by making their activities, their failures and successes, more visible. This article is a milestone in the field of statistical and comparative political ecology, made possible through the Atlas of Environmental Justice. We present quantitative analyses shedding light on the characteristics of environmental conflicts and the environmental defenders involved, as well as on successful mobilisation strategies. Environmental defenders are frequently members of vulnerable groups who employ largely non-violent forms of protest. In 11% of cases globally, they contributed to halt environmentally destructive and socially conflictive projects, defending the environment and livelihoods. Combining strategies of preventive mobilisation, protest diversification and litigation can increase this success rate significantly to up to 27%. However, defenders globally also face high rates of criminalisation (20% of cases), physical violence (18%), and assassinations (13%), which significantly increase when Indigenous people are involved. We find that bottom-up mobilisations for more sustainable and socially just uses of the environment occur worldwide across countries in all income groups, testifying to the existence of various forms of grassroots environmentalism as a promising force for sustainability.

The second recent collective academic article almost finished is on movements which are shaping climate futures from below. The article is inspired by the existence of Blockadia-type movements. It offers a systematic mapping of 649 protests against fossil fuels and also against some low-carbon energy projects, providing the most comprehensive overview of such place-based mobilisations to date. This is another article in comparative, statistical political ecology made possible by the EJAtlas. We find that place-based movements and related instruments such as blockades, litigation, and production bans are succeeding in curbing fossil-fuel production. Over a quarter of projects encountering social resistance have been shelved, suspended or delayed, incurring significant costs to investors as assets become stranded. The evidence highlights that low carbon, renewable energy and mitigation projects can be equally conflictive and that both project types disproportionately impact vulnerable groups such as rural communities and Indigenous peoples. This cautions that low carbon energy sources can easily replicate the logics, violence, colonialism and dispossession inherent to traditional extractive industries.

Among low carbon energy projects, hydropower is particularly socially and environmentally damaging. Other renewables (wind, solar, geo-thermal) were less conflictive and entailed lower levels of repression. Repression and violence against protesters and land defenders was high in almost all activities, and particularly in those involving hydropower, biomass, pipelines and coal extraction. Environmental defenders who protest destructive resource uses are indeed a promising force for global sustainability and environmental justice. However, their activism comes at a heavy cost: many face criminalisation, violence and murder. In 405 conflicts of the 3,155 registered in the EJAtlas by 30 May 2020, one or more environmental defenders (women or men) have been killed. However, evidence suggests that grassroots movements can play a substantial role in informing which fossil fuels should be kept in the soil and what low-carbon climate futures informed by environmental justice should look like.

A final note: optimism after the pandemic. Degrowth in practice
Why optimism? Firstly, because the pandemic has made us learn a lot of epidemiology and demographics, we've also seen how scientists explain it and don't always agree (this is healthy), and it is even healthier to see how politicians had no idea. For example, you learn from the

epidemiology discussions between Swede Johan Giesecke and Neil Ferguson of Imperial College London and the (perhaps wrong?) changes in strategy in England[5].

Now we're ready for other pandemics. Humanity is not in danger of death from this pandemic. A meteorite could be a lot worse. This pandemic has been fairly domesticated, six-year-olds are trained for other occasions. On the other hand, I think that there may soon be a serious nuclear accident, in some old nuclear power plant that is still in operation, in this I am pessimistic, or realistic. Despite Fukushima and the Chernobyl TV series, the public doesn't expect an accident like that.

Despite the mandatory confinement (very appropriate, it was already discussed and practiced in many places in 1918), we breathe democracy, a bit lukewarm but very alive. There are strong scientific and political discussions. We've all learned a lot more about China, or at least we want to know more about China. Globalised industrial capitalism is being discussed, imagine that. Universal basic income is proposed more strongly than before.

We see that we can save ourselves a lot of trips that were made simply to go to work or for no reason. A four-day week looks very reasonable. It seems to us now more than ever that housing is really essential, and we realise the number of flats, second homes and empty hotels there are in Europe and how they could be better distributed. There is consensus on public health investment. I do not believe that in Barcelona anyone has the audacity anymore to say that it is necessary to build one more runway at the airport as they said three months ago. Air trips for short distances will be discouraged. Proximity agroecology is encouraged. If we really lower global CO2 emissions by 2020, this will make us feel a little better, won't it? That decrease will hardly be noticeable in the Keeling curve that needs ten years of 50 percent declines. But it's a start. Let's not change the climate, let's change the system, we can do it. Let us enjoy the proximity of "peak human population" also.

The ideas of Degrowth and socio-environmental justice have been strengthened. The Degrowth movement in rich countries (or "prosperity without growth" as Tim Jackson calls it) must unite with the world movement for socio-environmental justice. *Leave oil in the soil, leave coal in the hole* were slogans invented by Nnimmo Bassey and others in Nigeria. The Blockadia movements that Naomi Klein explains, are "Degrowth in practice" preventing local damages and climate change.

5. https://unherd.com/2020/04/which-epidemiologist-do-you-believe/

In depth

Ajuntament de Barcelona

The socio-ecological functioning of Barcelona's metropolitan area in ten indicators

Joan Marull[a,b], **Roc Padró**[a,b], **Javier Gordillo**[a,c], **Tarik Serrano**[a,b], **Pau Guzmán**[a,c], **María José La Rota-Aguilera**[a,b,c] and **Joan Pino**[a,c]

Metropolitan systems are introducing a new paradigm into their approach: that open spaces constitute a green infrastructure providing a whole series of ecosystemic services, dependent on which are both the quality of life of people living in built-up spaces and also the possibility of developing a more circular and sustainable economy than the one in the current economic model. The debate that has been held to sharpen this new focus on interdependency between built-up space and open space has also highlighted the need for discovering and assessing the interactions that occur, or could occur, between the two subsystems. This article is intended to present an assessment of recent socio-ecological dynamics occurring in the Barcelona metropolis, through a selection of ten socio-environmental indicators. Conclusions and implications will then be drawn from these for the purposes of metropolitan management and planning.

Introduction

Metropolitan areas are introducing a new paradigm into their approach: that open spaces constitute a green infrastructure providing a whole series of ecosystemic services, dependent on which are both the quality of life of people living in built-up spaces and also the possibility of developing a more circular and sustainable economy than the one in the current economic model. This paradigm shift is considered crucial if metropolises are to be able to play their rightful role in achieving the sustainable development goals (SDGs) proposed in the UN 2030 Agenda and taken on by the Spanish Central government and the Catalan regional government.

The debate that has been held to sharpen this new focus on interdependency between built-up space and open space has also highlighted the need for discovering and assessing the interactions that occur, or could occur, between the two subsystems. It is currently accepted that this challenge requires another look at metropolitan socio-environmental systems that will identify their role in the functioning of the system and allows quantification of their energy and material flows, moving in both directions. This will enable us to study how such an exchange shapes a specific biodiversity and specific structures of land uses expressed in landscapes that need to provide vital ecosystem services for the network of cities and adaptations to global changes.

[a]Metropolitan Laboratory of Ecology and Territory of Barcelona (LET); [b]Barcelona Institute of Regional and Metropolitan Studies (IERMB); [c]Centre for Ecological Research and Forestry Application (CREAF).

The Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) was launched in 2018 to take on this challenge[6]. The LET was set up under an agreement between the Barcelona Metropolitan Area (AMB), the Barcelona Institute of Regional and Metropolitan Studies (IERMB) and the Ecological and Forestry Applications Research Centre (CREAF). The LET proposes three basic goals:

1. To complete and update databases and geographical information on the most significant biophysical variables in the metropolis of Barcelona, in accordance with the authorities involved, so that they can be used in the region's sustainable planning.

2. To monitor key aspects (metabolic efficiency, biodiversity conservation, functioning of the landscape, ecosystem services, global change and social cohesion) and planning tools (green infrastructures, peri-urban agriculture etc.,) of the metropolitan system.

3. To promote applied research for creating knowledge on the metropolitan socio-ecological system and identifying critical or strategic elements for planning and managing the region.

The LET aims, in particular, to hone criteria and tools for analysing Barcelona's metropolitan system from this functional perspective of the region as a system, with the aim of affecting the necessary change in public policies and regional planning to meet the challenges and proposed goals. From the regional planning perspective, landscape ecology concepts and methods are becoming increasingly important for linking patterns of land use and the ecological processes associated with the maintenance of biodiversity and ecosystem services. Likewise, there is often a failure to incorporate the perspective of how human activity, beyond its capacity for upsetting ecosystems, changes the general functioning of the metropolitan system with specific material and energy exchange processes. The conceptual and methodological framework of the ecological economy, and the focus on social metabolism in particular, also allow us to approach this new functional vision of the interactions between society and nature. In short, accounting for material and energy flows that are internal or with other regions, together with the renewed perspective of landscape ecology, enables a multi-dimensional and multi-scale assessment of the contribution of open spaces in the functioning of the metropolitan system and the design of multifunctional green infrastructures in the Barcelona metropolis.

This article is intended to present an assessment of recent socio-ecological dynamics occurring in the Barcelona metropolitan area (AMB) and region (RMB), through a selection of indicators devised by the LET (published in "La metròpoli en 100 indicadors. L'AMB en xifres 2019")[7] based on several sources: climatic variability; land uses; state of vegetation; plant biomass; functional structure of the landscape; state of biodiversity; water consumption for the green infrastructure; ecological state of rivers; energy consumption and greenhouse gas emissions and atmospheric pollution. Conclusions and implications will then be drawn from these for the purposes of managing and planning metropolitan socio-environmental systems.

1. Recent socio-ecological dynamics

1.1. Climatic variability

Monitoring annual meteorological indicators may prove useful for observing trends in climatic variables. Climate change is characterised by a sustained anomaly over time, despite any year-to-year variations there may be. That is why regional monitoring has been carried out, since 2008, of differences in annual average temperatures and rainfall with respect to a period of reference set by the IPCC (1961-1990), and recent climate variabilities are thereby observed.

While it may have been a brief series since 2008 for defining trends in climatic terms, the last few years have seen a sustained anomaly effect in temperatures, which have been at least 1°C above

6. See them on: https://iermb.uab.cat/ca/let-bcn/
7. See them on: https://iermb.uab.cat/es/amb-en-xifres/la-metropoli-en-100-indicadors-lamb-en-xifres-2019-2/

the average for the 1961-1990 period since 2014. These differences over the last five years have been above the average in Barcelona's case, a situation that has worsened the heat island effect there (figure 1). An above-average increase has also been maintained during the same period in the Montseny massif, with the impact this may have on its ecosystems. During the eleven-year series of data on average temperatures running from 2008 to 2019, it was only in 2010 that they came close to those of the reference period.

As for the precipitation anomaly, the variability is much higher than in the case of temperatures. So, while in 2018 the average precipitation was 50% above the reference, in 2019 it was 20% below in the Barcelona Metropolitan Region (RMB). The anomaly was distributed quite uniformly throughout the region (figure 1). No clear trend has been observed, given that a certain downward trend was broken in 2018, given that there has been no year since 2010 with an average precipitation above that of the period of reference.

Figure 1. Temperature and precipitation anomaly in the Barcelona Metropolitan Region (RMB). 2008 and 2019
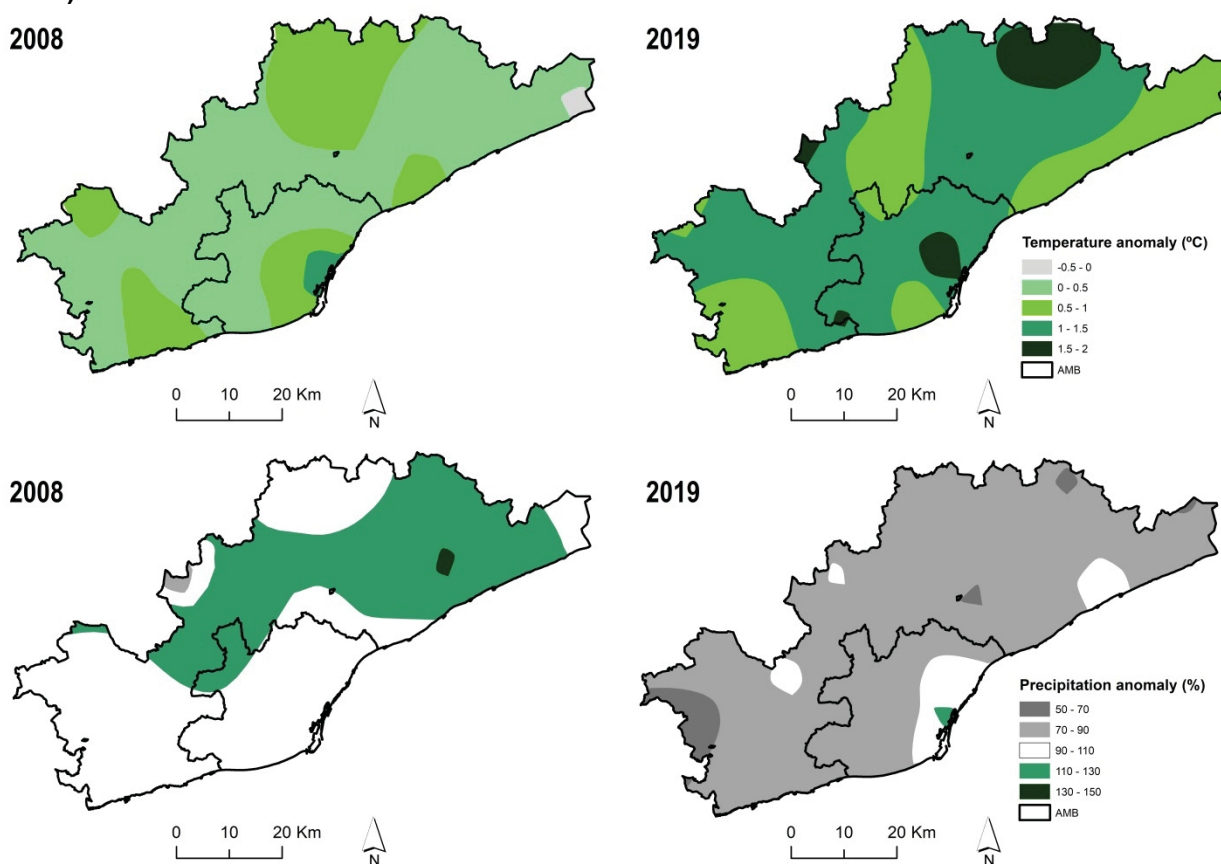
Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on the Figures produced by the Catalan Meteorological Service (SMC, 2020).

1.2. Land uses

As we all know, the most important change of land use in absolute terms over the last 30 years in the Barcelona metropolis has been its urban expansion (having increased by 70% in the RMB and by 37% in the AMB, according to data from the Landsat satellite), a process that has been accompanied by a very significant rise in road infrastructures (figure 2). The trend from 1987 to 2017 was not just generation of continuities and completions in urban sections but also the appearance of new, disperse urban developments. Despite the fact that open spaces still prevail, the impact that such urban space — whether dense or disperse — has on the fragmentation of the region and functionality of the landscape is the key to understanding the metropolis's present socio-ecological challenges.

Figure 2. Land uses in the Barcelona Metropolitan Region (RMB). 1987 and 2017

1987   2017

Land uses
- Vegetation in humid zones
- Road infrastructures
- Urban areas
- Arable crops
- Woody crops
- Fields and grasslands
- Thickets
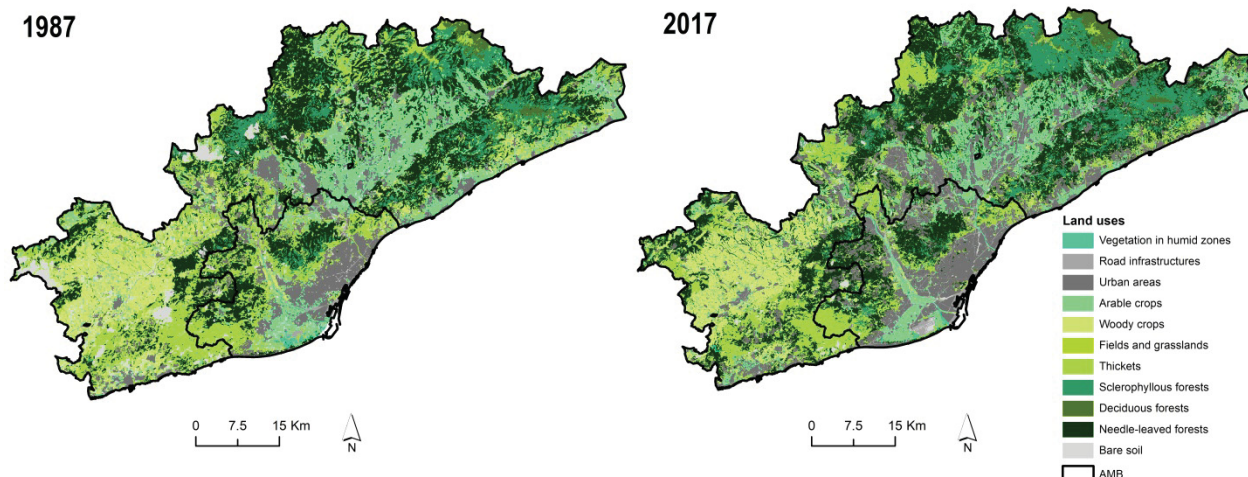- Sclerophyllous forests
- Deciduous forests
- Needle-leaved forests
- Bare soil
- AMB

Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on Figures prepared by the Catalan Ministry of Territory and Sustainability (DTES) and the UAB-CREAF (GRUMETS, 2018).

Urban expansion, along with the abandonment of agricultural activity, has led to a constant reduction in agricultural land to the point where it dropped by 25% in the AMB and by 18% in the RMB between 1987 and 2017. An large part of this land has become urban space, although some has ended up enlarging forest areas, mainly needle-leaved forests — dominated by Aleppo pine trees — and sclerophyllous forests — mostly holm-oaks—. Both processes also occurred in thickets, which dropped by 9% and 22% in the RMB and the AMB, respectively. There was also a lot of bare soil in 1987, as can be seen above all in the north-west, resulting from the areas burnt by the fires of 1986 (see the plant-biomass indicator).

As for agricultural uses, the area of cultivated land in the AMB is 8.1% of the total, whereas in the RMB it is still as much as 16.9%. The process of abandonment of this area of land has actively continued over the last decade, with an average annual loss of 231 hectares in the RMB and 37 hectares in the AMB, leading to a steady reduction in the food sovereignty of the Barcelona metropolis. Irrigated herbaceous crops (mainly in the Parc Agrari del Llobregat) and a fresh-fruit zone in Ordal predominate in the AMB (2019). By contrast, in the RMB, grapevines continue to predominate in the RMB, in the Penedès, treeless land intended for cereals on the Vallès plain and cultivated land in the Maresme.

1.3. State of vegetation

The normalised difference vegetation index (NDVI), obtained with Terra satellite data (MODIS), indicates the state and the abundance of vegetation. This is a relative measure (value between 0 and 1) of the photosynthetic vigour and activity of plant masses, widely accepted internationally. Values close to 1 indicate a better vegetative state, intermediate values relate to more stressed states of vegetation and low values correspond to non-plant covers.

In the Mediterranean context, this indicator relates strongly to the availability of water for the vegetation and is therefore used a lot in indicators for adaptation to climate change (see the water-consumption and climate-variability indicators). Even so, care should be taken when interpreting this indicator's values as they may vary with the most recent climate.

As can be seen in figure 3, the average NDVI values in the RMB are slightly above those in the AMB, given that this region incorporates large massifs with climate conditions that are more favourable to the development of large forest formations. The areas with more foliage correspond to the especially rainy massifs of the north-east (Montseny and Montnegre). By contrast, the values are lower in the southern slopes of the Garraf's massifs as well as in other areas where thickets predominate. As for the Penedès region, the NDVI is low in vineyards. This is due to the fact that

this is an annual datum and because they are deciduous crops, the land is bare for a large part of the year.

Figure 3. Annual average value of the NDVI vegetation index in the Barcelona Metropolitan Region (RMB). 2001 and 2019
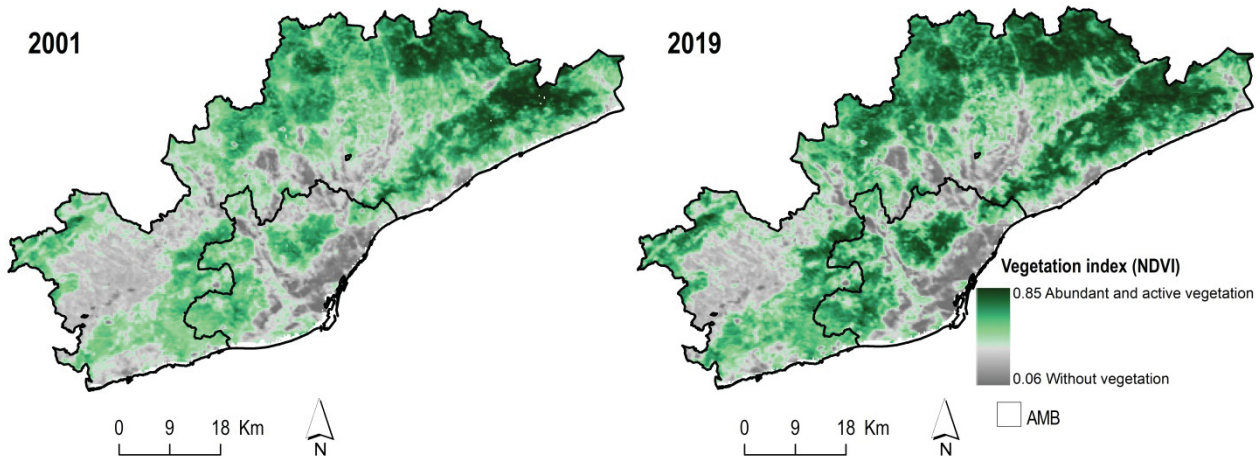
Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on data from the Terra satellite (MODIS).

The NDVI values in 2018 and 2019 were above the average of the series, especially in the autumn of 2018, which represented the maximum in 18 years of the data series, for the RMB and the AMB alike. Spring and the whole year in general were likewise wet. This effect of strong autumn rain in 2018 (see the climate variability indicator) also favoured a high-index spring in 2019. The fact that this was an especially wet year helped to increase the NDVI value in plant covers with intermediate values, whereas those that already had high values (such as Montseny or Montnegre) did not rise so much.

1.4. Plant biomass

Biomass accumulations in forests depend on multiple factors, such as the very growth of the forest masses or their management. The loss of an important part of the forests' management over the last few decades, woodlands have helped to bring about a state of forest masses prone to large forest fires. The areas with the highest biomass accumulation in trees (measured in carbon stock) are in Montseny and Montnegre, and in Collserola too, matching the high NDVI values (see the indicator for the state of vegetation). Between 2001 and 2013, biomass is estimated to have continued accumulating in most of the region, especially in forest masses which were already presenting high values because of the favourable climatology.

Over the last 30 years or so, some 32,000 hectares have been burnt in RMB (figure 4), almost 10% of the region's total area. The most devastating fires were the ones in 1986 and 1994 (in Garraf and Montserrat, as well as in several more of the RMB's municipalities, with 6 fire sources of over 1,000 hectares) and in 2003 (Sant Llorenç del Munt), which involved 60% of the area burnt throughout the period. As many as 1,700 hectares were burnt at least twice between 1986 and 2019, as were more than 900 hectares between Vacarisses and Collbató in 1986 and again in 1994. These re-occurrences pose further obstacles to the recovery of ecosystems after such serious disturbances. While a good part of the fires broke out in pre-coastal counties and in the Garraf, above all in the south-west half of the RMB where climatic (temperature and rainfall) conditions and weather (wind) conditions are especially favourable for outbreaks and the spread of fire, areas such as Montnegre have a large accumulation of biomass and high potential ignitability (unlike Montseny, which has a low ignitability value) and a large continuity of forest mass which pose a serious fire risk.

Figure 4. Burnt area (>1 ha) in the Barcelona Metropolitan Region (RMB). 1986-2019
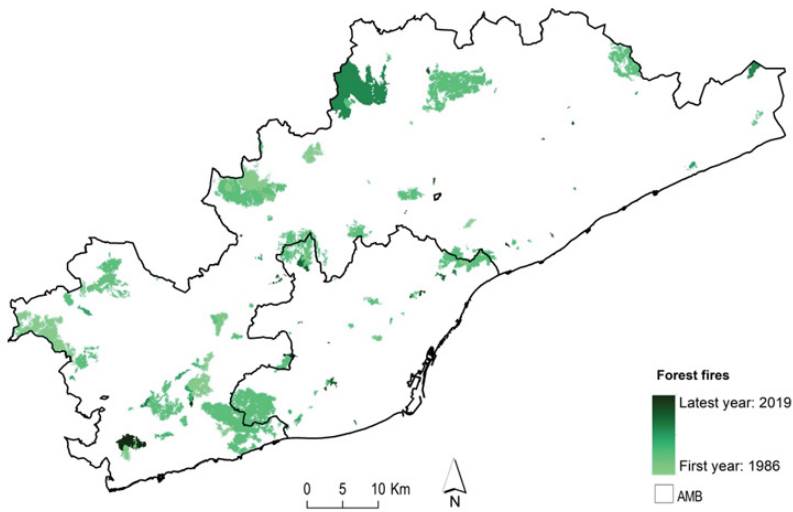
Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on data from the Catalan Ministry of Territory and Sustainability (2020) and the Catalan Ministry of Agriculture, Livestock, Fisheries, Food and Environment (DAAM, 2015).

1.5. Functional structure of the landscape

The ecological functioning of landscapes in the RMB is considerably affected not just by the progressive construction of urban uses but also by the transport infrastructures that connect them (see the land use indicator), as well as by the various disturbances that occur in the ecosystems (see the plant biomass indicator). There has been a continuous drop in the ecological connectivity of landscapes since 1956, although the index has always stayed above the AMB's in the rest of the region (figure 5). The effect of anthropic barriers (urban, infrastructures) on connectivity is very high, isolating some forest masses such as the Collserola, or even fragmenting larger-area spaces such as Montnegre, affecting their biodiversity (see the state of biodiversity indicator). By comparing the difference between 1956 and 2009 on Figures of the RMB, Garraf and the Llacuna area, above Vilafranca, [we can see] they are the only areas to keep their ecological connectivity index (ECI) values relatively similar to those of the baseline year. Urban expansion has fragmented the region in the Vallès plain, along with the barrier effect of the urban space and infrastructures, though this also extends to the entire coast, from Vilanova and Geltrú to the high Maresme.

Figure 5. Ecological connectivity index (ECI) in the Barcelona Metropolitan Region (RMB). 1956 and 2009
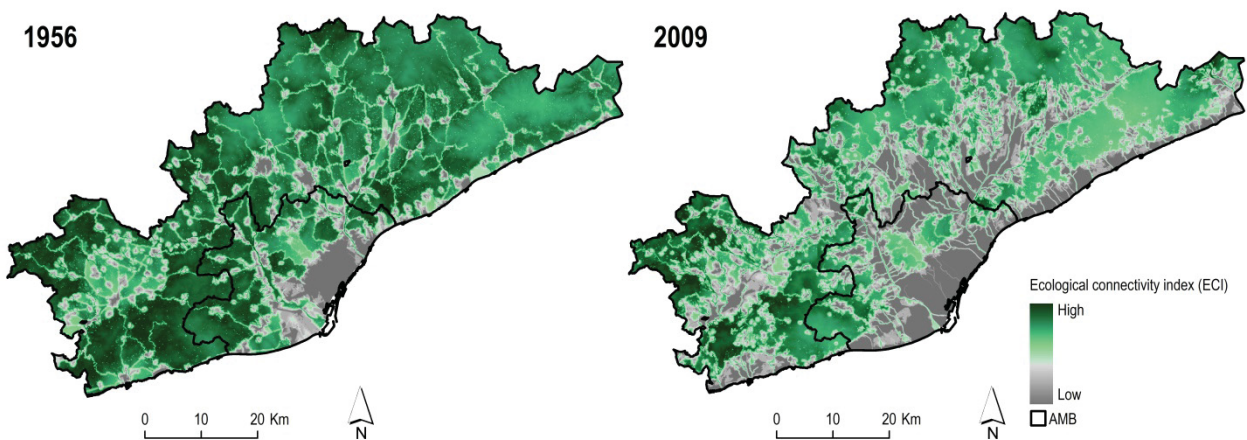
Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on the Land Cover Figure of Catalonia (CREAF, 2015).

A feature that also has an important effect on the ecological functioning and capacity for accommodating biodiversity is the complexity of landscapes, which not only take account of connectivity but also the diversity of their land covers. So, spaces with a dynamised agroforestry mosaic, such as the Penedès, are favourable to ecological processes, as they have a diversity of covers, besides good connectivity, and therefore heterogeneous habitats. To conclude, regions with less diverse uses but with important forest masses, such as Montseny, the cliffs of Bertí or Sant Llorenç del Munt and the Obac mountain range, present average levels of landscape complexity.

1.6. State of biodiversity

Butterflies and birds are groups of animal species used internationally as bio-indicators thanks to their extensive distribution, easy recognition and sensitivity to changes in socio-environmental dynamics. Number of species and abundance of butterflies and birds have been monitored in the Barcelona metropolis, under the Museu de Ciències Naturals de Granollers' Catalan Butterfly Monitoring Scheme (CBMS) — 41 transects — and the Catalan Common Bird Survey (SOCC) at the Catalan Institute of Ornithology (ICO) —91 transects—. The data obtained from them between 2005 and 2015 will now be presented.

In general, the trend observed (graph 1) is a reduction in abundance (number of observations), much clearer in the case of butterflies in open spaces and birds associated with agricultural spaces. This would tally with the fact that the loss of agroforestry area and ecological connectivity in the RMB (see the land-use and landscape-ecology indicators) is an important vector in the drop in biodiversity, given that these trends are stronger in open-space species, normally associated with agricultural activity (crops, pastures, etc.) Despite the fall in abundance, the number of identified species has been maintained with few variations throughout the 11 years of the series, but if the trend in population reductions continues, it will inevitably affect the wealth and diversity of species in the metropolis.

Graph 1. Diversity of butterflies and birds in the RMB between 2005 and 2015
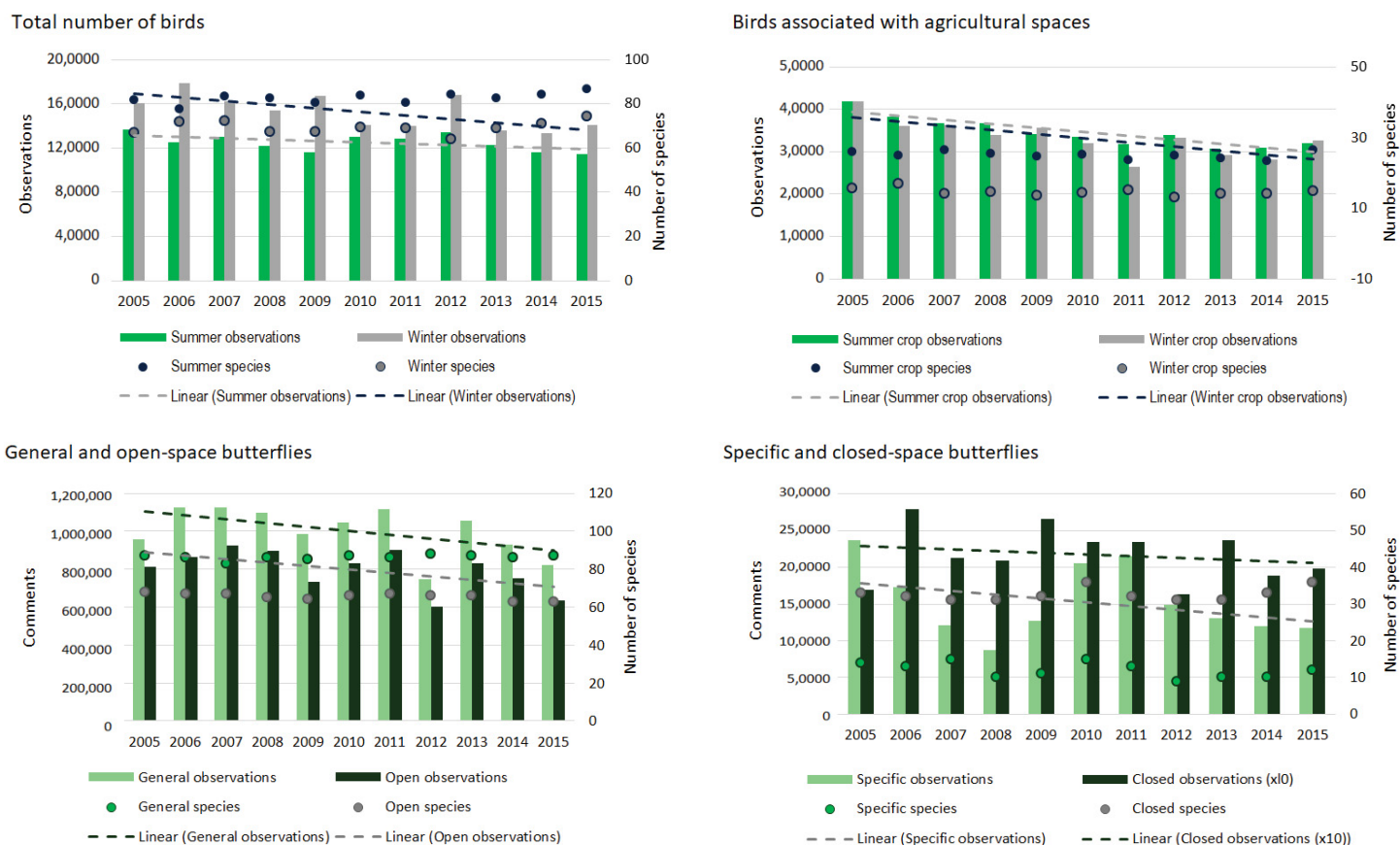
Source: LET based on data from CBMS (2016) and SOCC (2016).

1.7. Water consumption per green infrastructure

Water consumption per green infrastructure in the AMB, according to the vegetation's water requirements, is calculated through the evapotranspiration of agricultural covers, forests, thickets and urban parks (see the land-use indicator).

This datum allows us to estimate the green infrastructure's use of water and the water from precipitation that remains potentially available in each municipality. According to the municipality, between 20% and 80% of the precipitation in the AMB is estimated to be used directly for vegetation and naturally, it is the municipalities with the most urbanised areas of land which consume a smaller part of the precipitation in the green infrastructure.

Finally, as for water supplies (graph 2), it can be seen that the amount of water originating from the Ter dropped from 51% to 36% between 2002 and 2018, a trend that has been strengthened under the Ter Board's Agreement for a steady reduction in dependence on water transfers from this external basin. In addition, the total volume of supply dropped by 23% during the period analysed.

Graph 2. Provenance of water supplies (left) for all the sectors from 2002 to 2018, and water consumption (right) in the main sectors in the AMB in 2015 (hm^3)
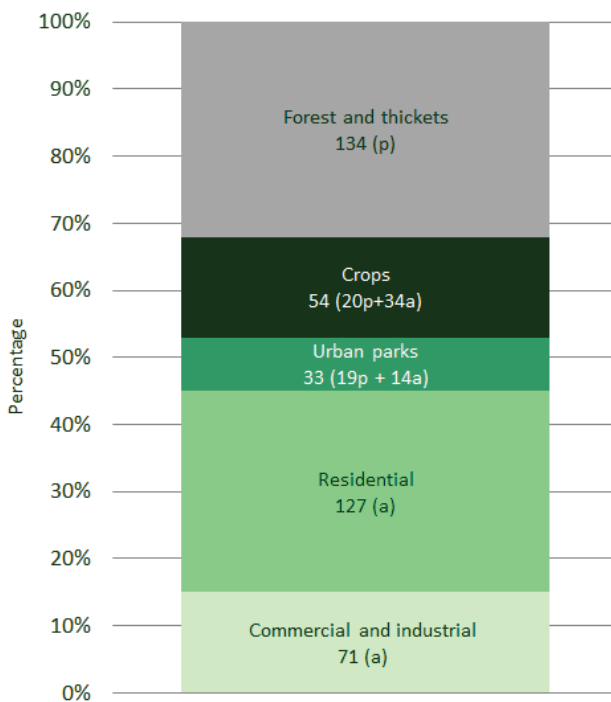
NB: *(p) = precipitation, (a) = supply. Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) and AMB.

1.8. Ecological state of rivers

The ecological state of rivers (figure 6) is a combination of their biological, physico-chemical and hydromorphological qualities, which are monitored in various sections of Barcelona's metropolitan rivers (IMPRESS, ACA). Biological qualities are a measure of the presence of macro-invertebrates, diatom algae, macrophytes and fish. Physico-chemical qualities are a measure of the concentrations of ammonium, nitrates, phosphates, organic load, conductivity, chlorides and other specific pollutants. And, finally, hydromorphological qualities are an assessment of whether there have been changes to the river which affect its fluvial continuity, hydrological regime or morphology.

Figure 6. Ecological state of rivers in the Barcelona Metropolitan Region (RMB). 2007-2012 and 2013-2018 periods
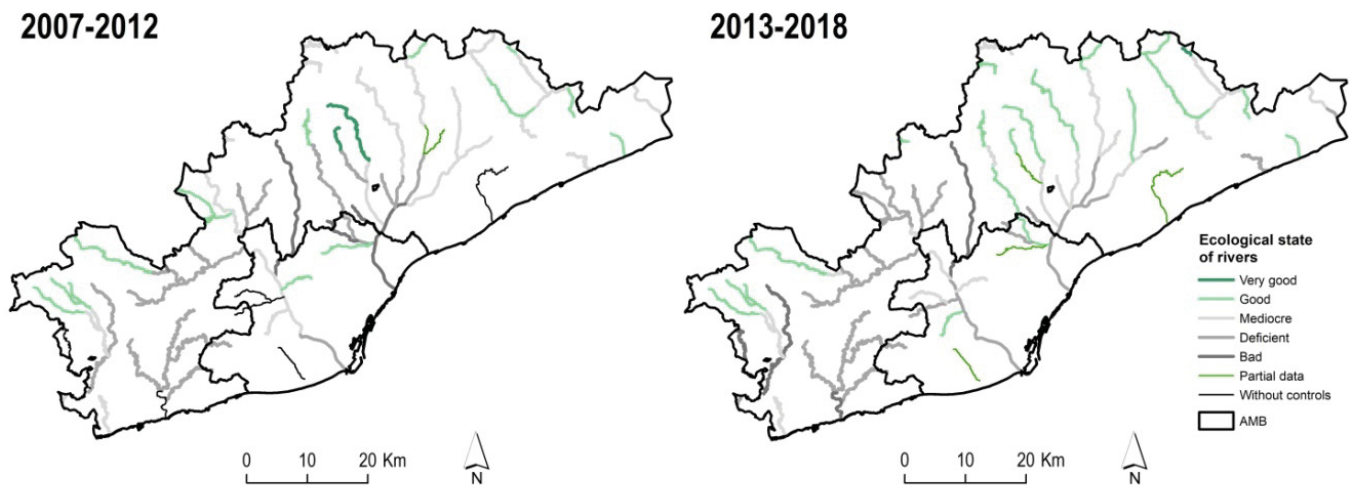
Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on data from the Catalan Water Agency (ACA).

If we compare the two periods analysed (2007-2012 i 2013-2018) [it can been that] sections inside the AMB went through different changes in their ecological state: eight sections improved, five stayed the same and only two became worse. Despite such variability, it can be said that the general trend was one of improvement, with the exceptions of the Riera de Vallvidrera and the Llobregat river, from the Riera de Rubí to Sant Joan Despí.

The chemical state of the rivers is an assessment of a series of pollutants (metals, pesticides, solvents and other chemical substances) according to the thresholds tolerated under legal regulations. In general, chemical pollution is concentrated in the river courses that pass through the more industrialised and populated areas, especially in the Llobregat and Anoia basins, and in the Besòs, where heavy metals and various industrial compounds are detected.

1.9. Energy consumption and greenhouse gas emissions

The light-intensity distribution provided by satellite data (NTL) are directly related to the total energy consumption in the regions. So, the distribution of primary-energy consumption (PEC) on regional scales can be estimated on the basis of State consumption (which is obtained from the energy balances provided by Eurostat). The PEC is concentrated above all in the Barcelona plain and also, very importantly, on the Vallès plain, and has been expanding through the Llobregat axis. At the same time, it can be seen that there was a slight general drop in the PEC values between 2012 and 2018 (Graph 3).

Primary-energy consumption since 2012 has tended to fall in the RMB (graph 3). While the drop in PEC reached 15% in 2017 compared to the initial year of the series, it went up again in 2018 by 8%, thereby breaking the trend towards a reduction in total energy consumption. Based on these PEC data, we can estimate the CO_2 values according to the sources of origin of the energy consumed in the RMB. Fossil fuels continue to represent practically 80% of the total primary energy consumption, a proportion that has experienced little variation. The second group as far as energy sources go are renewable energies, which are also a minority and range from 10% to 12% of our total primary energy consumption, followed closely by nuclear energy, which is following a downward trajectory and dropped from 9.8% contribution in 2012 to 8.6% in 2018. No substantial changes can be seen in the renewable energies throughout the period analysed, so the challenge for a genuine ecological transition is still very considerable.

