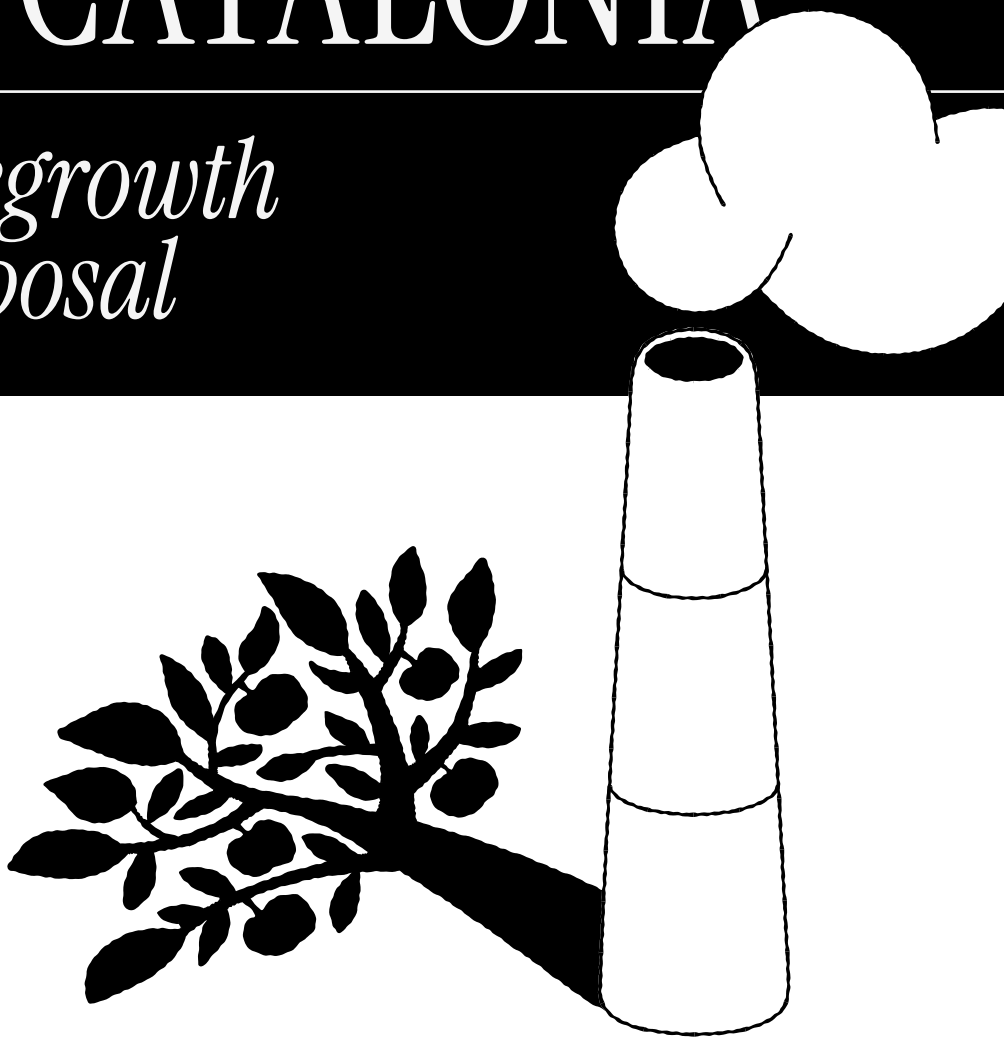
ECOSOCIAL TRANSITION IN CATALONIA

A Degrowth Proposal



Luis González Reyes, Erika González Briz and Adrián Almazán

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Índex

Why We Have Commissioned this Report

We find ourselves in the midst of the Capitalocene, immersed in an ecological and social emergency (one of biodiversity, climate, energy, materials, inequality, militarism, etc.) which is leading us towards civilization's collapse and the sixth mass extinction of life on Earth.

It is a multifaceted emergency with complex and interrelated dynamics at play. In a society where knowledge and "wisdoms" are ever more fragmented, this generates confusion and widespread ignorance about the correlations between the various underlying causes and the way they interact.

In this context, it is easy for the neoliberal dogmatic discourse - which actually causes the problem, with its need for perpetual growth in a limited environment - to take hold, since it promises to provide us with the solution to a disturbing scenario with the illusion that the same prescription that has led us to this impasse will get us out of it and that at most some reforms are necessary.

Both the Business as Usual (BAU) recipes and those of the Green New Deal (GND) are based on acts of faith, since in essence they entrust the future to economistic recipes with principles that are largely based on a high technocratic and techno-optimistic component that would supposedly allow us to continue down the same path.

Among them, the dematerialisation of the economy, something that has never happened and is not expected to happen within capitalism. This is because one of its main exponents, digitalisation and ICT, is in reality a major producer of externalities in the form of resource use and waste production. On the other hand, the energy transition via substitution of fossil fuel energy for renewable electric energy is manifestly impossible for multiple reasons. Firstly, the difference in Energy Return on Investment (EROI) rates and , secondly, the scarcity in the availability of energy and materials needed for it. And that's without taking into account the neoliberal transition's dependency on extractivism and colonialism for the building of its large solar parks and electric cars. A third reason is efficiency:it is of little use within the growth model, since any "savings" are automatically reinserted into the system since a surplus cannot be idle (as indicated by the Jevons' paradox). Supposed "new energies" such as green hydrogen, which is not an energy source but an energy vector, or nuclear fusion, which is still science fiction, do not seem to be alternatives either. Finally, the circular economy is entropically impossible, especially on a macro scale. All these measures throw us off the cliff or into an ecofascism (which has already hit the turbo) based on the fratricidal struggle for scarce resources (Europe lacks almost all of them) and which is reflected in the number of geopolitical conflicts around the world, the closing of borders, practices of entrenchment and social control measures.

Basically, we are forced to gamble our last chip on a series of myths, distorting and appropriating emancipatory concepts along the way such as *ecosocial transition*,

sustainability or *bioeconomy*, a concept coined by Nicholas Georgescu-Roegen to express the need to insert the economy within ecosystems. This term is currently being used by the "establishment", such as the Ministry for Climate Action, Food and Rural Agenda, to justify the monetisation and production of value through the exploitation of nature for the sake of its supposed conservation and on the basis of the Sustainable Development Goals (SDGs). A clear distortion of the concept, made possible by manifestly obsolete, insufficient and futile precepts that are not being fulfilled.

The same is happening with the concept of Degrowth, which accompanies the title of this roadmap determining what kind of ecosocial transition is necessary, possible and desirable based on general and sectoral analyses. Indeed, following the mention of the concept in the European Parliament, the approval of funding for its study and the irruption of citizen Leticia into the matter, the abstraction of the concept of Degrowth towards Social Ecology has become somewhat ambiguous, which is why it is important to make the effort to associate it with autonomous, just and egalitarian alternatives.

That is why this roadmap aims to outline a series of lines of action in accordance with the principles of social and ecological justice based on self-organising and mutual aid. The aim is to provide a response to a global problem in a way which is viable (within planetary boundaries), as well as fair and desirable (both emotionally and rationally). To this end, action is consigned, in most cases, to the micro level of "communalisms" and/or "eco-regions" that are "autonomous", "self-sufficient" and "self-organised", with their diverse social, cultural and ecological idiosyncrasies. But there are also actions at the meso level (confederations instead of states). Moving from market economies to economies with markets, from the state/market to oikonomia/communalisms.

In order to implement the principles of Degrowth and social ecology in the Catalan metabolism, it is necessary to articulate three strategies which are intertwined in "social movements": confronting power, articulating cultural frameworks and building alternatives.

With the desire to build a real and fair alternative to capitalism and its "hubris", we have gathered a diverse group of entities to advance the landing of theories, analyses and macro reports on Degrowth and the ecosocial transition in order to be able, through "self-organisation", to make increasingly informed decisions based on local realities and possibilities.

This is a task that will require the development of increasingly specific territorial and sectoral analyses and proposals with the participation of the actors involved, thinking and acting globally and locally, not allowing to turn back on our steps, and starting with the acceptance of the ecological emergency, of the exceptional situa-

tion we are living through, that we are in a triage period and that there is no time or resources for oligopolistic transitions, reformisms, or two-phase transitions.

We have no time, nor do we know of any other fair, feasible and desirable alternatives that do not lead us to catastrophic collapse or ecofascism. We cannot go on with false alternatives. That is why we encourage every individual and/or group to undertake the path outlined here together, especially trade unions, calling them to act as powerful agents for real change rather than instruments of reformism, which will eventually lead them to irrelevance.

In terms of structure, the report begins with an analysis of the Catalan economy from a metabolic and socio-employment perspective. The following section outlines the limits to sustaining this model , which is the result of the environmental crisis in its various facets (energy, material, ecosystemic and climatic). The third part of the report presents the key ideas of Degrowth policies which articulate this proposal. Starting from these, a suggested roadmap is deployed for several key sectors of Catalonia's productive economy: energy, materials and waste, ecosystem restoration - forestry, food and water, industry, transport, construction and housing, tourism, mining, and digitalisation. The last part of the report consists of a compendium of strategic proposals to implement the policies described.

Tariq Baig Vila

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1. Mapping the Economy of Catalonia

Metabolic analysis

Energy

A central starting point for understanding the metabolism of the Catalan economy is to analyse its energy consumption. We take as a reference the year 2019, the latest year for which information is available. All the energy data presented below, except those expressly specified, come from the Institut Català d'Energia (2023a). Primary energy consumption[1] in Catalonia amounted to 25,371.2 ktoe. This figure has increased between 2014 and 2019 (1.8% year-on-year), but the historical peak was in 2007, the year the Great Recession broke out, with 26,966.1 ktoe. Compared to this peak, consumption in 2019 was 5.9% lower, at a level equivalent to that of 2002-2003.

In terms of its composition by source, the main consumption was oil, reaching 46.0% of the total, while natural gas and nuclear energy accounted for 22.9% and 24.5%, respectively. Renewables accounted for 5.4% (Figure 1.1).

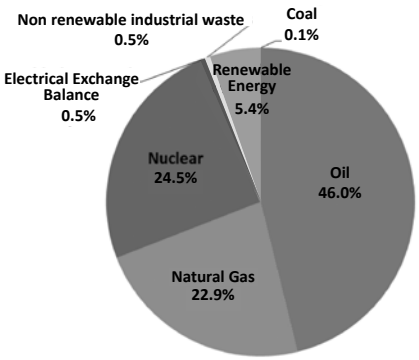

Figure 1.1: Primary energy consumption by source in Catalonia in 2019 (Institut Català d'Energia, 2023).

In terms of final energy[2] consumption, in Catalonia it stood at 14,446.7 ktoe in 2019 (56.9% of primary energy). Its variation curve over the last few years has been similar

1 Primary energy is the total energy, prior to its transformation, required to cover the energy needs of a territory. However, this figure does not accurately reflect what we could understand as total energy consumption. For this to be the case, we would have to take into account all the energy embedded in imported products and in their transport (minus those exported), which is difficult to calculate, but which would increase the reported figures considerably, as Catalonia is a net importer.

2 Final energy is the energy used at the point of consumption.

to that of primary energy. Oil products accounted for almost half of final consumption (49.8%). Electricity and natural gas accounted for 25.1% and 20.4%, respectively. Renewables accounted for 3.9% (Figure 1.2).

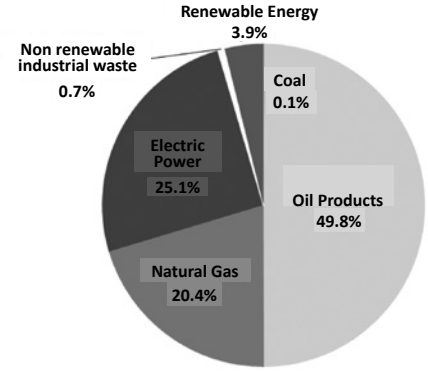

Figure 1.2: Final energy consumption by source in 2019 in Catalonia (Institut Català d'Energia, 2023).

The growth in energy expenditure in Catalonia is mainly due to an increase in the consumption of fossil fuels, which increased by 14.7% between 2014 and 2019. Compared to that, the consumption of electricity, where renewable energies are the main contributor, increased by 2.7%. Behind this figure is the rise in energy consumption in the transport sector: aviation paraffin (up 24.7%), diesel (11.9%) and petrol (23.8%). Gas flaring has also increased (9.1%). In any case, renewables have experienced the highest growth rate among the different types of energy, up 58.3% in this period, due to the increase in the use of biomass for thermal purposes (27.5%) and biofuels (80.5%)[3] .

Considering that Catalonia produced 89.2% of the electricity it consumed in 2021 (REE, 2022) and that in the same year 84.6% of this electricity came from non-renewables (OBERcat, 2022), it can be estimated that the level of external dependence on electricity is approximately 87.2%. Since virtually 100% of fossil fuels are imported, this means that Catalan energy sovereignty corresponds to 16.7% of its final energy consumption. In reality, its dependency is greater, as the technologies required to convert the sun or wind into electricity depend on global production chains and materials that are not present on Catalan soil. The trade deficit, measured in mass, of the Catalan metabolism, could be included too.This will be discussed further ahead. The implication is that more energy is consumed in the form of imported materials.