Graph 3. Evolution of primary-energy consumption (PEC) in the RMB, sources of origin and effect of associated greenhouse gases (CO_2). 2012-2018
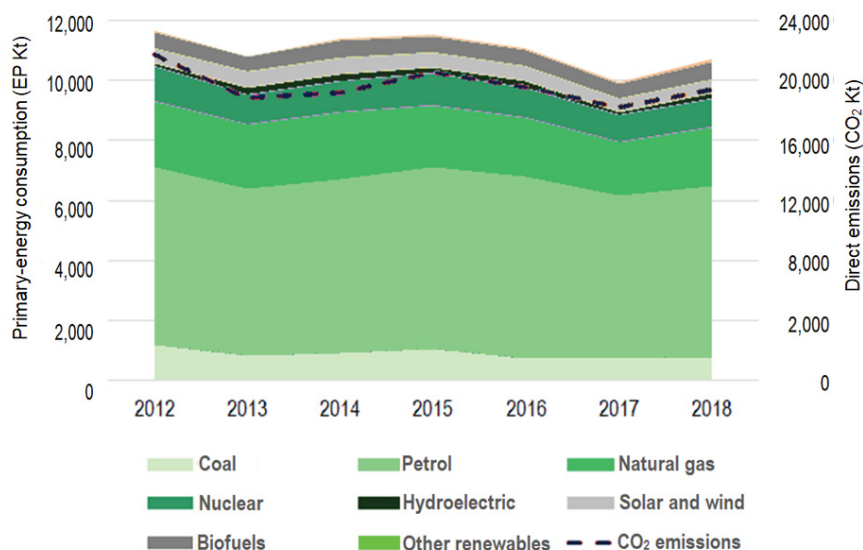
Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on data from State-energy balances (Eurostat, 2019) and the Catalan Climate Change Observatory's emission factors.

Even so, the direct CO_2 gas emissions associated with this energy consumption, calculated on the basis of criteria from the Catalan Office for Climate Change, ranged between 18,200 and 21,700 thousand tons throughout the 2012-2018 period, without any sustained downward trend having been observed.

1.10. Atmospheric pollution

The data on atmospheric pollutants (NO_2, $PM_{2.5}$ and O_3) in the Barcelona metropolis obtained by satellite (Sentinel-5) are based on annual observation averages, offering complementary information to the models interpolating sample data. That helps to give us a picture of the distribution of pollutants throughout the RMB. These satellite data, for example, enable us to observe the effect of the halt of economic activity caused by the COVID-19 health crisis.

Nitrogen dioxide (NO_2) is gas that causes respiratory diseases, acid rain and photochemical smog. In addition, it is the precursor of $PM_{2.5}$ and O_3. It is produced by combustion in motorbikes, thermal power plants and butane gas heaters. Concentrations are usually higher during the cold months of the year. Reductions in diesel vehicle numbers and improvements in technology at plants and factories have led to a drop in NO_2 concentrations over the last few years (figure 7, above).

Suspended particulate matter measuring under 2.5 micrometres ($PM_{2.5}$) represent a risk because they have a high penetration capacity in our respiratory tracts. Unlike the larger PM_{10} particles, which arise from natural sources such as sand, $PM_{2.5}$ particles come mainly from diesel fuel. There has been a slight downward trend in $PM_{2.5}$ levels over the last few years as a result of the new regulations for vehicles (figure 7, in the middle).

Finally, tropospheric ozone (O_3) is a gas which causes respiratory problems on ground level. It is a secondary pollutant, created through interaction of other precursor pollutants with solar light, which is why increases are observed during the hot months. It is not as abundant in large population centres as those in the AMB, as the precursors that come from these places have to be combined with other elements, which are spread outside this region, and it is therefore there where O_3 is mainly produced (figure 7, below).

Figure 7. Annual average concentration of NO₂, PM₂.₅ and O₃ (µg/m³) in the Barcelona Metropolitan Region (RMB). 2015 and 2018
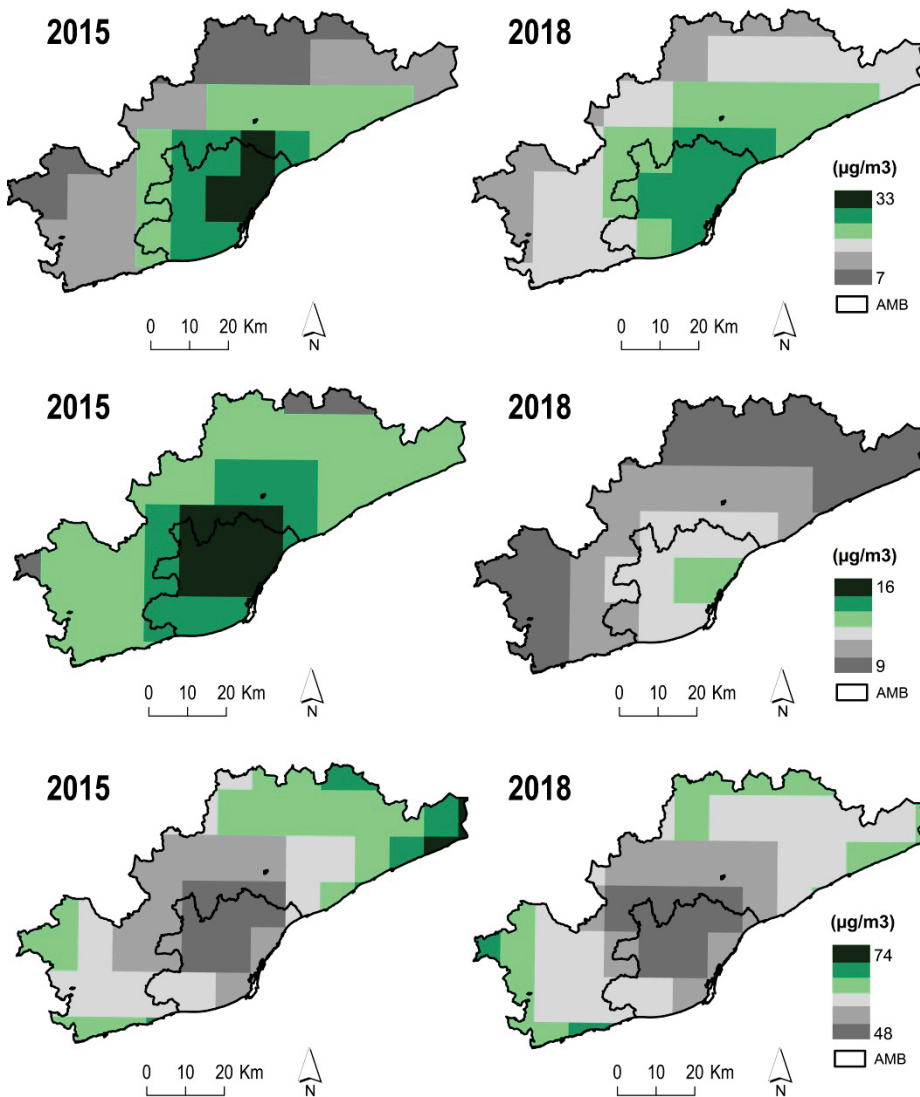
Source: Metropolitan Laboratory of Ecology and Territory of Barcelona (LET) based on a re-analysis of the ENSEMBLE model using data from the Sentinel-5 - Copernicus Atmosphere Monitoring Service (CAMS) satellite.

2. Conclusions

This article has assessed the main recent socio-ecological dynamics occurring in the Barcelona Metropolitan Area (AMB) and Region (RMB), through a selection of ten socio-environmental indicators prepared by the LET and based on several sources, enabling us to understand the interdependence between built-up and open spaces for the proper management and planning of the Barcelona metropolitan system. The results obtained from the application of these indicators are summarised below.

The results highlight several factors of change that have a direct or indirect impact on the functioning of the metropolitan area and on its capacity to integrate biodiversity and provide ecosystem goods and services: climate change and changes in land covers and uses.

Climate change in the metropolitan region is characterised by the appearance of a sustained anomaly over time. The last few years have seen a sustained anomaly effect in temperatures, which have been at least 1°C above the average for the 1961-1990 period since 2014. It can be observed that the year-on-year variability is much higher in the precipitation anomaly than it is in the temperature anomaly. Despite being a global phenomenon, the local repercussions of climate

change are clear. This thermal anomaly over the last five years has been above the average in Barcelona's case in particular, thereby worsening the heat island effect there.

As for land uses and covers, it is evident that the metropolitan area has undergone a spectacular change over the last half a century, caused mainly by urbanisation. As we all know, urban expansion in the metropolis has led to considerable fragmentation of the region and the consequent loss of the landscape's ecological functionality. But it is the abandonment of agricultural activity that has been even more important in terms of area, having brought about a constant reduction in the agricultural area which fell by 25% in the AMB and by 18% in the RMB (between 1987 and 2017), steadily reducing the metropolis's food sovereignty, an especially important aspect for closing the urban system's metabolic cycles.

On the other hand, this change in land covers and uses is also the result of the socio-economic change caused by a rural exodus and the disappearance of traditional uses. This brought about an expansion of forests, at the expense of the agroforestry mosaic, and the disappearance of pasture which, together with the practical disappearance of forest management, encouraged (along with other factors such as climate change and the growing recreational use of natural spaces) a state of forest masses prone to big fires in the Barcelona metropolis. The last 30 or so years have seen some 32,000 ha burnt in the RMB. The recurrence of fires in some areas poses a further obstacle to the recovery of ecosystems, causing degraded landscapes with little resilience against disturbances.

Since 1956, the first year in which we have historical data on land covers in the Barcelona metropolis, the drop in the landscape's ecological connectivity has been continuous and has affected the biodiversity and ecosystem services that it contributes to society. The loss of cultural landscapes, as expressed in agroforestry mosaics with an integrated circular economy, which also included livestocks, has diminished the functionality of the open spaces and their relationship to urban spaces, making the metropolitan system less and less resilient and more and more dependent on external inputs (energy, materials), and thereby increasing its ecological footprint.

The increase in forest covers has taken us to a new paradigm that is emerging with strength in the face of the current climate emergency: vegetation and society are increasingly competing for water. According to the municipality, between 20% and 80% of the precipitation in the AMB is estimated to be used directly by the vegetation. The green infrastructure (forests, crops and parks) in the AMB is consuming more than half of the region's water flows. Changes in land uses may alter the distribution of available internal water and therefore dependence on supply, an important aspect in climate change scenarios. The total volume of supply dropped by 23% during the period analysed (2002-20018), a positive trend. Satellite data have enabled an assessment to be made of the state and abundance of vegetation (NDVI) in the Barcelona metropolis, which relates to water availability and adaptation to climate change. Years with higher rainfall, such as in the last two years (2018 and 2019), present NDVI values above the (2001-2019) series.

As for biodiversity, the trend is towards its reduction and levelling down as a result of changes in land uses and covers, as well as the growing pressure on natural systems. It can be seen that there was a steady reduction in the abundance of butterflies (mainly in open spaces) and birds (above all those associated with agricultural spaces) in the RMB between 2005 and 2015. This has to do with the loss of agroforestry land areas and ecological connectivity in the Barcelona metropolis. The data are worrying given that, if this trend in population decline continues, it will inevitably affect the wealth and diversity of species and ecosystem services (supply, support, regulation and cultural) that they contribute to society, including the health and well-being of the population. It should be pointed out, in the current health-crisis context, that biodiversity is associated with the health and well-being of a population, and with the prevention of pandemics such as the COVID-19 one.

Likewise, the efforts made over the last few decades in the RMB to improve the region's green and blue infrastructures have yielded results. The trend (2007-2018) in the ecological state of rivers

was towards improvements, with exceptions such as the Riera de Vallvidrera and the Llobregat River, from the Riera de Rubí to Sant Joan Despí. Chemical pollution is concentrated in the courses that pass through the most industrialised and populated areas, above all in the Llobregat and Anoia basins or in the Besòs River, where heavy metals and various industrial compounds have been detected which need to be properly managed if we are to prevent spills with a high ecological impact such as the last one that occurred in the Besòs River (2019).

As regards the indicators for anthropic processes, note that there was a general reduction in primary-energy consumption (PEC) values in the Barcelona metropolis from 2012 to 2018. Fossil fuels continue to represent practically 80% of the total PEC, a proportion that has experienced little variation. Renewable energies are a minority and range from 10% to 12% of the PEC, followed by nuclear energy. The CO_2 emissions associated with the PEC range from 18,200 to 21,700 thousand tons throughout the 2012-2018 period, without any sustained downward trend having been observed, so the challenge for a socio-ecological transition continues to be very important.

The data on atmospheric pollutants (NO_2, $PM_{2,5}$, O_3) in the Barcelona metropolis obtained by satellite already show the effect of the halt of economic activity caused by the COVID-19 health crisis during the first months of 2020. Reductions in diesel vehicle numbers and improvements in technology at plants and factories have led to a drop in NO_2 concentrations over the last few years. A slightly downward trend in $PM_{2,5}$ has been observed over the last few years as a result of the new regulations for vehicles (2015-2018). Even so, the challenge of sustainable mobility in the Barcelona metropolis remains an outstanding issue.

The application of the ten indicators for assessing the Barcelona metropolis's socio-ecological dynamics highlights the strong relationship between open spaces and built-up spaces, as well as the need to take on five big challenges when it comes to understanding and therefore managing the urban system: i) multifunctional networks: we need to move from being a city to a network of cities (for example, the importance of the green infrastructure as a structuring ecological network of the region); complex systems: we need to move from being an urban economy to a metropolitan system (for example, the importance of peri-urban agriculture as a water-energy-food-society nexus); iii) dissipative systems: we need to move from urban metabolism to integrated socio-ecological analysis (for example a metabolic-regional model: energy cycles - land uses, emissions); iv) multi-scale analysis: we need to move from urban-scale to metropolitan scale (for example, resource management: water cycle, mosaic agricultural landscapes); v) multidimensional analysis: we need to move from sectoral policies to cross-cutting policies (system planning: strategic assessment of plans and programmes).

Starting from the conceptualisation of the contribution of open spaces to the metropolitan system, the LET is working on an integrated socio-ecological analysis (ISA), a model that is noted for a series of inter-related indicators that quantitatively support the contribution of the green infrastructure in the metropolis's sustainability, by considering six fundamental dimensions: metabolic efficiency (energy, water, waste), biodiversity conservation, landscape functioning, climate change, ecosystem services (provision, support, regulation) and social cohesion. The aim behind ISA is to advise on public policies, bearing in mind the five challenges for understanding and properly managing the region as a system. The ISA is currently being applied in the strategic environmental assessment of the Barcelona Metropolitan Area's Urban Development Master Plan.

The LET is therefore taking on the challenge of a socio-ecological transition in the Barcelona metropolis, incorporating the new paradigm mentioned in the introduction of this article into territorial planning: the need for a functional green infrastructure that enables us to provide a series of essential ecosystem services, on which the quality of life of the city's residents depend, as does the possibility of developing a more circular and sustainable economy than the current economic model, mitigating global change and adapting to it.

The LET, then, provides for the achievement of the following types of impact in the socio-ecological assessment of the Barcelona metropolis: i) strengthening the criteria and methods for treating the

region as a socio-ecological system; ii) completing the databases and knowledge regarding significant regional variables; iii) devising a support system for the metropolis's planning and management; iv) collaborating in designing policies and metropolitan governance, and v) enabling the transfer of ecological and regional information to citizens.

This paradigm shift is crucial if cities are to deploy the United Nations Sustainable Development Goals (SDGs), although that will require new criteria and innovative methods for planning cities in relation to their metropolises, in addition to political will.

Ajuntament de Barcelona

The impact of climate change on cities in the context of a systemic crisis

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Major cities depend on the daily entrance and transportation of large amounts of food, water, power and other materials. And also on complex waste disposal management systems. When combined, these factors require mass mobility. These elements, which are essential to the functioning of major urban hubs, will be compromised as a result of the climate change process in the context of a progressively more global systemic crisis. This makes cities like Barcelona unsustainable and social and economic ruralisation policies essential.

1. Urban ecodependences

The 20th century saw the explosion of the metropolis in a way never seen before in history. This growth has continued into the first decades of the 21st century[8]. In the case of the Barcelona Metropolitan Area, this is reflected in its 3.3 million residents, almost 50% of Catalonia's population. As part of its growth, the city has swallowed up spaces that had been saved as part of a centuries-old dialogue between humans and nature, destroying the memory held by this territory and breaking the ties that connected the historic city to the territory, which had already been severely affected by the industrial city of the 19th century. Furthermore, the eruption of the city has been blurred, with no defined borders, unlike the agrarian city or even the industrial city. This space, which has destroyed ecosystems and social frameworks, is now the main niche for the reproduction of capital[9]. Therefore, it represents the backbone of our socioeconomic system.

Different factors have driven this growth, but only one has made it possible: the environment. For cities to have become megalopolis, the provision of large amounts of power (electricity, fossil fuels) and materials (food, water, different goods) has been essential. Also, their ability to dispose of the huge amounts of waste that they generate has been fundamental[10].

This flow of materials and energy has had to satisfy three significant requirements: being fast, spanning large distances and facilitating the transportation of large masses. Furthermore, the

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8. A graphical image of the growth of Barcelona can be found on this page: http://ajuntament.barcelona.cat/museuhistoria/cartahistorica/.
9. They generate more than 80 % of the world's GDP (World Bank, 2020).
10. IN THE 21ST CENTURY, cities consume 78% of the world's energy and more than 75% of its natural resources in addition to generating 60% of GHGs and 70% of waste (UN-Habitat, 2012; Gardner, 2016). They demand 6 million tonnes of construction material and generate 2.6 million tonnes of waste and 200 million kilolitres of effluents (Pengue, 2017). Making a difference depends on new buildings and waste disposal sites.

movement of materials and energy is not only necessary between the city and the outside world, but also within the city itself, as the sheer size of cities has made it necessary to reproduce the same frameworks in place with the outside world, within the city itself. To this end, the urban explosion is inextricably linked to high-capacity roads (motorways, highways)[11], major airports and super ports, water supply networks, electric motorways, oil and gas pipelines and fibre optic networks. Not to mention motorised mobility: cars, lorries, ships and planes, in particular.

The approach used to manage this work is the power and material dependences of cities and how they will be affected by the systemic crisis, of which climate change is one of the most important manifestations.

2. Systemic crisis

Climate change will not only affect future generations: it is happening right now and will gradually worsen (even in the best case scenarios) in the coming decades. The path that the Earth system has taken is now unstoppable, even if we were to stop releasing greenhouse gases.

The impacts of climate change on human life are countless. One way of seeing these impacts is to monitor how global warming is already reducing, and will continue to do so, to a much greater extent in the future, the flow of materials and power required by cities to survive. For example, climate change is harming our ability to produce food, leading to greater evapotranspiration and, in the Mediterranean region, a decrease in rainfall.

The two fundamental vectors of greenhouse gas emissions are combustion, mainly hydrocarbons and the agro-industrial food model. To this end, reducing greenhouse gas emissions will inevitably require a very drastic reduction in energy consumption in general. This will affect other central elements of the urban metabolism, such as mobility, energy and available materials.

Furthermore, this reduction needs to take place very quickly (UNEP, 2019) to limit the likelihood of a series of positive feedback loops being activated. If this happens, the Earth system will take the reins to ensure that the climate evolves towards another balance of between 4 ºC and 6 ºC more and mankind will lose its ability to slow down this process. This new climate balance would mean that vast areas of land, including the Mediterranean basin, would be practically uninhabitable for mankind (Hansen *et al.*, 2017).

However, climate change is not the only environmental crisis that mankind currently faces. We are also coming to the end of the abundant and versatile availability of power offered by fossil fuels and many other elements. Added to this is the loss of mass biodiversity or, in other words, a malfunctioning of the ecosystems on which cities depend (to guarantee clean water, purify air, maintain the fertility of the soil, etc.) (Fernández Durán and González Reyes, 2018).

Faced with this major challenge, we can't expect developments in technology to overcome the systemic crisis (Fernández Durán and González Reyes, 2018). As a result, major cities like Barcelona will gradually lose the supplies they depend on due to climate change and other contemporary environmental crises. This will make them unsustainable in the medium term.

Furthermore, a multidimensional emergency is already with us: in just the first four months of 2020, we have seen unprecedented fires in Australia (with climate change playing a role in them), an extraordinary storm (Gloria) in the Eastern region (climate change once again), a pandemic that has brought half the world to a standstill (one of the causes of which was ecosystemic disruption) and an economic crisis usually seen only once every century in the capitalist world, just twelve years after the most recent economic crisis (catalysed by the energy crisis). Therefore,

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11. ALTHOUGH AT THE START OF THE 20TH CENTURY, THE RAIL NETWORK "only" encompassed the USA, Europe, India, Japan, Argentina, Mexico, with a few minor exceptions, the road network at the start of the 21st century spans almost the entire planet, with huge levels of capillarity and density.

implementing adaptation and mitigation measures cannot be put off: they must be implemented on a mass scale (and fast), right now.

3. Mobility

The Barcelona Metropolitan Area spans 3,300 km² and it is home to 3.3 million residents. In this space, as is the case in all major urban hubs, the main urban functions (living, working, enjoying leisure time) have been separated, creating dedicated spaces for each function. This means that mobility within the city is very high. This is not a circumstantial problem, but a structural problem in terms of the design and size of the space.

Therefore (in addition to other factors), despite the extensive public transport network, the number of private vehicles in Barcelona comes to almost 2.5 million, with more than 800,000 mopeds and motorbikes. And as it is not just people who need to travel long distances every day, there are also almost 500,000 lorries and vans on the road (IDESCAT, 2020). The issue lies in the fact that in Barcelona, urban transport is the sector that most contributes to total emissions (Graph 1).

Graph 1. CO$_{2eq}$ emissions per sector in Barcelona
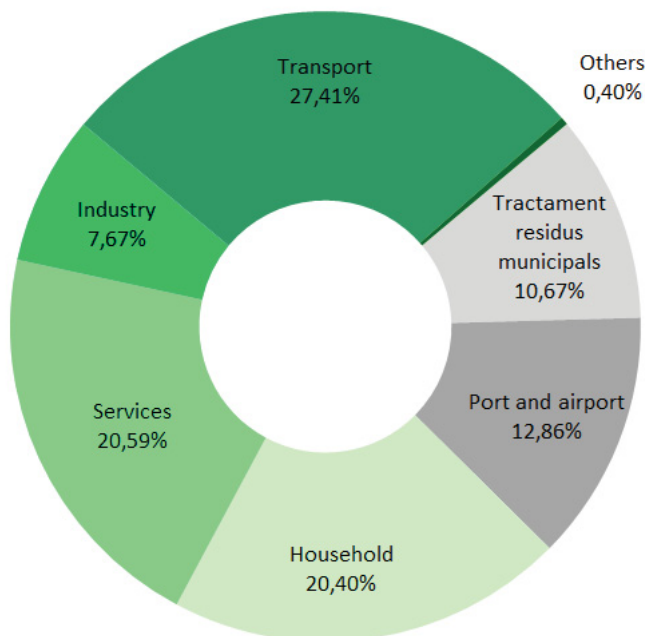
Source: Barcelona City Council (2020)

Two of the most commonly repeated proposals in the fight against the climate emergency (and the energy emergency) are to reduce mobility and commit to sustainable transport (public transport, by bicycle, on foot, etc.). In reality, when looking at the figures of people and goods, the distances travelled and the speed required to ensure the city remains competitive, it becomes obvious that this will not be possible. Mass private transport is no coincidence in metropolises, rather a factor that allows them to exist. It is irreplaceable.

In light of this, a switch to electrified private transport is being advocated. To make the mass use of electric cars a reality, we need to boost the integration of renewable sources of energy[12] into the power grid (which would also need to be restructured to support an intermittent and decentralised supply) as must the grid connection points (of which there would need to be more than petrol stations, as the autonomy of electric vehicles is smaller); major electricity storage systems would be needed, which poses huge, unresolved technological challenges, and a huge fleet of cars

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12. The electricity used by 24 million electric vehicles would add between 20% and 25% to Spanish electricity consumption. However, the power needed at charging stations would almost double the current installed capacity (Prieto, 2019).

powered by combustion engines would have to be replaced by electric cars, starting almost from scratch[13]. Furthermore, in a best case scenario, given the limited reserves of lithium, nickel and platinum, the number of electrical vehicles would be significantly lower than the current fleet of vehicles. On top of all this, in terms of the mineral value of the resources used to construct electric vehicles, 2.2 times more resources are needed than is the case for combustion vehicles (Almazán, 2018; Fernández Durán and González Reyes, 2018; Prieto, 2019).

Even if this mass electrification of the vehicles on our roads were possible (which it isn't), from a climate perspective, a significant reduction in numbers would be needed, as over the useful life of electric cars, CO_2 emissions when compared to petrol vehicles would only fall between 17% and 30% (Ecologistas en Acción, 2020).

However, in Barcelona there is an additional problem when it comes to mobility. The city's economy is structured around the service sector: accounting for 70.4% of the province's GVA in 2010 (González et al., 2015). Amongst these services, tourism is worth particular mention. The carbon footprint of more than 16.5 million international tourists in Barcelona is very high: 9.6 MtCO$_{2eq}$/year, much higher than the entire city (Figure 1). Of this amount, 78% arrive by plane, in other words, the main factor to blame for this carbon footprint (Rico et al., 2019). The problem is not just the fact that internal mobility and supply is essential, but that the economy relies on a sector that is also heavily dependent on hypermobility.

4. Food and water

Following a temperature increase of 2 ºC, there would be a net decrease in the yield of harvests (Peñuelas et al., 2017) and the nutritional quality of food (Högy and Fangmeier, 2013). Furthermore, access to water would be more scarce; salt-water would encroach on coastal aquifers; there would be an increase in erosion on account of dryer seasons followed by flooding; the rate of wildfires would be higher; and given the speed of climate change, it would be impossible to adapt harvests to these new conditions[14]. This would place the ability to feed the population in jeopardy.

However, the urban problem is much more serious, as cities are unable to produce the food they consume. In 2013, they consumed 1.1 million tonnes of food traded at Mercabarna, Barcelona's wholesale market. This figure continues to grow, as does the distance of place of origin of the food. In the case of fruit (which ranks second in terms of tonnes, not far behind first place), more than a third has travelled more than 2,000 km to reach Barcelona (Cotarelo, 2015).

Table 1. Food sold at Mercabarna in 2013 in tonnes

	Meat	Fish and fresh seafood	Fish and frozen seafood	Vegetables and others	Fruit	Total
Food	21,519	61,471	11,792	526,096	516,128	1,137,006

Source: Cotarelo (2015).

In any case, a significant part of the food needed could be produced in the city itself, as is already the case in Havana, Detroit or Rosario[15]. However, without the mass use of oil, this change will be difficult: whole blocks would need to be demolished, roads torn up, the soil decontaminated and water provided. Furthermore, foodstuffs like cereal, for which large areas are required, would have to be grown outside the city all the same. This change is no mean feat. It might not even be possible.

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13. The global energy cost of this would be similar to the annual energy cost of oil extraction (García-Olivares et al. 2018).

14. Elliott et al. (2014) predict that the loss of between 400 and 2,600 cal/person as a result of global warming (8 %- 43 % of current levels) may increase to between 600 and 2,900 cal/person when including the loss of irrigated land as a result of climate change.

15. In Havana, urban agriculture accounts for around 70% of all food. Detroit produces around 15% of the food consumed by the city and 50% when taking the surrounding areas into account (Fernández Casadevante and Morán, 2015).

In terms of water, in Barcelona 64 hm^3 per year was consumed by households, 26 hm^3 by industry and commerce and 5 hm^3 by the public sector in 2013 (Cotarelo, 2015). However, the contributions from natural systems that supply Barcelona fell by almost 20% between 1996 and 2005 compared to 1940 to 1995 (Ecologistas en Acción, 2016), and this trend has continued (Graph 2). Climate change is behind this process, which will inevitably continue this upward trend.

Graph 2. Water resources available in the Barcelona Metropolitan Area in thousands of cubic metres
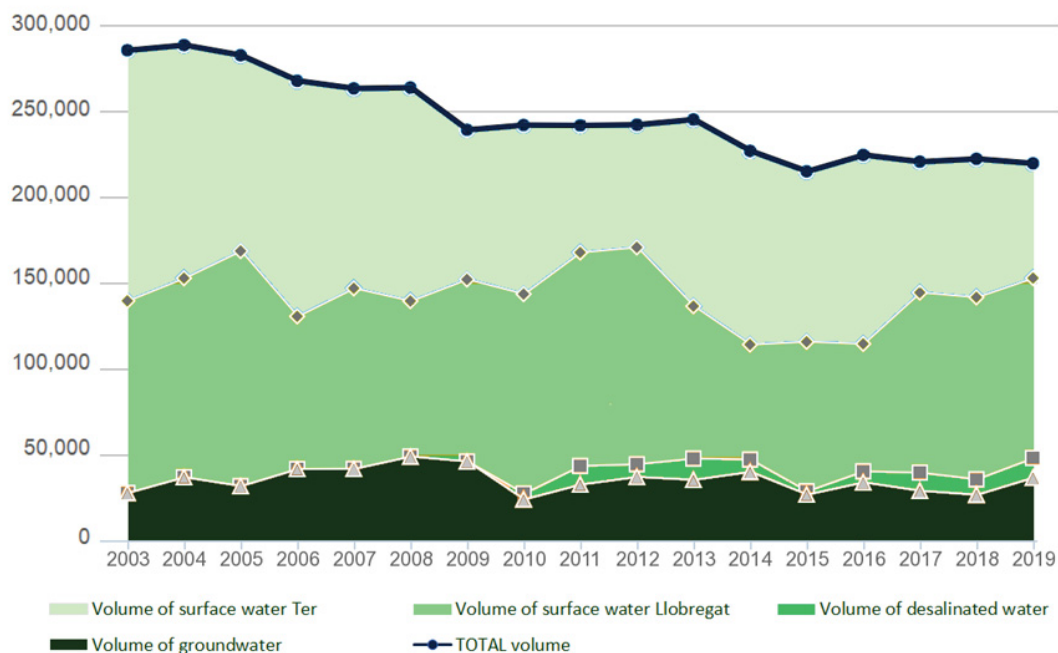
Source: BMA (2020).

Undoubtedly, consumption could be reduced by reducing losses (which are significant) and making lifestyle changes. First, with household consumption accounting for the majority of water use, rising temperatures will not leave much room for manoeuvre. Furthermore, water is likely to experience high levels of tension in terms of its use; for starters, agriculture, which will require growing amounts against a backdrop of increasing water stress. In short, water is another determining factor in the increasingly compromised metabolism of urban environments.

5. Energy
Since 2018, Barcelona Energía has managed 41 photovoltaic facilities installed in municipal buildings, the Sant Adrià del Besós incinerator and the Garraf biogas plant. In total, these plants transfer 1.3% of the city's consumption to the grid (author's calculation based on data from Barcelona City Council, 2020b). Cotarelo (2015) provides a more comprehensive view of Barcelona's energy metabolism (figure 1). The obvious conclusion here is that there is a huge reliance on energy generated elsewhere.

The issue here is not only the significant reliance on the outside world, but that these energy flows (including food) rely on sources that are located thousands of kilometres from the city (Figure 2).

Therefore, it is no surprise that the energy resources mostly correspond to goods entering the city via the Port of Barcelona, although many of them are not dedicated to internal consumption (internal consumption accounts for 22% of energy imports) (Cotarelo, 2015).

Figure 1. Barcelona's energy metabolism in 2013
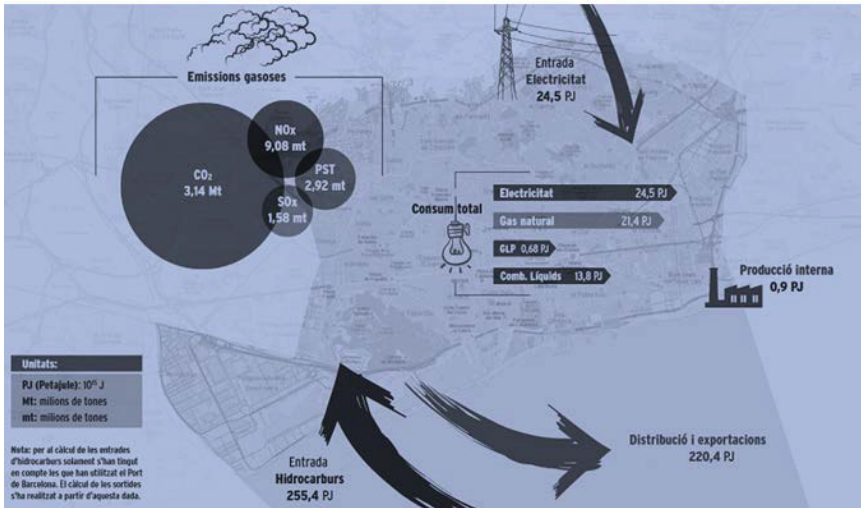
Source: Cotarelo (2015)
Note: To calculate the hydrocarbon input, only those used at the Port of Barcelona have been taken into consideration. The calculation of outputs has been carried out using this information.

Figure 2. Source of input energy flows in Barcelona

Source: Cotarelo (2015)

Believing that this huge reliance on energy produced elsewhere can be covered simply by committing to renewable energy and sustainable transport is unrealistic. Less so considering the time-frames available. A sustainable energy metabolism for the city of Barcelona inevitably involves significantly reducing energy consumption, which in turn requires a decline in urban population.

Renewable energy (including biomass) will not be enough to maintain current levels of consumption and, using the technology currently available, we would barely cover half of the world's consumption in a best case scenario (Fernández Durán and González Reyes, 2018). These limitations can be traced to three factors: the lack of concentration of renewable energy; the fact that, compared to fossil fuels, which can be stored, renewable energy takes the form of energy flows; and that the net energy provided by many of them is low. Physical issues, rather than technical issues, reduce the potential of renewable energy. And physical issues are non-negotiable.

This, combined with the fact that the industrial and hypertechnological format of renewable energies are an extension of fossil fuels, rather than autonomous sources of energy. They all

require a mining input and the processing of a range of compounds that are achieved thanks to fossil fuels. They also require heavy machinery that can only be powered by fossil fuels.

Currently, renewable energy is mainly used to produce electricity; however, not everything is powered by electricity. Around 75% of energy consumption in Spain is non-electric. Specifically, electricity is not ideal when it comes to powering trucks, tractors and diggers that require autonomy of movement, as their batteries are so heavy. Another sector with a strong reliance on fossil fuels is the petrochemical industry. To make matters worse, these two industries are two of the cornerstones of the Catalan economy.

The problem of the energy cost of the transition is no less great. Replacing 2% of coal-fired power capacity per year with renewable energies (assuming an energy return rate of 10:1, which is probably greater than the actual rate provided by renewable energies, over a lifetime of 40 years) requires an energy investment four times greater than the capacity to be installed, as nature is unable to offer an advance on energy credit (a wind turbine cannot be manufactured using tomorrow's energy). In reality, this entails a reduction in available power of 8%, rather than 2%. Therefore, investing in the energy transition involves reducing the energy available in the short term more quickly than would be the case if the commitment to a new energy model were not made. Only after seven years (more than one term in office) would the energy investment surpass the decline in fossil fuels. And the greater the amount of renewable energy to be installed immediately, the greater the energy investment, the decline in total energy available and the time from which the investment would be offset (Murphy, 2013).

Another factor that must be taken into consideration is time, as the time frames required to build the new infrastructures encroach on the drop in the availability of fossil fuels (the peaks of availability that have not yet been reached would be achieved in the coming years, or decades at most) and, therefore, represent a significant hurdle to an orderly energy transition. As part of the fossil fuel monopoly, new energy production systems have been installed over 50-75 years (Podobnik, 2006; Smil, 2017). And sources were not actually replaced in any cases; rather they were added. Instead of consumption being reduced, it was increased.

As if that were not enough, various elements that are key to the development of high-technology renewable energy are not available in sufficient volumes to support the mass explosion (Capellán-Pérez et al., 2019).

6. Materials

We will perform an analysis of Barcelona's material reliance based on the data for Catalonia, which are readily available. Furthermore, this is prudent from the perspective of sustainability: Barcelona needs to enhance its reliance on nearby production and extraction, i.e., sources within Catalonia. The functioning of the Catalan economy is based around the transformation of imports at early stages of transformation into manufactured products. It imports increasingly more consumables (fuels, minerals, agricultural biomass) to supply its main industries (food, automotive, chemicals), which in turn feed its exports[16] (González et al., 2015). The net physical balance is well in the red, standing at minus 47 million tonnes in 2016 (IDESCAT, 2020) (graph 3). In other words, it is a productive economy based on the mass consumption of fossil fuels, minerals and biomass, while at the same time being focussed on promoting mass consumption. The systemic crisis has put all of these under massive strain.

The main entry point for all these materials is the Port of Barcelona, with 35 million tonnes arriving in 2018 (not including foodstuffs, fish and local movement), of which almost 10 million tonnes were liquid petroleum (IDESCAT, 2020).

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16. Domestic extraction is mainly biomass (8.1 million tonnes in 2016), although for the main part non-metallic minerals (26.8 million tonnes in 2016) (IDESCAT, 2020), of which the most important fraction corresponds to construction materials (González et al., 2015).

Graph 3. International imports (a) and from the rest of Spain (b) cumulative from 1996 to 2010 in millions of tonnes in Catalonia. Physical trade balance (c)

(a) International imports
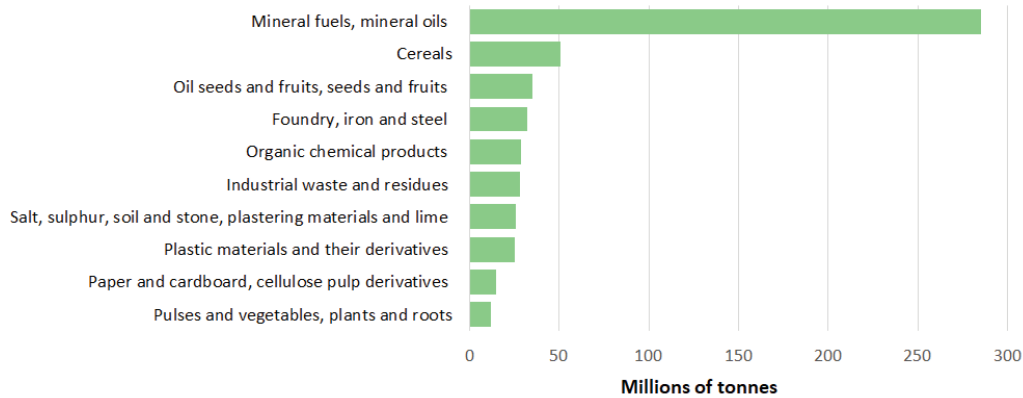
(b) Imports from the rest of Spain
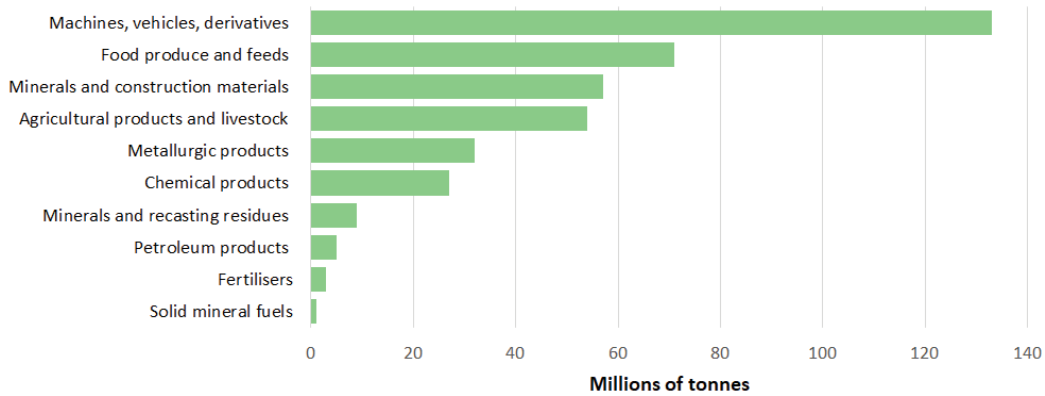
(c) Physical trade balance
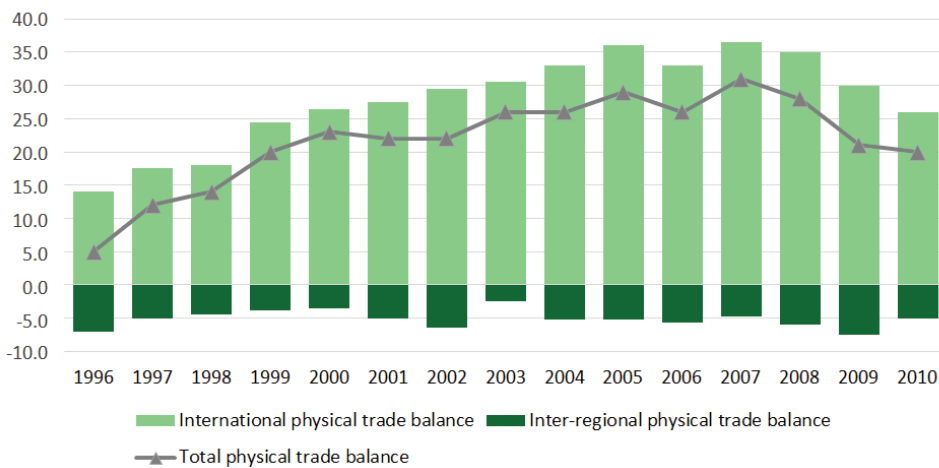
Source: González *et al.* (2015)

Faced with this, there are calls for a move towards a dematerialised economy and smart cities. This proposal is structured around an increase in efficiency thanks to the option of transferring data online. However, claims of the computerised world being of an immaterial nature and having a harmless environmental impact are unfounded. For example, the construction of a computer requires the extraction and processing of 1,000 times its weight in material, with the transportation of products that this entails and the ecological impact of its production. Furthermore, the materials used in their construction are scarce. The issue lies not just in the resources employed as part of their production, but the contaminating waste they generate. Furthermore, the functioning of cyberspace and image society require a considerable amount of energy: when adding together the

entire life cycle of devices, ICTs account for more than 4% of all energy (not just electricity) consumed on the planet (Turiel, 2018). Finally, there is no data to support the existence of such a dematerialisation (Parrique *et al.*, 2019).