A breakdown of the figures for electricity generation - the sector in which there has been the greatest commitment to the elimination of fossil fuels and nuclear - shows

3 It is important to note that because the starting point for consumption was very low, these high growth rates have been much easier to achieve than if the starting point had been higher.

that in 2021 13% of electricity consumption was covered by hydroelectric (5.9%), wind (5.4%), solar photovoltaic (0.9%) and other technologies (1.72%)[4] . Nuclear was the main form of electricity production, accounting for 52% of the total demand. Nuclear reactors in 2021 provided almost 7 times as much electricity as hydro, almost 9 times as much as wind farms and 62 times as much as photovoltaic panels. Self-consumption of renewable electricity is merely anecdotal at 0.9%[5] (Obercat, 2022). Moreover, the theoretical closure dates of the three active nuclear reactors are getting close: Ascó I (2030), Ascó II (2032) and Vandellòs II (2035).

If we look at the distribution of energy consumption by sector, we can see that the bulk is concentrated in the two "metabolic engines" of the Catalan economy: transport and industry, which accounted for 45.1% and 25.5%, respectively, of final energy consumption in 2019. The domestic, services and primary sectors together accounted for 29.4% of final energy consumption (Figure 1.3).

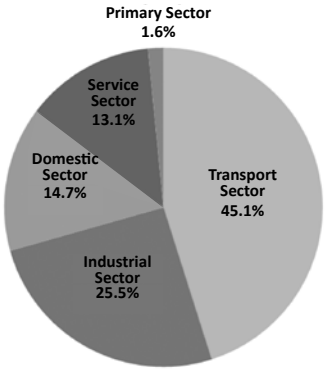

Figure 1.3: Primary energy consumption by sector in 2019 in Catalonia (Institut Català d'Energia, 2023).

The transport sector's energy expenditure in 2019 was the second highest in the entire time series since 1990, and the first in terms of contribution to total final energy consumption, which shows its behaviour is more decoupled from economic cycles than the energy sector as a whole.

In contrast, the industrial sector's contribution to final energy consumption is falling steadily (25.5% in 2019, compared with 30.3% in 2007). This points to the deindustrialisation of the economy across the territory, since, as we shall see, there has been no recognisable technological change in the sector that would allow this decline to be at-

4 The electricity generation capacity in 2021 in Catalonia through hydro, wind and solar was 4,031 MW. The remaining technologies totalled 11,859 MW (Obercat, 2022). There is only one large photovoltaic installation of more than 11 MW in Flix (REE, 2023a). The largest wind farms, those exceeding 50 MW, are in Lleida (Vallbona de les Monges, La Granadella) and Tarragona (Batea) (REE, 2023b).

5 It focuses on the metropolitan area of Barcelona, the Vic area and Lleida (Obercat, 2022).

tributed to an increase in efficiency. However, this does not necessarily imply that consumption in this area is lower in Catalonia. It is likely that the cost is embedded in imported industrial products and, therefore, that it is happening elsewhere in the world.

In terms of the contribution of renewable energy, it seeps to a limited extent into each sector and in some cases, it concerns energy vectors that generate a strong socio-environmental impact, such as agrofuels (table 1.1). Since the contribution of renewable energy to Catalan electricity production is poor, it is not recorded as essentially renewable energy in the table.

Sector	**Type of energy**	**Percentage of total**
Domestic	Fossils	54.6
	Electricity	40.8
	Biomass	*3.5*
	Solar thermal	*1.1*
Services	Fossil and non-renewable waste	32.5
	Electricity	65.2
	Biomass	*1.4*
	Biogas	*0.2*
	Renewable waste	*0.2*
	Solar thermal	*0.5*
Primary	Fossils	77.5
	Electricity	15.9
	Biomass	*5.1*
	Biogas	*0.7*
Industrial	Fossil and non-renewable waste	58.5
	Electricity	37.9
	Biomass	*2.4*
	Biogas	*0.2*
	Renewable waste	*1.0*
	Solar thermal	*0.0*
Transport	Fossils	94.4
	Electricity	1.4
	Agrofuels	*4.2*

Table 1.1: Percentage share of different energy vectors in the total consumption of the different economic sectors in Catalonia in 2019. Prepared by the authors based on Institut Català d'Energia (2023b).

The Sankey diagram of energy in Catalonia (Figure 1.4) summarises much of the information gathered so far.

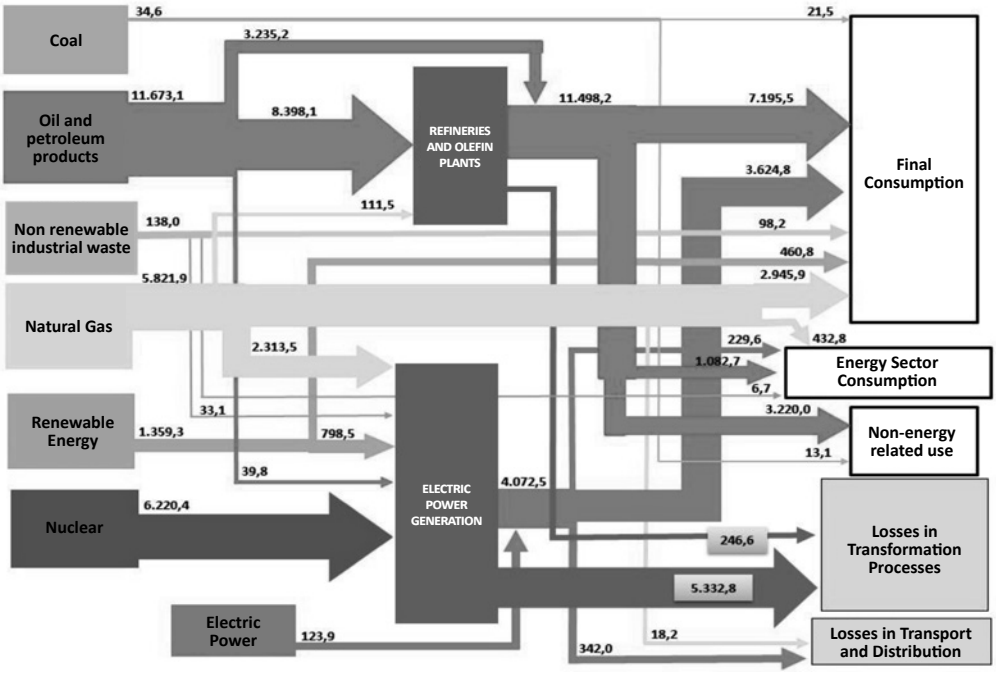

Figure 1.4: Sankey diagram of energy in Catalonia in 2019. Units are in ktoe (Institut Català d'Energia, 2023b).

At the territorial level, energy production is concentrated in Tarragona (refinery, nuclear, and part of what is generated from wind, photovoltaic, hydraulic and combined cycle plants), with some presence in Lleida (hydroelectric, photovoltaic) and Barcelona (combined cycle and regasification). In other words, there is an unequal distribution in the load and energy impact across the territory.

Materials

To get an overview of Catalonia's metabolism, it is necessary to complement the energy analysis with a consideration of the role played by material in Catalonia's economy. The first important insight is that the Catalan economy is in deficit in physical terms. In other words, it imports more material than it exports. This deficit is not based on trade with the rest of Spain (compared to which Catalonia has a surplus), but with the rest of the world (Figure 1.5).

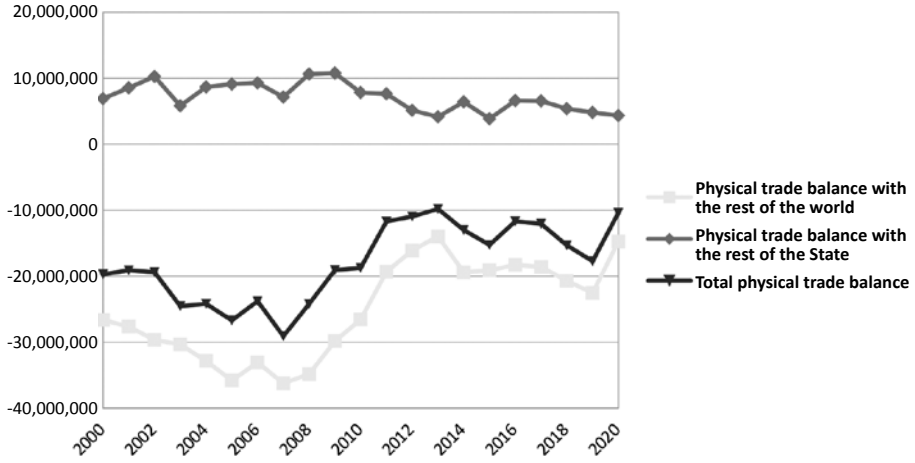

Figure 1.5: Physical trade balance of Catalonia with the rest of Spain and the rest of the world (excluding Spain). Prepared by the authors based on Idescat (2023a).

The second insight is that, although it might appear that domestic extraction covers an important part of material consumption if this is analysed in net terms (domestic extraction minus exports plus imports), in reality it is not such a high percentage once total material use (domestic extraction plus imports) is taken into account: while in 2000 domestic extraction accounted for approximately 50% of total consumption, in 2020 the percentage dropped to 33%, pointing to a growing dependence on foreign countries (figure 1.6).

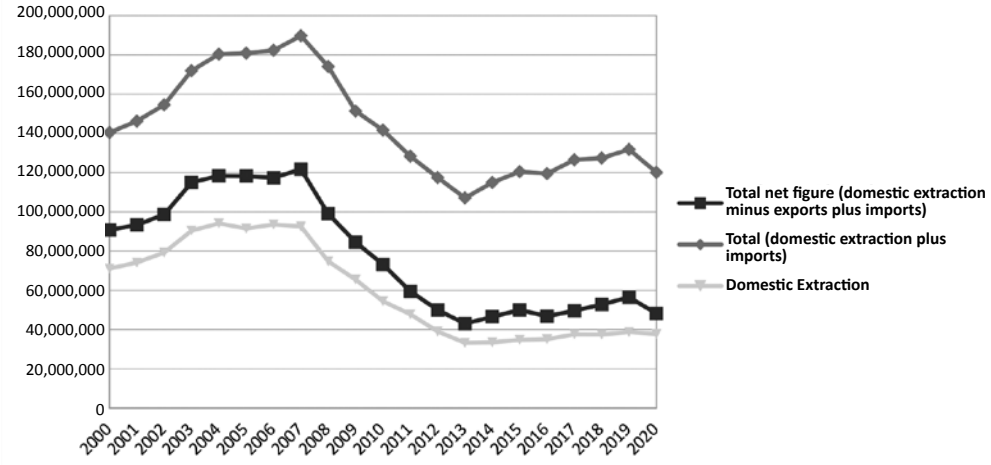

Figure 1.6: Net domestic consumption of materials in Catalonia (domestic extraction minus exports plus imports), total (domestic extraction plus imports) and domestic extraction. Own elaboration based on Idescat (2023a).

The third conclusion is that material consumption is strongly conditioned by economic cycles. The downturn since 2007 can be explained by the Great Recession and, more specifically, by the end of the real estate boom, which came with a high demand in materials. Furthermore, the crisis has discernibly worsened since the COVID-19 pandemic in 2020.

Added to this is the impressive inflow (93 million tonnes in 2019, 82 in 2020) and outflow (75 million in 2019 and 72 in 2020) of materials, and a more modest total net material use (56 million in 2019 and 48 the following year) (Idescat, 2023a). This points to the strong internationalisation of the Catalan economy and its increased connection with global value chains, on which it depends. It also points to the decisive importance of the impact of transport on the entire Catalan metabolism, as already pointed out in the section on energy consumption.

In any case, viewing all domestic material consumption in aggregate does not allow for the discernment of which materials are most in demand and where they come from. Specifically, 20-22% of domestic extraction is biomass (mainly fodder crops and grazed biomass, fruits and cereals), 78-80% non-metallic minerals (mainly limestone and gypsum, building materials and minerals for chemicals and fertilisers). There is practically no internal extraction of metallic minerals or fossil fuels, on the import of which the current Catalan metabolism depends 100% and which are central to industries such as the automobile, chemical and renewable energy industries.

These minerals have already been identified at the European level as a major metabolic and geopolitical Achilles' heel. The EU is a voracious consumer of mineral products which it does not produce domestically. These are naturally rare and in many cases they are found in geopolitically sensitive territories, such as China or Russia. For example, the aggregate market share of the world's top three extracting countries exceeds 80% of the total worldwide for rare earths, graphite, lithium and cobalt (and none of these states are in the European Union). And the issue is not only extraction, but also processing, where Chinese dominance is overwhelming: it controls 85% of global rare earth processing, 90% of electronic wafers (very thin semiconductor plates) for the solar panel industry, 90% of refined graphite used for the anodes of electric batteries, 83% of lithium-ion battery production, 76% of cobalt and 68% of lithium refining, as well as 40% of copper and nickel refining. And when this is not done on Chinese territory, in many cases it is still at least partially under Chinese control: Indonesia is on the verge of taking the world lead in nickel refining, but the four ongoing nickel processing projects that will enable it to do so are all run by Chinese companies (Testard, 2023).