7. Residues

The urban metabolism ultimately leads to waste. This is because the metabolism of cities is distinctly linear, rather than circular.

In terms of waste gas, the CO_2 emissions generated by the combustion of liquid fuels in Barcelona came to 3.14 million tonnes in 2013 (Figure 1). This confirms that urban centres are hubs of greenhouse gas emissions and that this situation is structural, as we have suggested.

In addition to this are the sulphur and nitrogen oxides and suspended particles (Figure 1) responsible for Barcelona's terrible air quality: in 2018, the Barcelona area once again exceeded the annual threshold for nitrogen dioxide and suspended particles measured at different stations (Ecologistas en Acción, 2019).

In 2018, Barcelona treated 265,000,000 million cubic metres of wastewater (BMA, 2020), accounting for just 2% of all the city's electricity consumption. In reality, energy consumption by the water network is much larger, as the pumping required as part of the supply, the treatment of drinking water and maintenance of infrastructures must all be taken into account. In terms of solid waste, in 2018, 1.6 million tonnes (459.5 kg per person) were generated, of which just 35.7 % was recycled or composted (BMA, 2020), confirming the linear nature of the urban metabolism.

Faced with these issues, there has been an increased commitment to the circular economy. However, the real circular economy, in which the reuse rate of elements can reach up to 99 %, is only achieved by nature. And let us not kid ourselves, these are the rates needed in a world of finite resources. To achieve this, the economy must be completely integrated into ecosystems. Only then will this feat be feasible. This requires economic systems based on solar power, biological products, refraining from using xenobiotics, travel over short distances and slow, small metabolisms (González Reyes, 2017). These factors are an impossible fit when it comes to major cities.

8. From the city to the countryside

The structural unsustainability of cities does not necessarily mean that the measures that mitigate their impact and increase their resilience to climate change would be unwelcome; particularly as the effects of global warming hit the most disadvantaged populations the hardest and they must receive protection. Simply, we should not get our expectations up about them being feasible in big cities in the medium term. The urban policies required involve reducing energy consumption and the transition of big cities towards a renewable model; however, these policies will most likely need to look beyond cities.

Renewable energy must really be renewable; in other words, energy produced with energy and materials that are actually renewable. In other words, those that for the large part use biomass and minerals that are in abundance. As a result of this ecosystemic crisis, a solid approach to managing and choosing biomass destinations is required. To achieve this, sights must be set on rural areas.
We also need renewable energy for much more than just producing electricity. For example, we need to recover machines that use the mechanical energy produced by water or wind to work. This entails decentralising production spaces and relocating them in areas in which renewable energies can bear fruit.

However, renewable energies are not limited to just wind, sun and water. Renewable energies include those provided by our muscles and the energy provided by other animals. Think of humans as self-repairing machines (when the damage is not serious), that are powered by 100% renewable and highly versatile sources. This revitalisation of human and animal work involves,

among other factors, populating rural areas to undertake agricultural work as the powerful machinery that currently performs this work starts to become more scarce.

There are no substitutes for oil that can sustain transporting large amounts of information, goods and people over large distances in short spaces of time. This will force us to move towards local economies. Economies will not only be more local; rather, they will also be essentially agricultural, as an industrial society can only be supported by fossil fuels.

Furthermore, decarbonising the economy within the time frames required to prevent climate change from running amok requires the removal of significant amounts of CO_2 from the atmosphere in addition to refraining from using fossil fuels. This can be achieved by applying policies for the mass renaturalisation of large regions and a staunch commitment to organic farming.

Renewable energy to power work, humans and animals as energy carriers, renewable sources of material, local and agrarian economies, rewilding, etc. requires a central objective for the eco-social transition: coordinating a living rural and agro-ecological world.

This objective is neither small nor simple. It requires a change in the way we view the rural world: revaluing it to the detriment of the urban world. To this end, significant investments are needed (which would likely be removed from urban spaces). For example, in public services (which are more expensive than in cities, as each infrastructure attends to a smaller number of people). In addition to legislation that promotes the rural exodus. At a municipal level, for example, reclassifying urban land in cities as land that cannot be used for building purposes. At a state level, revoking free trade treaties entered into and implementing regulations that prioritise fair and sustainable local production. And, as goes without saying, undertaking an agricultural reform process that fights against the division of land into large estates in favour of the community management of land.

In conclusion, we need to talk much more about the rural world than the urban world, as revitalising the former and dismantling the latter is imperative.

Bibliography

BARCELONA CITY COUNCIL. "Nuestra actividad afecta al clima". www.barcelona.cat/barcelona-pel-clima/es/el-cambio-climatico-en-barcelona/nuestra-actividad-afecta-al-clima [Consulted: 6 May 2020a].

BARCELONA CITY COUNCIL. "Balance de energía". www.energia.barcelona/es/balance-de-la-energia [Consulted: 10 May 2020b].

BMA (BARCELONA METROPOLITAN AREA). "Datos estadísticos". www.amb.cat/s/es/web/area-metropolitana/dades-estadistiques.html [Consulted: 14 May 2020].

ALMAZÁN, A. (2018). "Técnica y autonomía. Una reflexión filosófica sobre la no neutralidad de la técnica desde la obra de Cornelius Castoriadis". Madrid: Autonomous University of Madrid (Department of Philosophy).

CAPELLÁN-PÉREZ, I.; DE CASTRO, C.; MIGUEL, L. J. "Dynamic Energy Return on Energy Investment (EROI) and material requirements in scenarios of global transition to renewable energies". *Energy Strategy Reviews*, vol. 26, pp. 1-26. DOI: 10.1016/j.esr.2019.100399 (2019).

COTARELO, P. (2015). *Metabolismo de Barcelona. Hacia un nuevo modelo energético que no genere anticooperación*. Barcelona: ODG.

MARTÍN S.; GONZÁLEZ, E.; ANDALUZ, J. (2016). "Consecuencias del cambio climático sobre la disponibilidad de agua en España, tras la firma del Acuerdo de París". Madrid: Ecologistas en Acción.

ECOLOGISTAS EN ACCIÓN (2019). "La calidad del aire en el Estado español durante 2018". Madrid: Ecologistas en Acción.

ECOLOGISTAS EN ACCIÓN. "El coche eléctrico no resolverá la crisis climática" www.ecologistasenaccion.org/137544/el-coche-electrico-no-resolvera-la-crisis-climatica-2/ [Consulted: 28 February 2020].

ELLIOTT, J. *et al.* "Constraints and potentials of future irrigation water availability on agricultural production under climate change". *Proceedings of the National Academy of Sciences of United States of America*, vol. 111(9), pp. 32-44. DOI: 10.1073/pnas.1222474110 (2014).

FERNÁNDEZ CASADEVANTE, J. L.; MORÁN, N. (2015). *Raíces en el asfalto. Pasado, presente y futuro de la agricultura urbana*. Madrid: Libros en Acción.

FERNÁNDEZ DURÁN, R.; GONZÁLEZ REYES, L. (2018). *En la espiral de la energía.* Madrid: Ecologistas en Acción, Baladre.

GARCÍA-OLIVARES, A.; SOLÉ, J.; OSYCHENKO, O. "Transportation in a 100% renewable energy system". *Energy Conversion and Management*, vol. 158, pp. 266-285. DOI: 10.1016/j.enconman.2017.12.053 (2018).

THE WORLDWATCH INSTITUTE (ed.); GARDNER, G.; PRUGH, T; RENNER, M. (dirs.). (2016). "Las ciudades del mundo en un vistazo". Literature review on *Ciudades sostenibles. Del sueño a la acción*. Barcelona: FUHEM-Icaria.

GONZÁLEZ, A. C.; SASTRE, S.; RAMOS, J. "El metabolismo socioeconómico de Cataluña, 1996-2010", in Carpintero, Ó. (dir.) (2015). *El metabolismo económico regional español*. Madrid: FUHEM Ecosocial.

GONZÁLEZ REYES, L. "¿Qué implica una economía circular". www.eldiario.es/ultima-llamada/implica-economia-circular_6_689491068.html [Consulted: 29 September 2017].

HANSEN, J. *et al*. "Young people's burden: requirement of negative CO2 emissions". *Earth System Dynamics*, vol. 8, pp. 577-616. DOI: 10.5194/esd-8-577-2017 (2017).

HÖGY, P.; FANGMEIER, A. (2013). "Yield and Yield Quality of Mayor Cereals Under Climate Change". *UNCTAD: Trade and Environmental Review 2013. Wake Up Before Is It Too Late.* United Nations.

IDESCAT. "Anuario estadístico de Cataluña". www.idescat.cat [Consulted: 6 May 2020].

MURPHY, D. J. "The implications of the declining energy return on investment of oil production". *Philosophical Transactions of the Royal Society A: Mathematical, Physical & Engineering Sciences*. DOI: 10.1098/rsta.2013.0126 (2013).

PARRIQUE, T. *et al*. "Decoupling debunked: Evidence and arguments against green growth as a sole strategy for sustainability". *European Environmental Bureau* (2019).

PENGUE, W. A.. "Agroecología y ciudad". *Papeles*, vol. 139 (2017).

PEÑUELAS, J.; *et al*. "Shifting from a fertilization-dominated to a warming-dominated period". *Nature Ecology & Evolution*, vol. 1, pp. 1438-1445. DOI: 10.1038/s41559-017-0274-8 (2017).

PODOBNIK, B. (2006). *Global Energy Shifts: Fostering Sustainability in a Turbulent Age.* Philadelphia: Temple University Press.

PRIETO, P. "Consideraciones sobre el coche eléctrico y la infraestructura necesaria". *15/15/15 Revista para una nueva civilización* (2019).

RICO, A.; MARTÍNEZ-BLANCO, J.; MONTLLEÓ, M.; RODRÍGUEZ, G.; TAVARES, N.; ARIAS, A.; OLIVER-SOLÀ, J. "Carbon footprint of tourism in Barcelona". *Tourism Management*, vol. 70, pp. 491-504. DOI: j.tourman.2018.09.012 (2019).

SMIL, V. (2017). *Energy and Civilization. A History*. Cambridge (EE. S.A.): MIT Press.

TURIEL, A. "Las buenas noticias". http://crashoil.blogspot.com/2018/09/las-buenas-noticias.html [Consulted: 20 September 2018].

UNEP (2019). *Emissions Gap Report 2019*. Nairobi: UNEP.

UN-HABITAT (2012). *State of the World's Cities 2012/2013*. Nairobi: UN-HABITAT.

WORLD BANK "Desarrollo urbano". www.bancomundial.org/es/topic/urbandevelopment/overview [Consulted: 14 May 2020].

Energy insecurity from an ecofeminist perspective

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Energy insecurity is a complex, multi-dimensional problem that cannot be dealt with in an isolated manner without undertaking a global analysis of the energy model that is in use and its consequences for people and the environment. It is therefore necessary to force a discussion that goes beyond the capacity of households to pay, asking questions about regulations, the political context, social assumptions and, above all, the commercial perspective of energy. Energy insecurity has a major impact on the physical and mental health of families, and has a differential effect during childhood and adolescence. Similarly, the current energy model has a differential impact on women, by means of extractivism, the lack of access to energy services for carrying out the work of social care and reproduction and their exclusion from the decision-making process. It is therefore essential to review this energy model from an ecofeminist perspective and using social justice criteria that ensure a public and community control of energy which is in accordance with general interest, minimising the impact on territories and considering energy as a basic right for enjoying decent living conditions.

1. From energy poverty to energy insecurity

Covid-19 has had a major impact on our society. This mainly concerns the number of deaths caused, but it has also revealed the precarious management of some essential services for people —the clearest examples being healthcare and residencies for senior citizens— and it has focused attention on social inequalities, due to the measures proposed for dealing with it; lockdown and a partial shutdown of the economy.

The obligation to stay at home has further increased the insecure housing situation of a large proportion of the population: people who find it extremely difficult to meet rental or mortgage payments, who are enclosed in small spaces, with bad lighting and ventilation, or in a situation of energy insecurity. In this article, we will be taking a look at the concept of energy insecurity, a complex, multi-dimensional problem that has acquired relevance in the public agenda over the last decade and which, until now, was difficult to define, identify or measure.

We could say that there is a set of factors that indicate whether a household is at risk of falling into a situation of energy vulnerability, understood as a propensity for experiencing a situation in which the household does not receive a sufficient quantity of energy services (Tirado, 2018 citing Bouzarovski and Petrova, 2015). Energy vulnerability is a wider concept than the term traditionally used, energy poverty, as this is seen as a dynamic phenomenon (households can get into and out of energy poverty situations, depending on internal and temporary factors).

Table 1. Factors that may determine an energy-poverty situation. 2015

Factor	Driving force
Access	Low availability of suitable energy vectors to cover the household's needs.
Affordability	Disproportionate relationship between energy cost and household income, including the role of taxes and assistance mechanisms. Inability to invest in the construction of new energy infrastructures.
Flexibility	Inability to change to a means of energy provision that would be more appropriate to the household's needs.
Energy efficiency	Disproportionate loss of useful energy during conversion to household energy services.
Needs	Discrepancy between the household's energy needs and the available energy services, due to social, cultural, economic or health reasons.
Training contracts	Difficulties in gaining access to support programmes or efficient forms of energy use in the household.
Safety	A high risk of fire or electrocution, due to the presence of illegal supplies or the use of risky ways of providing heating.

Source: Own production based on Bouzarovski and Petrova (2015)

Table 1 lists the factors that may help in determining a situation of energy vulnerability. We identify those that were considered within the traditional definition of energy poverty, such as affordability —referring to both the price of energy and household income— and energy efficiency, but also others that describe other aspects of energy insecurity, such as flexibility, needs, practices or even access to energy services. It is also necessary to highlight safety as a relevant factor, linked to the risks of electrocution and fire, caused by illegal connections to supplies or the use of risky measures for obtaining heat —the use of candles, or the burning of newspapers, wood or pallets—

Although it offers a more global vision of energy vulnerability situations and integrates a North-South perspective into the various factors (such as access or accessibility), this definition is still overly based on the household as a measurement unit and practically the only space determining the lack of energy services. We propose a broadening of the perspective to include the structural causes of the problem, approaching it from the concept of energy insecurity.

We base this on two aspects to propose a change of concept. Firstly, energy-supply companies are clearly interested in installing the concept of poverty or vulnerability, which moves the entire onus of responsibility onto the person who "cannot pay for a service they are using", and therefore, the only possible action is the intervention of social services to "provide financial help to households so that they can access the service". This is a way of preventing the "service" itself from being questioned. Secondly, the concept of insecurity is much broader and also infers political responsibility. In fact "energy insecurity complements the frameworks of energy poverty and vulnerability by broadening knowledge about energy privation outside the home and linking it to institutional and political circumstances, which may (mobilise) particular socio-demographic groups to take action on the matter (Petrova, 2017: 3).

Therefore, the concept of energy insecurity makes it possible to consider all the factors involved, including abusive prices and opacity in invoicing costs, economic vulnerability in terms of meeting payments, the poor state of dwellings (damp, mould, etc.), the poor state of repair and maintenance of wiring and pipes, lack of safety in energy supplies (illegal connections) and even question the primary production of energy (fossil fuels, pollution, etc.) or its management model and marketing.

Indeed, one of the most worrying considerations, which makes detecting and tackling energy insecurity more difficult, as well as its consequences for families, is the stigmatisation and blaming of households that are in this situation. In this regard, it is important to propose the use of concepts that do not place the responsibility on households. It is therefore advisable to speak of neglected families rather than vulnerable ones, as this in some way recognises the role that society and public policies play in their situation. It seems obvious, but it is necessary to frequently insist on the fact that the families concerned do not wish to be in this situation, but that it is the result of processes that surround them, such as the job market becoming more insecure, the increase in social inequality and, in this specific case, the commodification and opacity inherent in energy

management. Therefore, we should complement individual and short-term solutions (vital for tackling family emergencies) such as specific financial transfers to households, with improvements in terms of regulations and public policies which lead to structural changes.

2. Clarifying concepts concerning energy insecurity

In Barcelona, "the results of the analysis of the Living Conditions Survey (ECV 2016) and the Barcelona Public Health Survey (ESPB 2016), both from 2016, indicate that around 170,000 people were unable to maintain their homes at a suitable temperature during the colder months or were in arrears with their basic utility bills, including electricity, gas and water. Of these, several thousand people also suffered the loss of some habitual energy sources at some time, i.e. they were disconnected either voluntarily or involuntarily, due to financial difficulties in the household" (Tirado-Herrero, 2018: 59).

The difficulty in measuring energy insecurity with a certain degree of accuracy is due to various factors. Sometimes, the perspective of energy as a commodified asset means that families assume that their inability to pay must result in them living in cold conditions and energy austerity (situations of energy insecurity that are not detected). Meanwhile, households develop various strategies for countering the difficulty of gaining access to energy services: some people minimise their use of these services, and therefore perceive their dwellings as being very cold in winter and very hot in summer; some people get into debt with companies so that they can keep warm, cook and have light; others reduce their expenditure on other essentials, such as food and, finally, there are families who feel they are obliged to illegally tap into supplies, with the resulting consequences of insecurity and social rejection.

The stigma and the blame that accompany households in a situation of energy insecurity are a result of the existing aporophobia in our society, but it is also because of some deeply entrenched misconceptions.

For example, training for households in energy saving or energy habits tends to be seen as a possible measures for dealing with energy-insecurity situations. Dangerous concepts are adopted, such as "if families ask for help, they have to do their part by reducing their energy consumption to the minimum". The reality is that, in general, families in this situation consume energy at levels that are below their basic needs. They are perfectly aware of their use of energy and if "energy saving" was in response to a demand for sustainability, as we are led to believe, then it would be applied with the same stringency to families and industries which, although able to pay, consume excessive amounts of energy and should reduce their energy expenditure.

Figure 1, produced by the Barcelona Institute of Regional and Metropolitan Studies, shows the serious disparity in *per capita* domestic electricity consumption in the City of Barcelona and it indicates where it is really necessary to improve energy habits and reduce consumption, not in terms of a family's ability to pay, but as a more profound reflection on energy uses in a climate-emergency context.

Another erroneous concept, which is very widespread and difficult to counter, is the one referring to families that illegally tap into the electric grid "because they don't want to pay" and "prefer to put their neighbours' lives at risk". The reality is very different. Nowadays, for most families, it is very difficult to gain access to decent housing, and this risk is especially worrying in terms of women who are in charge of single-parent households or who live alone, households with children, migrants, unemployed people or women working in the care sector, among others. Having a dwelling is essential in order to live a decent life and families are forced to resort to squatting to get a roof over their heads. In these cases, the companies supplying gas or electricity refuse to install meters. This means that, in order to get energy services, which as we have said, are essential for living a decent life, they tap into the grid illegally.

Figure 1. Per capita domestic electricity consumption
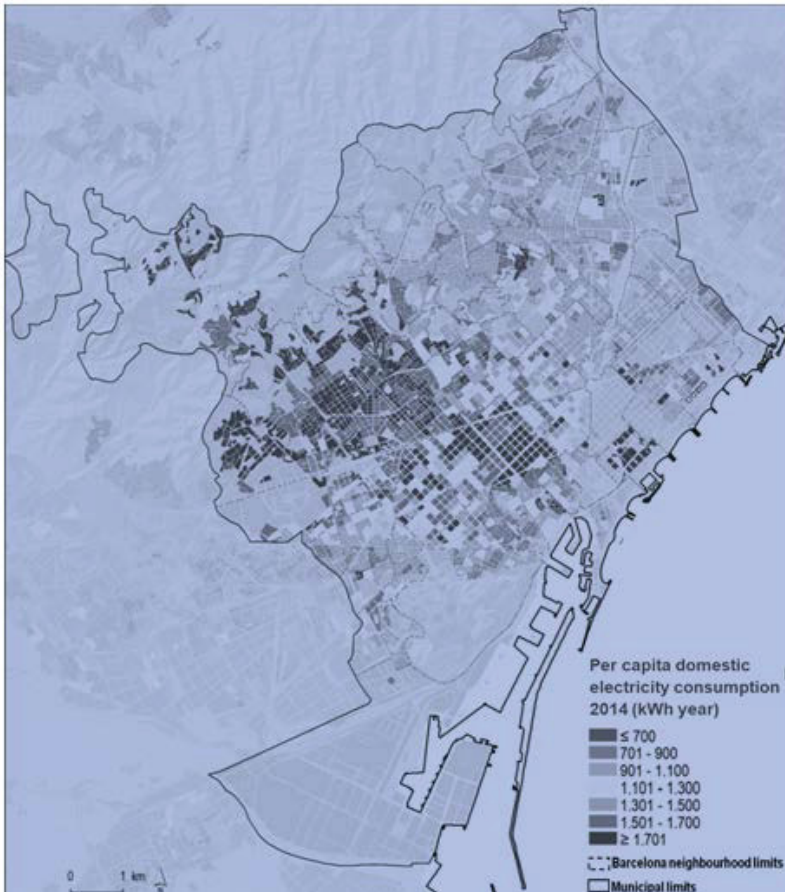
Source: The Barcelona Institute of Regional and Metropolitan Studies (Domene, Garcia-Sierra, 2017)

Firstly, it is important to put the problem into the correct perspective. Data provided by the *Ara* newspaper for 2018 reveal that, according to sources at Endesa, only 1% of what the company considers to be "electricity fraud" originates with vulnerable families. In reality, the major culprits are some of their "big customers".

Two years earlier, in 2016, as the firefighters belonging to the UGT warned in a communique, there had been 4,497 fires with 29 fatalities, an increase of 18% over the previous years. They spoke about "substandard housing, electrical risks as a consequence of defective installations, tapping electricity without adequate protection, the overloading of installations and electrocutions". That year, there was also a 20% increase in CO_2 poisoning as a result of bad boiler combustion or the use of risky methods for heating food or the dwelling. In 2014, four children lost their lives in Vendrell in a substandard dwelling that Bankia had evicted them from, but which they had later returned to as squatters, tapping illegally into the electricity grid.

A survey of 160 households with illegal energy supplies carried out by the Alliance Against Energy Poverty (APE) in the Barcelona Metropolitan Area indicates that over 60% of the families had tried to regularise their electricity supply without success, and that nearly 14% hadn't even been able to register as residents (when it is obligatory in law to do so).

Based on the experiences related to the APE by the affected people (Angel, 2019), many people who are illegally connected do so against their will, as the company concerned does not allow them to regularise the service, and they feel ashamed, guilty and even see themselves as "electricity thieves". The testimonies often speak about rejection and criminalisation by neighbouring families and public opinion in general, and this leads to isolation and a very high impact on the family's mental health.

Given the situation as a whole, it may be worthwhile to reflect on the need to abandon criminalising discourses born of prejudice and persevere in the demand for regularising meters in all dwellings, in order to prioritise the physical and emotional health of the people concerned and to guarantee their energy rights.

3. The impact of energy insecurity on children
A relevant question about energy insecurity, and something that has received little attention, is finding out what differential impact it has during childhood and adolescence.

In the City of Barcelona, 15% of households with children cannot maintain an adequate temperature in their home during the colder months and 13.4% have fallen behind in utility payments connected to the dwelling. Although these figures are high, they are averages that conceal large inequalities between districts and realities, such as Nou Barris, where 35% of households cannot maintain adequate temperatures and nearly 29% get into arrears with their bills. This data also reveals that the correlation between these two indicators is really rather low; i.e. the families that have problems in keeping their homes at an adequate temperature are not necessarily those that have outstanding bills.

Table 2. Material deprivation of children aged 0-17, by residential district

	Ciutat Vella	L'Eixample	Sants - Montjuïc	Les Corts i Sarrià - Sant Gervasi	Gràcia	Horta-Guinardó	Nou Barris	Sant Andreu	Sant Martí	Total
More than one deprivation	56.2	12.9	41.4	11.3	19.2	19.4	55.2	28.1	30.4	**27.1**
One or more deprivation	67.4	22.2	58.1	22.5	28.6	42.9	66.5	38.6	44.9	**40.0**
Cannot make a meal that includes meat,	14.2	1.9	7.1	0.9	6.7	3.4	7.5	3.5	3.5	**4.4**
chicken or fish at least every other day	32.3	6.2	25.4	3.5	9.3	12.4	35.0	16.3	13.4	**14.9**
Cannot maintain their home at an adequate	31.0	3.1	10.7	8.7	3.9	8.9	26.2	14.9	16.3	**12.4**
temperature during colder months	7.8	7.3	5.8	4.8	2.6	7.5	13.3	9.9	15.2	**8.0**
Falling into arrears with household payments	27.3	6.6	16.4	7.5	7.7	10.7	28.7	12.0	15.5	**13.4**
Falling behind on payments of deferred purchases	57.5	17.9	41.4	9.2	25.4	34.3	59.2	35.4	36.2	**31.7**
Falling behind on payment of household utility supplies	42.4	10.7	33.6	6.4	11.7	15.4	45.6	19.2	26.4	**21.0**
Unable to meet an unexpected expense	12.8	1.4	10.2	0.6	5.3	3.1	14.4	3.0	3.9	**5.1**

Source: Key data for children and adolescents in Barcelona 2018 (Barcelona City Council, 2018).

The data becomes even more alarming when we start to consider groups that are more stigmatised and invisible, such as families with illicit energy supplies: in the 160 families surveyed by the APE, there were at least 145 minors. These minors live in a permanent state of insecurity and risk of fire or electrocution due to the refusal of energy suppliers to install emergency meters in squats.

In spite of the evidence, the focus of energy insecurity has never been on children and adolescents and there is therefore little data in this regard, along with a lack of specific public policies. However, various studies and interviews with experts and affected families indicate that exposure to deficiencies such as the lack of decent energy services during the first years of a person's life, may have an irreversible impact on the future physical, cognitive and social health of those children.

This impact may be on physical health, with a high incidence of asthma, bronchitis and other airway disorders that are recurrent and difficult to cure; as well as malnutrition, due to the bad diets which families who have to decide between eating well or paying bills often suffer from.

Other factors can have serious effects on the mental health of children and young people, such as those related to a possible lack of personal hygiene, stigma, isolation, family stress due to the impotence of not being able to provide their children with decent conditions and the harassment connected to unpaid debts, guilt, etc. The situation of adolescents is especially delicate: they ask for more privacy, access to technologies, they prioritise a relationship between equals and may seek differentiation or confrontation with the family. A study produced by the United Kingdom's National Children's Bureau notes that one out of every four adolescents living in energy insecurity is at risk of suffering mental health problems (in other adolescents this ratio is one in twenty).

Neither should we underestimate the possible impact of energy insecurity on education, which leads to absenteeism due to recurrent illnesses, lack of concentration, difficulties studying at home, possible bullying situations, stigma or lack of night-time rest.

Lastly, it is necessary to consider the impact on children's safety, due to illegal connections to utility supplies. As we commented earlier, it is essential to understand that, given the energy needs involved in the tasks of caring for and sustaining life, families will seek a way to obtain energy services even if the means is unsafe. Reversing this situation is a matter of urgent necessity.

The situation in the Girona neighbourhood of La Font de la Pólvora is worth a special mention. In spite of the lockdown and the ban on cutting off supplies, there are a massive number of daily disconnections, justified under the classification of "electricity fraud". 80% of the 462 families are forced to have generators that they pay for —just like electricity bills—, they have suffered 7 fires in 4 years, they have gone back to using butane gas and wood stoves, the children are unable to keep up with their school work, etc. Last summer, during the heat wave, they had 20 minutes of electricity in 48 hours and their fridges and freezers stopped working.

Given the consequences that living in energy insecurity can have for minors, it is necessary to take cross-cutting measures to counter this situation. Organisations such as Engineers Without Borders, and the Alliance Against Energy Poverty have proposed an increase in the detection of risk situations, as many families fall outside of official circuits: e.g. working on a proposed detection protocol in education centres. It is necessary to establish financial aid aimed at children and adolescents that do not paternalise the families and which counter situations of severe vulnerability from a perspective of social justice. In other countries, per-child allocations aimed at reducing the risk of poverty in households with children have proved effective. It is necessary to introduce a guaranteed minimum income.

From the perspective of children's rights, if we provide them with education and healthcare, and energy insecurity undermines both of these, why should we not be thinking of decent housing conditions and sufficient water and energy to ensure that their physical and mental health are not compromised? How do we expect equal opportunities to function if we do not include basic supplies and residential security in our basic provisions for children? In other words, what kind of social justice do we expect to achieve if we don't put them at the centre of all socio-economic policies?

4. Energy insecurity from a gender perspective

Today, many voices are raised to denounce how unsustainable the economic system is, from an ecological, social and reproductive point of view. Amaia Pérez Orozco (2012) sustains that the current crisis indicates an ecological crisis, a social reproduction crisis in the Global South (the impossibility of satisfying people's material and emotional reproductive expectations, food/humanitarian crisis) and a care crisis in the Global North (malfunctioning of circuits that ensured the essential care needed to live).

From a physical and material point of view, energy has a major role to play in the fight against the ecological crisis —and the long-awaited energy transition—, a predominant role in the area of social justice and a close connection to the tasks of caring for, reproducing and sustaining life. It is therefore essential that the fight against energy insecurity is undertaken from an ecofeminist

perspective, contrary to extractivism's current logic of plundering and accumulation of economic benefit.

In recent years, we have seen how women's organisations, which have defended and connected their lives to the territory, have now stepped forward to denounce the profound impact of extractivist projects. Latin American groups have denounced the patriarchal violence associated with extractivism and have explained their *modus operandi*, which begins with the deliberate exclusion of women from decision-making processes that affect the territory and their lives (the company's negotiation), superimposing them with pre-existing patriarchal structures. Once the company is established, this is followed by ecological imbalances, depending on the territory: pollution of water sources, the disappearance of fishing stocks or other sources of food, difficulties for agriculture, etc., together with the employment of the male workforce by the company, disconnecting them from the territory and increasing the care workload for women (division of work by gender). In general, the projects are accompanied by the militarisation of the territory (which contributes to its masculinisation), and the reclusion of women into domestic areas, or as an object for sexual abuse in the brothels and canteens that accompany the introduction of a megaproject.

Contrary to what extractive capitalism defends, extractivist megaprojects have no positive economic impact on the communities that suffer them. They transport the energy far from the plundered lands and market it under the principle of economic gain, which in turn generates even more energy insecurity (the lack of decent energy services in households) and more impacts on women.

For example, in the City of Barcelona, the salary gap, the part-time and insecure work available to women (i.e. the vertical and horizontal segmentation of the job market) and the strong presence of gender roles, are some of the factors responsible for what we call the *feminisation of poverty*. Consequently, gender inequality affects energy insecurity, which threatens *single-mother* families, migrant women, women working in the care sector and women who live alone, especially those over the age of 65.

In regard to gender roles, in Graph 1 we can see how, on average, there are still twice as many women connected to care work —household and family— than men. This fact, together with the existing link between basic services and housework, increases still further the impact of energy insecurity on women and explains why organisations such as the APE are deeply feminised and that nearly 70% of financial aid for energy services was requested by women in 2015 (González Pijuan, 2017).

Graph 1. Average number of hours per week for household and family activities and paid work in Catalonia (2011)
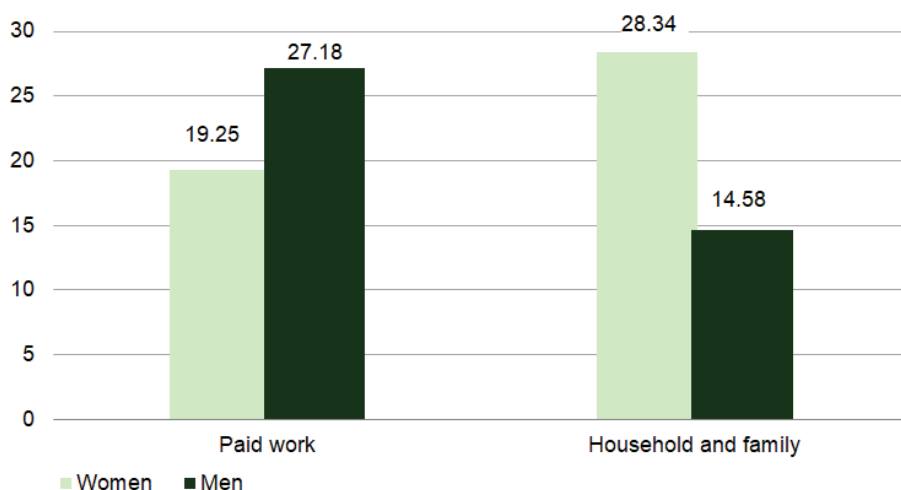
Source: Own production based on data from the IQ observatory, extracted from the Catalan Government

Given their connection to essential tasks for sustaining life and their recognition from a human rights perspective, one of the necessary reflections to make on energy services is: why is it that, far from prioritising and protecting family consumption, we take on a disproportionately high cost, 21% VAT and fixed costs on our electricity bills that excessively penalise domestic consumers? In other words, we take it for granted that energy orientated towards economic benefit is prioritised over energy for care work and social reproduction.

Lastly, it is necessary to highlight that decision-making in the electricity sector is also highly masculinised, as recounted in the book *Tenim energia* [We Have Energy], published by the Xarxa per la Sobirania Energètica [Network for Energy Sovereignty]: in 2016, only 5% of Management Board executive and leadership positions in relevant energy and utility sector companies around the world were held by women (Ernest & Young, 2016). The absence of women on executive boards was accompanied by an absence of women in the academic sector and a minority presence in the sector's relevant congresses and debates. However, as we said, women are leading both the defence of their territories against the current energy model in the Global South and the fight against energy insecurity and for a socially fair energy transition in Catalonia and in other countries.

To sum up, approaching energy insecurity from an ecofeminist perspective primarily involves recognising the impact that the current energy model has on women (from extractivism to the lack of sufficient energy services in the home), but also highlights other structural problems, which include the following:

  - Those who control the energy sector (is there any public, democratic control, connected to the territory, which ensures the general interest or is it based on the principal of social justice?).

  - To what end is energy transformed and consumed? (Do we prioritise vital energy needs, orientated towards decent energy services for households, for care and social reproduction?).

  - Where does the energy we consume come from? (What are the sources of the energy we use? Is the "production/transformation" of energy carried out using ecological and social-justice principles?).

5. Who controls the energy model (and how)?
For too long, energy insecurity (or poverty) has been separated from energy's global management model. There is a lot of evidence to suggest that we should think about whether, in reality, increasing energy insecurity is really just a consequence of the model and the commodification of a basic service that should never have been taken out of the public sphere.

However, in recent decades they have tried to convince us that private management was far better than public management: more efficient, less corrupt, more geared towards profit.

In 2009, two European directives (2009/72/EC and 2009/73/EC) helped to consolidate the liberalisation of the electricity and gas sector (initiated at the end of the 1990s in Spain) and separate the processes: generation, transport, distribution and commercialisation.

Since then, a series of things have occurred:

  - Between 2008 and 2018, electricity prices went up by 66.8% in Spain.

  - In the same period, the CNMC imposed sanctions on big companies for manipulating prices, including Iberdrola (€25 M in 2015), Endesa (€5.8 M between 2016 and 2017) and Naturgy (€19.5 M). In spite of this, the upward trend in prices continued.

- Between 1998 and 2013, a report from the Observatory on Debt in Globalization calculated that illegal payments (outside the interest of the general public) in the electricity sector as somewhere between €81,709 million and €103,899 million.

- From the start of privatisation, 24 ex-ministers have obtained executive posts in the 6 main electricity companies operating in Spain, according to information provided by the newspapers Marea and Crític.

At a European level, the consequences of the liberalisation of the energy sector have been widely denounced by the union of public-service workers (EPSU), who published a report in July 2019 concerning the failure of EU policies on the liberalisation of the energy sector.

The study shows how, under the paradigm of liberalisation and free market, a significant amount of power has been accrued by certain energy companies (the Big Five). Consequently, the prices of gas and electricity have risen throughout Europe (in 2014, European families spent an average of 9% of their income on energy services), energy insecurity has doubled, the rights of workers in the sector have been reduced and renewable energies have been blocked by private initiatives, subsisting on public money that have made their current development possible.

Furthermore, other studies[17] have shown that there is a chronic lack of prevision, investment and maintenance for networks, and an increasingly large number of city councils in Catalonia denounce recurring power cuts without any apparent cause.

In the area of sustainability and the fight against climate change, which is now inescapable, we find that both Naturgy Generación and Endesa Generación are among the 15 most polluting companies in Catalonia, according to a ranking published by *Sentit Crític*, based on data from the Ministry for Ecological Transition[18].

We should also remember the Energy Charter Treaty, an investment-protection agreement signed in the mid 1990s, although it is not often mentioned. The Energy Charter is the investment-protection treaty that has given rise to the most financial claims made against member states; 129 claims in the last 20 years. Since 2011, Spain has been subjected to 47 claims, due to the changes it made in 2013 to the guaranteed prices for renewable energies.

In regard to energy insecurity, one emblematic case is Bulgaria, which is facing three energy claims from Austrian and Czech Republic companies, because the Bulgarian government promoted a 7% reduction in electricity costs. In 2018, 34% of Bulgaria's population could not maintain their homes at an adequate temperature and 30% could not pay their bills on time, according to data from the European Observatory of Energy Poverty.

A report published by the Transnational Institute and the Corporate Europe Observatory warned of the possibility that, by means of the Energy Charter Treaty, international investors could register claims against Spain (remember that Endesa owns the Italian company Enel) because of the measures introduced during the state of emergency and the ban on cutting off power supplies.

The mere existence of these investment-protection treaties and the threat of claims being registered via arbitration courts are frequently enough to dissuade countries from making major changes to their legislation in favour of the environment and people, or reversing liberalisation processes.

6. Conclusions
Energy insecurity is a complex, multi-dimensional problem that cannot be dealt with in an isolated manner without undertaking a global analysis of the energy model and its implications. It is

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17. https://esf-cat.org/wp-content/uploads/2017/06/ESFeres19-RecuperantControlEnergia-web.pdf
18. https://www.elcritic.cat/dades/aquestes-son-les-15-empreses-mes-contaminants-a-catalunya-49732

necessary to move towards a discourse and terminology that does not hold families responsible, as their energy rights have been violated.

It is also necessary to avoid discourses that only consider the ecological perspective and ignore social justice. For example, it is necessary to analyse how possibly better forms of energy production and management, such as energy communities, could reach families in a situation of energy insecurity under equal conditions. The struggle for the energy model should not leave any group behind. We have to ensure that everyone has the energy services that are essential for life, ensuring that illegitimate debts don't smother families, ensuring workers' rights, holding companies to account and demanding that basic services return to the public sphere.

At present, energy insecurity affects many families and Covid-19 may cause this number to increase even more. Emergency measures are therefore needed now, including a ban on cutting off power supplies, writing off the debts of vulnerable families and ensuring that they have energy services, through discounts and paying off their bills. Energy-advice offices are needed; they have proved useful in improving access to energy services for families living in the city.

However, this is not enough to solve the problem of energy insecurity. We need to rethink the model, to demand that something that is of public interest, and a right, should be returned to the public sphere, under citizen control and participation, of course. Nationalising the big electricity companies, abandoning international investment protection in order to begin the task of protecting the economic, social and cultural rights of the people.

No more thirst, cold or darkness: the right to energy.

Bibliography

ADAM, S.; MONAGHAN, R. *Fuel Poverty. What it means for young parents and their families*. Economy Energy, National Children Bureau, 2018.