This fragility has officially been recognised by the European Commission, which has identified which raw materials are crucial for allowing the continued operation of sectors such as electric mobility or hyper-technological renewables. It has also ranked them according to their supply risks (Figure 1.7).

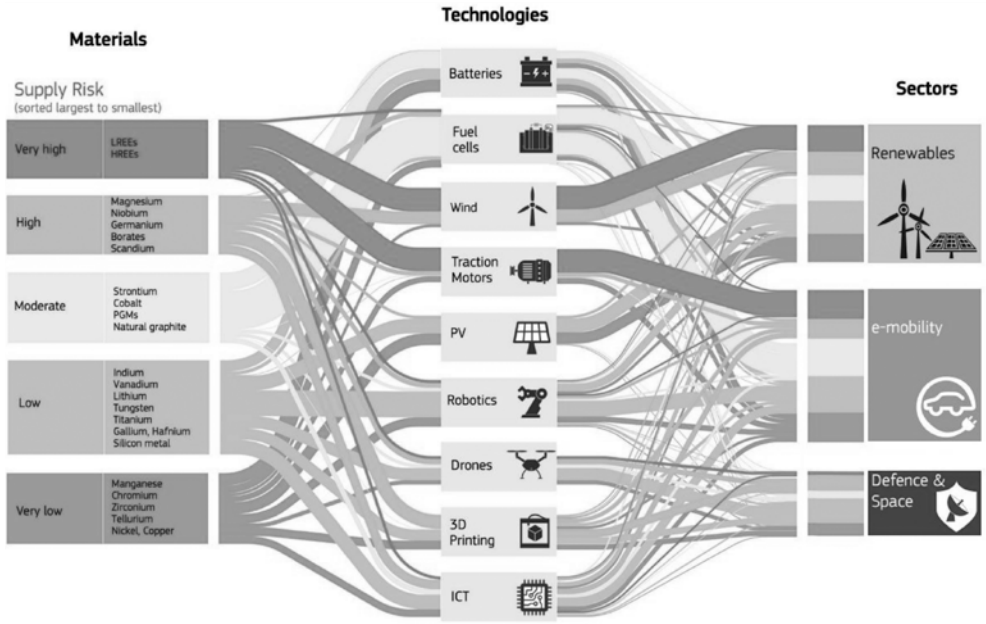

Figure 1.7: Diagram showing the conclusions of the EU critical raw materials guideline. The materials are organised according to their supply risk, related to the specific technologies in which they are used and associated with the three sectors considered most important for the European economy (EC and JRS, 2020).

In addition to this almost absolute dependence on imports of minerals and fossils, in the case of biomass, the dependency level stands at 81% and for non-metallic minerals it is at 14% (Idescat, 2023b). In other words, except for construction materials, the Catalan economy is highly dependent on imports.

Moreover, biomass, the only type of material that is renewable, accounts for 32% of Catalonia's total consumption (Idescat, 2023b), another indicator of how far we are from establishing practices which are sustainable in the long run .

Metabolism is not only about extraction, imports and exports of materials, but also about waste. Among this waste, we must consider that which is classified as disposed waste (for example, domestic waste), that which is emitted into the environment (such as CO_2), that which gets accumulated (as in the case of buildings) and that which is dispersed (such as the rubber that remains on roads). The first three categories are discussed below, but not the fourth, for which there is no data for Catalonia. In terms of global figures, it can be estimated that 22% of all waste is dispersed, 15% is emitted, 31% accumulates and 33% becomes disposed waste (Circle economy, 2022).

In terms of disposed waste, 5.7 million tonnes of construction and demolition waste, 3.5 million tonnes of industrial waste (3.8 million tonnes in 2019) and 4.0 million tonnes of municipal waste were produced in 2020. That amounts to about 13.2 million tonnes in total. In general, this number stays in line with the pace of the economy (ARC, 2020, 2022).

Industrial waste is concentrated in the areas of Vallès Occidental (0.09 hazardous and 0.62 non-hazardous), Vallès Oriental (0.11 hazardous and 0.27 non-hazardous), Baix Llobregat (0.02 hazardous and 0.30 non-hazardous) and Barcelonès (0.02 hazardous and 0.17 non-hazardous). 28% of this waste comes from the food, beverage and tobacco industry, 22% from metallurgy, 14% from the chemical industry, 11% from the paper industry and 9% from the manufacture of machinery such as transport, electrical and electronic equipment. These percentages correspond approximately to the weight of each of the industries in Catalonia, as will be analysed in the section on industry. 73.6% of industrial waste is recovered and 11.9% ends up in landfills. 12% is hazardous (ARC, 2022).

Of the total municipal waste, 43.4% was separately collected in 2020 (gross separate collection). In the end, 39% was recycled, 34% went to landfill and 18% was incinerated. As for construction and demolition waste, 58.3% was recovered. The remaining 41.7% ended up in landfills (ARC, 2022).

It should be noted that the term "recovery"[6] hides a great deal of ambiguity. Furthermore, the category "separate collection"[7], used by public administration and companies, acts as a black box that makes it impossible to determine how much is actually recycled. And the question is not only about quantity, but also about quality, since the recycling of waste which preserves the properties or usefulness of the elements (as would be the case for recycling glass or organic matter) is not the same as a process that involves less specific uses (as is the case for most plastics or a large part of industrial waste). In any case, when looking at data from communities such as the Basque Country, where recycling and landfills (use of construction waste for new construction projects) together account for 7% of the total material used by the Basque economy - a figure that is notably far from circularity (IHOBE, 2018) - there is no reason to suspect that the data will be much different in Catalonia.

With regard to the gaseous waste emitted, total GHG emissions have been increasing between 1990 and 2007, which marked a historical peak of emissions with 57.11

6 It is an umbrella term for the recovery (use of waste) at source, waste management as a by-product, external material recovery and energy recovery (incineration). In some cases, the output of the waste can be high in terms of its uses, as is the case of composted organic waste from the food industry or sewage sludge added to soils as fertilisers, but in many cases there is a loss of properties/usefulness of the waste with respect to the initial product. The paradigmatic case is incineration, which is also a potent source of toxins.

7 Separate collection of municipal waste does not imply adequate subsequent recycling.

million tonnes of CO_{2eq}. As a result of the economic crisis, annual emissions decreased up to 2013. Then they increased again until 2017. In 2020, they fell due to the worsening of the crisis (Gencat, 2023). However, in 2022, after the end of the restrictions on mobility and economic activity derived from COVID-19, across all of Catalonia, nitrogen dioxide (NO_2), PM10 and PM2.5 particles and tropospheric ozone were once again above the values recommended by the World Health Organisation (Ecologists in Action, 2023).

Finally, the amount of accumulated material, mainly in the form of buildings, should be taken into account. Although official sources do not provide this data, an intuitive guess can be made by observing the variation in the amount of land devoted to new construction. In 2020 it was 2,577,396 m^2, while in 2022 it reached 3,483,488 m^2 (Idescat, 2023c). In terms of housing numbers, while in 2015 there were 6,176, in 2022 there were 16,311, with an upward trend that was only broken in 2020 (Idescat, 2023d). In other words, there is a sustained increase in accumulated materials.

Conclusions

In terms of its metabolism, we can conclude that Catalonia's economy is characterised by strong internationalisation, linearity and a very high dependence on non-renewable substances. At its heart is the industrial production-transport duo. Catalonia's economy functions as a great digesting agent of non-renewable materials (fundamentally fossil fuels and minerals that come from outside its territory), which it manufactures and then exports again outside its borders. Maintaining this dynamic requires a very significant consumption of energy, which is concentrated in the transport and industrial sectors.

As the Catalan energy *mix* is fundamentally fossil in nature, its metabolism results in a significant amount of CO_2 emissions into the atmosphere and impacts on ecosystems in general.

Finally, the evolution of this metabolism has, in general, followed the economic rhythm while no structural transformations have been observed related to political measures or to the transformation of the economic model.

Socio-labour analysis

The analysis of the Catalan economy's metabolism has to be completed with an overview of the type of distribution of jobs that is coupled with this particular material and energetic organising.

Firstly, as can be seen in Figure 1.8, in Spain, the number of working hours devoted to unpaid care work is greater than those devoted to employment, accounting for 53% of the total number of hours worked. Within the segment of unpaid care work, the importance of maintenance and management activities in the household is clearly decisive (36.7 billion hours per year), well ahead of those dedicated to childcare (6 billion) or adult care (260 million). Even so, the time spent on childcare is second only to that spent on paid jobs in the market-based care sector (which includes education, health and social services, among others). The sum of hours spent on care work inside and outside the market account for 61% of total working hours over the year (González Reyes et al., 2019). In short, the figures show the central importance of care activities, mostly carried out in the home, and how serious it is to ignore them when analysing and planning the future organisation of work in our society. There is no equivalent accounting for Catalonia, although it seems reasonable to assume that the data is similar.

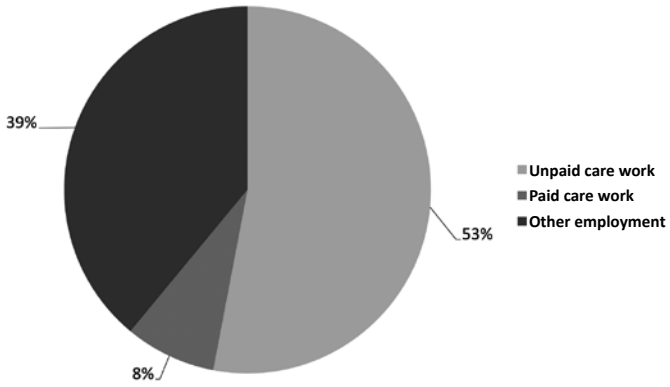

Figure 1.8: Distribution, measured in hours, of care work (paid and unpaid) compared to other jobs in the Spanish economy. Data from 2018. (González Reyes et al., 2019).

These jobs, moreover, are highly feminised. The 2020 gender equality index of the Statistical Institute of Catalonia shows that 80% of women carry out household chores, while only 49% of men participate in these activities (Idescat, 2020a). With regard to the average length of time dedicated to "home and family", as one of the main activities on an average day, it amounts to 4:41 hours for women and 2:35 for men (Idescat, 2011). In order to gain more details on care work, we need to return to the 2006 survey on living conditions in Catalonia (we have not found more up-to-date data). In "standardised household tasks", 69.2% of women are responsible for caring for the elderly, compared to 4.3% of men. In the case of caring for sick people at home, 44.4% of women carry out this task, while only 11.3% of men do so (Idescat, 2006).

If we now turn our attention to the area of paid work, that of employment, the question is whether there is a correlation between higher energy consumption in certain sectors and their ability to secure more jobs. From this information it will be possible to analyse whether there is more job creation in those sectors that are more fragile, unsustainable and energy guzzling. In 2022, a total of 3,514,300 jobs in Catalonia were recorded. These were distributed as shown in Figure 1.9. The overwhelming majority, 75%, were jobs in the service sector. This was followed by industry (17%), construction (6%) and agriculture (2%).

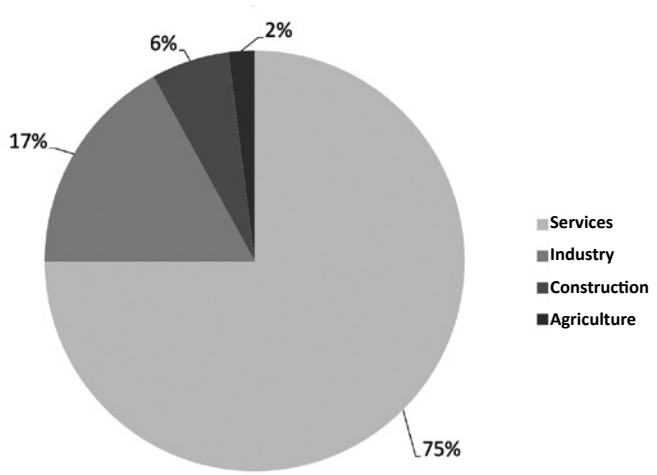

Figure 1.9: Employed population aged 16 and over in Catalonia. Data from 2022 (Idescat, 2022).

The data supposedly shows a majority of employment in sectors which would appear to be less energy intensive, such as services. In this sense, the greatest complication when considering an eco-social transformation would be primarily the industrial sector, which combines high energy consumption and a significant amount of the wage-earning population. But this is a hasty conclusion, as it is questionable whether the service sector really requires low energy consumption.