ANGEL, JAMES. "Irregular connections: Everyday energy politics in Catalonia". *International Journal of Urban and Regional Research*. Vol. 43, Nº. 2 (2019), pp. 337-353

BARCELONA CITY COUNCIL. Key data on children and adolescents in Barcelona , 2018.

ERNEST & YOUNG. All tied up. Working capital management report, 2016.

BÁRCENA, L.; APARICIO, M.; FLORES, L. "España expuesta a demandas millonarias por las medidas sociales ante la covid-19. ¿Ha llegado la hora de abandonar los Tratados de Inversiones?" https://blogs.publico.es/dominiopublico/33087/espana-expuesta-a-demandas-millonarias-por-las-medidas-sociales-ante-la-covid-19-ha-llegado-la-hora-de-abandonar-los-tratados-de-proteccion-de-inversiones/ [Consulta: 2 June 2020]

BAUTISTA, J.; DOMINGUEZ, D.; ROBAINA, E. " Les portes giratòries dels polítics a les grans empreses energètiques". www.elcritic.cat/investigacio/les-portes-giratories-dels-politics-a-les-grans-empreses-energetiques-10509 [Consulta: 27 May 2020]

CARVAJAL, L. *Extractivismo en América Latina. Impacto en la vida de las mujeres y propuestas de defensa del territorio.* Fondo de Acción Urgente América Latina y el Caribe, 2016.

COLECTIVO MIRADAS CRÍTICAS DEL TERRITORIO DES DEL FEMINISMO. "(Re) patriarcalización de los territorios. La lucha de las mujeres y los megaproyectos extractivos". www.ecologiapolitica.info/?p=10169 [Consulta: 27 May 2020]

COTARELO, P. *El coste real de la energia.* The Observatory on Debt in Globalization , 2015.

DOMENE, E.; GARCIA-SIERRA, M. (2017). "El funcionament del sistema metropolità. Cap a una transició sociometabòlica." Barcelona Institute of Regional and Metropolitan Studies. Available online at: https://iermb.uab.cat/ca/iermb/estudi/el-funcionament-del-sistema-metropolita-cap-a-una-transicio-sociometabolica/

FERREIRO, E.; FORNIÈS, D.; TROBAT, A. *Dones, feminismes diversos i drets col·lectius.* Col·lecció Drets Col·lectius. CIEMEN, 2017.

GONZÁLEZ PIJUAN, I. *Desigualtat de gènere i pobresa energètica, un factor de risc oblidat.* Esferes. Engineers Without Borders, 2017.

NETWORK FOR ENERGY SOVEREIGNTY. *Tenim energia.* Icaria Editorial, 2017.

PETROVA, S. "Encountering energy precarity: Geographies of fuel poverty among young adults in UK". *Transactions*. Vol. 43 (1) (2018), pp. 13-30.

PÉREZ-OROZCO, A. *Subversión feminista de la economía.* Traficantes de Sueños, 2012.

TIRADO-HERRERO, S. *Indicadors municipals de pobresa energètica a la ciutat de Barcelona*. Barcelona, 2018.

WEGHMANN, V. *The failure of energy liberalisation.* PSIRU, University of Greenwich, 2019.

The Social Impact of Climate Change: between collapse and social metamorphosis

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Climate change has been regarded as the biggest risk facing contemporary societies. In this article we reflect on its social impact, including institutional architecture and policies, as well as the conceptualisation of vulnerability, resilience, mitigation and adaptation, all key issues in the fight against climate change. Cities play a fundamental role in the fight against climate change but they have not been studied as much as nation states. This analysis will take the form of a kind of reflective essay on some of the aspects of interest for analysing the social impact of climate change, specifying, where possible, the city of Barcelona.

Introduction[19]

The sociologist Ulrich Beck (2017) described contemporary societies as societies at risk, not so much from the natural threats and risks that society has suffered throughout its history – an argument counterbalanced by the increase in life expectancy, mainly in the economically developed societies – as by the new types of risk arising from human activity itself. Apart from the risks posed by the nuclearisation of the world – with the capacity to destroy the world in an instant (Robock and Toon, 2010) – climate change (hereinafter CC) – capable of destroying the world as we know it or leaving it seriously damaged in the medium and long term (IPCC, 2014) – exemplifies this type of risk. The evolution of language itself – from *risk to nature* to *climate change* – acknowledges that. Moreover, the global, planetary changes that have occurred since industrialisation and which are affecting the functioning of the planet as a system, have led to our epoch being described as a new geological era, the Anthropocene (Crutzen, 2006).

It is a social fact because it is caused by human activities, more specifically greenhouse gas emissions into the atmosphere, which combine with the natural variability of the climate, and also because of the consequences for societies and all that they need and value for subsistence, namely, nature. Climate change has made it clearer than ever that nature and society are not opposing, antagonistic realities. It is not possible to understand society without taking into account its dependence on the biogeophysical environment. Nor is it possible to understand a biogeophysical environment without considering how societies have historically intervened in it. This is already the first social impact of climate change: the necessary epistemological change that

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enables us to understand the problem and, therefore, have better knowledge tools at our disposal for "solving" it.

Furthermore, CC expresses the relationship between local and global like no other social problem. We are talking about a global, planet-wide problem whose causes are to be found at a local level. And here cities take on a special prominence as the cause (because of their economic activities, mobility, population concentrations, consumption of resources, etc.) but also as those who suffer the consequences (pollution, flooding and so on).

Cities are aware of that. As early as 1994, they made it very clear in the Charter of European Sustainable Cities: "We understand that our present urban lifestyle, in particular our patterns of division of labour and functions, land-use, transport, industrial production, agriculture, consumption, and leisure activities, and hence our standard of living, make us essentially responsible for many environmental problems humankind is facing. We are convinced that sustainable human life on this globe cannot be achieved without sustainable local communities"[20]. The point had already been made by Maurice F. Strong, Secretary-General of the United Nations Conference on the Environment and Development held in Rio de Janeiro in 1992, when he declared that the global battle for sustainability would be won or lost in cities.

Barcelona City Council agrees with that diagnosis, not only on the human cause of the problem but also on the solution. On 1 January 2020 it declared the 'climate emergency' (Barcelona City Council, 2020). That municipal positioning is important, since political-institutional leadership is key in the fight against climate change (Barcelona City Council, 2018).

The controversies with the deniers and sceptics have been superseded21. There is now clear proof: an increase in the average temperature of the planet, melting ice caps and rising sea temperatures. The consequences for the planet's biogeophysical system will mean an increase in the number and intensity of extreme meteorological phenomena, including heat waves, storms and hurricanes, among others (IPCC, 2014, 2018). In a nutshell, it is forecast that the Iberian peninsula will be hotter and drier, mainly the southern part, sea levels will rise and it will experience greater meteorological extremes (AEMET, 2019).

The projections for Barcelona to 2100 (AEMET, 2020) are an increase in temperature, more hot and torrid nights, as slight reduction in rainfall and a greater frequency and intensity of extreme weather events. To those projections we need to add the current "heat-island" effect (Arellano Ramos and Roca Cladera, 2016; Martín-Vide, 2017) and the risk of a rise in the sea level, resulting in receding or disappearing beaches, flooding and the corresponding impact on port and coastal infrastructures (Barcelona Regional, 2017). This is not a new phenomenon. The city has already suffered significant contemporary experiences of heat waves, water stress and flooding that will foreseeably increase with climate change.

That is the framework for the analysis of the social impact of climate change in Barcelona, both in terms of its negative aspects and those with the potential for its social transformation to a city based on sustainable development. This analysis, by way of reflection, moves from the global to the local, given we are dealing with a problem where, as we said earlier, global and local are connected in the causes and the consequences.

1. The social impact of climate change
The benchmark report by the Intergovernmental Panel on Climate Change[22] (IPCC) has diagnosed the problem on a planetary level, located the causes and projected the probable consequences.

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20. http://www.sustainablecities.eu/fileadmin/repository/Aalborg_Charter/Aalborg_Charter_English.pdf
21. There are important differences between deniers and sceptics but they do not affect the central issue of this article.
22. Commissioned by the United Nations Programme for the Environment (UNEP) and the World Meteorological Organisation (WMO). https://www.ipcc.ch/ [retrieved on 26/4/2020].

We are talking about a problem of global environmental change affecting the whole of the Earth in how it functions as a system, and which will have – already is having – consequences, to a greater or lesser extent depending on the location, but inevitably for all humankind, with catastrophic global risks if the average temperature of the Earth's surface increases by more than 2º C (IPCC, 2014, 2018).

Citizens, economists and politicians have been slow in recognising and taking on board the importance and urgency of a problem that climate scientists have been reporting on for decades. The Paris Agreement (UN, 2015a), despite its limitations (Clémençon, 2016), has given an unprecedented political impulse to global, worldwide action in the fight against climate change. The 190 plans for fighting CC put forward by the ratifying countries must be reviewed every five years (starting in 2023). Whether that will be enough to achieve the Agreement's goals and targets is questionable. Either way, in a world where sovereignty is in the hands of nation states, entailing severe limitations on global agreements, the world's climate now matters. However, that is the space of politics, necessary but not enough in the workings of complex societies like those of today.

1.1. Impact on recognising science as a reference

That has been one of the first, important, social impacts of climate change. World science, through the IPCC, is playing a central role in the world's and countries' political decisions. The Paris Agreement (UNa, 2015) set a target of not exceeding an increase of 2º C, and if possible 1.5º C, in the Earth's average temperature, based on the analyses of the IPCC (2014). In the post-truth era, that is no trifling matter.

Although science is now internationally connected, climate change science has some unique characteristics. The IPCC is a global panel that synthesises scientific knowledge by means of a meta-analysis of scientific literature. Not only that of climate science but also natural and social sciences – rather more limited in the latter sphere. This is another important characteristic: an interdisciplinary approach, which is necessary for achieving a better understanding of the biogeophysical and social reality of our planet and finding solutions to the problem.

In addition, there are the benchmark reports of the IPCC which, despite being a panel that only scientists sit on, is a framework for interaction with governments.[23] That structure is necessary for discussing issues relating to the impacts, adaptation, vulnerability and mitigation of climate change.

In short, it is a panel capable of synthesising global knowledge on this issue, of doing so with an interdisciplinary approach and through dialogue with governments. Regardless of the critical aspects (Trainer, 2017) any one of those areas could be subjected to, the existence and work of the IPCC is proving key in the fight against climate change.

Barcelona has recognised that. Climate change is a reality and the IPCC is the benchmark scientific body (Barcelona City Council, n.d.).

The credibility achieved by the IPCC's reports is extremely noteworthy and very rare in science or politics and key in the fight against climate change.

1.2. Impact on the important role of the United Nations as a global institution

As a global problem affecting the planet, climate change must be addressed globally (IPCC, 2014). In a world organised around nation states, global agreements and globally coordinated decision-making are no easy task.

With regard to climate change, despite having different responsibilities, all societies have some level of responsibility in its causes and solutions (United Nations Framework Convention). The United Nations has been a key player in coordinating and reaching agreements on the fight against

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23. https://www.ipcc.ch/about/structure/

climate change. Said agreements are difficult and complex. Countries participate not so much because they consider the climate to be a global asset, a common good, but to project their particular, one could say selfish, national interests in the global sphere (Nava Escudero, 2016; Pardo and Ortega, 2018).

1.3. Impact on the important role of the European Union

The European Union is at the forefront of international efforts on the climate. At the end of 2014, it was the first big economy in the world to present its 2030 commitment (EC, 2019) to reduce greenhouse gas emissions by 40% compared to the baseline year of 1990, with a view to increasing that target to 50%-55% in the recent European Green Deal (CE, 2019), aimed at reconciling the economy with taking care of the planet. Other targets have been set too, namely to have a renewable energy share of at least 32% and a 32.5% improvement in energy efficiency.

This leadership, with the capacity to change the coordinates of geopolitics (Oberthür, 2016), is another of the results of CC, in a political context where there is a lack of interest on the part of the United States[24] in this matter and the emergence of China as an important player in world climate policy (Hilton and Kerr, 2017). The fight against CC therefore has the potential to be a kind of European identity, at a time of crisis for that identity (Kaina and Karolewski, 2013) with some member states questioning their membership of the EU, as well as the UK's Brexit.

Barcelona has aligned itself with the EU's commitments to reduce greenhouse gas emissions by 40%-45% by 2030.

Leadership and political consensus is a key question in the fight against climate change. The European agreement and the corresponding national and local ones are, therefore, other positive aspects that need highlighting.

1.4. Impact on the role of cities in the fight against climate change

Cities have a central role in the fight against climate change (Rosenzweig *et al.*, 2010). More than 70% of carbon emissions can be attributed to urban areas (Bazaz *et al.*, 2018), involved in a process of economic and population growth, even with the "temporary" standstill caused by the COVID-19 pandemic.

Traditionally the focus has been on nation states which, in many cases, have been incapable of tackling the fight against climate change extensively and effectively (Rosenzweig *et al.*, 2010). Cities, on the other hand, are emerging as important players, carrying out risk assessments and drawing up climate change mitigation and adaptation plans. However, cities have largely been ignored in research on climate change until very recently (Rosenzweig *et al.*, 2010).

International political landmarks for cities include the Paris Agreement (UNa, 2015) and the Sustainable Development Goals (SDGs from now on) – the so-called 2030 Agenda – (UNb, 2015), as well as the United Nations' New Urban Agenda (UB, 2016). In Spain this has taken shape in a Ministry of Social Rights and 2030 Agenda with the rank of Deputy Prime Minister. As a municipality, Barcelona has committed itself to the SDGs of the 2030 Agenda. (Barcelona City Council, 2020b).

The next step is to go from targets to action. It's high time to take climate change seriously! Nevertheless, it is important to make clear the radical change that is required to achieve those targets. Decarbonising cities means mobilising large-scale investment in renewable energies, public transport, energy-efficient buildings and solid waste management, among other areas. But reversing the historical trend that has produced climate change will require much more than policy change or infrastructure investment. It is necessary to give shape to cities so they satisfy the needs of their inhabitants, reduce their consumption of resources and maintain economic development. It

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24. The United States has not ratified the Paris Agreement, although many of its States, counties and municipalities have set ambitious targets in that regard.

requires breaking down the cultural and mental barriers that support the *modus operandi*. However, cities cannot do all this alone. Regional and national governments need to create their own frameworks for that, helping the different players to coordinate their efforts. (Broekhoff *et al.*, 2018). For example, private investment is probably a key question for satisfying the deficit in infrastructure investment. 2017).

Milestones have included the creation of the Covenant of Mayors, promoted by the European Commission, in 2014, and now called the Global Covenant of Mayors for Climate and Energy (which rewarded Barcelona for its Climate Plan in 2018); recognition by the Paris Agreement (2015) of the importance of non-signatory interested parties: cities and other sub-national administrations, civil society and the private sector, among others; the Summit of Cities and Regions at UN COP23, in 2017, inaugurated by Barcelona's mayor, Ada Colau[25], where cities called for national governments to give them the tools to fight against CC, and the Spanish Network of Cities for the Climate under the framework of the Spanish Federation of Municipalities.

While the United States often fail to see the risks, as Beck (2017) pointed out, in relation to CC, cities are in a better position to see the opportunities. Climate change could be inverting the state-city relationship to the extent that cities are becoming pioneers in this important matter. A good example is the role cities are playing in turning the energy model towards local, renewable energies or transforming urban planning from an infrastructure-based model to an ecosystem-based one (Rueda, 2016; López *et al.*, 2020).

It is no longer a question of just having top-down vertical structures and action – global, national, local – but horizontal as well, in this case between cities, whether they are local, national or international. And, most important of all, given globalisation and that horizontality, cities are becoming global players, global cities, seeking partnerships between institutions, civil society and businesses. It is a question of developing the opportunities for horizontal alliances with other cities (spaces of freedom, autonomy and innovative leadership) as the protagonists. This global cooperation between cities has the potential to be a vital lever in advancing the fight against CC.

Cities now have the opportunity for a transformation, a metamorphosis towards sustainability with a forward-looking approach. As we were saying, they can be the producers of their own energy with renewable energies, of a new, ecosystemic urbanism and buildings that take CC into account (López *et al.*, 2020), urban mobility based on collective transport and shared electric cars, freeing up space for other public uses, smart water and waste management in a circular economy, citizen participation in city management, and so on.

1.5. Impact on the awareness of opinion leaders and society

Environmental values and awareness, whether they be precursors or normalisers, are necessary for social behaviour and action in relation to climate change (Pardo, 2006). The fight against CC requires the participation of all social sectors, not only top-down but also bottom-up, not just vertical but horizontal too.

There has been an exponential increase in societal awareness of the risks of climate change in recent years. This is illustrated by the *Laudato si* (Praise be to You) encyclical of Pope Francis[26], with its message for humanity to proceed with modesty in the face of arrogance that ignores long-term effects, or the "Muslim Declaration on Climate Change"[27], calling on people not to endanger the planet's delicate "balance" (*al-mizan*). But above all there has been the emergence of a global social movement, mainly of young people, such as the Climate Fridays or Extinction Rebellion[28]

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25. https://ajuntament.barcelona.cat/premsa/2019/09/20/ada-colau-presideix-a-nova-york-la-inauguracio-de-la-cimera-mundial-de-grans-ciutats-per-lemergencia-climatica/
26. http://w2.vatican.va/content/francesco/es/encyclicals/documents/papafrancesco_20150524_enciclicalaudato-si.html [retrieved on 26/4/2020].
27 .http://www.ifees.org.uk/wp-content/uploads/2017/04/ICCD-Spani-Full.pdf [retrieved on 26/4/2020].
28. https://www.fridaysforfuture.org/ (retrieved on 10/9/2919). https://rebellion.earth/ [retrieved on 26/4/2020].

launched by the Swedish teenager Greta Thunberg, which has succeeded in putting the climate emergency on the political and economic agenda. A movement that is not merely ideological but more profound, a movement of action.

Barcelona's citizens are not immune to that social conscience. Some 800 citizen organisations have made their commitment to the climate (Barcelona City Council, n.d.) explicit with specific projects to be carried out.

It is a starting point for fostering a global-local climate-conscious citizenry, which not only requires a process of information and communication but a training and participation process as well.

The planet is a limited, "closed" system. Societies, on the other hand, are open systems which, as such, have seen how the climate and environmental crisis has revealed the urgent need to not exceed those limits. A citizenry that is organised, committed and active in defence of the common good – the environment, the climate – has the potential to support and drive social changes that turn "bad things" into "good". Thus climate change amounts to a metamorphosis of society and politics.

Social participation, in a process of constructing "ourselves", is the necessary tool for said training and social transformation. The success or failure of the fight against climate change depends to a large extent on what this climate citizenship is like.

1.6. Impact on health, the economy and infrastructures
The threats posed to Barcelona by climate change have already been identified (Barcelona City Council, 2018): a rise in the temperature and more extreme weather phenomena mean risks for human health[29] and economic activity and infrastructures worthy of consideration. However, the consequences of these risks go much further and have the potential to affect virtually each and every one of the spheres that make up a society – social, economic, political, institutional, biophysical and so on.

Future scenarios are based on two perspectives: the passive scenario and the committed scenario. For Barcelona (Barcelona City Council, n.d.), with a baseline year of 2015, the respective data in 2100 would be: higher temperatures, +3º C and 1.7º C; less rainfall, -26% and -14%; a rise in the sea level, between 64 cm and 133 cm and between 46 cm and 115 cm; 16 times and 8 times as many heat waves; 6 times and twice as many torrid nights (more than 25º C).

Based on those two scenarios, the Barcelona study indicates the following effects (Barcelona City Council, n.d.): "People's health will be affected by heat, insect-transmitted diseases and lower water availability [...]. Inequalities will become more evident with more social conflicts as well [...]. The supply of basic resources such as energy or water will not always be guaranteed [...]. The cost of living will be directly affected by possible increases in the price of fossil fuels – those we still depend on – and derivative products or those transported over long distances [...]. The city's biodiversity and nature, both flora and fauna, will be affected by the expected climate changes".

In other words, even in the committed scenario, the social impacts of climate change will leave their mark on health, infrastructures, social vulnerability and the economy. Mitigation and adaptation measures are key.

Recognising CC as a social fact has far-reaching implications for all the spheres that make up a society, because it would mean the solution to the problem does not lie in nature itself but in society. The social impact of climate change will depend on what society does or doesn't do. The risk and its social significance are not static questions. The impact is the result of the danger – in this case, climate change – in its interaction with the environment, in this specific case, Barcelona's physical and social environment. In sum, threats, dangers, what type they are, represent a risk for

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29. The heat wave that hit Europe in the summer of 2003 produced around 70,000 deaths, direct or induced.

societies which, depending on the characteristics of said societies and the measures taken, will have a greater or lesser, negative or positive impact, with more or less possibilities for mitigation or adaptation in a dynamic process. It is important to stress this, as it implies putting the emphasis on action, on social change, on transforming the systems that make up Barcelona in line with the fight against climate change.

1.7. Mitigation and adaptation to climate change

Mitigation and adaptation to climate change comprise the tools for combating it (IPCC, 2014). By *mitigation* the IPCC (2018) means human intervention aimed at reducing greenhouse gas sources or enhancing their sinks. *Adaptation* in human systems, is understood as the process whereby societies adjust to the actual or expected climate and its affects, in order to moderate harm or exploit beneficial opportunities. It also adds an adaptation gradient: incremental adaptation which maintains the essence and integrity of a system or process at a given scale. In some cases, incremental adaptation can accrue to result in a transformational adaptation, that is, one that changes the fundamental attributes of a socio-ecological system in anticipation of climate change and its impacts.

In this framework it remains to be written how exactly CC is changing or transforming society. Social scientists have a responsibility to contribute knowledge here but are late in doing so. In the opinion of the sociologist Ulrich Beck (2017), climate change has the potential not only to produce social change but a social metamorphosis, which he regards as the opposite to social change. Change refers to society's ongoing evolution, while metamorphosis means a radical change, a historical change in our world view. This could be summed up as what was impossible yesterday is real today. Apart from the harm they can do, disasters can also serve as a catalyst for change, for social transformation (Birkmann *et al*., 2010), in the different parts of a society, on an economic, political and social level, in this case due to climate change. We are talking about a civilising change in the relationship societies have with nature, with the planet as a biogeophysical system that makes human habitation possible.

Key issues in this metamorphosis include the vulnerability, resilience and strength of cities' social, economic, political and institutional structures to prevent, mitigate and adapt to climate change and, more specifically, to the actual, aforementioned increase in heat waves and night-time temperatures, as well as the increase in the heat-island effect, flooding and possible situations of water stress. The Barcelona Climate Plan includes mitigation and adaptation measures, and Barcelona is one of almost 80% of European cities with over 500,000 inhabitants that have already drawn up plans in that regard (Reckien, 2018).

On that path, it is important to clarify and specify the concepts of vulnerability, resilience and strength, as these are the frameworks on which mitigation and adaptation to CC are based.

Although there is no universal definition for the concept of vulnerability and, moreover, it is a very complex question, for the purposes of this article we will follow the definition of the IPCC (2018:92), according to which "vulnerability encompasses a variety of concepts including sensibility or sensitivity to harm and lack of capacity to cope and adapt, in this case to climate change". Somewhat broader is the definition of Wisner *et al*. (2004:11), who refer to it as "the characteristics of a person or group and their situation, which influence their capacity to anticipate, deal with, resist and recover from the impact of a threat". Phillips and Fordham (2009), for their part, add that social inequality (economic, cultural, etc.) is a key factor in vulnerability which, moreover, is embedded in the social structure. In other words, vulnerability is not merely associated with the conditions of specific individuals but also those of the environment in which their lives develop. All that gives us a body of elements that are relevant to an analysis of social vulnerability in Barcelona in relation to climate change.

Regarding risk in relation to climate impacts, the IPCC (2018:89) defines it as "the potential for adverse consequences from a climate-related hazard, or from adaptation or mitigation responses to that hazard, for livelihoods, means of subsistence, health and well-being, ecosystems and

species, economic, social and cultural assets, services (including ecosystem services) and infrastructure. Risks derive from the intersection between vulnerability (of the system affected), exposure over a long period of time (to the hazard), the (climate-related) hazard and the likelihood of it happening".

Note that the risk will have a greater or lesser impact depending on the vulnerability and hazards derived from climate change. Once again, insisting on the importance of identifying, eliminating or reducing the vulnerabilities, in this case of Barcelona, is key in the fight against climate change. Furthermore, insofar as a risk is a social construct, both this and vulnerability can be interpreted in different ways that have to be taken into account to understand them and act.

The other side of vulnerability is the social category of resilience. It has been adopted from social psychology and is used a great deal in analysing environmental stress of the physical environment. Attempts have been made for decades now to include social dimensions in the concept of resilience (Folke, 2006). It is another concept with a range of definitions. The question of cities' resilience is not new. Pickett *et al*. (1992) discussed the difference between definitions that consider resilience in equilibrium or in non-equilibrium. For the general purpose of this article, we take the distinction made by Cartalis (2014:1); "in the first (equilibrium) the city must design and plan to avoid reaching a terminal point. In the second view (non-equilibrium), the city needs to define multiple (internal) states and ensure that the interaction of the processes will facilitate its stability".

This is what the IPCC (2018:88) has done in its analyses, where it defines resilience as "the capacity of social, economic and environmental systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure while at the same time maintaining their capacity for adaptation, learning and transformation". It is a concept that has come to be implemented in action structures, as in the case of Barcelona City Council's Urban Resilience Department.

In reality, vulnerability, risk, adaptation and resilience are not separate issues but closely related, so their analysis requires a holistic framework to know and understand them better (Birkmann *et al*., 2013), in a context of multi-risk management in contemporary societies.

Having included these categories in the analysis of societies, that analysis is sometimes carried out as if society was a homogeneous whole, with no analytical breakdown of significant socio-demographic variables. Yet gender, economic status, age and education, among others, are variables that enable us to study the vulnerability, risk and resilience of societies in more depth.

Although gender has been recognised as an important factor in developing public policies, it seldom features in climate change analyses (Pearse, 2017), with some recent exceptions, such as the one for Latin American countries (Aldunce *et al*., being printed). The IPCC (2014) believes it is highly likely that the effects of CC will be different for reasons of gender. Regrettably it does not say much more.

The still scarce literature on CC and gender has mainly revolved around two thematic axes: women as vulnerable and women as virtuous, showing good behaviour, in this case in relation to climate change (Arora-Jonsson, 2011). Vulnerable mainly in the South, due to their poverty, and virtuous in the North for their environmental awareness. A critical analysis of that classification is beyond the scope of this article. We merely note as a hypothesis the rigidity and, probably, error of those two thematic axes.

The vulnerable connection stems from the close relationship between poverty and vulnerability and the fact that women as a social group are poorer and have less power than men. Good behaviour in relation to CC is associated with the fact that women use public transport more, mostly carry out the domestic tasks, and therefore influence the consumption of water, power, food, etc., and, in

short, with the close connection between gender and productive and reproductive activities (Pardo, 2002; Pearse, 2017).

A bibliographic review on gender and climate change concludes that "literature has established that gender relations are an integral feature of the social transformations associated with climate change. This poses a challenge to gender-blind social research into climate change. Without gender analysis, we omit key aspects of social life in a changing climate. It is vital that the gendered character of climate change is recognised and further explored in the social sciences and humanities" (Pearse, 2017:1).

In Barcelona's case, the Climate Plan (Barcelona City Council, 2018) includes the gender variable mainly with regard to two questions: gender justice and gender vulnerability.

In the still scarce body of research on gender and CC, particularly with regard to the specific contributions women make and can make in relation to adaptation measures, Barcelona has an opportunity to develop further these analyses and proposals, which complement the identification of women's vulnerabilities in social inequality and injustice.

2. Conclusion

Contemporary societies will have to live with multi-risk situations and environmental conditions that are constantly changing, often at great speed, such as some of the consequences of climate change, among others, and many with a high degree of uncertainty.

Climate change is a worldwide, global change and, as such, it requires global governance. Major progress has been made in this area in recent decades, where the United Nations has been a key player and the IPCC a benchmark scientific body with the capacity to influence public policy. Global institutional architecture and the agreements on fighting climate change, implemented at national and local levels, represent a solid foundation. The credibility of science and international organisations is an important matter and it must be maintained and reinforced.

However, this internationalisation is not always governed by the common good, the Earth's climate. Often countries come together to pursue their own particular interests. While that attitude has its logic, the gravity of the problem requires them to overcome their "short-sightedness". Disasters, climate change provide an opportunity for educating political, economic and social leaders on the nature of vulnerability faced with the risk of disaster and, therefore, on the importance of reinforcing social systems to make them more resilient. The policies of mitigation and adaptation to climate change are ideal frameworks for that.

Moreover, disasters, in this case climate change, can serve to bring about changes in the very structures that have led to the problem, a social metamorphosis, an opportunity for social transformation.

Climate change expresses the relationship between local and global like no other issue. And cities have a key role to play in that regard. As a global city, Barcelona has a hand in creating the climate change problem (due to its economic activity, mobility, dense population, consumption, etc.) but also in solving it, or, at least mitigating and adapting to it. The strategic plans, programmes and actions drawn up by Barcelona City Council, despite the controversies, make the city, its institutions, organisation and citizens an active player in combating climate change.

Various issues have been identified as possible steps in those processes. Analyses of vulnerability and resilience require society to be broken down into meaningful social groups. It is not enough to analyse it as if it were homogeneous.

Adaptation and mitigation should be considered together, to help identify the synergies they share, positive and negative. This is especially important for cities, where these factors are closely intertwined. In those synergies, it is necessary to take into account the impact that mitigation and

adaptation measures can have on meeting the Sustainable Development Goals. Not everything goes in the fight against climate change, which must be geared towards achieving sustainable cities.

Urban planning will have to be linked to climate change issues in a cross-cutting manner. Cities will be safe if, in their risk reduction assessment, they consider climate change and disasters together.

Finally, and running through all the aspects mentioned previously, there is a need for scientific knowledge to be more closely linked with the needs and requirements of city planners. For science to be useful in combating climate change, it has to be interdisciplinary and transdisciplinary. The social impact of climate change is very complex and to be understood it requires interactive research and action on the part of both natural and social sciences, as well as citizen science.

Bibliografhy

Scientific articles:

ARORA-JONSSON, S. "Virtue and vulnerability: Discourses on women, gender and climate change". *Global Environmental Change*, 21(2) (2011), pp. 744-751.

BIRKMANN, J.; CARDONA, O. D.; CARREÑO, M. L.; BARBAT, A. H.; PELLING, M.; SCHNEIDERBAUER, S.; WELLE, T. "Framing vulnerability, risk and societal responses: the MOVE framework". Natural Hazards, 67(2) (2013), pp. 193-211.

CARTALIS, C. "Toward resilient cities – a review of definitions, challenges and prospects". *Advances in Building Energy Research*, 8(2) (2014), pp. 259-266.

CLÉMENÇON, R. "The two sides of the Paris climate agreement: Dismal failure or historic breakthrough?". *The Journal of Environment & Development*, 25(1) (2016), pp. 3-24.

FOLKE, C. "Resilience: The emergence of a perspective for social-ecological systems analyses". *Global Environmental Change*, 16(3) (2006), pp. 253-267.

HILTON, I., & KERR, O. "The Paris Agreement: China's 'New Normal'role in international climate negotiations". *Climate Policy*,17(1) (2017), pp. 48-58.

KAINA, V.; KAROLEWSKI, I. P. "EU governance and European identity". *Living Reviews in European Governance*, 8(1) (2013).

NAVA ESCUDERO, C. "El Acuerdo de París. Predominio del soft law en el régimen climático". *Boletín mexicano de derecho comparado*, 49(147) (2016), pp. 99-135.

OBERTHÜR, S. "Where to go from Paris? The European Union in climate geopolitics". *Global Affairs*, 2(2) (2016), pp. 119-130.

PEARSE, R. "Gender and climate change". *Wiley Interdisciplinary Reviews: Climate Change*, 8(2) (2017), e451.

RECKIEN, D.; SALVIA, M.; HEIDRICH, O.; CHURCH, J. M., PIETRAPERTOSA, F.; DE GREGORIO-HURTADO, S.; ORRU, H. "How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28". *Journal of Cleaner Production*, 191 (2018), pp. 207-219.

ROBOCK, A.; TOON, O. B. "Repercusión planetaria de una guerra nuclear regional". *Investigación y ciencia*, (402) (2010), pp. 40-47.

ROSENZWEIG, C.; SOLECKI, W.; HAMMER, S. A.; MEHROTRA, S. "Cities lead the way in climate-change action". *Nature,* 467 (7318) (2010), pp. 909-911.

TRAINER, T. A. "Critical Analysis of the 2014 IPCC Report on Capital Cost of Mitigation and of Renewable Energy". *Energy Policy*, 104 (C) (2017), pp. 214-220.

Books:

BAZAZ, A.; BERTOLDI, P.; BUCKERIDGE, M.; CARTWRIGHT, A.; DE CONINCK, H.; ENGELBRECHT, F.; LWASA, S. *Summary for Urban Policymakers: What the IPCC Special Report on global warming of 1.5° C means for cities*. Geneva: IPCC, 2018.

BECK, U. *La metamorfosis del mundo*. Barcelona: Paidós, 2017.

BROEKHOFF, D.; PIGGOT, G.; ERICKSON, P. *Building Thriving, Low-Carbon Cities: An Overview of Policy Options for National Governments.* London and Washington D. C.: Coalition for Urban Transitions, 2018.

DASGUPTA, A. *IPCC 1.5° Report: We Need to Build and Live Differently in Cities*. Washington D. C.: World Resources Institute, 2018.

FLOATER, G.; DOWLING, D.; CHAN, D.; ULTERINO, M.; BRAUNSTEIN, J.; MCMINN, T. *Financing the Urban Transition, Policymakers' Summary*. London and Washington D. C.: Coalition for Urban Transitions, 2017.

IPCC. *Cambio climático 2014: Informe de síntesis.* Contribución de los Grupos de trabajo I, II y III al Quinto Informe de Evaluación del Grupo Intergubernamental de Expertos sobre el Cambio Climático [Equipo principal de redacción, R. K. Pachauri y L. A. Meyer (eds.)]. Geneva: IPCC, 2014.

RUEDA, S. *Urbanismo Ecosistémico.* Barcelona: BCNEcología, 2016.

Chapters in books:

ALDUNCE, P.; M. P. GONZÁLEZ, A.; LAMPIS, M.; PARDO-BUENDÍA, S. V.; POATS, J. C.; POSTIGO, A.; ROSAS, R.; SAPIAINS ARRUE, A.; UGARTE CAVIEDES, M.; YAÑEZ FUENZALIDA, N. "Sociedad, gobernanza, inequidad y adaptación", en Moreno, J. M.; Laguna-Defior C.; Barros, V.; Calvo Buendía, E.; Marengo, J. A.; Oswald, U. *Evaluación de actuaciones de adaptación al cambio climático en los países RIOCC*. Madrid: McGraw Hill (being printed, ISBN: 978-84-486-2164-3).

ARELLANO RAMOS, B.; ROCA CLADERA, J. "Identifying urban heat island: the Barcelona case", en *Back to the Sense of the City: International Monograph Book.* Centre de Política de Sòl i Valoracions (2016), pp. 798-812.

CRUTZEN, P. J. "The anthropocene", in Ehlers; Eckart; Krafft; Thomas (eds.). *Earth System Science in the Anthropocene.* Berlín and Heidelberg: Springer (2006), pp. 13-18.

IPCC. MASSON-DELMOTTE, V.; ZHAI, P.; PÖRTNER, H. O.; ROBERTS, D.; SKEA, J.; SHUKLA, P. R.; PIRANI, A; MOUFOUMA-OKIA, W.; PÉAN, C.; PIDCOCK, R.; CONNORS, S.; MATTHEWS, J. B. R.; CHEN, Y.; ZHOU, X.; GOMIS, M. I.; LONNOY, E.; MAYCOCK, T.; TIGNOR, M.; WATERFIELD, T. "Anexo I: Glosario", in Matthews, J. B. R. (ed.). *Calentamiento global de 1,5 °C, Informe especial del IPCC sobre los impactos del calentamiento global de 1,5 °C con respecto a los niveles preindustriales y las trayectorias correspondientes que deberían seguir las emisiones*

mundiales de gases de efecto invernadero, en el contexto del reforzamiento de la respuesta mundial a la amenaza del cambio climático, el desarrollo sostenible y los esfuerzos por erradicar la pobreza (2018), pp.73-94.

MARTÍN-VIDE, J. "Cambio climático y modificación local del clima en Barcelona", in Corbella, D. *L'aigua i l'espai públic. Anàlisi dels efectes del canvi climàtic,* Barcelona: University of Barcelona (2017), pp. 21-32.

PARDO, M. "Women, Transport, Cities Sustainability, and Social Participation", in Leal Filho, W. (ed). *International Experiences on Sustainability.* Frankfort, Berlin, Berne, Brussels, New York and Oxford: Peter Lang Publisher (2002), pp. 221-233.

PARDO, M. "El análisis de la conciencia ecológica en la opinión pública: ¿contradicciones entre valores y comportamiento?", in De Castro, R. (coord.). *Persona, sociedad y medio ambiente*, p*erspectivas de la investigación social de la sostenibilidad.* Seville: Junta de Andalucía (2006), pp. 71-82.

Websites:
AEMET. "Efectos del Cambio Climático en España" (2019). http://www.aemet.es/es/noticias/2019/03/Efectos_del_cambio_climatico_en_espanha [Consulted: 3 April 2020].

BARCELONA CITY COUNCIL. Barcelona for the Climate (2018). https://www.barcelona.cat/barcelona-pel-clima/es/ [Consulted: 3 April 2020].

BARCELONA CITY COUNCIL. "Climate Emergency Declaration" (2020a). https://www.barcelona.cat/emergenciaclimatica/sites/default/files/2020-02/Declaracion_emergencia_climatica_es_0.pdf [Consulted: 3 April 2020].

BARCELONA CITY COUNCIL. "2030 Agenda" (2020b). https://ajuntament.barcelona.cat/agenda2030/esay [Consulted: 3 April 2020].

BARCELONA CITY COUNCIL. "Climate change, a reality" (n.d.). https://www.barcelona.cat/barcelona-pel-clima/es/el-cambio-climatico-en-barcelona/el-cambio-climatico-una-realidad [Consulted: 3 April 2020].

BARCELONA CITY COUNCIL. "More Sustainable Barcelona" (n. d.). https://www.barcelona.cat/barcelonasostenible/ca [Consulted: 3 April 2020].

BARCELONA CITY COUNCIL. "Future Scenarios" (n.d.). https://www.barcelona.cat/barcelona-pel-clima/es/como-nos-afecta-el-cambio-climatico/proyecciones-de-futuro

BARCELONA CITY COUNCIL. "In what way are we vulnerable" (n.d.). https://www.barcelona.cat/barcelona-pel-clima/es/como-nos-afecta-el-cambio-climatico/en-que-somos-vulnerables [Consulted: 3 April 2020].

CE. "European Green Deal" (2019). https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf [Consulted: 3 April 2020].

CE. "2030 Framework for Climate and Energy". https://ec.europa.eu/clima/sites/clima/files/strategies/2030/docs/2030_euco_conclusions_en.pdf [Consulted: 3 April 2020].

UN. "Paris Agreements"
(2015a). https://unfccc.int/files/essential_background/convention/application/pdf/spanish_paris_agreement.pdf [Consulted: 3 April 2020].

UN. "2030 Agenda for Sustainable Development"
(2015b). https://unctad.org/meetings/es/SessionalDocuments/ares70d1_es.pdf [Consulted: 3 April 2020].

RECC. "Quinto Informe sobre las Políticas Locales de lucha contra el Cambio Climático"
(2016). http://www.redciudadesclima.es/sites/default/files/1505732767_0-v-informe-sobre-politicas-locales-de-lucha-contra-el-cambio-climatico-femp_0.pdf [Consulted: 3 April 2020].

Experiences

Reducing inequalities with a social energy policy

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Energy policy offers a valuable framework for contributing towards a reduction in inequalities, although the possibility margins depend on the biophysical constraints and intervention methodologies that have prevailed on an international, state and local level since the climate crisis was recognised. Making progress on guaranteeing the right to energy on the supply and demand side is one way of coordinating the different institutional arrangements (from cooperatives to municipalism, for example) but requires the central role of the public authorities to be recognised. The article addresses this question, as well as the strategic space between energy policy and social policy that should be used, citing examples such as the electric social bond, energy advice points, and other potential designs and programmes it is worth considering in a social energy policy. Fighting inequalities cannot be the role of social policy alone. As in other areas of public policy, energy policy also has a lot of potential.