Firstly, we find that salaried jobs in transport, a major consumer of fossil fuels, are included in the service sector. In 2020, the number of people employed in this subsector amounted to 177,085, representing 5% of the total in Catalonia and 6.7% of jobs in the service sector. Of these jobs, a majority are in road freight transport, representing 96,873 jobs, 54.7% of the total for the subsector (Idescat, 2020b). The data presented here, however, is underestimated, as it does not include the people who work in the international transport of goods by sea (both in and out of Catalan territory), a crucial element in the metabolism of globalised capitalism. Nor does it include a substantial part of transport that is included in many other jobs (commuting to the workplace, business trips, etc.).

It should also be borne in mind that proposals for a dematerialisation of the economy based on its reliance on the service sector forget that this type of activity cannot function without consuming matter and energy. If an overall assessment is made that includes all the logistical and material requirements embedded in it (Fix, 2019), it is clear that it requires the industrial and transport sector in order to exist. Therefore, it should necessarily incorporate an important part of the energy consumption demanded by these sectors.

A third argument against the hasty conclusion we were aiming at is that an economy solely or fundamentally based on services is incompatible with capitalism, since the consumption of services has narrow limits (the time available to people) and cannot be accumulated (like material goods). This implies insoluble problems for Capitalism's expanding reproduction.

In conclusion, it is not easy to combine, within the existing capitalist structures, a reduction in energy and material consumption with the ambition to maintain jobs in many sectors.

Another way of observing this difficulty in the reconversion of many sectors is to carry out a qualitative analysis of the companies in Catalonia that currently have the highest turnover and number of employees. The *top* 20 business turnover in 2021 appeared as shown in Table 1.2. It is clear that this turnover, which Catalonia's taxation and therefore much of its policies and actions depend on to a large extent, is inseparable both from the type of metabolism described in the previous section, as well as from an economy heavily geared to transport and industry.

The activities that occupy the top positions, such as the manufacture and sale of cars, or intermediation and retail trade, reflect an economy that is highly dependent

on fossil fuels. On the other hand, the catalan economy's role as a digesting agent can also be recognised by the centrality of industrial sectors such as pharmaceuticals or metallurgy.

Finally, activities linked to the agro-industry sector stand out, such as the production of meat and the processing of other food preparations. The food industry faces serious problems of unsustainability and global logistical dependence. In fact, two of the main companies in terms of turnover are involved in food intermediation: Bunge Ibérica and Cargill. The industrialisation of this sector has introduced many vectors of unsustainability: it is highly dependent on machinery, fossil fuels, mineral fertilisers and chemical insecticides and, furthermore, it forms part of global production and distribution chains. However, as we shall see, the food sector could be brought back within the biophysical limits of the planet if it were reorganised along agro-ecological principles.

Company name	**Activity**	**Invoicing**
Seat	Manufacture of motor vehicles	9,257 million €
Lidl Supermarkets	Food sales	5,144 million €
Volkswagen Group Spain	Car sales	5,404 million €
Carburants Axoil	Wholesale of fuels	2,827 million €
Bunge Iberica	Wholesale trade in cereals, seeds, animal feed	2,572 million €
Nestlé Spain	Processing of food preparations	2,313 million €
Guissona Food Corporation	Manufacture of meat products	2,250 million €
Bon Preu Sau	Retail trade in non-specialised shops	1,782 million €
Point Fa	Retail trade in clothing	1,771 million €
TD Synnex Spain	Wholesale of computers	1,765 million €
BASF Spain	Manufacture of basic organic chemicals	1,752 million €
Cargill	Wholesale trade in cereals, seeds, animal feed	1,673 million €

Company name	Activity	Invoicing
La Farga YourCopperSolution	Copper production	1,499 million €
GM Fuel Service	Wholesale of fuels	1,401 million €
Spanish Rolling Mills Company	Manufacture of basic iron, steel and ferro-alloy products	1,332 million €
FCC Construcción	Road and motorway construction	1,254 million €
Novartis Pharmaceuticals	Manufacture of pharmaceutical specialities	1,227 million €
Bayer Spain	Manufacture of basic pharmaceutical products	1,207 million €
Tarradellas House	Food processing	1,070 million €
Nissan Motor Iberica	Manufacture of motor vehicles	1,046 million €

Table 1.2: Turnover of the 20 largest companies in Catalonia. Data from 2021 (El Economista, 2021).

What would the same *ranking* look like if we were to look at it from the point of view of jobs? Figure 1.10 shows jobs by company. This representation does not include the employment category which incorporates the largest number of workers in Catalonia: public institutions and companies, upon which 228,116 jobs depend. We can observe that the construction company ACS has the largest workforce, followed by Seat and various retail companies, which combined represent a high turnover and extensive job creation. On the other hand, there are different financial institutions such as Caixabank, Sabadell and BBVA, which were not included in the turnover ranking because only non-financial companies were included. The data on the workforce dates back to 2018 and, considering the cuts made in recent years, it is quite possible that the group of banks as a whole has reduced the amount of people they employ. It should not be forgotten that after the merging of Caixabank with Bankia, it was announced that 8,300 people would be made redundant in 2021. In short, the employment of a significant number of people depends on activities belonging to the Catalan economic metabolism itself: car manufacturing, construction and commerce.

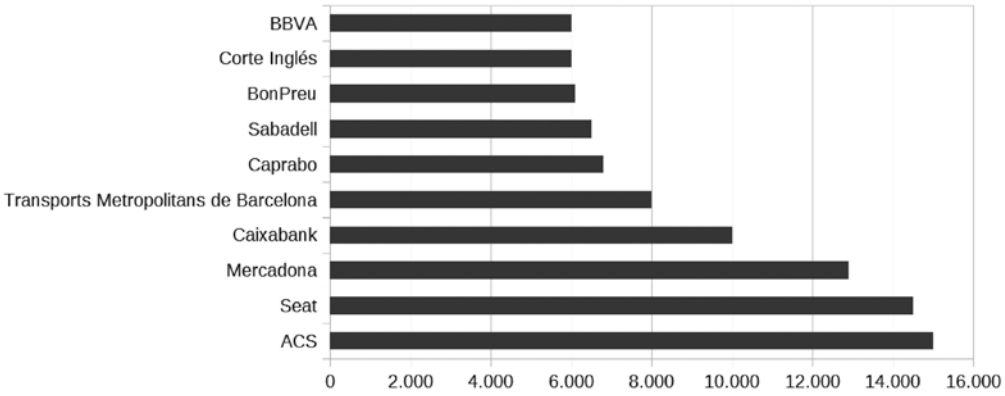

Figure 1.10: Employment *Ranking* in Catalonia (TMB, 2018).

Finally, there are companies which would not be able to exist without the current fossil and material-intensive framework, such as those dedicated to intermediation (Carburants Axoil, Bunge Iberica, TD Synnex Spain, Cargill and GM Fuel Service), which have a significant turnover but do not generate much employment.