Introduction: inequalities and climate change

Reducing inequalities has become a priority policy objective for many local institutions. An objective that has acquired a central role in the actions of Barcelona City Council with the failure to correct the effects of the 2008 financial crisis and the socio-economic dynamics in an unfavourable Spanish and European context. The current crisis associated with the Covid-19 pandemic means an even more adverse conjuncture, because everything points to some of the improvements achieved recently being rolled back. Likewise, the climate emergency will clearly affect the design and implementation of new local public policies aimed at combating inequalities. The climate crisis means we face a scenario in which it is highly likely that the available resources will gradually become fewer and of less quality, as regards both assets (e.g. energy) and sinks (e.g. the atmosphere, the oceans and plant mass). Moreover, this likelihood will probably occur in a situation where the possibility of accessing a sufficient quantity of these resources will be determined by income level.

The complexity and potential of energy policy, as an element linked to both climate change and material living conditions, offer us a good analysis and reflection framework for trying to draw some conclusions on the role of sectoral policies such as energy in the objective of reducing inequalities. This article intends to make a contribution along these lines.

1. Climate emergency context and institutional architecture

The idea that climate changes poses a real threat to social well-being, not only to future generations but also the current generations who are already suffering it, has taken hold in recent

years, especially in Europe. Previously held positions that maintained climate change was not a problem because it was a natural phenomenon not linked to our socio-economic model, and that, in any case, the effects it might cause would be borne by future generations, are slowly being abandoned. However, the possibility of advancing further down this road, leaving such outlooks behind and putting effective solutions into practice, is rather complex, because it depends on both the biophysical conditions that impose the problem of climate change as well as the political conditions associated with the institutional structure and intervention methodologies for tackling this problem that gradually became fairly widespread and established on an international scale during the last quarter of the 20th century. (Cotarelo, 2015)

As regards the latter aspect (we do not deal with the biophysical conditions in this article), let us recall that the Rio Summit in 1992 is the historical reference point for recognising climate change as a phenomenon with international implications and since when plans have gradually taken shape – notably the United Nations Framework Convention on Climate Change (UNFCCC) and Agenda 21 – that had already begun at the United Nations Conference on the Human Environment (UNCHE) in Stockholm 20 years earlier. In 1997, the Kyoto Protocol (KP) became another reference milestone as the agreement that committed 43 countries, including those belonging to the European Union (EU), to reduce their greenhouse gas (GHG) emissions by 5%, compared to the 1990 levels, between 2008 and 2012.

Global concern for climate change has gradually generated considerable institutional architecture directly linked to the impact capacity of scientific reports published by the Intergovernmental Panel on Climate Change (IPCC) since 1990, which serve as the basis for creating the UNFCCC and the contents of the KP, and have increased the influence capacity of many NGOs on both a local and a global level.

Spain and Europe have also been building their own reference framework which influences their approach to tackling climate change today. The EU[30], beginning with its commitment to the KP, and apart from creating all the institutional apparatus around the Emissions Trading System (ETS), has been and is developing various climate and energy reference tools such as the packet of climate and energy measures up to 2020, the 2030 Climate and Energy Framework and the Long-Term Strategy to 2050, which the European Commission now wants to consolidate by means of a climate law.

On a state level, Spain[31] has developed the corresponding 2005-2007 and 2008-2012 national emission assignation plans, the 2007-2012-2020 Spanish Climate Change and Clean Energy Strategy, the 2021-2030 National Integrated Climate and Energy Plan (PNIEC in Spanish), and the national adaptation plans for 2006-2020 and 2021-2030 (currently at the drafting stage). Added to these, the autonomous regions have their own plans and strategies and the local authorities their Agenda 21s. Besides the international and state-level plans and agreements for confronting climate change, lower-level authorities have felt obliged, called on and pushed into taking the initiative.

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30. For more detailed information and to access the documents, we recommend you consult the following links on the European Commission website: https://ec.europa.eu/clima/policies/eu-climate-action_es; https://ec.europa.eu/clima/policies/strategies/2020_es; https://ec.europa.eu/clima/policies/strategies/2030_es; https://ec.europa.eu/clima/policies/strategies/2050_es; https://ec.europa.eu/clima/policies/eu-climate-action/law_en
31. For more detailed information and to access the documents, we recommend you consult the following links on the Ministry for the Ecological Transition and Demographic Challenge: www.miteco.gob.es/es/cambio-climatico/planes-y-estrategias/; www.miteco.gob.es/es/cambio-climatico/publicaciones/publicaciones/Libros.aspx; hwww.miteco.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/Estrategia.aspx; www.miteco.gob.es/es/cambio-climatico/legislacion/; www.miteco.gob.es/es/cambio-climatico/temas/impactos-vulnerabilidad-y-adaptacion/default.aspx.

On a local level, Barcelona[32] has not remained on the sidelines either. The city drew up the 2011-2020 Barcelona, Energy, Climate Change and Air Quality Plan in 2010 and, subsequently, the 2018-2030 Climate Plan, in line with Catalan Climate Change Act (Act 16/2017). During the recent wave of climate change declarations, Barcelona announced its own in January 2020[33], driven by an explicit spirit of co-responsibility and as a catalyst of the ambition of city climate and environmental policies. The local authority believes that the climate crisis is already having an effect on the organisation of social life and that, in the future, even if the commitments stemming from the 2016 Paris Agreement are met, it foresees a series of biophysical alterations taking place that justify an institutional statement on the climate emergency.

This brief overview of the context makes it clear to us that there is an institutional climate history on an international, state and local level that influences the way the climate emergency situation is being tackled today. Any attempt to gradually introduce new intervention approaches, such as the one announced here of adopting climate policies that incorporate the objective of reducing inequalities, will have to make the most of the possibilities arising from the frameworks outlined above but will also have to overcome the obstacles that those same frameworks might impose, explicitly or implicitly. Given that climate policies have largely been translated into energy policies in recent years, we will now deal with how the latter interrelate with the aforementioned objective. In the next section, we will analyse questions related to the energy institutional framework and its architecture to try to understand where the impulse for an energy policy to reduce inequalities can come from. Then we will look at current and potential intervention methods for making that possible.

2. Reducing inequalities: guaranteeing the right to energy

The question of energy institutions is linked to the 'energy model'. Concern about how the current energy model is unsuitable for covering the social needs of the population and how it contributes to the generation of inequalities has been expressed in various ways in recent years. Assuming that the right to energy is not guaranteed as such at present, various initiatives have been launched to transform this energy model and redress the aforementioned situation. Some approaches pose this transformation in terms of structural and legislative changes in favour of an energy model that provides regulatory and instrumental guarantees for the right to energy (under equity and sustainability criteria) and is based on decentralised institutional and physical architecture, open to citizen participation in the democratic processes of controlling and designing energy policies, as well as in the democratic processes of power generation, through individual and collective self-generation schemes. It is therefore usual to identify this stance in terms of 'energy democracy' (Angel, 2016; Sweeney, 2014; Cotarelo and Riutort, 2017). Equally, however, the strategies for making progress in this democratic direction are diverse and vary, depending on the context.

If we focus our attention on our immediate environment, we can identify two unique strategies. First, those citizen cooperative initiatives that have emerged particularly over the course of the last decade with the aim of not only being collective practices for promoting renewable energies but also for promoting a clearly emancipatory form of relationship with energy based on cooperative principles (Riutort, 2016). One of the most successful cases is without a doubt Som Energia (SE), a non-profit cooperative in the renewable electricity generation and marketing sector. Set up in Girona nearly 10 years ago now, it ended 2019[34] with over 63,000 members around Spain and a work team of over 70 people, managing more than 107,000 electricity contracts (mainly to individuals but also companies, communities of home owners, public authorities and social economy entities), an annual production of 13,838 MWh through its own projects (photovoltaic, hydroelectric and biogas) and 15 collective purchase agreements of domestic self-production for

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32. For more detailed information, please go to the following link: www.barcelona.cat/barcelona-pel-clima/ca/el-pla-clima/diagnosis-de-partida/mesures-de-govern-i-plans-estrategics.

33. On 15 January 2020, Barcelona City Council published 'This is not a drill. Climate emergency declaration', available at: www.barcelona.cat/emergenciaclimatica/sites/default/files/2020-02/declaracio_emergencia_climatica_ca.pdf.

34. For further details you can consult Som Energia's 2019 Social and Economic Report: https://drive.google.com/file/d/1QhN_O4TITTOF_YNGPjdDgTKd4njjR3Jq/view.

875 households. Aside from its business side, SE is also an example of modernising the cooperative model in its more associative side. It has some very diverse in-person and virtual participation, collective learning and territorial-based spaces (53 local groups, including one in Barcelona) which, together with some other activities apart from generating and marketing electricity, help to fertilise a democratic economic and – in this case – energy culture.

Second, we would highlight the role local authorities have been playing in recent years in addressing climate change and equity. In that regard, some cities have taken a step forward and become proactive in the energy sector. In Barcelona's case, that means setting up Barcelona Energia (BE) in 2018. This is a public renewable electricity marketing company which supplies electricity to municipal buildings and facilities and others in the metropolitan area, as well as private homes since January 2019. Its appearance follows energy (re)municipalisation processes (Cumber, 2016) carried out in other European cities and reflects the determination to provide an instrument that contributes to a form of energy provision with a public service vocation, working to defend the right to energy access and restoring the leading role of the public sector. This stance is reflected in the government measure Transition to Energy Sovereignty (Barcelona City Council, 2016).

As far as this article is concerned, it is relevant to ask to what extent these initiatives, one that emerged from the private sector (in this case with a cooperative logic) and another from the public sector (in this case through municipal action), have the capacity to guarantee universal access to energy from every possible sphere in terms of equity in demand as well as supply and generation, including the associated decision-making processes and relevant control mechanisms. Can energy cooperatives and municipal bodies act so people who find themselves in a more vulnerable socio-economic position can gain access to all spheres of the energy model?

Ultimately, the possibility of recognising and guaranteeing basic social rights – among which we would include the right to energy – with regulations and policies rests with institutional politics and public management bodies. The public authorities' role is essential in ensuring electricity is supplied under an overtly public-service logic (decommercialised, cost adapted to income bands and responsible consumption) that guarantees universal access and, therefore, reduces the inequality in accessing electricity use at a time when energy prices are beyond the reach of a growing part of the population. It is also essential in facilitating universal participation on the supply side, devising public policies that would ensure a person's level of income was not an insurmountable barrier to their being a participant in this sphere. In the latter case, therefore, it would contribute to reducing the inequalities in accessing power generation (taking advantage of the capture of flows stemming from common assets such as the sun or the wind), to its efficient management and to the democratic governance processes of energy policy.

In order to move in that direction, the public sector can learn from the innovative experiences like those of SE. We are referring to what can be learnt from the business operations environment (which is related to service provision and management), from the democratic governance model and, finally, from adopting a comprehensive approach that embraces different aspects from an energy and social point of view.

As has already been pointed out, in the last decade, with the effects of the 2008 crisis, the objective of reducing inequalities has been at the heart of many local public policies, in Barcelona too. Nevertheless, we still face the challenge of ensuring that this objective is not tackled from different angles with little integration or from the logic of closed public policy compartments.

3. Between energy policy and social policy
In order to understand the limitations of current energy policies faced with the challenge of reducing inequalities, we will now look at two examples that illustrate an energy policy with a social side and a social policy with an energy side. In both cases, we are talking about public policies designed by the competent areas for each policy – energy and social – and based on their own approach.

3.1. An energy policy with a social character: the electric social bond

The most obvious example of an energy policy with a social character is the 'electric social bond' (*bono social de electricidad*). This is a social discount rate applied to the electricity bills of people who meet certain vulnerability requirements established by law in order to protect this type of consumer. It can only be offered by the so-called 'reference distributors' (*comercializadores de referencia*). That excludes both SE and BE, the initiatives outlined above. The discount is currently applied to the 'Voluntary Price for the Small Consumer' (PVPC in Spanish) with an upper limit on the electricity consumed in the period covered by the bill.

In the initial period following its implementation (by Royal Decree-Law 6/2009) between 2009 and 2014, the social bond consisted of covering the difference between the PVPC, previously called the 'tariff of last resort' (*tarifa de último recurso* – TUR) and a base rate corresponding to the tariff in force when the TUR was launched. That meant freezing the tariff paid by beneficiaries at the 2009 levels, so their saving grew over time. From 2014, it was decided that the social bond would be a discount of 25% on the PVPC.

Until October 2017, the criteria for defining vulnerable consumers, beneficiaries of the electric social bond, were as follows: (1) people with contracted power under 3 kW in their usual home; (2) people over 60 or more in receipt of a minimum retirement, invalidity or widowhood pension; (3) large families, and (4) families where all the members were unemployed. Subsequently, the social bond conditions were modified by Royal Decree 897/2017, which introduced concepts such as 'vulnerable consumer', 'severely vulnerable consumer' and 'vulnerable consumer at risk of social exclusion', for whom the PVPC discounts were basically linked to income criteria.

The results regarding the electric social bond's effectiveness in securing universal access over the last decade are worrying, with the rise of so-called 'energy poverty'. According to a study by the Environmental Sciences Association (Tirado Herrero *et al*., 2018), around 15% of Spain's population are unable to access sufficient electricity. Moreover, everything suggests there are features that reduce the possibilities of potential beneficiaries actually getting the discount. For example, applicants must use channels that are not universally accessible and they must have a contract with a specific electricity distributor (from a small group of such companies). In fact, according to the same study, out of 9 million potential beneficiaries, only two thirds actually do benefit from the electric social bond, and only 32% of the total would really find themselves in difficulties with regard to accessing electricity. The majority of effectiveness indicators rate the electric social bond below 50%. In other words, less than half the people experiencing conditions associated with energy poverty in their home meet the requirements for getting the new social bond.

In this case, the social bond appears to be a public policy that fails to prevent a situation as worrying as energy poverty. That has undoubtedly got something to do with the vague definition of its aims, the failure to link those with specific measures and the administrative process for applying for it (which is not automatic and in some cases may itself be a barrier so people end up not applying, even though they have a right to it). To sum up, everything suggests that the social bond has little effect if we consider its function is to ensure universal access to energy or, at least, to reduce the inequality in accessing it.

3.2. A social policy with an energy character: the PAEs

In general terms, the relationship between municipal social policy and energy has to do with interventions aimed at guaranteeing basic supplies to people in a situation of socio-economic vulnerability. Initially, the focus was on providing cash benefits on a temporary, discretionary basis to help people pay their bills. Since 2012, these have included the concept of energy poverty (financial help with household supplies). Over time, however, and without stopping the cash benefits, the focus has gradually shifted and crystallised in the current energy advice points

(PAEs). Set up in the light of the impact of the 2008 crisis, the PAEs are information points open to anyone seeking information on their energy rights and advice on optimising their energy consumption. Therefore, it is a universal service. Likewise, they are a place for spotting whether the people who go there are in a situation of energy poverty and vulnerability.

Once identified, the city's 11 PAEs offer people advice tailored to them, with the aim of ensuring their electricity supply and compliance with Act 24/2015, which forbids companies to cut off the supply to vulnerable households and requires them to maintain the service while the situation of economic difficulty lasts. According to the data from 2019[35], 62% of the people attended to by the PAEs showed one of the three energy poverty indicators: difficulties in maintaining their home at a suitable temperature, difficulties in paying their bills or poor housing conditions. And 39% of people who go to a PAE do so with a warning that their supply is going to be cut off. In 2019, the PAEs attended to 12,079 households, which means 31,569 people.

By way of example, the PAEs actions in that regard include the following: help with getting electricity supplied or the supply reconnected, electric social bond applications (24% of households attended to in 2019 were not getting this discount even though they had a right to it), changing the contracted power, changing the tariff or distributor (actions that can help to generate savings), drawing up the Risk of Residential Exclusion Report (IRER) to prevent people from getting cut off, interventions in homes to apply energy efficiency measures (1,448 households in 2019) or talks, meetings and workshops open to the general public (221 in 2019). The activity of the PAEs has led to a fall in the prescription of cash benefits for energy poverty.

In addition, it is worth pointing out that the PAEs also represent an active policy for fostering employment, another way of combating social exclusion. This line of activity consists of training people having difficulties finding a job in the work of the PAEs, thus giving them the opportunity of gaining work experience in the service itself. Some 40 people, 76% of whom were women, took up this option in 2019. During the same year, 49% of all the people who took part in the PAE employment plans from the start of the service (four insertion plans) found work once their link with the project finished.

The PAEs are a device that has the virtue of managing to attend to the part of the population most in need of help and support in defending their energy rights, as the majority of the people who benefit from their activity are experiencing one of the conditions associated with energy poverty or vulnerability in Barcelona (Tirado Herrero, 2018). Moreover, the PAEs contribute an element of comprehensive vision, as not only do they tackle vulnerability by offering support in relation to energy rights, but they also offer skills training and work experience in the area of energy advice and intervening in households. This is another way of combating social exclusion. However, we wonder whether the energy dimension could be explored even further or integrated much more into social policy, either through the PAEs or other interventions, current or still to be set up in the near future, in order to increase the independence levels and resilience capacity of vulnerable groups.

3.3. An example to illustrate a new approach
We are thinking of an example that would enable us to transcend, to a certain extent, the traditional intervention model. Let us take the case of promoting renewable energy installations based on photovoltaic technology and, more specifically, that of subsidies for using the terraces or roofs of housing and communities of owners. This type of public subsidy system is usually based on the premise that beneficiaries have some initial capital which the corresponding public authority tops up with a certain percentage to cover the total cost of the installation. Here we have an initial barrier at the outset for people on low incomes. Under the logic of universal access to energy and reducing inequalities, the design should not exclude the most vulnerable social strata. Let us imagine for a moment that the logic associated with these kinds of public subsidies were changed

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35. The data given here come from the '2019 Report on the Work of Barcelona's Energy Advice Points. Service for detecting and reducing energy poverty and improving the efficiency of the households of vulnerable people', drawn up by the Area for Social Rights, Global Justice, Feminism and LGBTI but still pending publication.

so they were clearly targeted at housing with low-income households and that the subsidy covered 100% of the cost of the intervention, making an economic contribution from the recipients unnecessary[36].

A design of this kind would help to improve the socio-economic situation of those people by providing an economic asset (in this case energy) that would enable them to cut their energy expenditure in the long run and, at the same time, would improve their quality of life, apart from the obvious contribution to improving the city's metabolic balance implied by connecting a new photovoltaic installation to the grid. It could bring about a social balance in the use of public financial resources. In other words, the public investment in this case would obtain a smaller energy return in terms of MWh/year per euro invested, as the total cost of the intervention would fall to the corresponding public authority (the City Council, if that were the case). However, the extra social returns in relation to rights and social cohesion with an energy culture, and, as regards local consumption capacity, would even contribute towards a social energy policy of this kind in an essential future investment.

It is quite usual to use exclusively or primarily economic criteria for designing energy policy, in the municipal sphere too. For example, when planning the installation of photovoltaic energy in private homes (the same would apply to mini-wind installations), planners weigh up the relationship between the power generated and the investment cost. The results of this energy and economic return will determine the public funds allocated for carrying out the interventions. The potential results that may be achieved in social terms are not yet decisive. Carrying out power generation interventions with people on low incomes at the heart of the project is more likely to be viewed as a limiting factor, a hindrance to the project rather than an opportunity. That is mainly because they are profiles with a very limited economic investment capacity, if not nil, people regarded as having an inadequate education (and energy culture) level for understanding the meaning of the intervention and who for the most part rent their homes. At best, the possibility of obtaining social returns might have some bearing on the final decision to allocate resources but there is no sign to say that is linked to a comprehensive and strategic vision.

However, this approach would be in contrast with the concept of resilience which has featured quite strongly in the public policy framework in recent years, including that of Barcelona City Council. Broadly speaking, the concept of resilience refers to the capacity to face changes with some guarantees. As regards the urban context, the definition by Barcelona City Council is (2016b: 3),'a resilient city is not just a city that protects itself against the impacts or critical situations it expects to face, either because it has suffered them in the past or anticipates them occurring in the future; it is a city with the capacity to plan and to anticipate risk by means of preventive actions, and to intervene in order to modify the boundary conditions that will enable us to move towards the city model we wish to build'. By contrast, the example outlined above would fit in with this perspective of resilience, because it would adhere to the values of mainstreaming, a holistic approach, co-responsibility and generating co-benefits.

4. Towards a new framework for generating public policies?
In the current context, fighting inequality is a challenge facing every area of public policy. It goes beyond the sphere of influence and power of policies traditionally defined as social policies. Or, to put it another way, over the years it has become clear that the fight against inequality is not, nor can it be, the exclusive function of social policy. All areas of public policy (in the municipal sphere, as regards the case that concerns us here) have a role to play. We are gradually seeing that, for example, with regard to urban planning and housing policy, cultural policy or mobility policy. Among those policies that have traditionally been regarded as remote from social policies in

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36. It is worth mentioning here that, in 2018, the Barcelona Municipal Institute of Housing and Renovation (IMHAB) promoted subsidies under the programme for fixing the housing of people in vulnerable situations, which was geared to covering all the expenses associated with intervening to improve living conditions and included the possibility of carrying out action to improve home energy efficiency. https://bcnroc.ajuntament.barcelona.cat/jspui/bitstream/11703/108864/1/ArrenjamentHabitatges_2018.pdf.

general – and the objective of reducing inequality in particular – it is also opportune to include energy policy.

Mainstreaming it requires putting into practice new methods for designing and carrying out actions which, on the one hand, definitively break away from the traditional way of implementing public policy under the logic of sealed compartments and, on the other hand, consolidate the efforts that can be seen in different areas of municipal intervention to attack all inequality and guarantee rights from a more comprehensive and permeable vision of interdepartmental cooperation. To achieve that, however, it seems essential that a shared methodology be created and put into practice, a methodology that is objective as possible, capable of quantitatively and qualitatively measuring social and economic return in a suitably weighted manner, and sufficiently effective and transparent for both political decision-taking as well as accountability or democratic control processes on the part of our citizens.

Bibliography

BARCELONA CITY COUNCIL. *Government measure*: *urban resilience.* Barcelona: Barcelona City Council,
2016b. https://bcnroc.ajuntament.barcelona.cat/jspui/bitstream/11703/88323/6/resiurbmeg-20160217.pdf [Consulted: 15 June 2020].

BARCELONA CITY COUNCIL. *Government measure: transition towards technological sovereignty*. Barcelona: Barcelona City Council,
2016a. https://ajuntament.barcelona.cat/ecologiaurbana/sites/default/files/MesuraGovern_TransicioSobiraniaEnergetica.pdf [Consulted: 15 June 2020].

ANGEL, J. *Strategies of Energy Democracy*. Brussels: Rosa Luxemburg Stiftung, 2016.

COTARELO P.; RIUTORT, S. 'Energía local, democracia real: una reflexión sobre la democracia energética'. *Dossieres Economistas sin Fronteras*. Vol. 24 (2017), pp. 30-33.

COTARELO, P. 'El canvi climàtic ja no és un problema'. CRÍTIC. https://www.elcritic.cat/opinio/el-canvi-climatic-ja-no-es-un-problema-13984 [Consulted: 15 June 2020]

CUMNERS, A. 'Remunicipalización, la transición hacia una economía baja en carbono y la democracia energética'. In: The Worldwatch Institute (ed.). *La situación del mundo 2016. Ciudades sostenibles. Del sueño a la acción*. Barcelona: FUHEM Ecosocial - Icaria, 2014, pp. 257-273.

RIUTORT, S. *Energía para la democracia. La cooperativa Som Energia como laboratorio social*. Madrid: Los Libros de la Catarata - Fuhem Ecosocial, 2016.

SWEENEY, S. 'Hacia una democracia energética'. In: THE WORLDWATCH INSTITUTE (ed.). *La situación del mundo 2014. Gobernar para la sostenibilidad*. Barcelona: FUHEM Ecosocial - Icaria, 2014, pp. 319-336.

TIRADO HERRERO, S. *Indicadors municipals de pobresa energètica a la ciutat de Barcelona.* Barcelona: RMIT Europe, 2018.

TIRADO HERRERO S.; JIMÉNEZ MENESES, L.; LÓPEZ FERNÁNDEZ, J. L.; IRIGOYEN HIDALGO, V. M. *Pobreza energética en España. Hacia un sistema de indicadores y una estrategia de actuación estatales*. Madrid: Asociación de Ciencias Ambientales, 2018.

Cities, climate and eco-social transition. Taking stock after the short summer of municipalism

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The transformational experience first embarked on by the City Councils of Change in 2015 may be interpreted from very different perspectives. It has had many achievements, and failures too, starting with the most obvious one, the majority loss of municipal power in 2019. During this process, public policies for eco-social transition and fighting against the climate emergency merit a detailed analysis. Added to the conclusions that can be drawn from the general track record of municipalism is the difficulty of making ecological policy at the level of the transformations that the urgency of our unsustainable situation requires. This texts offers a reflective survey of this process, putting the emphasis on the eco-social, and availing itself of the neo-Gramscian use of the notion of hegemony for interpreting its limits and drawing useful lessons for the coming political cycles.

Introduction: autumn reflections

It was during the prevailing climate of collective sadness and disappointment that on 27 May 2019, Kois Casadevante coined the nostalgic but highly accurate term, noted for its powerful symbolic and historical resonance, 'short summer of municipalism'. A term of office that lasted as briefly as the libertarian revolution in 1936, as recreated by Hans Magnus Enzensberger in his historical novel *The short summer of anarchy*. Out of the wave of City Councils of Change that arose in 2015, that promising open breach in neo-liberal governance which the shock waves from Spain's 15M anti-austerity movement were turning into local institutional politics and of which so much was expected, four years later only Cádiz, Valencia, Barcelona – by the skin of its teeth – and the missing taxon of Zamora remained. Another example of how ungrateful the history of that so-called Spain is for its working classes, where our political conquests have a somewhat ephemeral interval that invariably ends too soon.

These autumn reflections are therefore intended to take stock with the goal, as Kois affirmed, of 'tipping sadness more towards hope than towards impotence' (Casadevante, 2019). My intention here is to assess how the political power of the municipalist option and the way in which it has responded to the climate emergency as a problem of the times have come together in the City Councils of Change, and what can be expected for future waves of municipalism.

1. The Necker cube of eco-social policy: small big steps

A minimally exhaustive review of the achievements of the City Councils of Change in the eco-social transition and fight against the climate emergency is beyond the possibilities of this text. By

way of example, we will take a few representative projects of the process's two most iconic cities: Madrid and Barcelona.

The legacy of successful public policies of Madrid and Barcelona, as heads of the transformational municipalism process, has been notable. Some have been recognised not just internationally but by their electoral rivals too. Debt reduction, increased social spending and the public network of children's schools, in Madrid's case. Housing policy, tourist regulation and the 'Radars' project against unwanted loneliness, in Barcelona's case. Both cities have seen very substantial advances made in other fields too, such as participatory governance, feminism and public-social collaboration (Casadevante *et al*., 2018).

Sufficiently memorable progress has been made on the eco-social-transition front as to transcend and strengthen its hold on the collective imagination. Its image is already part of that dictionary of political symbols which hegemonic narratives are woven from. A pioneer in Spain is the notable case of Madrid's *Plan A de Calidad del Aire*, with the application of a reduced-emissions zone in Central Madrid as an emblem of a cutting-edge ecologist government. Less known by the public at large, but unanimously admired by specialists, is the highly successful *Renaturalización del Manzanares* [Renaturalisation of the Manzanares river], an exemplary project in restoring the biodiversity that had been lost from the pressures of urban planning on the river bed. For Barcelona, the creation of the public energy distributor Barcelona Energía, which offers local, 100%-renewable energy, has certainly represented a courageous and ambitious measure which highlights the heart of the fair ecological transition: common control of energy. And the functional superblock pilot in Poblenou has involved an urban-planning experiment with enormous international repercussions, which has demonstrated the feasibility and interest of the ideas of the ecosystemic urban planning that Salvador Rueda has been promoting since the 1990s.

These certainly are *small big steps*. Small because, compared to the dramatic emergencies challenging us by the climate emergency and ecological crisis, they have erred, at best, in being timid, partial and very limited measures. Big because, given the initial situation and *the anthropological correlation of such unfavourable forces*, they have represented a wedge in very rocky neo-liberal consensuses. Let us now analyse this ambivalence in a little more detail.

Paco Segura, a member of Ecologists in Action and an expert in atmospheric pollution, declared in March 2019 that Central Madrid had somewhat improved the dramatic situation of public health seen in Madrid. But it was not enough by a long way. According to Madrid-based environmentalists, Carmena's action here has been 'too slow and too spineless' (Segura, 2019), with an exasperating procedure. The tone is partly justified: even in Central Madrid, the legal limits for air pollution continued to be overshot. And Central Madrid is only one of some thirty measures contemplated under Plan A, although most remain unimplemented.

Stringent analyses of social movements are understood when achievements and challenged are checked. If we confine ourselves to the atmospheric side, and according to data from the European Environmental Agency, in 2014 alone the chilling number of premature deaths caused by air pollution in Europe came to 480,000, some 31,000 of whom were Spanish (EEA, 2017). Two figures which deserve to be written out and read again and again for being absolutely implausible and radically shocking: half a million deaths a year in the EU, some thirty thousand of which in Spain. In other words: pollution is causing a genocide every year in Europe. And a figure in Spain that is three times higher than the total number of deaths from the civil conflict in Yemen. Using this expressionist, almost demagogic language, is interesting for the purposes of checking, however, whether social perceptions on this issue are radically different. It is enough to compare the treatment of air pollution victims with that of other scourges which have managed to be construed as official social problems: gender violence, traffic accidents, crime and terrorism.

Fortunately, there is already social consensus on the absolutely intolerable crime that is death of a woman at the hands of her partner. And that no political cause justifies murder as a means to achieving an end. But the total for all these pale in significance compared to the annual number of

pollution-related deaths. While there is no intention here to play down the importance of these problems, the comparison is sociologically revealing when it comes to the prevailing collective mentalities. Those shaping the limits and possibilities of public debate, and therefore of political action. Another example of the big contradiction dividing us IN THE 21ST CENTURY: after forty years of neo-liberalism, which were forty years lost for taking on an eco-social crisis we knew almost everything about in the 1970s, what is ecologically necessary is *almost* politically impossible.

Barcelona's social movements speak in similar terms of Barcelona Energía: recognising its progress, the main criticisms point to its short-sightedness, highlighting the need to 'go beyond distribution by recovering the distribution networks, a policy of rates that incentivise saving and prioritise energy vulnerability' (Casadevante *et al.*, 2018: 214), in addition to a strong initial controversy over waste incineration, an option that was eventually abandoned. If we only have one or two decades to make a renewable energy transition under democratic control, and the pace of change is the one we have known from created tools such as Barcelona Energía, it will be impossible to meet the Paris Agreement.

As for the pilot project of the Poblenou superblock, the assessment is much the same. Outstanding results have been obtained, strengthening the initial hypothesis: a new functional urban-planning cell, with a number of vehicles in a perimeter similar to the one that existed before its implementation, but with car-free inner streets, reclaimed for community life and with a notable improvement in environmental quality. But one new superblock, added to the previous other three (one in El Born and two in Gràcia), is a far cry from the pace and scale of implementation for a city whose proposed Urban Mobility Plan is aimed at reaching 500 interventions.

It is true that the Poblenou superblock had to face a significant local resident focus of resistance to the change, conveniently extended by the media war of attrition against the Barcelona en Comú government. This certainly helped to prevent the government's minimum-targets plan for the 2015-2019 term of office, which had been developing at least four more superblocks (in Hostafrancs, Horta, Les Corts-Maternitat and Sant Antoni), from being implemented within the deadline. Having broken up this focus of resistance through citizen participation, but above all through the project's empirical success, it will speed up Barcelona's transformation under the parameters of ecosystemic urban planning. But there is doubtless room here for the pessimistic reflection that Jorge Riechmann raises over the case of Gorona del Viento, the project that supposedly grants renewable-energy sovereignty to the island of El Hierro: 'over three decades to do by halves what ought to have been quickly implemented in the 1970s... And in the end, all we have is just another pilot project' (Riechmann, 2019: 18). The most important environmentalism reveals that a spirit of gradual reform no longer fits the times as they are, which are of extreme historical emergency.

But that half-empty glass assessment can and must be weighed against the half-full glass approach: the triumph that these measures have represented on the cultural-war map. What had been an extravagant demand from radical movements four years ago is now on the official agenda of two global cities, and is already being tried out as embryonic public policies that have it, which Errejón and García Linera have called 'relative irreversibility' (Errejón and Linera, 2019).

Let us continue studying the case of Central Madrid, which is an especially interesting ecological urban-policy experiment for two issues at least: because it has been inherited by a government team with a different political orientation, intent on dismantling it, with little success at present, and because it has the advantage of facing the ecological crisis from this narrative proximity offering the notion of health. Perhaps the difficulties that the Almeida government has come across for dismantling the Central Madrid legacy can be explained by the second of these issues. While climate change refers us to the narrative of something that always seems to happen elsewhere, tropospheric ozone peaks are stinging our eyes and throats. While the exhaustion of basic resources only scares us when expressed in an indicator as deceptive as prices, the black fog in the Madrid sky is an image that the whole world recognises as a nightmare postcard. Central Madrid's popular success hides key clues to construing majority environmentalist proposals.

This success is especially significant for the symbolic role of cars in the anthropological model of the Great Acceleration created after the Second World War. The anthropologist Marvin Harris used to say there was no need to go to India to see a sacred cow. All we had to do was look at a car from outside our home window. In many aspects, our relationship with cars appears more like totem worshipping than the rational use of a potentially useful item. As with other prevailing collective forms of behaviour in capitalism, our addiction to cars has a little to do with free decision and a lot to do with structural blackmail. Direct blackmail because the structural deficiencies in public transport and intense daily mobility required by today's labour market is a perverse combination. Even in Madrid's metropolitan area, which has the densest network of public-transport infrastructures in the country, cars are the only option for many when it comes to balancing work hours and minimum time for family life (especially, perhaps, in Madrid's urban model, whose two decades of government headed by Esperanza Aguirre has offered an imitation of North American *suburbia*). Indirect blackmail given that the car industry has not spent billions of euros in advertising over decades without its psychological conditioning having made its mark. So, for an important part of the population, freedom continues to look very much like driving a car through a solitary road in a landscape of untamed beauty. And with this desire, as with any other, the slate cannot be wiped clean. Desires are also changing, but over a low flame and never by the imperative of a municipal decree.

Between the devil of pollution and the deep blue sea of such blackmail, which the political opposition invariably exaggerates, the resulting squeeze summarises the dangerous challenge of urban sustainability: for example, how to reclaim the city for the people, away from cars, reducing pollution and emissions, and not dying politically in the attempt. To inhabit this narrow space with some transformational yield, the City Councils of Change have had to obtain a doctorate in the art of contradiction.

Eco-social public policies are condemned to be like a Necker cube, that famous optical illusion whose perceived depth remains ambiguous until the observer decides how they wish to see it. Approached from planetary boundaries, they almost all fail. But when approached from political boundaries imposed by a very settled neo-liberal hegemony, the successes are notable. Let us remember here that neo-liberalism is an ideology no longer solely composed of myths and emotions made up of metaphors but also a *discurso encarnado* in infrastructures as inflexible as the closed architecture of the new Urban Development Action Plans (PAUs) or the territory's arrangement. The political value of the breaches opened by projects such as Central Madrid and Barcelona Energía in the prevailing conventional wisdom has to be assessed from the recognition of this double limitation: ecology and policy.

2. A short-circuit in municipalism as a hegemonic process
Both Madrid and Barcelona have experienced frustration, or at least parking in administrative limbo, of some of their star measures in eco-social transition. The most striking case in Barcelona is its municipalisation of water: a tough legal battle at the Supreme Court was finally won by Agbar, the company that has been managing Barcelona's water through a century-long concession granted during the Francoist dictatorship. But at least the continuity of the government of change in Barcelona can still get this measure to work, even if the margin for manoeuvre has been substantially narrowed.

In Madrid, however, the coalition government led by the PP and Ciudadanos has not only put an end to that city's municipalist experience but also put special emphasis on a scorched-earth policy on the Ahora Madrid government's work. Bringing the Central Madrid project to an end was the electoral *casus belli* of the right. Photos of Almeida and Villacís celebrating the de-pedestrialisation of Calle de Galileo are a semiotically perfect declaration of intentions.

Significantly, for the specific case of Central Madrid, the dismantling could not be carried out and the promise has so far failed to be kept. The reason was intense citizen opposition, whose biggest victory were two court rulings that overturned the moratorium in fines, decreed by Almeida's City Council, which had effectively been abolishing Central Madrid's low-emissions zone. The

infringement proceedings opened since 2010 by the European Commission against Madrid for its systematic failure to comply with the legal limits set for NO2 pollution and which threatens to become a million-euro fine offers little margin of manoeuvre for the reversal. By contrast, the MARES project has been dismantled. MARES was a big social economy incubator created by Madrid City Council, with European funds, to promote a change of production model, which set its employment sights on the ecological transition (renewable energies, agro-ecology, mobility, circular economy and so on) and the feminist care economy.

The capacity of these two projects' differential resistance offers clues on the level of hegemonic power of the various core ideas of the environmentalist discourse. And let us remember that the hegemony, in the Gramscian sense of the term applied here, does not consist so much in promoting for example the partisan alienation of a favourable judiciary (appointing similar judges) as in establishing interpretative perspectives on social issues which, being ideologically partisan, have such a capacity for bringing together different demands that may end up as something of general interest. So damage to public health is starting to become an intolerable externality within the prevailing conventional wisdom which is the raw material of the political game. Enough to be able to establish an ambitious jurisprudence attempting to prevent it. But promoting an economy where internal democracy, gender equality and sustainable production are distinguishable features meriting reward is still not enough. That is why Central Madrid is resisting and MARES was easily closed down.

The reference to the Gramscian notion of hegemony proves essential given that the deficiencies in the Councils of Change's eco-social transition cannot ignore the sort of short circuit suffered by municipalism during the hegemonic process it was starting. The 2019 elections demonstrated that the municipalist proposal failed to win a political majority for its city model and style of governance. In other words, they were unable to maintain the tension typical of a hegemonic political project. Which explains the brevity of its consideration by the government, with Barcelona the exception, whereas Madrid's experience proved especially hard in political terms. On 26 May 2019, Barcelona en Comú lost five percentage points of the vote and a councillor, but even weaker politically, and by exploiting an anomaly in the dynamics of political blocks which can only be explained in the specific context of Catalonia, it managed to bring continuity to its project. The Más Madrid platform, after losing one percentage point, ended up with one less councillor, and despite being the City Council where the forces of change kept the highest level of votes after Cádiz (30 %), lost the mayor's office.

A common pattern emerges from the small selection of measures analysed, which can furthermore be extrapolated to most municipalist public policies relating to the right against the climate emergency. There has been a genuine proliferation of strategies, agreements, motions and participatory processes over the last four years, and in many places apart from Madrid and Barcelona, in such issues as urban agro-ecology, energy sovereignty, community composting, cyclist mobility and renovation. In general, we can conclude that municipalism achieved significant advances in many eco-social-transition tasks, so long as we accept one small qualification: their transformations have failed in remaining trapped inside a certain symbolic status. As essentially cultural victories with little verifiable impact in statistical terms beyond a few over-represented experiments in the very image of the city model that was meant to be planned.

As we have argued, that result is logical given the context of the correlation of anthropological forces it was starting from. And in a certain sense, it matches the political hegemony's prototype circuit. Álvaro García Linera established that the transformation hegemonic process can be summarised in a system of stages he calls Gramsci-Lenin-Gramsci (García Linera, 2017). First, by disputing the unifying symbols, the discourse is at its most linguistic, softest level, with victories that are intellectual, cultural and moral. Then there is a naked clash of forces resolved by the monopoly of power. And once the effective control of the State's structures has been consolidated, a Gramscian stage comes back into play, in cultural-domain building, but from the mass-intervention tools offered by legislation, state budgets and public policies. This is, by intervening in the most objectual and harshest levels of the discourse. This system presents blurred boundaries

in pluralistic democratic societies (the Lenin stage never boils down to electoral dates, but goes on at least during a good part of a government's first term of office), but broadly continues to be a valid path.

If we use this system as an interpretative tool, we will be able to conclude that municipalism failed to complete the hegemonic process. It suffered a short circuit between the Gramsci stage that burst into the scene from 2014-2015 and the Lenin stage during the term of office, which prevented it from consolidating itself as a sound alternative governance. That is why its achievements, especially in the eco-social realm where its support base was smaller, continue to present this style of superficial re-writing of the city's semiotic code condemning some transformational social movements. And that for ambitious transformational expectations, it can be confused more with political marketing than with transformational political action.

A satisfactory explanation of the hegemonic short circuit of municipalism is yet to be given, and it will be crucial for having an assessment of the political cycle that first began with the 15M anti-austerity movement. Three complementary hypotheses are briefly explained which, among many other things, could be interesting to explore by adding a specifically eco-social approach:

• Like a cascade effect, municipalism suffered from the loss of hegemonic power of the political space of change in the national arena. The old adage that municipal elections are never local elections has continued having its effect on electoral behaviour in the Spanish State. And in that regard, it is hard to explain the initial drive of municipalism, but also its decline, without the carry-over effect of the Podemos phenomenon, whose fall has been practically as fast and worthy of study as its meteoric rise. That story is yet to be researched, let alone written. We will need to understand the resilience of Spain's Regime of 1978, regarding which a fatal constitutional crisis was presumed, perhaps hastily. But more interesting, from a perspective committed to social transformation, is understanding what happened within the political space of change so we can learn from the experience. We cannot add much here, only an important consideration that has tended to be ignored in the most immediate analyses. Besides interpersonal conflicts, malfunctions that have been shown to be inherent in certain types of organisation, disputes over the control of the machinery between political families, quarrels over tactical support and clashes between incompatible strategies and their various costs of opportunity, Podemos was subjected to a harrowing theoretical dispute: whether or not its foundational hypothesis was valid. That is, the populist hypothesis, which assumed, among other 'parent killings' that the political topology of the 20th century, the left-right divide, had become obsolete after 2008. Like a single-use weapon, the populist hypothesis was abandoned after the general elections of December 2015, with Podemos gradually sliding towards a conventional post-communist political niche, comparable to what existed in Spain and Europe before the 15M anti-austerity movement.

• In its government tasks, municipalism underestimated that central element which, according to Clausewitz, distinguishes real war from war in theory: friction. Governing a city, managing a public administration, also implies 'movement in a resistant element' (Clausewitz, 2017: 120). Which was made especially hard given the inexperience over the political spaces where the municipalist commitment had been created. Co-governing with partners hardly predisposed to collaboration and much more skilled in the institutional game and its tricks, absence of legal and technical expertise, little experience in negotiating, ignorance of the 'profound institution', lack of harmony with the civil service networks running the real and informal functioning of the administrative machine, the saboteur and highly belligerent attitude of certain interest groups, etc. As a general rule, municipalism had to go through harsh climatisation to a relatively new and largely hostile political ecosystem, under enormous pressure from the opposition (exaggerated insofar as the oligarchies understood that City Councils were the prologue to an assault on national power), and limited by some self-imposed mortgages resulting from a certain ingenuous anti-political romanticism, very close to the emotive atmosphere of the 15M anti-austerity movement. The case best illustrating the latter was the decision, taken by many municipalist groups in government, to reduce the quota of advisers and positions of trust that

legally corresponded to them as a gesture of rejection of the *habitus* typical of old-school politics.

• Besides external friction, municipalism had to support an intense inner friction, caused by the high participatory expectations of its political origins. The structural gap within this framework between supporters and leaders, which is universal and inherent in every institutional policy, acquires an intensity that can end up deeply destabilising. Whereas supporters, especially those politically socialised in social movements, usually maintain maximalist, impatient stances and are more predisposed towards feeling wronged from gestures with a strong symbolic impact on their identity system, a municipal government can only function by applying a certain pragmatism, capacity of assignment and a certain strategic patience. This gap is inevitably widened owing to the fact that government and grassroot political supporters are subject to very different times, responsibilities and rewards. As for range of specific goals, authorities are antediluvian monsters and grass-roots movements flexible players. But the time for everyday work, especially when linked to institutional management, is devilishly fast, whereas the response times of the grassroots supporters are necessarily slow. This makes it hard to delegate tasks among supporters that the leaders tend to perceive as ineffective. As the responsibility for failing in one or other area is radically distinct, the leadership tends to distrust grassroot supporters and monopolise tasks according to the perceived weight of their responsibility. This is understood by grassroot supporters as a closure that undermines the democratic quality of a political space. Add to that the fact that there can never stop being a very important division between leadership and grassroot supporters in the realm of reward (some are professionals spurred on by a salary, others are volunteers driven by ethics) the vicious circle of delegation-disaffection almost always tends to grow. Finding a third way that productively manages the tension between the technocratic bunkerisation that bypasses participation, and the dysfunctional radicalism imposed by oversized activist minorities, is a need of the municipalist political culture that is very far from being resolved. And which in eco-social public policies can end up especially inflammable, given the enormous distance between the ecologically urgent and the politically feasible.

3. Conclusions: the limits of municipalism
Two ideas frame the assessment of the short summer of municipalism in eco-social transition and the fight against climate change: i) the results have been ambivalent and ii) although the eco-social transition implies some specific difficulties, its performance cannot be detached from reflection on the general limits of the municipalist commitment.

It is clear that a qualitative leap was made in the eco-social agenda between 2015 and 2019, which shifted from the margins to the centre of the political debate. The avant-garde action of the City Councils of Change contributed to that in key issues, such as air quality, sustainable mobility and citizen control of energy. There is no doubt that the 2015-2019 period has seen an explosion of global climate conscience and, starting with the Paris Agreements and reaching a 2019 that was a landmark in the history of environmentalism, with the Greta phenomenon bursting on the scene, the mass civil-disobedience Extinction Rebellion actions and the big worldwide strike for climate, represented a favourable tailwind. But for all those advances, no city in the world today is a sustainable entity, especially if we make a comprehensive analysis of its material energy metabolism: the European *Green Smart City* would not be possible without China's conversion into a Dickensian hell. The 'geopolitical illusion' factor, which hides the processes of outsourcing in the extraction of minerals and CO_2 emissions, cannot be ignored if we wish to have a complete perspective of what the ecological transition implies.

Sustainability, as defined and applied in the strong sense that requires confronting the climate emergency and ecological crisis, and, what is more, modulated through social justice and feminism, is a political goal that is launching a change to everything that is profoundly revolutionary in every aspect of our social life. Taking it on compels us to disrupt not just well-organised economic interests, which are always capable of defending themselves, such as those of the energy oligopoly or fossil-fuel lobby. To become sustainable cities and societies, we have to

change the basic rules of the economic game that has prevailed over the last 200 years. Strongly affect the current distribution of power and wealth. Deploy immense technological substitutions that have a strong political component in themselves. Intervene in very deep and unmanageable strata for short-term policy of our metabolic reproduction in its three dimensions: the techno-material, the social and the symbolic. We are referring to such tasks as dismantling the *infrastructure hardware* that is inherited by our regional arrangements, opening up alternatives to the structural dynamics that are holding our economies ransom to permanent expansion and deconstructing the most profound mythologies of our anthropological framework, as the 'technolatry' or the myth of progress.

Environmentalism points out with reason that in a finite planet a sustainable society will have to give rise a post-growth paradigm, to a stationary state economy. By historical comparison, the socialist enterprise, which aimed to transform practically everything and whose study is a must-stop for considering a post-capitalism worthy of the 21st century, never attempted anything as revolutionary as to stop growing, and cannot teach us anything in that respect. As we move on blindly, without inspiring models, in building an exciting utopian policy formulated from a certain idea of material austerity in contrast to the idea of abundance that has dominated almost all the proposals of social reform during the industrial age. An especially complex work when neo-liberalism has a libidinal economy, a social configuration of desires, based on an eco-cidal waste of resources, in a good part of the world's population (in emerging countries in the form of a framework of expectations). Riechmann gave a perfect definition of the neo-liberal social contract: a *low cost* world, with cheap flights, meat and mobile phones, within reach of the masses, having a gigantic ecological impact spreading towards others or the future, in exchange for precarious lives and economic insecurity.

It is easy to conclude, therefore, that negotiating the steep divide between the ecological emergency of the 21st century and coordination of transformational political hegemonies is an *especially* big task for our cities. And this is occurring because, in one of these necessary types of excitement required by policies, the municipalist commitment overestimated its capacity for historical impact. The short summer of municipalism knew little in the most activist environments because too much was certainly being required of it.

Municipalities control a minimum part of public wealth in the Spanish State, below 15%. They have little authority in the matters of law and tax and their effective exercise of such authority is often dependent on financial transfers and agreements with higher authorities under unclear criteria, giving rise to every type of political arbitrariness unless, in turn, the upper echelon is politically controlled. The public network on which the Governments of Change worked is also a public network abused by the vicious cycle of neo-liberalism: dismantled from a decade of cuts, reduced from two decades of privatisation processes, therefore inflexible and castrated, which feeds back the perverse need of embracing neo-liberal recipes as a lifeboat in the middle of a shipwreck. The clearest example is the connection between municipal funding and the sale of land: an institutional design which, as confirmed by Naredo (2010), is one of the cursed driving forces feeding the speculative quick-rich economy, political corruption and the urban-planning melanoma destroying our regions. Because of their electoral weakness, the Governments of Change have been working as well either as a minority or in coalition governments, which has caused many situations of fragmented power, intensifying the dysfunctional fragmentation that public authorities are already prone to. And not only that but the short summer of municipalism has been confined through the draconian and partisan intervention of the Ministry of Finance and the austerity policies championing the Budgetary Stability Act.

In this 'resistant element', if we take up the Clausewitz image once more, and with such weak weapons, leading processes of profoundly revolutionary change, as is the ecological tradition, can only be justified from certain *magical democratic thought*: closeness to the people and possibilities of high citizen participation will make good all the deficiencies. This is a widespread enthusiasm, never explicit but strongly present in some transformational spaces and which is no mean matter as it shapes certain political provisions that are determinant. Namely: consider that the immense

social force that plebeian and working-class outbreaks can end up putting into play during the great revolutionary times is not quickly dispelled. And which can therefore act as a sort of fusion reactor which puts the inexhaustible energy of the stars at the service of transformational policies. By analogy with the comic, Asterix, one of the unconscious myths of the municipalist commitment was the belief that making democracy more profound was a kind of magic potion that gave superpowers to the Gaulish village besieged by Roman troops.

This brief review of its limits is not intended to deny the transformational potential of municipalism. Cities with progressive Governments working in a global network with common agendas have proved themselves to be players with an interesting political capacity. According to Jessop's analysis (2017), nobody can think now of political power in the old-school terms created under the Treaty of Westphalia, as if it were 'something' concentrated in the government of an air-tight spatial enclosure bounded by frontiers. Political power is a highly complex, multi-level social relationship which allows disputes and is partially exercised by hoards of very diverse players and social agencies. Alliances between big cities, especially those with an international reputation, have been playing a leading role in the civilisation change that is being contested today on the matter of ecological transition, but also feminist public policies, advances in the redistribution of wealth and the creation of new common assets.

But the State in the classic sense is not beating a retreat. It would be an enormous political mistake to think that. And its role is proving to be especially irreplaceable in what García Linera called the *Lenin stage*: the move from an essentially symbolic cultural-hegemony construction, based on narratives, to an actual cultural, systematic, reproductive and unconscious hegemony, based on the material weight of the law, infrastructures and administrative and economic routines, in short, the hegemony that allows directing in your favour the drag effect of a good part of social inertia. The task ahead at least is analogous to the neo-liberal revolution, with transformations of a scope and speed similar both in their socio-economic and in their anthropological aspects. Does anyone believe the neo-liberal revolution could have been promoted only through the London and New York mayor's offices without the governments of Thatcher and Reagan?

In sum, the experience of the short summer of municipalism strengthens the following idea: the transformational governments of our cities can substantially improve the lives of their citizens in whatever is within their reach. For example, breathing in air that poses no public health problems. That is valuable in itself. But facing social transformations of greater scope, such as solving the climate emergency, municipalism operates more as one of the best popular tools in the initial Gramscian stage of the hegemonic process. That is, the stage of the cultural dispute over the meanings shared by social majorities. But this will be short if the political project inspiring it does not succeed in climbing the steps up the higher echelons of institutional power. In the future roles that municipalism will be playing within the eco-social transition, it will be important for us to bear in mind this partial, profoundly performative role of the city as a builder of political discourses and feelings that go further. And to learn together how to act as a result better than we have done in the past.

Bibliography

CASADEVANTE, KOIS (2019). 'El corto verano del municipalismo'. *El Diario* [online]. Available at: https://www.eldiario.es/ultima-llamada/corto-verano-municipalismo_6_904019614.html

CASADEVANTE, KOIS; MORÁN, NEREA; PRATS, FERNANDO (2018). *Ciudades en movimiento. Avances y contradicciones de las políticas municipalistas ante las transiciones ecosociales*. Madrid: FUHEM-Foro de Transiciones.

CLAUSEWITZ, KARL VON (2017). *De la guerra*. Caracas: El Hormiguero.

EUROPEAN ENVIRONMENT AGENCY (2017). *Air Quality in Europe 2017 Report* [online]. Available at: https://www.eea.europa.eu/publications/air-quality-in-europe-2017

GARCÍA LINERA, ÁLVARO (2017). 'Tiempos salvajes. A 100 años de la revolución soviética', in Andrade and Sánchez (eds.). *1917. La Revolución Rusa 100 años después*. Madrid: Akal.

GARCÍA LINERA, ÁLVARO; ERREJÓN, ÍÑIGO (2019). *Qué horizonte. Hegemonía, Estado y revolución democrática*. Madrid: Lengua de Trapo.

JESSOP, BOB (2017). *El Estado: pasado, presente, futuro*. Madrid: La Catarata.

NAREDO, JOSÉ MANUEL (2010). 'El modelo inmobiliario español y sus consecuencias'. *Sin Permiso* [online]. Available at: https://www.sinpermiso.info/textos/el-modelo-inmobiliario-espaol-y-sus-consecuencias

RIECHMANN, JORGE (2019). *Otro fin del mundo es posible*. Barcelona: MRA Ediciones.

SEGURA, PACO (2019), interview in *El Salto* [online]. Available from: https://www.elsaltodiario.com/medioambiente/paco-segura-ha-habido-algunas-mejoras-en-temas-como-la-calidad-del-aire-pero-les-ha-faltado-rematar-la-faena

Health in the streets: assessing the health effects of superblocks

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The Barcelona Public Health Agency is evaluating the environmental and health effects of the Superblocks programme through the 'Health in the streets' project. It is being carried out in three districts of the city: Poblenou, Sant Antoni and Horta, using qualitative and quantitative methods. This article describes the project and presents some preliminary results.

Introduction

Barcelona city presents numerous social, environmental and health challenges. Some of these challenges are high levels of noise and air pollution, lack of green space and living space, and traffic injuries. In recent years, Barcelona City Council has begun the deployment of the Superblocks model in different districts of the city, which is included in the government measure 'Let's fill the streets with life'. The aim of this programme is to improve the habitability of public space, advance sustainable mobility, increase and improve urban greenery and diversity, and promote citizen participation and co-responsibility (Barcelona City Council, 2016).

In order to evaluate the health effects of this programme, a project is being carried out, led by the Barcelona Public Health Agency (ASPB), with both quantitative and qualitative methods and with the participation of health professionals from different areas and institutions. This project is called 'Health in the streets' (*Salut als carrers*: SAC) and aims to assess the environmental and health effects of the Superblocks model with an equity perspective. A protocol explaining the project in the form of a scientific article has recently been published (Palència, et al., 2020).

In a first phase, a specific conceptual framework for the evaluation of superblocks was developed (Diagram 1). This model shows how urban governance, through the Superblocks intervention, aims to impact public space, the various types of mobility, green spaces and community participation. This intervention is expected to have effects regarding the neighbourhood (decreased air and noise pollution, increased road safety and walkability, etc.) and regarding individuals (increased

active transportation and support social, etc.), but it could also lead to an increase in the cost of living and housing and the possible expulsion of residents from the neighbourhood. All this will have effects on health and, if the effects vary according to the different axes of inequality, on social inequalities in health.

The evaluation was carried out in the neighbourhoods of Poblenou, Sant Antoni and Horta, taking into account the times of implementation of the superblocks. The following are the interventions being evaluated and the methods that are being carried out, as well as some preliminary results.

Diagram 1. Conceptual model for assessing the health effects of superblocks
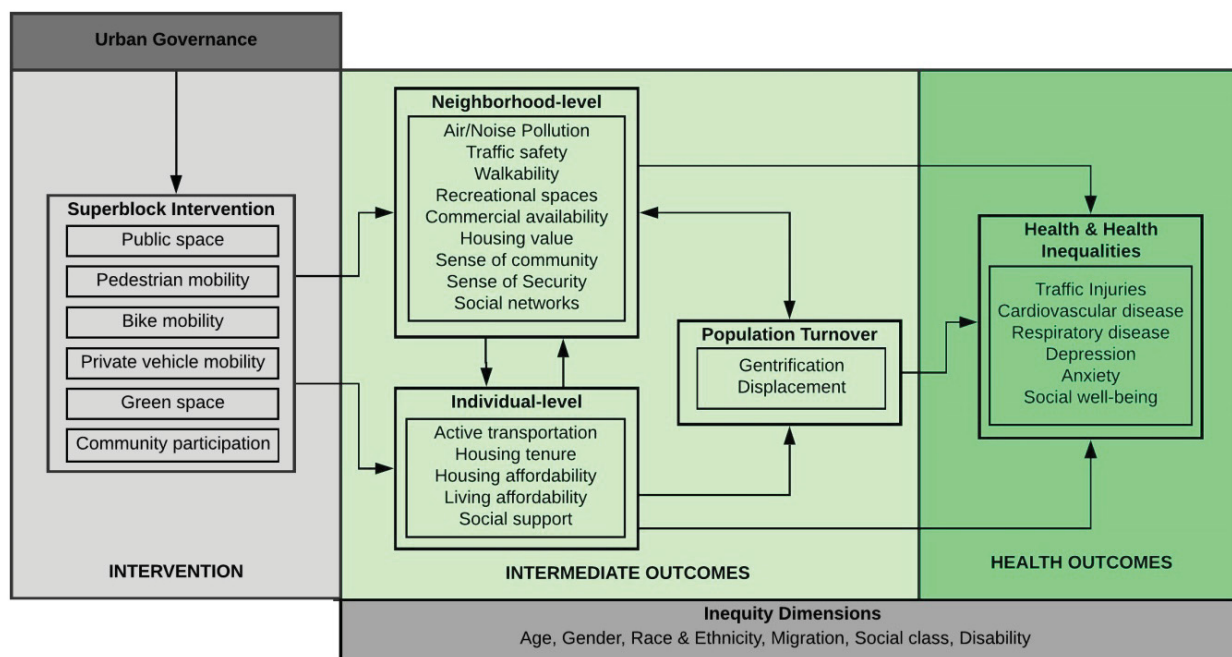
Source: Mehdipanah *et al.* (2019)

Poblenou Superblock

It was inaugurated in September 2016 and was the first to be implemented by the common government of Barcelona. It is the pacification of motorised traffic, prioritising pedestrians and bicycles, in an area of 3x3 blocks. Thus, the superblock includes the creation of new living spaces in sections of the old streets and their confluences freed from traffic, with picnic tables, literary tours, spaces for occasional markets and sports and games areas.

When the 'Health in the streets' project began, this superblock had already been implemented. For this reason, a qualitative study was carried out with the aim of determining the perception of residents about the effects of the superblock on public space, mobility and the health of people living in the neighbourhood or who make use of the superblock, taking into account the gender perspective. The following six discussion groups were formed, from eight to ten people each, which due to their profile could make a different use of the superblock: 1) parents of children; 2) teenagers studying in the superblock; 3) the elderly; 4) adults studying or working in the superblock; 5) other adults not included in any of the above groups, and 6) an exclusive group of women. Through the dynamisation of the groups, a moderator of the Pere Tarrés Foundation proposed different topics related to the effects in the following aspects: a) the use of the space; b) mobility; c) physical and mental well-being; d) social cohesion, and e) the economy of the neighbourhood, always keeping in mind the gender perspective. These groups were held during the months of February to June 2019.

All groups agreed that the groups that use the Poblenou superblock most frequently are families with children (especially mothers, due to their greater role in reproductive work), who use children's play areas, as well as working people, who frequent it to eat or when they finish the day. The other groups mostly use it in passing. Young people think that it is a space that is not designed for them, and the elderly agree that they do not use the superblock and that it seems to them an isolated space. Among the group of women, some consider this area to be a deserted area and perceive some insecurity, while others perceive the opposite due to it being an open space.

Both the group of young people and the two groups of adults highlight the positive effects that a reduction in pollution and an improvement in air quality can have on health. The three groups also highlighted the positive effect of a decrease in noise pollution. The group of adults without dependent children specifically talks about a more relaxed environment and a reduction in stress. In the elderly group, however, no health effects derived from the superblock are perceived. In the case of the group of workers, there is talk again of the positive effects of a decrease in pollution, but in this case it is also clear that in the streets around the superblock pollution could be increased and, therefore, produce negative effects on people living on these streets. In this group, there is also talk that picnic areas could encourage people to bring their lunch from home and therefore lead to an improvement in diet. Also, that the space of the superblock makes it easier to walk and also provides peace of mind, and therefore this means an improvement in mental health. In the case of women, the idea arises that the space facilitates interaction between neighbours, and thus promotes relationships and social networks, and the issue of a potential negative effect on the streets around the superblocks reappears.

Sant Antoni superblock
The first phase of the Sant Antoni superblock consists of the redevelopment of the public space around the new Sant Antoni market. Specifically, the pacification of Carrer del Comte Borrell between Floridablanca and Manso and that of Carrer de Tamarit between Viladomat and Comte d'Urgell. This represents the creation of a large public square at the intersection of the streets, as well as the creation of new living spaces and more green presence on the pacified streets.

In this superblock, as part of the 'Health in the streets' project, three studies have been carried out. The first study is an audit to assess the effects of the superblock on the physical activity patterns of superblock users with a tool called SOPARC (McKenzie, 2006). This is a methodology that allows us to assess the patterns of use of the spaces with a quantitative look, counting the number of people who use the space and assessing the different profiles of people and the activities they do there.

Graph 1. Evolution of the number of people per hour counted in the Sant Antoni superblock
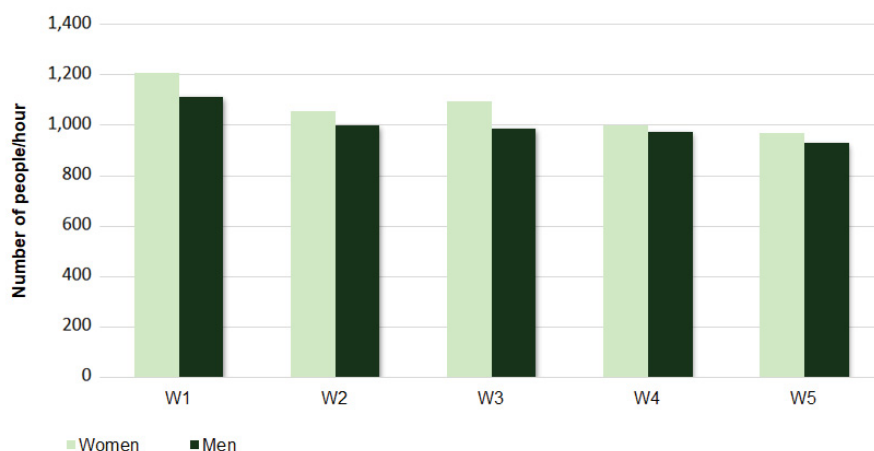

Note: weeks (W) of measurement. W1 (May 2018), W2 (October 2018), W3 (November 2018), W4 (March 2019), W5 (May 2019).
Source: Own production

The use of the superblock was maintained at a level above 900 people per hour during the course of the study (Graph 1). The first measure, which coincided with the week after the inauguration of the superblock, was that which featured a larger number of people per hour.

As can be seen in Graph 2, during the study it was observed that, on average, the superblock was mostly used by adults and for walking there. Women used it slightly more, but men did more vigorous activity than women. We see that the second age group that uses the Sant Antoni superblock is the group of elderly people, both men and women, although women are a little more present.

Graph 2. Percentage of people according to the physical activity they did, the times in which they were present and their age group, in men and women, in the Sant Antoni superblock.


Women   Men
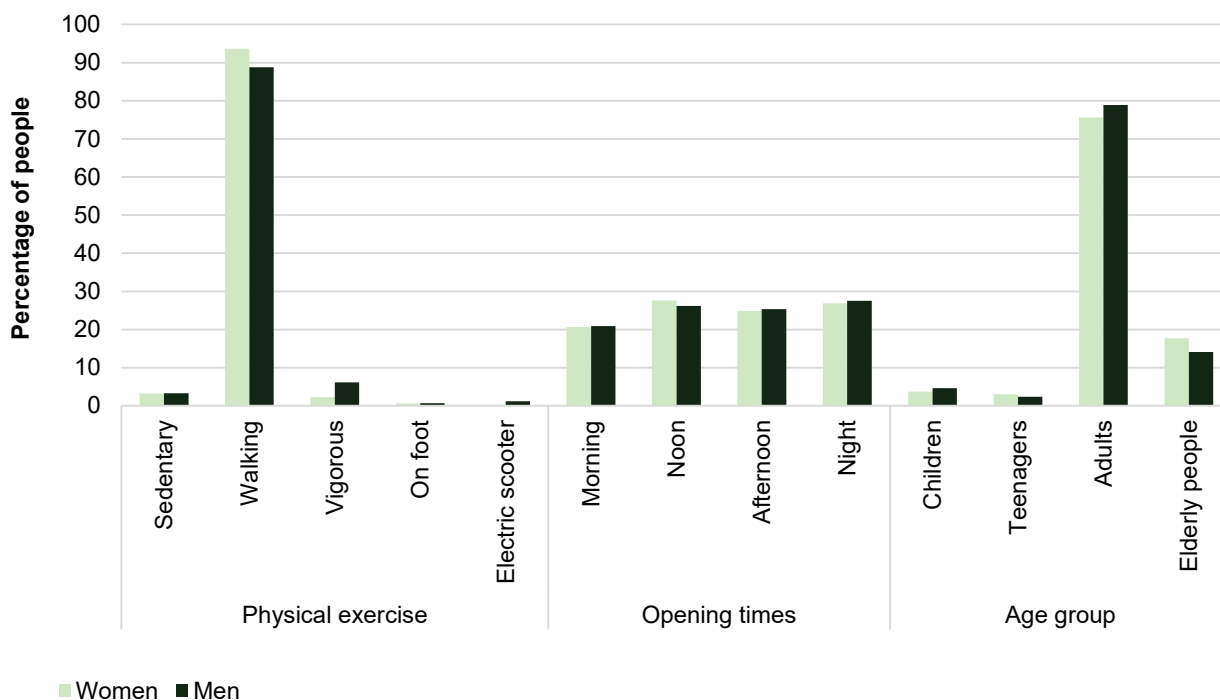
Source: Own production

The second study is an 'ethnographic guerrilla', a study with a qualitative methodology that combines observation with semi-structured individual or group interviews where the phenomenon to be studied takes place. Multimedia data such as photos and videos are also collected. There were three sessions of five hours each in which 74 people were interviewed in 45 interviews. The results show that in general the reform around the market (not always known as the superblock) is valued very positively, with an overall rating of between 8 and 10. The most striking positive aspect is the prioritisation of pedestrians over cars, which provides a safer and more comfortable experience, as well as the open and bright, clean and attractive space. On the negative side, it is estimated that there is still too much traffic, the poor condition of planters, the little green area, some uses considered problematic, the presence of temporary fences, the absence of a play area and too many bicycles and scooters. The superblock has a diversity of uses and, in general, an increase in the use of space; emotional health benefits, better rest, less pollution and more socialisation are reported; there are a lot of elderly people but not so many young people and families with children consider it a space that allows you to move comfortably but generates stress, as it gives a feeling of false security, because cars can pass and at some speed.

Although environmental measures have been taken in most superblocks, results are already available in Sant Antoni (Graph 3). NO2, PM10 and PM2.5 measurements were taken with a mobile unit, before and after the intervention, to analyse the changes in air quality. Contamination

data were measured at the junction (Comte Borrell with Tamarit) before and after the intervention and compared with a fixed control station outside the superblock to reduce the effect of other variables, such as differences in weather conditions during the two sequences of measurements (pre- and post-intervention). The average differences in the postoperative period were compared with the average pre-intervention measurements to see if the superblock had had an effect on pollution levels. As can be seen in Graph 3, NO2 pollutant levels decreased substantially (14 µg / m3) with the implementation of the superblock (the result for the other pollutants is similar). This average a 33% reduction in NO2 levels.

Graph 3. Change in the average NO2 levels in the Sant Antoni superblock before and after the intervention.

Average time differences
Difference post-pre: -14.57 µg/m3 IC 95% = (-17.01; -12.14)
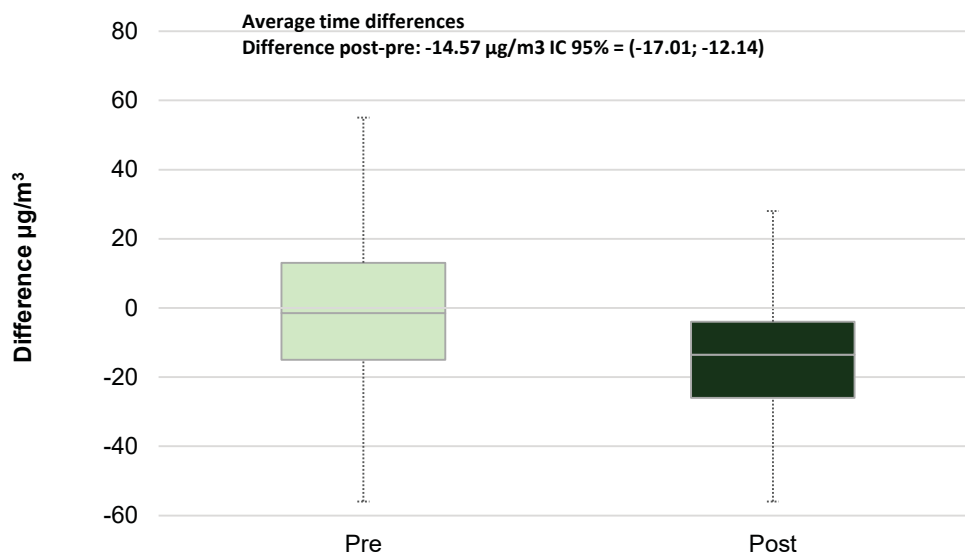
Note: The average of the NO2 hourly averages in the superblock with respect to a control station is shown.
Source: Own production.

The Horta superblock
The Horta superblock began work in October 2018, after a two-year participatory process to develop an action plan to improve mobility and quality of life in Horta. The actions are based on the redevelopment of Carrer de Fulton and part of Carrer d'Horta (single platform and speed limit of 10 km/h), part of Carrer de Chapí and Carrer Feliu Codina (single platform and reduction of parking) and Carrer d'Eduard Toda (reduction of parking and creation of living areas), apart from the redevelopment of two more corners.

In the case of the Horta superblock, several evaluation studies were proposed before and after the intervention: a specific health survey, environmental measures and a walkability index. In all cases, measures were taken between May and September 2018 and will be taken again when the works are completed.

The health survey was carried out on the basis of the methodology of the Barcelona Health Survey[37]. 1,200 people living in Horta were surveyed through a census sample. The questionnaire consisted of 141 questions about perceived health, quality of life, social support, mental health, mobility, physical activity, neighbourhood characteristics and housing. Image 1 shows an infographic, with some relevant results, that was sent to respondents in return for their participation. A report was also prepared which can be found on the Agency's website[38]. Regarding the assessment of the neighbourhood by the residents, in general we can say that it is good. As an example, we can say that the report shows the percentages of people who strongly agree that they

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37. Available at https://www.aspb.cat/arees/la-salut-en-xifres/enquestes-de-salut/
38. Available at https://www.aspb.cat/documents/aspb_informe-salut-carrers-2018/

like living in the neighbourhood of Horta (62.4% of women and 55.4% of men). The percentages of people who strongly agree with the questions 'Are there good relationships in the neighbourhood?', 'Can people be trusted?' and 'Is it safe?' are around 10%, except when asked whether or not they can influence neighbourhood decisions, for which the percentage is 2.8%. They are also asked to rate a number of aspects of the neighbourhood, of which the following stand out with high scores (around 8 out of 10), 'It's easy and nice to walk in my neighbourhood', 'It's a good place to raise kids', and 'There is a wide range of fruit and vegetable shops in my neighbourhood'. In contrast, the lowest averages were found around the statements associated with noise.

Image 1. Infographics with some of the main results of the pre-intervention survey of 'Health in the streets', Horta, 2018.

It had been planned to contact the people who responded to the survey in May 2020 in order to assess changes in the health and assessment variables of the streets and the neighbourhood before and after the intervention. Unfortunately, the lockdown situation caused by the coronavirus epidemic will not allow the survey to be conducted as planned and will have to be postponed. A qualitative study with ethnographic guerrilla methodology had also been planned to be carried out, which would also complement the information obtained from the survey. This is now expected to be developed a few months later.

In terms of environmental measurements, measurements of NO2, PM10 and PM2.5 have also been taken (with the same methodology as in Sant Antoni), as well as measurements of black carbon, a component of the fine particulate matter that is produced through incomplete combustion of fossil fuels, biofuels and biomass. The latter have been taken in three types of streets: intervening streets, in which interventions related to the superblock have been carried out; indirectly affected streets, that is, streets that are not affected but where traffic changes are expected to occur, and streets that are not affected, where no changes are expected. Measurements have been taken at seven different points on each type of street. These measurements will be repeated after the interventions and once usual mobility has been restored after the exceptional period for the coronavirus.

Finally, in Horta, whether or not the interventions improve the walkability of the streets has also been evaluated. The characteristics of the built environment considered relevant to pedestrians have been assessed with a tool called the Microscale Audit of Pedestrian Streetscapes (MAPS) (Millstein, et al., 2013). These characteristics include details about streets, footpaths, intersections and design (pedestrian crossings, trees, bike lanes, curbs), as well as the characteristics of the social environment (graffiti, rubbish) that influence the experience of pedestrians and therefore the walkability of the streets. These measures will be repeated once usual mobility can be restored.

In this specific case (Table 1), the MAPS tool made it possible to detect potential improvement challenges in the streets evaluated in Horta (Chapí, Fulton, Feliu Codina and Eduard Toda streets). In this sense, in Horta, the contextual characteristics with a lower score and therefore a

negative impact on the physical activity of pedestrians are found in the intersections section, with an average score in the streets of 1.85 (on a scale that has an overall score of 8). Likewise, characteristics related to street segments also show low scores, especially for the elderly, with an average score of 5 (on a scale that scores out of 19). The streets with the most room for improvement are Chapí, in terms of the total score of the route, and Eduard Toda, in terms of

Table 1. Total scores for the route, segments and intersections of the streets in Horta before the implementation of the Superblocks programme (Chapí, Fulton, Feliu Codina, Eduard Toda). 2018

Subscales (Total score)	Number of items (score range)	Average (standard deviation)			
		Chapí Pre-intervention	Fulton Pre-intervention	Feliu Pre-intervention	Eduard Toda Pre-intervention
Of route score	3 (-2 to 33)	10 (0)	24 (	19 (0)	12.5 (0.70)
By segments (children / adolescents)	2 (-1 to 19)	5 (0)	10 (1.41)	11 (1.41)	2 (1.41)
By segments (the elderly)	2 (-1 to 19)	3 (0)	8 (1.41)	9 (1.41)	0 (1.41)
Of intersections	2 (-4 to 8)	2 (0)	2 (0)	1.50 (0.70)	2 (0)

Source: Own production.

Finally, in all the implemented superblocks, a quasi-experimental study will be carried out with a comparison group, with the aim of evaluating the effectiveness of the superblocks in reducing traffic injuries. The intervention group will be the superblocks already implemented and the comparison group will be the areas planned for future superblocks. Based on the traffic injury data provided by the Guàrdia Urbana, it will be possible to identify the collisions that occurred in the areas involved and compare them from 2002. An analysis will be made before and after the intervention in which the results to be analysed will be the total number of collisions, the number of injured people and the number of injured pedestrians. The models will take into account the volume of traffic and the characteristics of the street.

Conclusions

This study will provide information on the real impact of the implementation of superblocks on air quality, health and quality of life, mental health, social support, physical activity and traffic injuries, with a perspective on gender and social inequalities. It will evaluate the effectiveness of public policy in improving health and reducing health inequalities.

Preliminary results indicate that the Sant Antoni superblock has drastically reduced the levels of air pollution in the affected area, but more measures are needed to assess the impact on the entire area of the superblock. In addition, residents value the benefits to their well-being. In the Poblenou superblock, its use is not so widespread but potential benefits have also been detected. In this sense, the Poblenou superblock was more frequently used by families and working people, while the Sant Antoni superblock was used mainly by the elderly. The impact on use and the health benefits provided will depend, to some extent, on the type of intervention, as well as the characteristics of the neighbourhood in which the interventions have been carried out. Ongoing studies will provide more information and more evidence on this.

Bibliography

BARCELONA CITY COUNCIL. (2016). *Medida de Gobierno. Llenamos de vida las calles. La implantación de las supermanzanas en Barcelona*. Disponible en https://www.slideshare.net/Barcelona_cat/mesura-de-govern-oomplim-de-vida-els-carrers-lla-implantaci-de-les-superilles.

MCKENZIE, T. L., COHEN, D. A., SEHGAL, A., WILLIAMSON, S. & GOLINELLI, D. (2006). "System for Observing Play and Recreation in Communities (SOPARC): Reliability and Feasibility Measures". *Journal of Physical Activity and Health*, 3, supplement 1, p. 208-222.

MEHDIPANAH, R. *et al*. (2019). "Effects of Superblocks on health and health inequities: a proposed evaluation framework". *Journal of Epidemiology and Community Health*, 73(7), p. 585-588.

MILLSTEIN, R. A. *et al.* (2013). "Development, scoring, and reliability of the Microscale Audit of Pedestrian Streetscapes (MAPS)". *BMC Public Health*, 13(403).

PALÈNCIA, L. *et al.* (2020). "Study Protocol for the Evaluation of the Health Effects of Superblocks in Barcelona: The 'Salut als carrers' (Health in the Streets) Project". *International Journal of Environmental Research and Public Health*, 17, p. 29-56.

Women, mobility, health and sustainability. A new paradigm in everyday mobility

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In the context of the current climate crisis, this article aims to highlight the main differences in women's behaviour, compared to men's, in terms of their mobility habits and the externalities deriving from them. They will be contextualised in relation to women's role in society (in the labour market, in family roles and in social relationships) and will be linked with structural gender inequalities. Finally, we will indicate some of the issues to be addressed from the perspective of mobility policies in Catalonia and the Barcelona Metropolitan Area.

1. Basic concepts regarding mobility's contribution to climate change and the deteriorating environmental quality of cities, with a gender perspective

With the economic reactivation that began in 2013, the emissions deriving from diffuse sectors like transport rose again, after a slow but steady decrease due to the economic crisis. Today, the mobility and transport sector is responsible for 32% of the greenhouse gases emitted in the province of Barcelona (2018), making it the biggest polluter after the industrial sector. In particular, land transport is responsible for 55% of NO_2 emissions and 59% of particulate matter that is harmful to health – such as PM_{10} or $PM_{2.5}$ – and for the increase of noise pollution in the towns and cities of the Barcelona Metropolitan Area.

It must be remembered that in the province of Barcelona, where some 20 million journeys take place daily – without counting long-distance or last-mile goods distribution – most of this mobility occurs through active mobility (like walking or cycling) or public transport. However, 7 million journeys (36% of the total) still take place in private motor vehicles, 57% of which run on diesel and 40% on petrol, with just 3% in alternative vehicles, such as electric or hybrid cars. This use of a private vehicle is clearly associated with a male profile. As we will see below, women have healthier and more sustainable mobility habits. Nonetheless, on some occasions, they suffer inequalities for this reason, particular when they are more affected by some of the externalities generated by the use of private motor vehicles.

The situation with regard to deteriorating environmental quality in the city of Barcelona has not changed substantially in recent years, and current forecasts indicate that it will not change in the medium or long term unless decisive actions are taken to respond to the requirements set by various bodies and institutions.

The European Union in particular has promoted initiatives, directives and regulations that establish various targets with a view to reducing emissions of these different local and global pollutants.

Specifically: the 2016 Paris Agreement, the White Paper on Transport, the 2030 Agenda and Directive 2008/50/EC on air quality. The United Nations, meanwhile, has underlined the importance of minimising our impact on cities' air quality and the need to mitigate or adapt to the effects of climate change in its Sustainable Development Goals (SDG) 11 and 13, respectively. The WHO has also taken a stance, given the serious effect on health that exposure to these local and global pollutants can have.

However, the Catalan or metropolitan policies aimed at minimising the transport sector's impact on climate change, on environmental quality or noise pollution have not had the desired effect, unlike those in other sectors. Nonetheless, the situation in terms of sustainable mobility regulations and planning is much more optimistic here than in other regions. Broadly, difficulties in reaching inter-administration agreements to apply certain initiatives, often met with significant social protest from economic agents and certain pressure groups, are the reason behind the lack of substantial improvement seen in this area. Decision-making on this subject covers more than just specific mobility policies; it cuts through a host of other areas, such as the economy, work, welfare and social rights, tourism, urban planning, education and others.

It is particularly relevant to note that, in recent years, the gender perspective has started to be seen in the design of mobility and transport planning instruments, policies and initiatives, with a focus on women's better mobility habits and lesser impact on climate change, environmental quality, noise pollution and road accidents. However, at the same time, it is important to understand the causes behind this different behaviour compared to men and to avoid increased inequality on gender grounds in this area.

2. How can women's mobility be characterised and what elements explain it?

The Working Day Mobility Survey (EMEF by its initials in Catalan)[39] is the only existing source of information in the Barcelona Metropolitan Area that offers a snapshot of different behaviours in terms of day-to-day mobility habits among different population profiles. Below, there is a brief summary of the differing mobility characteristics of women living in the city of Barcelona and in the rest of the Barcelona Integrated Fare System area (hereinafter, IFS), based on data from the 2018 edition of the survey. Meanwhile, to provide a more intersectional perspective in keeping with their social diversity, aspects like age, employment situation, educational level and urban characteristics of the place of residence (household income, access to public transport, etc.) are taken into account. The information is accompanied by explanatory elements and other useful sources.

2.1. Immobility and degree of mobility

Some people report that they do not make any journeys over the course of a working day; in other words, they do not leave their home. Basically, they do not leave their home as they are unable to (due to illness, a disability, care duties, etc.) or for other work or personal reasons. The percentage of the population that is non-mobile tends to remain stable and has a clear structural bias according to sex. In 2018 in Barcelona, 7.8% of women were non-mobile, while the figure stood at 5.1% for men. One of the reasons for this difference is the higher proportion of women in the older population, which has an impact on health.

It must be noted that, although the ageing of the population is more pronounced in Barcelona than in the rest of the province, the degree of immobility is higher among women who live outside the city (up to almost 10% in the rest of the IFS). Therefore, older women in Barcelona lead a more active life in terms of mobility than the population outside the city. A priori, this could be associated with a healthier lifestyle among the older women of Barcelona, but it is difficult to confirm categorically, as physical activity and exercise may also take place in the private sphere. Other aspects relating to this different mobility should probably also be taken into account, such as the population's ability to travel in appropiate conditions.

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39. For more information on this official statistical initiative, please visit https://iermb.uab.cat/ca/enquestes/enquestes-de-mobilitat/

As well as immobility, the number of journeys made by each person over the course of a working day is a relevant figure. The value is similar among men and women, in aggregate terms (in Barcelona, 4.17 for women, and 4.13 for men), but there are significant differences when socio-demographic profile is taken into account. For example, economically active women (employed or unemployed) are the group that makes more journeys over the course of the day, and therefore, they carry out more daily activities outside the home. This is a group of women whose use of time is complex; as well as journeys linked to work (if they are employed), many of their journeys are linked to domestic activities, childcare, or care of other dependent persons. The number of these other journeys tends to be higher among unemployed women.

2.2. Different reasons for journeys

The reasons for these day-to-day journeys clearly reflect the population's social uses of time, as well as being closely linked to age and employment situation. What is more, everyday routines differ according to sex, which is evident when we examine day-to-day mobility. Both in Barcelona and in the rest of the IFS, a clear pattern emerges: women make fewer journeys for work and more for personal reasons. Furthermore, within the sphere of personal mobility, women make more journeys for essential activities (unavoidable personal mobility), necessary as part of everyday life or for care duties, like going to the doctor's, accompanying other dependent persons or doing grocery shopping. At the same time, within other types of mobility that are more optional, there are differences in types of activity depending on sex. Men make more journeys for leisure purposes and go on more walks, while women make more journeys to visit family and shop for items other than groceries.

Graph 1. Distribution of journeys according to reason (aggregate). Residents of Barcelona and the rest of the IFS. 2018
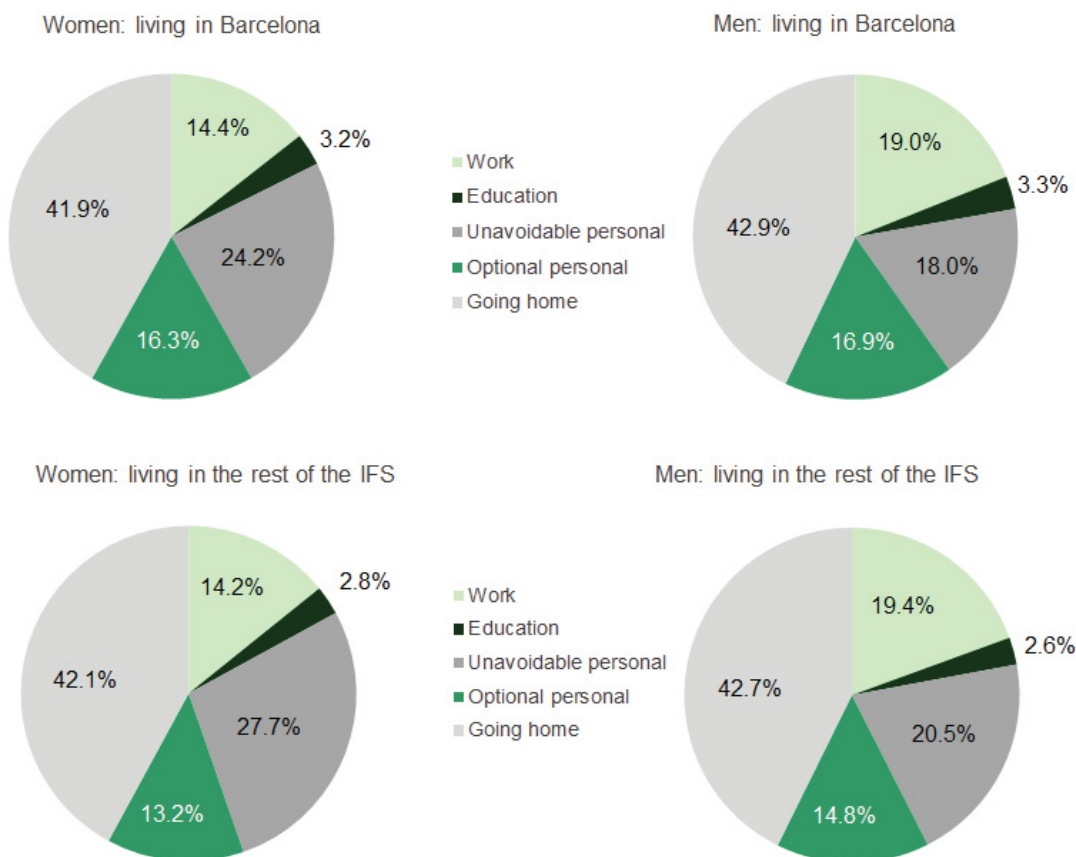
Source: Produced using data from EMEF 2018 (ATM).

The origin of these differences is obvious and well known: the roles traditionally assigned to women are more intensely associated with care duties and contributing to maintaining human life. This higher degree of responsibility in domestic and family activities has an impact on many areas

of life, which generates differences in everyday routines. For example, in 2011 in Catalonia, women dedicated twice as much time as men to the home and the family, while men dedicated 34% more time to paid labour and 42% more to hobbies and digital activities (Use of Time Survey 2011, Idescat). As well as generating more unavoidable personal journeys, women's unpaid labour has a negative impact on their participation in the labour market, and causes them to make fewer journeys for work reasons. It is worth noting that these differences are especially pronounced in the economically active population and in the population aged between 30 and 64, as everyday activities are similar among younger men and women. This reflects how gender inequality is closely linked to motherhood and the adoption of certain roles within the home.

2.3. Means of transport

As women carry out more activities associated with local travel, they tend to walk more. Although walking as a means of transport is also common among men, the use of a private vehicle is much more prevalent in the male population, especially when linked to work mobility (often related with longer distances). What is more, women make more journeys on public transport.

Particularly in Barcelona, although active mobility and use of public transport are common throughout all sections of the resident population, the percentage of women who use these means of transport is 88%, while the proportion of men is just 70%.

Graph 2. Distribution of journeys according to means of transport. Residents of Barcelona and the rest of the IFS. 2018
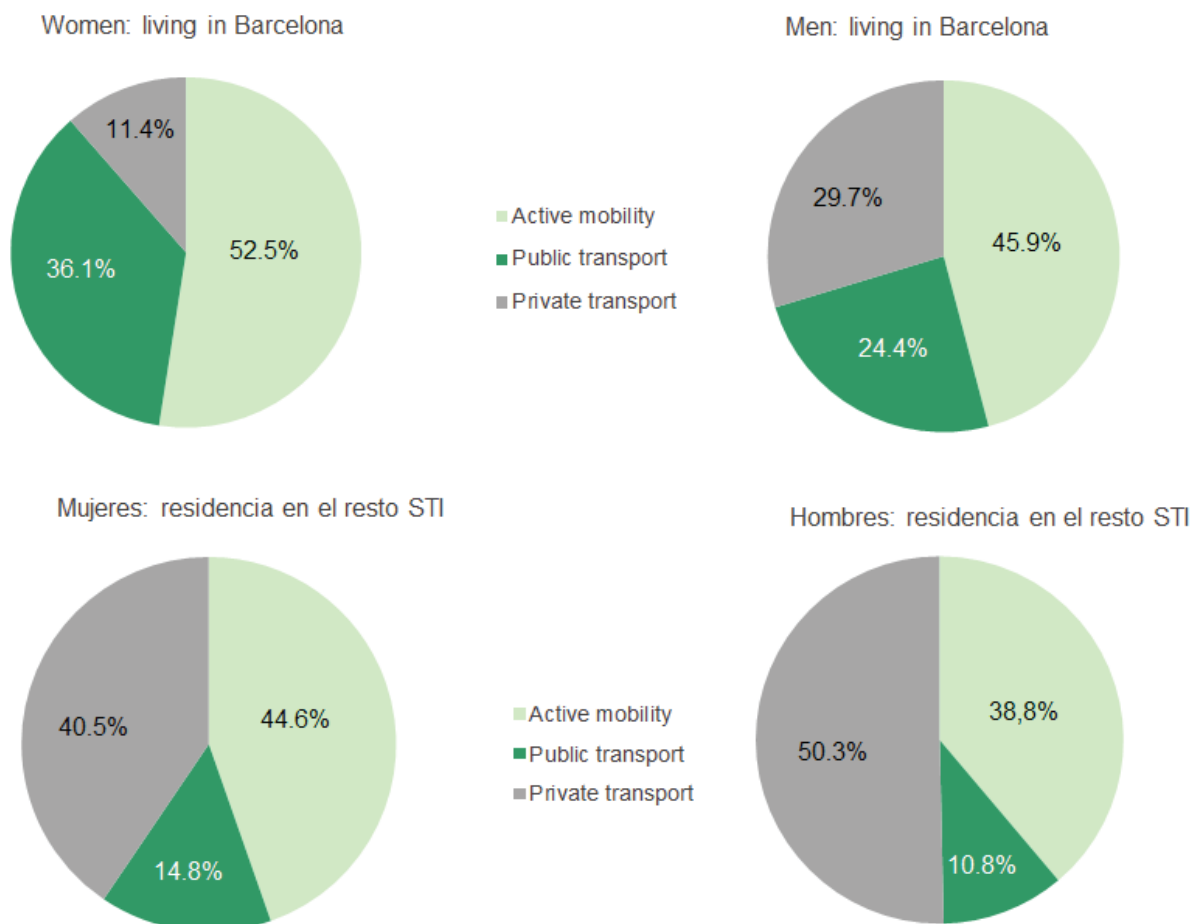
Source: Produced using data from EMEF 2018 (ATM).

However, the explanation behind this data goes far beyond women's lesser participation in the labour market. In the same age strata, employment situation, income and level of accessibility to public transport, women continue to have more sustainable mobility habits. For instance, although there are no notable differences among young men and women in terms of reasons for journeys,

men between 16 and 29 and male students tend to choose a private vehicle more (50% of journeys made by female students in Barcelona take place on public transport, while this figure is just 43% among male students).

The following summarises some reasons for these differences in use of different means of transport:

- **Less need to use a private vehicle**: as we have seen, some of women's reasons for journeys are related to activities that, in our society, tend to be local; these journeys are therefore often made by active means of transport. What is more, in many cases, women choose jobs closer to home, to which they can easily walk. Therefore, the need to balance work with family life explains the fact that 81% of women who live in the Barcelona Metropolitan Area work in the municipality in which they live, compared to 65% of men. Furthermore, the jobs to which they have access (or the jobs they prioritise) tend to be located in urban locations where access on foot or via public transport is more viable (Urban Cohesion Survey, 2017).

- **Less access to a private vehicle**: the inequality generated by women's different participation in the labour market (more part-time work, more temporary contracts, less access to management positions, etc.) leads to less access to a private vehicle due to the lower income associated with precarious work, as well as perpetuating traditional feminine and masculine roles. When a woman's participation in generating household income is less than the man's, the man tends to use the private vehicle more habitually. In 2011, only in the 17% of households in the Metropolitan Area with just one private vehicle was the woman the one who used the car more often (ECVHP, 2011).

These two elements aside, it is important to consider the territorial component, as it helps us to understand certain mobility patterns through a gender perspective. In areas with lower population density with mainly residential functions or with a semi-rural dynamic in the IFS and, in general, in places where public transport is less accessible, private vehicles are much more common among women. Therefore, although men's and women's routines continue to differ, they use private vehicles almost equally – at a figure of up to 53% – in the outer zone of the IFS (see table 1). In these areas (and the outer areas of the conurbation of Barcelona), access to a private vehicle is particularly necessary for women, as not having one entails a significant loss of opportunities.

Table 1. Modal share of motorcycle and car according to zone of residence. 2018.

Zone of residence	Modal share motorcycle (%)		Modal share car (%)	
	Woman	Man	Woman	Man
Barcelona	3.1	10.3	8.2	18.0
Rest of zone 1	1.1	7.0	23.3	30.9
Rest of Barcelona Metropolitan Region	0.8	4.3	43.7	44.9
Rest of IFS	0.7	2.3	53.6	53.2

Source: Produced using data from EMEF 2018 (ATM).

In contrast, women living in denser areas present much healthier, more environmentally friendly mobility patterns. In Barcelona, for example, women make 11.4% of their journeys in a private vehicle, while this figure increases to 27.9% among men. However, this behaviour may be caused by inequality. Indeed, in many cases, urban pressure prevents households from owning more than one private vehicle (see table 2), and for cultural reasons associated with gender roles, it is often the man who uses it in his daily routine.

Table 2. Percentage of cars per household according to the number of inhabitants of the municipality of residence in the IFS and Barcelona. 2018.

Cars per household	Fewer than 5,000 inhabitants	5,000–20,000 inhabitants	20,000–50,000 inhabitants	Over 50,000 inhabitants (not including Barcelona)	Barcelona	Total IFS
No car	2.2	5.1	9.5	12.9	28.0	14.9
1 car	30.0	40.7	48.6	55.3	57.0	51.0
2 cars or more	67.8	54.2	41.8	31.8	15.1	34.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Produced using data from EMEF 2018 (ATM).

As for the evolution of this data over time, the EMEF's time series has not shown a clear trend towards changing everyday mobility habits in women or men yet. Currently, most of the changes observed are associated with changes deriving from economic cycles (for example, during the 2009–2014 crisis, men's mobility patterns were 'feminised'). Nonetheless, it is true that the gap in access to a private vehicle is shrinking, as the percentage of men drivers registered in Spain is displaying a clear downward trend.

Graph 3. Proportion of men in the total number of driving licence holders in Spain. 1991–2019
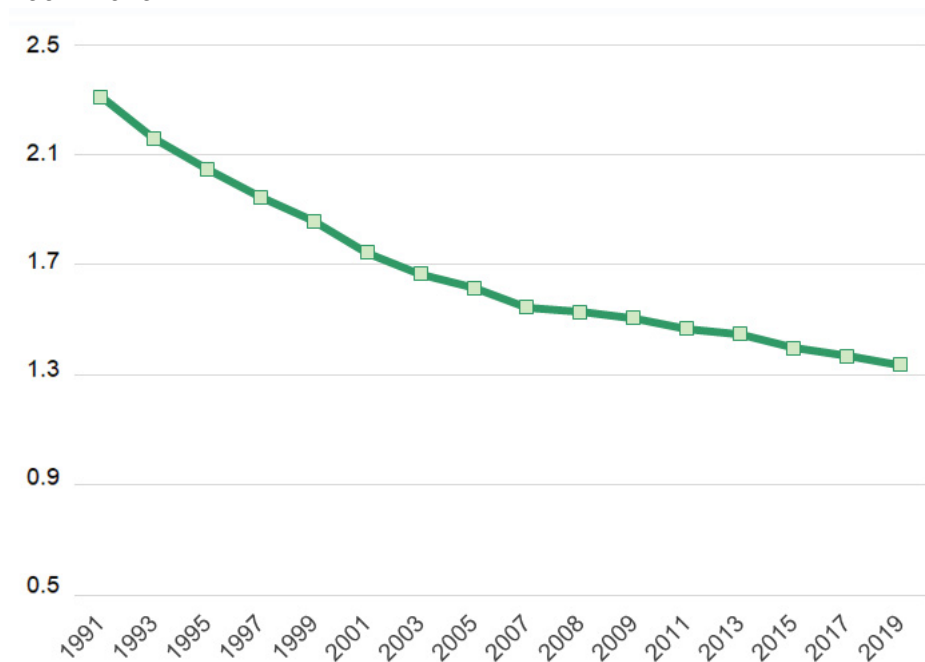
Source: Produced using data from the Directorate-General for Traffic (DGT).

2.4. Preferences and predispositions

Year after year, the EMEF observes that our society values individual means of transport over public transport, and that there are no significant differences according to sex in this area. After walking and cycling, motorcycles and cars are the means of transport with the best rating every year. All public transport receives poorer ratings, though the tram obtains the best rating. Nonetheless, men rate some means of transport, like the motorcycle or the metro, more highly, probably because they offer a feeling of speed, which is something culturally more associated with masculinity. EMEF also notes that the preference for private transport is a common answer as a reason for not using public transport (between 8% and 10% of answers), with no significant differences between men and women.

Table 3. Satisfaction with means of transport. Residents of Barcelona and the rest of the IFS. 2018 (10 = very satisfied, 0 = very dissatisfied).

Means of transport	Barcelona		Rest of IFS	
	Woman	Man	Woman	Man
Walking	8.5	8.3	8.4	8.2
Bicycle	8.2	8.2	8.2	8.2
Scooter, segway, other personal transporters	7.3	7.4	7.6	8.1
Metro	6.8	7.2	6.9	6.9
TMB bus	7.0	7.0	6.9	6.8
Other urban bus	6.5	6.6	6.6	6.5
Interurban bus	6.6	6.7	6.8	6.6
Tram	7.4	7.3	7.5	7.2
Renfe Rodalies (local train)	6.3	6.2	6.4	6.3
Regional/mid-distance Renfe train	6.4	6.3	6.9	6.4
Taxi/Uber/Cabify	6.6	6.6	6.7	6.4
Car (driver)	7.3	7.1	7.8	7.7
Car (passenger)	7.7	6.9	8.0	6.9
Motorcycle	7.9	8.1	7.7	8.3
Public transport	7.0	7.0	6.9	6.8

Source: Produced using data from EMEF 2018 (ATM).

This data highlights the preference for private vehicles throughout the population. Factors behind this include freedom of movement, time flexibility, physical privacy and social status. The lack of significant difference according to sex also emphasises how, in the current context of the climate emergency, both men and women continue to favour private motorised mobility over public transport.

3. Can the current mobility model accentuate situations of gender inequality?

As we have seen, women's more sustainable, healthier mobility habits can largely be explained by the structural gender inequality that persists and is highly evident in our everyday lives. In addition, we have examined how the urban model and the accessibility of public transport, as well as the construction of the urban public space, contribute towards shaping women's day-to-day mobility patterns and generate differences according to gender. The following paragraphs will briefly express the extent to which the female mobility model, which is much more adapted to the context of a climate emergency, helps to perpetuate or exacerbate inequalities between men and women.

First, it is important to highlight women's different contribution to climate change and to the deterioration of air quality in urban areas. Despite being just as exposed to air pollution and the risks associated with climate change, they contribute to them less than men. A preliminary study (IERMB, 2017) gave an estimation of the impact of everyday mobility among the residents of the AMB's municipalities according to sociodemographic profile. The results showed that, in all age groups, women's mobility contributes less to climate change (energy consumption and CO_2 emissions) and to worsening air quality (NO_X and PM_{10} emissions). They highlighted the disadvantage suffered by women and other groups who mainly travel using active transport or use public transport more (children and young people, elderly people, people with a lower income, etc.): they contribute less, but they are still affected by all the impacts of climate change.

In parallel to the health impacts generated by noise pollution deriving from motor traffic (which probably displays a similar pattern to that of pollutant emissions, in terms of gender differences), another unwanted effect of mobility must be considered: road traffic injuries. It is true that, in this case, the number of deaths and serious injuries is much higher among men, as more men drive than women. Nonetheless, some recent studies on the risk of road accidents in the city of Barcelona indicate that more men are responsible for traffic accidents, and more women are involved as pedestrians or passengers.

Apart from the health impact, the mobility system generates a host of externalities that affect women's everyday lives. These include inequality in terms of territorial accessibility, as lack of access to a private vehicle may limit women's ability to access the whole territory, thus shrinking

their territorial reference framework even further. As a result, when the distances to be travelled cannot be covered through active means of transport and public transport services are insufficient, women who do not have a driving licence or a vehicle may be restricted in their personal development expectations (access to work, to education, to culture, to social relationships, etc.). In fact, it is common for the percentage of non-mobile population to be higher among women who live in neighbourhoods with few public transport services. So, although in these areas women tend to use a private vehicle more frequently, those who cannot use it suffer more from inequality, due to their lack of access to the urban space or the territory. This situation may be accentuated among women who live in neighbourhoods with a high poverty rate or among women with some sort of sensory disability or disorder, as the proportion of immobility among these two groups is higher.

Table 4. Percentage of non-mobile population and restriction to municipality of residence according to sex and public transport accessibility index. 2018

AMB	Poor accessibility by public transport (%)		Good accessibility by public transport (%)	
	Woman	Man	Woman	Man
Non-mobile population	10.0	5.2	8.6	5.5
Restriction to municipality	49.9	42.7	83.6	74.8

Source: Produced using data from EMEF 2018 (ATM).

It must be noted that the city of Barcelona is home to an extensive public transport network, as a response to the high level of mobility of the population. It is a system that can be considered satisfactory in general terms, though the city's complexity and diversity do not always guarantee the same services everywhere. In this context, it must be remembered that 10% of the AMB's population live in neighbourhoods with poor or non-existent accessibility, which highlights the possibility that there are people in this state of disadvantage.

Another of the costs felt by women is linked to inequality in work-life balance. As is well known, the average time of a journey by public transport is longer than one by private transport. This is a constant in the Barcelona Metropolitan Area. Consequently, as they use public transport more, women spend more time travelling each day, because even though the distances they travel are shorter, their journey time is longer. According to ECURB 2017, 87.5% of men in the Barcelona Metropolitan Area take less than 15 minutes to get to work when it is located in their neighbourhood of residence; meanwhile, for women, this figure stands at 76.3%.

4. Some toughts and final conclusions

As we have seen, less dependence on private motor vehicles, more local journeys, and more frequent use of public transport in the most urbanised, densest areas make women's mobility habits an example to be spread throughout society in this context of climate emergency. However, these patterns are often a response to structural gender inequalities; it is therefore essential to break the link between sociodemographic profile and use of transport. The aim should be for the population to choose the most efficient means of transport at all times, regardless of sociodemographic or economic status, place of residence and type of activity to be carried out. Pursuing this path means that, as social and gender inequalities diminish, women or any other group that suffers from inequality (such as those living in poverty) will not adopt less sustainable and healthy mobility habits. Quite the contrary.

This premise aside, there are some ways through which progress could be made in the public mobility policies:

- Reforming the urban space according to the principles of feminist, sustainable and healthy urban planning.

- Promoting a change in habits in urban contexts, particularly among men: the 'feminisation' of men's mobility patterns is essential in the city especially, where air and noise pollution levels

exceed the recommended limits year after year. A huge supply of public transport services and a largely compact, diverse city model allow this change to be made through private vehicle demand management measures (extension of car and motorcycle parking regulation, urban congestion and pollution tax, etc.), paving the way for a modal shift.

- Offering training and disseminating knowledge: individual perceptions must be changed to favour means of transport that are more resilient in the face of climate change through sustainable mobility education in schools and other educational environments.

- Backing interdisciplinary approaches: more working groups must be created with experts in various disciplines to encourage a more cross-cutting approach. These teams are often made up of engineers or architects, most of whom are men or have been exposed to androcentric perspectives of city and transport system design.

- Improving governance: inter-administration agreements must be made to invest in public transport infrastructures and to implement action deriving from approved mobility plans. Horizontal collaboration within and between administrations must be encouraged in areas of action previously not associated with mobility, such as health, education, work and social rights.

Bibliography

ARORA-JONSSON, S. (2011). "Virtue and vulnerability: Discourses on women, gender and climate change", *Global Environmental Change*, 21, pp. 744–751.

DOMENE, E.; GARCIA, M. (2017). *Avaluació dels efectes de la mobilitat en la salut i el benestar de la població a l'àrea metropolitana de Barcelona*, Bellaterra: Barcelona Institute of Regional and Metropolitan Studies.

MIRALLES-GUASCH, C.; OLIVER-FRAUCA, L.; PÉREZ, N. (2008). *La mobilitat quotidiana des d'una perspectiva de gènere*, Bellaterra: Barcelona Institute of Regional and Metropolitan Studies.

MIRALLES-GUASCH, C. (2010). *Dones, mobilitat, temps i ciutats*, Quaderns de l'Institut, 14, Catalan Women's Institute. Government of Catalonia.

PEARSE, R. (2017). "Gender and climate change", *WIREs Climate Change*, 8, e451, doi:10.1002/wcc.451.

PÉREZ, M.; PÉREZ SANS, N.; COLL, F.; PONS, M. (2020). "Les desigualtats en el sistema de mobilitat: situació i reptes en l'àmbit metropolità de Barcelona", *La metròpoli en transició. Reptes i estratègies. Anuari Metropolità de Barcelona 2019*, Barcelona: Barcelona Metropolitan Area.

PÉREZ, M.; PÉREZ SANS, N.; COLL, F. ANDRÉS, D. (2018). *Relacions entre sistema de mobilitat i desigualtats socials i urbanes (Fase 1 i Fase 2)*, Bellaterra: Institute of Regional and Metropolitan Studies.

PÉREZ SANS, N.; PÉREZ, N.; SOLÉ, G. (2016). *La política social en la mobilitat quotidiana. Diagnosi i reptes per a la inclusió social.* Bellaterra: Barcelona Institute of Regional and Metropolitan Studies.

Barcelona's energy advice points and the climate emergency

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"It's not normal to be cold / hot at home." "We're putting all our energy into preventing your electricity supplies from being cut off." You may have seen these slogans on the metro, on the bus, in the street, in the newspaper, in a pamphlet, or on a website in recent years. What's behind these messages? We are introducing a young public service that has been created with the aim of tackling situations of energy-related vulnerability, in order to guarantee our rights in this area, but also to provide global responses from local action to the climate emergency in which we are immersed. This involves challenges and actions from everyday life, with a desire to address a global issue.

EAPs: what are they and what do they do?

Barcelona's energy advice points have become a point of reference for the city since they were deployed. The energy advice points (EAPs from now on) have been serving all of Barcelona's districts since January 2017 and there are 11 offices distributed throughout the city. This service aims to guarantee energy rights and basic supplies (water, gas and electricity) as well as improve home energy efficiency in Barcelona, especially for the most vulnerable. Every year it promotes the hiring of 20 people finding it difficult to enter the job market to join their permanent staff. These people become part of the formal teams and as energy professionals provide advice in any of the city's 11 EAPs. The service is owned by the municipality and is currently managed by a group of social entities: the UTE ABD-Ecoserveis, responsible for general coordination, and five entities that provide the service in the different parts of the city: ABD-Ecoserveis, Suara, Fundació Surt, Fundació Ciutat i Valors and Fundació Salut i Comunitat.

The service is aimed at all Barcelona's citizens but especially those people who are in a situation of energy poverty and in which some indicator of vulnerability is considered, such as people who suffer from economic and employment difficulties arising from specific or structural long-term unemployment, termination of social benefits or lack of income, people living in homes in poor conditions (poorly insulated, with humidity, leaks, etc.), people in a situation of dependency (elderly people, people with disabilities) or who suffer from some type of socio-sanitary difficulty that requires electrical appliances for the optimal development of their daily lives, and families with dependent children, especially single parents.

The service provides three levels of intervention depending on the tasks to be performed and the professionals who perform them:

- Information and energy rights service or the front office: throughout the city, open to the general public.

- Energy advice service or the back office (personalised and by appointment): aimed at vulnerable people or those suffering from energy poverty.

- Home intervention service: the intervention is performed at the person's home. This service is aimed at people who are suffering from energy poverty or who cannot move outside their home. In this case, an energy officer goes to diagnose the energy efficiency of the home and decide what interventions should be carried out. During the visit they provide information on energy saving habits that can be applied in the home and the regulation of consumer equipment. They also show the people they are visiting the different types of low-cost saving materials that can be installed in the home to reduce energy consumption and maintain thermal comfort. In the case of social services users, this type of material is installed in the home.

The EAPs arose from two previous pilot experiences: the Energy Poverty Care Points (PAPEs in Catalan) trialled between November 2015 and March 2016, and the employment and poverty reduction programme "Energia, la justa", which took place between February and July 2016. The EAPs as they are currently provided are, therefore, a hybrid between the two programmes. On the one hand, like the PAPEs, they offer a service to all citizens and advise and intervene in proportion to the needs detected, while on the other hand, inspired by the "Energia, la justa" programme, they favour the employment of long-term unemployed people in the niche of home energy efficiency.

It was in January 2017 that the 11 front offices and five back offices were created, all of them spread out between five territorial blocks in Barcelona, comprising the following districts: 1) Nou Barris; 2) Sant Andreu and Sant Martí; 3) Ciutat Vella and L'Eixample; 4) Sarrià - Sant Gervasi, Les Corts and Sants-Montjuïc; 5) Gràcia and Horta-Guinardó. Each of these has two information offices (front offices), except for block 4 which has three, and an advice and intervention by appointment office (back office).

In most cases, the information offices are located in the Housing Offices. The exceptions are Nou Barris, where a front office is located in an alternative community management space (the Casal de Barrio del Verdun, a neighbourhood centre), and in Horta-Guinardó, where the front office is in the Mas Guinardó offices.

But what do we mean when we talk about "energy poverty"?
Energy poverty can be defined as a situation in which members of a household cannot access basic energy services (such as heating, cooking, electricity, etc.), or when these services represent an excessive cost for the family unit (Tirado *et al*., 2012). Energy vulnerability refers to households that, although not considered to be in a situation of energy poverty, may be at risk of suffering from it when certain conditions internal to the home (such as job loss) or external or contextual conditions (such as rising energy prices or the economic crisis) occur (Tirado *et al*., 2016).

Incidence of poverty and energy vulnerability in public health
Energy poverty is a variable that has a great impact on the public health of citizens and that, taking into account the factors that generate it, has an increasing incidence.

In Spain, the current situation can be explained by several factors. Firstly, the increasing prevalence of energy poverty associated with the loss of household purchasing power due to the economic crisis (Tirado and Jiménez, 2016). The increase in the risk of poverty or exclusion is manifested in different ways, including energy poverty, one of the many deprivation factors of the most deprived households.

Secondly, the characteristics of homes that have an impact in this area due to factors such as their age and the architectural quality associated with compliance with building regulations (IDAE, 2011). Practically half of the housing built in the Spanish context were built before 1979 and without any building regulations that required minimum thermal characteristics (Ortiz and Salom, 2016). As a consequence, it has significant deficits in terms of energy efficiency.

Thirdly, the price of energy paid by consumers in Spain has risen sharply in recent years. Both electricity and gas prices have risen, and the increases have been among the most pronounced in the EU-27.

Energy poverty is a significant public health problem that is becoming increasing visible. Resource-saving behaviour – such as the use of alternative fuels (solid fuels, for example) or not fully lighting up the home – expose members of vulnerable families to indoor pollution and increase the risk of falls and fires (Marmot Review Team, 2011).

The health and well-being impacts described are unevenly distributed across social class or ethnicity, for example (Walker and Day, 2012). In addition, there are groups that are more vulnerable to the effects of energy poverty on health, such as the elderly, children, and people with chronic health conditions (Hills, 2012). It has also been reported that women may be more susceptible to the effects of low temperatures (Barnett *et al*., 2005).

In the Spanish context, the economic situation of crisis experienced in recent years, and the unequal exit from it, have aggravated the problem of energy poverty. The percentage of households that could not maintain an adequate temperature in 2015 in the Spanish context was 10.6%, an increase of 43% compared to 2010. This increase was one of the largest in Europe, surpassed only by Greece, Lithuania and Italy. In Spain, the low-income population who declared that they could not maintain an adequate temperature at home in 2015 was 23.3%, above the European average. This percentage is aggravated if we focus on people in a situation of social exclusion. A Red Cross report observed in a sample of people at risk of poverty or social exclusion attended to in 2014 that up to 41.4% stated that they could not maintain an adequate temperature in their homes (Spanish Red Cross, 2015).

In Catalonia, in 2016, 9.1% of households in Catalonia could not maintain their home at an adequate temperature during the winter and 7.4% had delays in the payment of bills (gas, electricity, water etc.). Moreover, 5.9% reported having damp or mould on the walls, floor, ceiling or foundations, according to data from the 2016 Living Conditions Survey (ECV). Although these percentages are comparatively slightly better than the Spanish average, they have all worsened significantly since 2007.

The prevalence of energy poverty in low-income populations, below the monetary poverty line, is at alarming percentages and is a situation that many Catalan families are far from resolving. Thus, the percentage of households that could not maintain an adequate temperature is double for this population, 22.7%. The same goes for the indicator of late payment of ECV energy bills, which stands at 12.6%. And in the case of the presence of moisture or mould on the walls, floors, ceilings or foundations, the figure triples to 24.9%.

In 2016, the percentage of people living in households in Barcelona who declared that they were unable to maintain their home at an adequate temperature in the cold months was 7%, a percentage that is below the values calculated for Catalonia. The percentage of people in households with late payment of bills was 5%, and in homes with leaks, moisture or rot, 6%. Therefore, these indicators are also below the prevalence obtained for Catalonia. However, Barcelona presents important gradients of inequality, i.e. pronounced differences between areas of the city that remain relatively stable. This unequal distribution throughout the city crosses different aspects of life and affects the population in areas such as education, income, access to the labour market, access to housing and its characteristics.

People living in big cities usually have access to more jobs and better wages, but they are also subject to a higher general level of prices for goods and services, and Barcelona is no exception. In addition, residential insecurity is a major problem now that housing has taken on the dimension of an asset for global investors. As a result, households spend a significant portion on housing and have difficulty meeting other equally necessary expenses, including energy supplies. To better

understand this phenomenon in Barcelona, it is worth consulting the report "Municipal Indicators of Energy Poverty in the City of Barcelona" (Tirado, 2018).

In 2015, Act 24/2015 of 29 July was passed on urgent measures to tackle the emergency in the field of housing and energy poverty. Among other precepts, it guarantees access to basic supplies by people at risk of residential exclusion. While there are several difficulties in enforcing this Act, it is a vital tool for protecting vulnerable families from the housing emergency we are experiencing (Tirado et al., 2016). One of its essential features is that it introduces the precautionary principle, so that the supply company cannot cut off supply if the vulnerability of the affected consumer has not been previously verified.

Consequently, with these aspects, Barcelona is one of the municipalities that is acting most decisively to guarantee the right to housing and living conditions. With regard to energy poverty, it has been the first city council to approve an instruction that develops the application of Act 24/2015. This establishes coercive and sanctioning measures in case of non-compliance with the standard. In addition, the EAPs guarantee the processing of reports on the risk of residential exclusion (IRERs) for situations of great social vulnerability, in order to avoid the supply of water, gas or electricity being cut off. And the local authority has also promoted various initiatives and programmes to reduce energy poverty and transform energy culture in the city.

EAP challenges: to influence the change in the current social, economic and environmental model towards a more just and sustainable one
The general objective of the service is to combat the situation of energy poverty in Barcelona, especially for the most vulnerable people, and thus guarantee energy rights and basic supplies provided for in current legislation, to improve the efficiency of city homes and to take advantage of this project to implement green job initiatives, promoting the employment of people who find it especially difficult to enter the job market. The answers to this great challenge have been articulated through three main measures:

1. The EAPs, as a service that promotes the guarantee of energy rights and the improvement of home energy efficiency for Barcelona's citizens, ensuring access to basic supplies, through the defence of housing and energy rights promoted by Act 24/2015, of 29 July, on urgent measures to address the emergency in the field of housing and energy poverty. How does it work? Basically, by detecting situations of energy poverty or potential risk of suffering, and increasing the energy efficiency of homes.

2. The EAPs, as a service to promote employment and improve employability, professionally qualifies people with difficulties in accessing the labour market and improves the skills and degree of employability of people who are part of the territorial support teams.

3. The EAPs, as a service to drive community action, foster employment in the city's neighbourhoods and districts to combat energy poverty, as well as promote actions to prevent situations of deprivation, vulnerability and energy poverty and encourage citizen empowerment.

More and more families are coming to learn about their energy rights, what they can do to make their homes more efficient and reduce their bills. The EAP service has helped a total of 79,168 people since its inception in 2017 (23,231 people in 2017, 33,434 people in 2018 and 31,569 people in 2019.) That means a total of 30,472 households (8,462 households in 2017, 13,301 households in 2018 and 12,079 households in 2019) and represents an average of 2,199 people per month and 940 households per month attended to in the city.

The district breakdown for 2019 was as follows: Nou Barris (21% of people attended to in the city as a whole), Sants-Montjuïc (14%) and Sant Martí and Ciutat Vella (each with 13%), followed by Horta-Guinardó (10%) and Sant Andreu (9%).

Table 1. People attended to by the EAP service. 2019

	Nou Barris	Sants-Montjuïc	Ciutat Vella	Sant Martí	Horta-Guinardó	Sant Andreu	L'Eixample	Gràcia	Sarrià - Sant Gervasi	Les Corts	Total
People attended	2,506	1,767	1,613	1,611	1,219	1,112	996	769	261	225	12,079

Graph 1. Percentage by districts of the people attended by the EAP service respect to the total number of people attended in the city. 2019
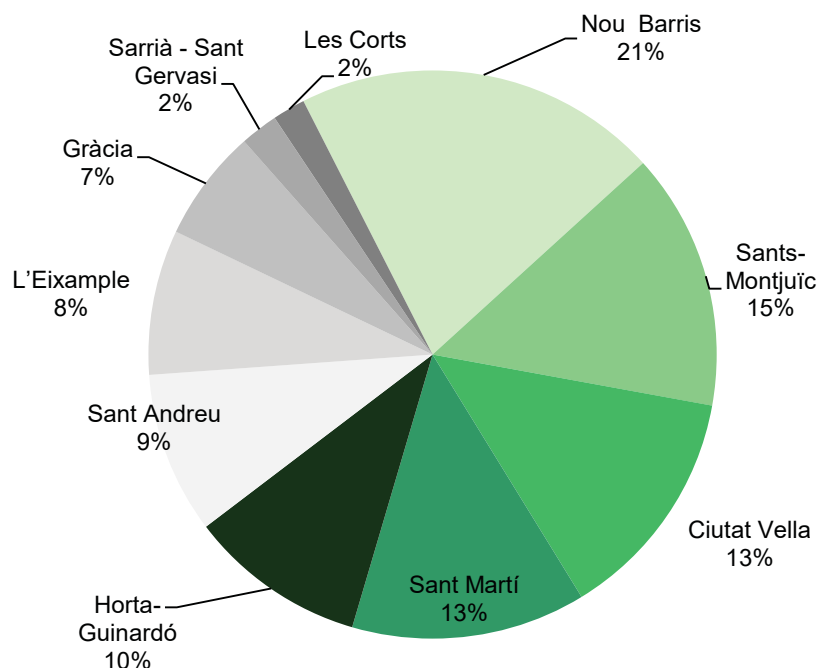
Source: Energy advice points (EAPs). Action report 2019.

It should be noted that the number of people returning to the EAPs the following year increased: 2,261 people who had been helped in 2017 returned in 2018, while the recurrence of people already helped by the service has increased to 3,370 people in 2019.

In addition, 10,354 risk of residential exclusion reports have been issued in the first three years of service to protect the vulnerable cohabitation units that have visited it from being cut off, and a total of 37,923 vulnerable customers in the city have been informed, in compliance with Article 6.4 of Act 24/2015, of 29 July, on urgent measures to address the emergency in the field of housing and energy poverty. Also, the action of the service has prevented a total of 5,700 energy-vulnerable families in the city from being cut off.

In terms of the advisory service, a total of 20,544 people were served in the first three years (5,289 in 2017, 7,740 in 2018 and 7,515 in 2019); and a total of 3,655 people have been attended to in their homes (1,378 in 2017, 1,188 in 2018 and 1,089 in 2019) in order to detect situations of energy poverty or potential risk of suffering from them. Home energy efficiency has also increased thanks to the equipment installed in 1,796 households attended to by social services (768 in 2017, 647 in 2018 and 381 in 2019), and the consumption of 9,143 households has been reduced by applying power reductions (1,428 in 2017, 2,165 in 2018 and 5,550 in 2019).

As far as promoting employment and improving employability is concerned, five employment plan programmes have been run with the aim of getting more people with difficulties in accessing the labour market into work. Each one has lasted eight months, except for the last one, which has lasted up to a year, and in total 100 people have been hired.

The beneficiaries have been people in a difficult situation for accessing the job market, in a situation of long-term unemployment and linked to the Làbora programme. People pre-selected by City Council Làbora programme staff who have joined the service and participated in the training programme on energy efficiency and work and social skills over two months. Afterwards, they work professionally as energy advisers for six months in the different city districts. In total, each edition has involved 1,335 hours of energy and social training, plus 430 hours of practical training in the service. This training has not only sought to provide participants with new technical training in energy efficiency, but also to strengthen their cross-cutting skills in order to empower people in a vulnerable situation in terms of joining the job market who, after passing through the service, can re-enter the regular job market with more tools.

Data for 2019 indicates that 37% of the 40 participants hired have found work after completing their employment plan at the EAPs; 74% were women with an average age of 50.5; 34% of the total were previously in a situation of long-term unemployment, and 73% in a situation of severe material deprivation. Specifically, in the last edition, the programme consisted of 267 hours of social and energy training and 60 hours of practical training.

At the community level, since the beginning of the project, a total of 472 community actions have been carried out, 116 in 2017, 188 in 2018 and 168 in 2019 in different formats:

- Workshops / capsules and informative training and education days for people in a situation of social vulnerability to help them understand bills as well as advise them on changes in behaviour and low-cost measures to save on bills.

- Sessions to present the service to the CAPs, the Home Care Service, the Barcelona City Council Telecare Service, social service centres, health boards and residents 'associations.

- Meetings with districts, associations, foundations and neighbourhood organisations.

- Development of different protocols for the detection and referral of energy vulnerable cases with various municipal services in the city (Fire Service, Housing, Social Services, Immigration, care for women, etc.).

During 2019, one of the most important channels for reaching the public has been to promote the community axis plus knowledge and recognition of important players in the city who work on caring for people. This is one of the challenges that had been established for 2019, with a greater impact on the professional group that could be a prospector and derivator of the service, holding meetings, gatherings, talks or participating in debates or round-tables. Of the total of 168 community actions carried out in the last year, 40% have been addressed directly at the public and 57% at the professionals attending them.

... And now, how should we deal with the climate emergency?
So far, we have described the service as a care device for fulfilling the energy rights of Barcelona's citizens which, with small home and educational interventions, aims to contribute towards making the city's homes a little more energy-efficient. We have also made clear the project's commitment to implementing green employment programmes, generating jobs linked to the prevention of climate change, the exercise of fundamental housing rights and generating more decent job opportunities for the vulnerable population. Finally, we have highlighted the service's commitment to community and local action, as a privileged space for preventing situations of vulnerability or energy poverty.

But why all this? In the current context, there are plenty of reasons to continue advancing and developing EAPs so that they can be definitively consolidated as an essential basic service in the context of the climate emergency in which we are immersed.

Firstly, because it is a public health issue. In situations of energy poverty, the cold outside penetrates inside houses and ultimately, by various means, impacts on the state of people's health. Moisture inside homes promotes mould and visible microbial growth, which can have a direct effect on health. Cold inside the home has impacts that can trigger life-threatening diseases such as some affecting the circulatory system (strokes or acute myocardial infarction) or exacerbate some previous diseases of the respiratory system (asthma, chronic obstructive pulmonary disease, etc.). Additionally, it can also act on people with weak health or other previous illnesses, and increase both morbidity and excess winter mortality or have psychosocial impacts because it limits people's normal activity, both indoors and outdoors, limiting socialisation and the fact of being able to enjoy being at home. These factors have an impact on mental health and well-being, and are related to situations of stress, anxiety and depression. Indirect health effects have also been reported: people living in energy-poor households do less physical activity and eat less healthy foods. In addition, energetically vulnerable people often live with the stigma of this situation. All of these circumstances can worsen the physical and mental health of those who suffer from them.

The Barcelona City Council Climate Emergency Declaration on 15 January 2020 states that "Excessive and sustained heat leads to an increase in mortality and morbidity, especially in the most vulnerable human groups, as well as in the rest of the natural world. Between 1992 and 2015, it is estimated there were 980 deaths among men and 2,729 among women (natural deaths of people aged 25 and over) that were attributable to extreme heat, generally fragile older people [...]". Therefore, this climate crisis affects health and quality of life and appears to be one of the major threats to the survival of the species. There are many variables that influence its impact: income levels, age, gender, physical condition and state of health, state of housing. And from the service's accumulated experience it can be concluded that the climate emergency does not affect everyone equally, and that services such as the EAPs can contribute significantly to ensuring basic supplies and thermal comfort indoors as subjective and universal right services, and thus work for real climate justice.

In this context, EAPs play an important role in the city as a matter of right and social justice. One of the main goals of the service has been to give continuity and put into practice what the great social mobilisation against the problem of energy poverty achieved in the years prior to the approval of Act 24/2015. That mobilisation helped to highlight the problem, to empower citizens in terms of energy rights, to achieve this legislative change and to ensure Barcelona City Council was actively engaged in the fight for greater climate justice, understanding it was not only something that concerned the association movement but also public and the private institutions, which had to be co-responsible for this change.

Investing in public services aimed at this paradigm shift also means working from the local administration for a clearer and more active communication of energy rights, making it easier for the most affected people to also become aware of what they can do. After three and a half years, it is necessary to go further and consider whether the EAPs should primarily be a service that guarantees this fundamental right and basic need or also work for more ambitious goals.

In the current context, if we really want to opt for "people first", we must accept that the current social organisation is no longer viable and that our ecosystem is collapsing. Institutions, administrations, companies and citizens must accept their respective responsibilities and try to settle the ecological debt by minimising the impact that the inaction of some and the perversion of others has generated.

It is at this point that we need to consider putting more emphasis on those measures that have the greatest impact on changing the cultural and educational model and community action. From the point of view of a service such as the EAPs, it is necessary to work so that each person, from their field of action, can contribute to the fight against the climate crisis and do their bit. Not only at a micro level, but also at a macro level.

The Barcelona City Council Climate Emergency Declaration of January 2020 raised the need to "Promote the current energy advice points as climate advice points (on green roofs, low carbon supply, etc.) and to continue guaranteeing the basic services of people in a situation of vulnerability "as one of the measures to take care of health, well-being and environmental quality. So, the EAPs want to continue emphasising the axis of guaranteeing rights, where water, electricity and gas for domestic use are understood to be a fundamental basic right. But we must also play a key role in promoting the change in the cultural and educational model called for by our city's new energy and climate model. And that is because, in the coming years, at the community level, the PAEs will advance in the work of influencing the change in culture and the collective consciousness that this change in the productive, economic and social system requires. Thus, it will be necessary to place even more emphasis on dissemination, training and outreach side, on an individual, group and community scale, and to help our citizens recognise our planet's limits.

One of the challenges that needs to be addressed immediately and that can have a deeper and longer-term impact is working with and influencing the educational community. As EAPs, this means raising awareness among children, young people and the general public regarding what specific changes this transition to a new model, implies and helping them to understand the environmental impact of the consumer habits which we currently have.

People need to know the repercussions of our consumption model, of our water and energy model: what it means environmentally not to recycle, what it means for our ecological system to consume more than we need without taking into account the waste that this generates. We need to get the message across to the public of how consuming with our current model , wasting water and failing to reduce consumption to 100 litres per inhabitant per day – the target the city has set itself this year – not opting for local agro-ecological production, for mobility habits based mainly on public transport or electric mobility, and so on, affects our energy model and the emission load. We must help to publicise how self-responsible consumption is exercised and what can be done individually to reduce the current 20.4% of total CO_2 emissions in Barcelona that are generated by the domestic sector. (Barcelona City Council, 2017). We need to work with the Energy Agency to encourage citizen initiatives that are committed to self-consumption and the generation of renewable and local energy to the detriment of the current model based on fossil fuels and nuclear power plants.

In short, we must be able to convey to the public what it means to change the current economic model and move towards a model based on energy saving and efficiency, on a rational use of water and energy, on the use of green energy and the use of renewable resources.

In that regard, to achieve this goal it is necessary to carry out actions in the field of education and awareness so that citizens become active agents of change, demanding and vindicating the transition to a new model, demanding legislative measures consistent with the political discourse, bonuses for those who make the effort to operate "in a green way", more investment in aid for the rehabilitation and promotion of the public housing stock that is more affordable and within current building regulations. It is also necessary to work together with the community fabric to be able to increase and expand all this work. There is still a long way to go. It will not be simple or easy, but we must act quickly and decisively, because the current context of climate emergency leaves no other alternative if we want to guarantee the future of the generations that will come after us.

Bibliography

BARCELONA CITY COUNCIL (2020). *This is not a drill. Climate emergency declaration.* Available online at: https://www.barcelona.cat/emergenciaclimatica/ca/aixo-no-es-un-simulacre.

BARCELONA CITY COUNCIL (2017). Energy Balance and Greenhouse Gas Emissions in Barcelona. Barcelona Energy Agency - Energy Observatory 2019. Available online at: https://energia.barcelona/sites/default/files/documents/balanc_energia_2020-portatil1320.pdf

BARCELONA CITY COUNCIL (IMSS), UTE ABD-ECOSERVEIS, FUNDACIÓ SURT, SUARA, FUNDACIÓ CIUTAT I VALORS, FUNDACIÓ SALUT I COMUNITAT (2017). *Action Report. Barcelona's Energy Advice Points. Service for detecting and reducing energy poverty and improving the efficiency of the households of vulnerable people'.* Available online at: https://ajuntament.barcelona.cat/dretssocials/sites/default/files/arxius-documents/memoria_pae_2017.pdf.

BARCELONA CITY COUNCIL (IMSS), UTE ABD-ECOSERVEIS, FUNDACIÓ SURT, SUARA, FUNDACIÓ CIUTAT I VALORS, FUNDACIÓ SALUT I COMUNITAT (2018). *Actions Report. Barcelona's Energy Advice Points. Service for detecting and reducing energy poverty and improving the efficiency of the households of vulnerable people'.* Available online at: https://ajuntament.barcelona.cat/dretssocials/sites/default/files/arxius-documents/memoria_pae_2018.pdf.

BARNETT, A. G.; DOBSON, A. J.; MCELDUFF, P.; SALOMAA, V.; KUULASMAA, K.; SANS, S. (2005). "Cold periods and coronary events: analysis of populations world wide". *Journal of Epidemiology and Community Health*, No. 59(7), pp. 551-557. http://doi.org/10.1136/jech.2004.028514

SPANISH RED CROSS (2015). *Boletín sobre vulnerabilidad social*. Madrid: Spain.

HILLS, J. (2012). *Getting the Measure of Fuel Poverty - Final Report of the Fuel Poverty Review: Summary and Recommendations*. Department of Energy and Climate Change (DECC). Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48297/4662-getting-measure-fuel-pov-final-hills-rpt.pdf.

IDAE (2011). *Analysis of Energy Consumption in the Residential Sector in Spain, SECH-SPAHOUSEC Project.* Madrid. Available online at: https://www.idae.es/uploads/documentos/documentos_Informe_SPAHOUSEC_ACC_f68291a3.pdf.

MARMOT REVIEW TEAM (2011). The Health impacts of cold homes and fuel poverty, Londres: Friends of the Earth & the Marmot Review Team.

ORTIZ, J., SALOM, J. (2016). "Estimación del efecto de la rehabilitación energética en la salud de las personas", Institut de Recerca en energia de Catalunya. Disponible en línia: http://www.lacasaqueahorra.org/documentos/estimacionEfectoRehabilitacionSalud.pdf

TIRADO HERRERO, S.; LÓPEZ FERNÁNDEZ, J. L.; MARTÍN GARCÍA, P. (2012). *Energy poverty in Spain. Potencial de generación de empleo directo de la pobreza derivado de la rehabilitación energética de viviendas*. Asociación de Ciencias Ambientales, Madrid.

TIRADO HERRERO, S. (2018). *Municipal Indicators of Energy Poverty in the City of Barcelona*. RMIT Europe, RMIT University, Barcelona. Available online at: https://habitatge.barcelona/sites/default/files/documents/indicadors-municipals-de-pobresa-energetica-a-la-ciutat-de-barcelona.pdf.

TIRADO HERRERO, S.; JIMÉNEZ MENESES, L. (2016). "Energy poverty, crisis and austerity in Spain". *People Place and Policy Online*, No. 10(1), pp. 42-56. http://doi.org/10.3351/ppp.0010.0001.0004

TIRADO HERRERO, S.; JIMÉNEZ MENESES, L.; LÓPEZ FERNÁNDEZ, J.; PERRERO VAN HOVE, E.; IRIGOYEN HIDALGO, V.; SAVARY, P. (2016). *Pobreza, vulnerabilidad y desigualdad energética. Nuevos enfoques de análisis.* Madrid: Spain.

WALKER, G.; DAY, R. (2012). "Fuel poverty as injustice: Integrating distribution, recognition and procedure in the struggle for affordable warmth". *Energy Policy*, No. 49, pp. 69-75. http://doi.org/10.1016/j.enpol.2012.01.044.

We are transforming Barcelona's schools to adapt them to the effects of climate change

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Barcelona City Council has received funding from Urban Innovation Actions (UIA), a European Commission programme for the 'Adapting schools to climate change through green, blue and grey' project, which plans interventions in eleven schools with a set of measures involving nature, water and architecture. Both school pupils and local residents will be able to enjoy these improvements, as school playgrounds will remain open throughout the summer, while during emergency heat-wave situations they will act as climate refuges. The project will also have an educational side to it, as children will take part in designing climate solutions and evaluating the measures taken. Meanwhile, various research centres will scientifically assess the results of the implemented measures, in terms of health and climate comfort. Participants in this project include Barcelona City Council – through the Area of Urban Ecology, the Barcelona Education Council, the Barcelona Water Cycle, the Barcelona Public Health Agency, the UB's Barcelona Institute of Global Health, and the UAB's Institute of Environmental Science and Technology, along with the eleven selected schools.

Climate change is a reality and it affects people's health and quality of life. In order to tackle this problem, Barcelona City Council declared a climate emergency in January 2020[40]. Barcelona is facing the challenge of preparing for the high temperatures which will affect the city, according to climate forecasts. A sizeable part of the solution lies with cities themselves, and they must also show leadership in formulating the main demands. Barcelona City Council wants to be at the forefront of speeding up the necessary cross-cutting changes to the way we live. We need everyone to get involved and join forces with all the stakeholders involved.

Since April 2018, Barcelona has had its own Climate Plan[41], which is a road map for establishing the necessary mitigation, adaptation, resilience and climate justice measures, as well as the promotion of citizen action. The main aims of the Climate Plan are to reduce Barcelona's contribution to climate change, anticipate climate risks in order to ensure and improve the city's ability to respond to the inevitable effects that are now inevitable, and reduce people's vulnerability to climate change, in order to guarantee their health and well-being. The Climate Plan is an opportunity to join forces and make Barcelona **a** pioneering city that accepts responsibility for its contribution to climate change and makes preparations to reduce the city's vulnerability to its effects while becoming a fairer and more participatory place. The Climate Plan's Line of Action 3

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40. https://www.barcelona.cat/emergenciaclimatica/ca
41. https://www.barcelona.cat/barcelona-pel-clima/ca/

refs to mitigating heat. More specifically, it proposes the improvement of thermal comfort in city buildings and public areas, and creating a network of climate refuges to deal with high temperatures, in order to ensure people's health and provide special care for the population's most vulnerable groups.

The **Barcelona Climate Plan** is a cross-cutting strategy that includes the execution of 242 measures before the end of 2030. A strategic plan containing proposals to mitigate the effects of climate change, including projects to adapt the city, promote climate justice and foster citizen participation. Among other things, it includes measures to increase the city's adaptation and resilience to the climate-change effects that we are already experiencing. These measures, which must be implemented from 2021 to 2030, establish the following steps:

• Identifying existing and potential climate refuges: public and private facilities and public areas which could provide suitable thermal-comfort conditions during extreme episodes and establishing the services linked to heat-wave action protocols that these spaces need to offer, aside from quantifying the extra resources required (parks open 24 hours a day, use of 'greened' school playgrounds, city block interiors, etc.). Mapping the degree of cover to ensure territorial fairness and taking into account the areas identified as the most vulnerable to heat.

• Creating water gardens with children's games that combine permanent actions with ephemeral or seasonal ones. With regard to these gardens, they should have acceptable levels of water consumption, comply with all necessary sanitary requirements and be equitably distributed around the territory.

• Improving the thermal comfort of climate-refuge facilities, giving priority to those that serve the most vulnerable population (nurseries, schools, residences, etc.), wherever possible, without any increase in energy consumption (by using passive measures such as cross ventilation, better insulation, darkening with dissipated natural light or geothermal cooling, among others).

• Creating new climate refuge areas (green spaces or facilities) to ensure territorial cover.

The 'Transforming Barcelona's schools to adapt them to the effects of climate change, through green, blue and grey' project fits in especially well with these proposals and, as a pilot scheme, implements the planned actions in some of the city's state schools.

Barcelona City Council applied for funding from the ERDF, through its Urban Innovation Actions (UIA)[42] projects. This is a European Commission programme that proposes interventions concerned with adapting to climate change, air quality, employment and housing. In 2018, this programme was allocated €372 million, for the 2014-2020 period, in order to fund innovative projects in cities that fell within the proposed thematic frameworks. The campaign's budget for 2017 was €50 million. Through the Municipal Institute of Urban Planning, Barcelona City Council asked for the maximum possible amount, which was €5 million, with 80% funding through the UIA and 20% through municipal budgets. The municipal proposal was accepted and subsequently validated. The planned execution period is three years, from October 2018 to October 2021. The UIA promotes initiatives that aim to find and test new solutions to sustainable urban development challenges which prove to be relevant to all members of the European Union.

The 'Adapting schools to climate change through green, blue and grey' project proposes interventions in eleven state schools, with a set of measures that may be enjoyed by school pupils and the general public, as the school playgrounds will remain open during the summer. The project will also have an educational side to it, as children will take part in designing climate solutions and in their evaluation. Meanwhile, various research centres will scientifically assess the results of the implemented measures in terms of health and climate comfort.

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42. https://www.uia-initiative.eu/en/news/barcelonas-pilot-project-beat-heat-0

The first question that must be considered is how to define the term 'climate refuge' and how it may be adapted to a state school facility, as well as the subsequent form of management. Through the cross-cutting participation of various municipal areas, Barcelona City Council has created a committee which is drafting a management protocol for climate refuges in the city. One of the first measures was to define what climate refuges should be like and who they should be for. In this regard, the following points were established:

- They will be places that provide climate comfort to the population, through the implementation of passive measures.

- They will be places for common use in public facilities.

- They may be indoor places, not necessarily air-conditioned, or outdoor places, such as parks and gardens, with ample vegetation and water features.

- They must be safe, easily accessible, provide rest and relaxation areas and have water.

- They will be used in emergency heat-wave situations, but they will also have additional uses. They will therefore be places characterised by diversity and multi-functionality.

- They will be aimed especially at people who are vulnerable to heat (babies, young children, people over the age of 75, people who are chronically ill and people who lack resources, etc.).

- They will not be sensitive facilities that shelter vulnerable people, nor places for medical care, because these places can be overwhelmed during heat waves.

- Climate refuges will form a city-wide network and they may be established in public facilities (libraries, universities, sports centres, multi-sport courts, civic centres, neighbourhood centres, environmental classrooms, museums, state schools), in private facilities (cinemas, theatres, shopping centres, gyms, churches, subsidised and private schools), and in open areas (urban parks that have ample vegetation and water).

As part of the climate-refuge network, and to comply with the proposal presented to the UIA, it was decided to take action on state primary schools, for various reasons:

- The distribution of schools around the city is as widespread as possible and public facilities are more closely tied to the dynamics of their communities, which means that any action taken to transform them has a domino effect because they are visible, well-known and included in the educational project.

- The proposed solution is to turn the schools into climate refuges that are open to local residents. Nowadays, many city schools are already part of the Open Playground project.

- The city has a very active network of schools that include sustainability as just one more factor in their educational project. The More Sustainable Schools Programme[43] was launched in 2001 as part of Barcelona's Citizen Commitment to Sustainability, with the aim of contributing to sustainability through education and recognising schools as agents of change in the city. A total of 472 educational centres have taken part in the programme during its 19 years of existence. Throughout this time, the participating centres have developed a range of initiatives for improving the schools and their surrounding areas, so this current initiative will have no problem in adapting to a project that has been running for years.

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43. https://www.barcelona.cat/barcelonasostenible/ca/escoles-sostenibles

- The schools habitually accept vulnerable people among their pupils and they have a considerable capacity for taking in more, because they are local, neighbourhood places.

- The proposal is a project created for each school with the potential for being used as a model that can be applied in other situations; this is a pilot scheme that will have an ensured, intense use.

The project aims to turn eleven school areas into shelters for people who are vulnerable to heat. In other words, climate refuges that are open to all city residents, employing traditional solutions to combat high temperatures in buildings and transforming playgrounds by introducing vegetation, shaded areas and water features. It is therefore an architectural project that affects school infrastructure. However, this project is cross-cutting and cannot function optimally if it is only considered from this reductive perspective. If one thing characterises climate emergency actions, it is their capacity for co-creating projects and acting in various areas at the same time. We could therefore define this action as a process of processes that is adapted to schools, but which becomes a pilot scheme for new actions and involves multiple areas of work.

Participation is one of the key factors in the design of the new spaces and the specific needs of each centre. It is through participation that the education community (children, families, education management and team, and non-teaching staff), the project's partners and technical and scientific experts can reach an agreement on the actions that need to be taken in each school, while working on the idea of climate adaptation.

The educational project ensures the proposal's inclusion in the school environment and the raising of awareness about climate change, as well as offering an educational opportunity for working on the climate emergency with a significant number of city school children.

Opening up these places to city residents maximises resources and gives local residents access to climate refuges outside of school hours, as an intangible parallel process that will complement the infrastructure.

The impact on health and the evaluation will be monitored from the perspective of well-being, to make an assessment based on environmental, learning achievement, well-being, social inclusion and gender parameters.

As this is a pilot project, communication is a basic factor in order to scale the project to the city, so that all schools can eventually be transformed and adapted.

Through these measures, the aim of replicability is to ensure that city residents and the school community understand the need to promote initiatives that adapt the city to climate change and that these measures are replicable in other buildings, particularly in city schools and in other cities.

The 'Adapting schools to climate change through green, blue and grey' project is complex: it is also highly cross-cutting and collaborative in nature, because of the wide variety of actions and processes that have to be carried out in parallel. It is being coordinated by Barcelona City Council's Area of Urban Ecology and it brings together a series of partners who develop specific actions defined by a joint strategy. These partners are:

- Barcelona City Council and municipal organisations: The Area of Urban Ecology, the Area of Social Rights, the Barcelona Public Health Agency (ASPB), Barcelona Water Cycle (BCASA), the Energy Agency

- Barcelona Education Consortium (CEB)

- Research organisations: The University of Barcelona's Institute of Global Health (ISGLOBAL)44 and the Autonomous University of Barcelona's Institute of Environmental Science and Technology (ICTA)

- School community

Once the project's strategy and schedule had been defined, in agreement with all the partners, the Barcelona Education Consortium initiated a campaign to encourage all city state primary schools to apply for the project, by means of registering as partners in the joint work on the defined processes and by offering the use of their facilities for carrying out the projects. 45 schools applied. The schools were selected using criteria that awarded them specific scores, assessing the suitability of each school facility. These criteria form an evaluation table, by analysing environmental and other specific aspects:

- Data that is specific to each school, their location in the city and district, the year they were built, shared uses with other facilities and adjacent playgrounds.

- The climatic assessment took into account the school's urban environment, its vulnerability to heat waves and the presence of green cover in the area.

- With regard to the buildings, their energy behaviour was identified by assessing the classrooms and façades exposed to the sun, the roofed spaces, the building's energy certification and any protection from the sun.

- The playgrounds of each school were also analysed and evaluated. More specifically, their surface area, the ratio of paved to green areas, the amount of direct sunlight falling on them and the water features, in terms of their number and position.

- Lastly, some aspects that were specific to each school were considered, such as the index of complexity, their membership of the More Sustainable Schools network or if their playgrounds were open to the general public.

As a result of this evaluation, the following ten schools were selected: Cervantes, Els Llorers, Ramon Casas, Ítaca, Poeta Foix, Rius i Taulet, Font d'en Fargas, Antaviana, Can Fabra and Poblenou, with the addition of the Vila Olímpica school, as an initial partner of the project.

The selection process also chose ten control schools. Although no actions would be carried out in their facilities, they would be monitored through the use of sensors that evaluate the climate response of their buildings and playgrounds, in order to compare this information with the schools undergoing interventions.

Once the schools had been selected, they were included in the project as full partners and a participatory process was initiated to evaluate the needs of each one. At the same time, the technical partners initiated a detailed analysis of the buildings and playgrounds in question. This parallel operation was to verify the type of priorities for the interventions and the suitability of those interventions. In order to fine-tune the project's participatory process, a catalogue was drawn up listing the features and solutions that could be implemented according to the technical analysis, which would improve the environmental conditions of the schools while also being in line with the project's objectives.

Participatory process
A participatory process is proposed that involves the education community in the project, i.e. the pupils, the education team, the parents association (AFA), the non-teaching staff and ultimately, all

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44. https://www.isglobal.org/ca/healthisglobal/-/custom-blog-portlet/les-escoles-com-a-refugis-climatics/7305043/0

the stakeholders involved in the life of the school. This participatory process aims to help define the measures that need to be applied in each school, by means of detecting needs and assessing the impact of the measures on the people using the facility, once they have been implemented. This line of action is developed through participatory sessions held at each school, organised through the More Sustainable Schools programme.

The proposal is based on four sessions with the education community: the first, to validate the challenges facing each centre in terms of climate adaptation and to prioritise the measures that need to be implemented (in accordance with the catalogue of available solutions). The second, to help the technical team assigned to each school to specify the chosen measures and draft the executive project for the work. The third, for carrying out a preliminary evaluation of the implemented measures, and the fourth, scheduled for the hottest part of the year, for assessing whether the implemented solutions improved thermal comfort.

As overall results, it can be seen that throughout the participatory sessions, the education community of every school was well represented and that this project has aroused everyone's interest, something that has led to a generalised demand for continuing with more participation. The improvements that schools prioritise most are to facilitate natural cross-ventilation, add new vegetation, treat surfaces, introduce drinking fountains and install mixed solutions featuring shade, vegetation and water.

Educational process
The participatory process was accompanied by an educational proposal for the entire school community and more specifically for the 5th year primary-school pupils, which is the school year that runs the project in the centre. Three training seminars were held for the teaching staff, offering educational resources for dealing with the subject of climate-change adaptation, as well as specific experiences for monitoring the scientific measures in conjunction with the technical teams. They also went into greater detail about communication strategies for informing local residents about the school being used as a climate refugee, and activities were suggested for making the best teaching use of the implemented measures. Lastly, the schools were also offered the chance to establish an exchange between their pupils and one of the schools taking part in the Oasis Project in Paris.

The project's objective once the three year period has finished is for the centre to continue with the subject of climate change as a major part of its curriculum, with the support habitually offered by the More Sustainable Schools programme. For this reason, they will be provided with a guide and an education kit on the subject, while the sensors will be kept in place so that the pupils can continue to monitor the indicators.

The technical analysis
In order to define what kind of actions can be carried out in each school, a technical analysis was carried out to identify the conditions of the building and the playground, while also looking for weak points and opportunities. This was done by means of in-person inspections, cartography and specific data, with the aim of evaluating the school and the immediate surroundings that affect it. Meanwhile, each school was modelled using simulation programmes, for the incidence of direct sunlight and the possibilities for natural ventilation. This analysis was carried out by the project's municipal technical partners: the Area of Urban Ecology, the Barcelona Public Health Agency (ASPB), Barcelona Water Cycle (BCASA) and the Energy Agency, along with the collaboration of the Barcelona Education Consortium.

The analysis focused on three areas:

- Architectural limitations: with an analysis of the urban situation, general information about the building (dates and conditions), volumetrics, the type of layout, the type of playground, the relationship between the building and the playground, the relationship between the building and the surrounding area, the surface area of playgrounds, the ratio of open space (m2) per

person, the zoning and uses of the playgrounds, the type and conditions of roofing and the active ventilation and air-conditioning systems.

• The limitations of the site: with an assessment of the type of solar protection, the ratio of hard surfaces that could be covered to the total surface area of playground, the presence of intermediate spaces (porches), shade in the summer, the position of vegetation, the ratio of vegetation to playground surface area, vegetation supports, the surface area suitable for new vegetation, the species of trees and plants, the prevailing wind, the water features, the materials used for surfaces and façades, the colour and nature of the materials, the percentage occupied by sandpits and the surface area that could be transformed.

• Urban limitations: with the measurement of the urban environment, air quality and exposure to PM10 and NOx pollution, exposure to noise and the potential for accumulating high temperatures from sunlight.

Indicators were also obtained for an objective comparison of the schools.

The analysis resulted in a series of improvement proposals for each school, which were sent to the Barcelona Education Consortium (CEB) and compared with every other school during the participatory process. It should be said that this scientific analysis was very well received by the schools and that it almost exactly coincided with their needs and proposals.

The catalogue of elements and solutions
Once the analysis by the project's technical partners (the Energy Agency, BCASA, Directorate of Urban Greenery and Biodiversity and the IMSPB) had been carried out together with the CEB, a catalogue consisting of fourteen elements and six mixed solutions was drawn up. This included examples for creating projects in the three planned intervention areas: green (nature), blue (water) and grey (architecture). The catalogue was put together using technical files that will be developed in the definitive executive projects.

The catalogue defines common ways of working on the building, the playground and the fences of each school, while also ensuring solutions for the three types of intervention indicated in the project objectives (green, blue and grey). In other words, it specifies how to act during a pilot project in a replicable way, with a series of shared strategies for school infrastructures that will turn them into climate refuges.

With regard to the green part, nature, it defines the places suitable for new plantings: playgrounds, roofs, façades and dividing walls, while also indicating the type of vegetation: trees, plants and vegetable gardens. It specifies that all the species, including both trees and other plants, should be native or well-acclimatised species, while rejecting invasive species, and that they should meet the functional requirements for improving the school's climatic conditions. The catalogue has an appendix listing the species of trees and other plants to be used in the projects.

In regard to the blue part, water, the catalogue proposes solutions involving water intake points, drinking fountains, leisure features such as fountains and sprinklers, symbolic play features, naturalised ponds and pools for vegetable gardens, and tanks and reservoirs for collecting rainwater. There is a benchmarking appendix for water features.

Lastly, with regard to the grey part, architecture, the following types of action are indicated: power generation using photovoltaic panels, thermal solar panels and low-voltage wind energy, the insulation of roofing and façades, insulation and thermal bridging for doors and windows, solar protection: curtains, blinds, *brise-soleils*, porches, awnings, arbours and cold roofs.

International references
The project aims to transform Barcelona's schools in order to adapt them to the effects of climate change, through green, blue and grey, and it is being promoted at a time of generalised climate

emergency. There are various international programmes that share similar experiences, either in the type of operations or the project concept.

The city of Paris has the Oasis project[45] aimed at gradually transforming school playgrounds in order to create places that are cooler and more pleasant for enjoying everyday life, which can be shared to a greater extent. This initiative is the result of the resilience strategy adopted by Paris City Council in September 2017. It is aimed at reinforcing the territory's capacity for dealing with the big climate and social challenges of the 21st century. The renovated playgrounds are more natural, have more vegetation, employ better management of rainwater and water features, have installations that are more fun and more suitable for children, and are relaxed places with a better spatial distribution. One of the project's main objectives is to improve the well-being of children during the hottest periods of the year. These playgrounds, designed as cool oases, can also have a wider range of public uses outside of school hours and, in particular, they can be turned into 'refuges' for vulnerable people during heat waves. The Oasis Project is also part of a European UIA campaign. Paris has also paid special attention to Barcelona's Open Playgrounds programme and there have been a number of knowledge exchanges with the Municipal Institute of Education (IMEB), which manages the Open Playgrounds programme.

In 2018 and 2019, Madrid carried out a pilot project for turning school playgrounds into places that were healthier, more socially inclusive and diverse, with a greater ability to adapt to the effects of climate change. First, the city carried out an analysis to evaluate the state of 241 state schools using quantitative criteria (e.g. playground surface area, school/playground ratio, equipment) and qualitative criteria (e.g. shade, vegetation, construction materials, accessibility). The three pilot schools were selected based on the results of the analysis and their vulnerability to extreme heat (sensitive population + high exposure). Madrid collaborated with its partners in order to carry out a thorough, three-month consultative process with the various interested stakeholders from the schools (pupils, families, teaching staff, local residents, etc.) to co-create solutions for cooling systems suited to each context, as well as producing more design guidelines for school playgrounds.

The C40 city network promotes daring climate initiatives, for a healthier and more sustainable future. The C40 has evaluated Barcelona's Schools as Climate Refuges project as a good practice at an international level and has included it in the 'Cooling schools. programme. Experiences from C40's cool cities network. On how to adapt schools to rising urban temperatures' programme, together with the cities of Madrid, Paris, Philadelphia, Accra and London.

Monitoring the project
The project includes various monitoring and data collection systems before, during the work and as an evaluation of the final results. This part of the project is coordinated by the Barcelona Public Health Agency (ASPB), the University of Barcelona's Institute of Global Health (ISGLOBAL) and the Autonomous University of Barcelona's Institute of Environmental Sciences and Technology (ICTA).

It is planned to draw up studies and conclusions on the environmental conditions of the schools, the air quality in the surrounding area and the cognitive capacity of the pupils with regard to temperature variation.

The ISGlobal technical and research team, in coordination with the Barcelona Public Health Agency, is responsible for assessing whether these adaptations have effects such as changes in temperature, humidity and air quality, as well as **what impact this has on the health and well-being of the pupils.** For example, they analyse thermal comfort, the children's levels of physical activity and attention before and after the intervention, as well as the use of the spaces and the social interactions between the pupils and other people using the space.

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45. https://www.paris.fr/pages/les-cours-oasis-7389

The **ICTA-UAB** will scientifically evaluate the results of the interventions, in terms of health and learning achievement. These actions coincide with those of the 'Escola respira' [School breathing] programme[46], which focuses on children and promotes new actions in school environments, as well as reinforcing existing ones aimed at lowering pollution in schools and increasing awareness about the negative effects of pollution on the school population.

As this is an innovation project, it is possible to try out various measures for creating changes, with the aim of seeking solutions that are replicable in the local environment and in Europe as a whole. The evaluation results help to identify which adaptations have generated improved results, so that they can be used as examples in the future.

The projects

The process ends with the cross-referencing of all the data and observations from the previous stages and with clear prioritisation of school-by-school solutions, detailing main and complementary actions. Therefore, the projects are defined using the priorities determined by the participatory process involving the management teams, the school's parents association (AFA) and the technical analyses carried out by project partners. An evaluation table was drawn up and scored, which included technical criteria, the suitability of the solutions, management and maintenance, and the needs of the schools. This table resulted in some actions. Lastly, the works budget caused the type of actions to be adjusted and concentrated, in order to make them as effective as possible in terms of climate impact. The results arising from the evaluation and the priorities were communicated to the project partners.

The technical teams that drafted the projects received a number of inputs, such as the catalogue of elements and solutions, the technical analysis of the schools, the proposal for priority and secondary actions, and the maximum budget for each school, which could not exceed €240,000 and had to be similar for each facility.

The final projects showed a good balance between their initial objectives, the wishes of the schools, the diagnostics and the more technical questions that were proposed to all of the partners by the monitoring committee. The technical observations on the preliminary projects were included in the executive projects, provided that this was possible in technical and budgetary terms. All the projects also include a catalogue of features and solutions, which they develop.

The innovation represented by these actions on the schools is assured, as a new concept of climatic spaces is being designed which is new to Barcelona and adapts perfectly to the city's Climate Emergency Declaration. Enquiries for information about the projects and the possibility of replicating them have been received from other cities, including Paris and Milan. Furthermore, the C40 cities network has asked us for information and considers the project to be a major good practice. The use of passive elements to achieve the project objectives and the production of the catalogue have been a success.

All the projects use nature, the green element, as an essential part of the project, with the aim of achieving greater biodiversity in school playgrounds while also obtaining new cool and shady areas. A considerable number of new trees have been planted and, as a consequence, we are reducing the amount of paved surface area and obtaining more natural, porous ground. Some of these actions include:

- Green walls in the Cervantes, Poeta Foix and Antaviana schools

- Mediterranean gardens in the Els Llorers, Rius i Taulet, Font d'en Fargas and Can Fabra schools

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46. https://ajuntament.barcelona.cat/qualitataire/ca/qualitat-de-laire/com-es-lluita-contra-la-contaminacio/escola-respira

- Shady areas with trees in the Ramon Casas, Ítaca, Font d'en Fargas, Antaviana, Can Fabra, Poblenou and Vila Olímpica schools

- Green fences and arbours in the Cervantes, Els Llorers, Ramon Casas, Poeta Foix, Rius i Taulet, Antaviana, Can Fabra and Poblenou schools.

The blue element was the most difficult to work on. The proposed benchmarking features were questioned by all the schools. They received negative feedback for sanitary reasons and their high cost meant the number of actions had to be reduced and it became impossible to implement them as part of the agreed priority actions. However, the projects include some solutions that approach their initial objectives and are also adapted to the wishes of the schools. Furthermore, they meet the technical and health requirements indicated by BCASA and the IMSPB. Some examples include:

- Multi-function fountains that are introduced in all the intervention areas, and in addition to supplying drinking water, they can be fitted with adaptors for water games and hose pipes.

- Singular areas for playing with and manipulating water in the Els Llorers, Ramon Casas, Ítaca, Rius i Taulet i Font d'en Fargas schools.

- An arbour with water in the Antaviana school.

The third element of the project, grey, was also implemented in a positive way. In this case, the use of passive architecture has been a key feature. The high cost of this kind of action meant working only on key and priority elements, as well as specially selecting the types of intervention from a wide range of possibilities. Some of these actions include:

- New roofs for three schools. At Escola Cervantes, the skylight was modified in order to create a central ventilation shaft at the school; at Escola Poeta Foix, a new cold roof was built (ventilated and reflective), and at the Institut Escola Antaviana, a green roof was proposed (trees in planters and a green arbour) on the nursery school's concrete roof, which is also the primary school playground.

- Shade for the roofs of the Rius i Taulet, Can Fabra and Poblenou schools, using awnings and arbours in order to obtain shady spaces on the roofs used as children`s play areas.

- Façades. Solar protection are being installed on various façades, including those of the Cervantes, Ítaca, Antaviana, Can Fabra, Poblenou and Vila Olímpica schools.

- Arbours to create shady areas in the Cervantes, Ramon Casas, Els Llorers, Ramon Casas, Poeta Foix, Rius i Taulet, Antaviana, Can Fabra, Poblenou and Vila Olímpica schools.

- New cross-ventilation for the Cervantes, Font d'en Fargas, Can Fabra and Poblenou schools.

In conclusion, the projects establish a wide range of proposals in the three areas of action, and they comply with the project's objectives, which are to improve climate conditions in schools and construct pilot-scheme, replicable climate refuges. The eleven schools concerned regard them as a great opportunity. The main adaptation work on the schools is scheduled for the summer of 2020.

Schools play a vital role in urban life, and they are not only places where children socialise and receive education; they also act as local centres. Cities are facing greater and greater impacts from climate change and urban heat islands are becoming increasingly intense. Therefore, cities all over the world are starting 'Cool Schools' projects in order to adapt schools and protect children from extreme heat.

There are seven reasons for initiating a 'Schools as Climate Refuges' project in Barcelona:

1. Children are especially sensitive to extreme heat; any action designed for them benefits the population of vulnerable people as a whole.

2. Improving the condition of school buildings and playgrounds using passive architecture, shade and natural ventilation increases thermal comfort and creates a better learning environment.

3. The creation of school playgrounds that have shade, water and children's areas encourages them to play and increases the physical activity of pupils, thereby improving their health.

4. The use of schools as community centres creates social and climatic awareness in the community.

5. Through this project, state schools are acting as a pilot scheme that demonstrates the characteristics which an urban climate refuge should have, as well as being an example of how to reuse existing facilities.

6. The schools will act as comfort areas during periods of high temperatures and they will be open to local residents during heat waves.

7. The formation of a climate-refuge network in public facilities reinforces the idea of a city that uses local facilities to make everyday life easier.

Image 1. At the Escola Els Llorers, in the Eixample, the hard surface used as a sports court is downsized to include more green areas, shade and a proposal for a multi-functional games area

© Jaume Barnada

Image 2.The pupils of Escola Can Fabra take part in the decision-making process for solutions to be implemented in their school

© Laia Ventayol

Image 3. Shady area, climate-refuge project at Escola Poblenou

© BT arquitectes

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Barcelona