Conclusions

In the socio-labour sphere, the Catalan economy needs to face the enormous challenge of democratising and recognising care work, the majority of care work, which continues to be invisible and feminised.

On the other hand, its economy is highly internationalised in terms of its business structure. At the top of the *ranking of* Catalan companies for turnover are those related to car sales, intermediation and retail trade. All of them are dependent on globalised logistics and are highly energy-intensive. Those which follow, but which are also significant, act as digesting entities of raw materials for the production of goods with high added value (automobiles, alloys and pharmaceutical products). Thus, and bearing in mind that there is a link between turnover and taxation in the current neoliberal institutional architecture[8], both public institutions and public action appear to be dependent on the type of metabolism linked to transport and industry, which is typical of the current business structure in Catalonia.

8 This link is not only due to the taxation of companies, which has been falling as a result of neoliberal policies, but it is also sustained by the taxation of the people who work in or for them, which has been gaining relative weight.

For economic activity as a whole, petroleum-dependent and highly energy-intensive transport is a determining factor. It plays a qualitatively crucial role, since an economy as linear and internationalised as the Catalan one would not be possible without it.

In other words, there is currently a strong correlation between jobs, economic and fiscal stability on the one hand, and energy and material consumption on the other. A correlation that takes a slightly different form in the case of the food industry, as it contributes strong environmental impacts, such as water and soil contamination, on top of its energy and material consumption. However, in some cases, at least at the level of distribution it remains less internationalised.

Our proposal for Degrowth which we will develop in the following sections is based on a critique of the current metabolic structure. This implies an analogous questioning of the labour and institutional structures. Or, in other words, in the face of a worldwide metabolic contraction which, as we shall see in the following section, is inevitable, our proposal is that the Catalan economy should set in motion very profound structural transformations that imply changing its physiognomy, its sectoral distribution and its qualitative functioning. Only in this way will it be able to combine a profound adaptation to the new metabolic conditions with a break with colonialism and extractivism at the global level.

2. Limits to the Maintenance of the Catalan Economic Structure in the Near Future

The catalan economy depends on non-renewable materials which mainly come from outside its territory, as we have seen in the previous section. With this situation as a starting point, a central question for the purpose of assessing the need for transformation and the possibilities for reorientation is whether it is possible to maintain the same type of uninterrupted flow of materials and energy in the near future.

Limits to the availability of fossil fuels and materials

The exploitation of a mineral resource follows a bell-shaped trajectory with different slopes in the initial and final phases. Extraction rates start on an upward curve because increased amounts of the raw material can be obtained at first. The most accessible and largest deposits of the resource are found at this stage. But, inevitably, there comes a point at which extraction capacity begins to decline and this is the inflection point called the "substance peak". During the second phase, the resource begins to be extracted in decreasing quantities and its quality becomes poorer, as the best deposits are exploited first. The difficulty in the extraction process increases, as the largest and most easily extractable sites are chosen first, and as reserves are depleted, the material becomes increasingly difficult to extract. Thus, once the peak is passed, what remains is a decreasing availability of a resource which, moreover, is of poorer quality, since the deposits with the best market returns have been exploited first[9] . This is coupled with an increase in the technical, financial and energetic difficulties in the extraction processes. It is also common for increasingly polluting methods to be used and thus for more mitigation measures to be necessary. Therefore, the key moment in the extraction history of a resource is not when its reserves fall to zero, which never happens, it is actually when they reach their zenith.

The extraction peak of a given resource is a parameter that is determined by geology and can be calculated by starting from the available data on its reserves. But there are other factors which intervene at the moment when it reaches its peak: political

9 This is not true for all substances, as some do not have differentiated qualities, but it is true for some key resources, such as oil.

(public aid, instability), economic (investments, economic crises), social (resistance to exploitation), ecological (lack of necessary elements for extraction) or technological (improvements in machinery). Some of these are included in the calculation of reserves, but others are not. In any case, they all contribute to determining when the peak happens and what form the decline in extraction will take once that peak is surpassed. In other words, the zenith cannot be determined by geology alone, since it is inseparable from other socio-economic factors.

In the metabolic analysis of the Catalan economy, the bulk of the materials used are non-renewable and some of the strategic ones are currently at their peak of maximum availability. The world oil peak was likely reached in 2018, the diesel peak in 2016 (central for transport and agriculture[10]), the uranium peak in 2016, and the gas and coal peaks are due during the current five-year period, if they have not already occurred (Turiel, 2021).

More specifically, the main supplier of gas for Spain in 2022 was the United States, followed by Algeria and Russia (Eurostat, 2022). Consequently, Catalonia receives gas from these same countries. In the case of oil and coal, their sources are more diversified. The main oil suppliers in 2022 were, in this order: Nigeria, USA, Saudi Arabia, Brazil, Libya, Mexico and Iraq (Eurostat, 2022). Many of these countries have already entered an irreversible extractive decline, particularly the top three in the list (Prieto, 2022).

The same situation is also beginning to apply to many materials that are crucial for Catalan metabolism, such as copper (electricity), phosphorus (crucial in food production), tellurium or silver (electronics, including that of renewable energy collectors) (Valero and Valero, 2021) and even sand (Friedmann, 2019).

There is undoubtedly a geostrategic side to the phenomena of depletion. The example of the EU's conflict with Russia is clear in this respect. Before the war in Ukraine, the EU imported from Russia 45% of the gas it consumed (100% in several countries), 50% of its coal and 30% of its oil (Prieto, 2022). Given the magnitude of imports, switching supplier country is proving complicated. In the case of gas, the search for alternatives is focused on finding ways of bringing it in by using methane tankers from the USA. However, this is a much more energy-intensive and economically costly option[11] . This rush forward for gas supply is a highly temporary measure, as the US extracts gas by means of hydraulic fracturing, a mode of exploitation that is now severely in crisis (Quark, 2023).

For oil, the situation is not much better. Some 95 million barrels of oil are extracted daily, but only 40 million barrels are available for export (the rest is consumed by the

10 In Spain as a whole, vans, trucks and buses consume approximately 50% of diesel fuels, and agriculture and fishing 15% (Prieto, 2022).

11 About 50% more expensive (Prieto, 2022).

extracting countries). Russia extracts 10 million barrels, of which it exports about 7 million (17% of the world's available oil). Of this, Russia exported about 3 million barrels per day to the US, the EU and its allies, most of it to the EU (Prieto, 2022). In this context, in which peak oil extraction has likely already been reached, replacing Russia as a supplier is a very complex task in the medium term, because there is no capacity to increase global extraction.

We could also focus on other materials for which Russia and Ukraine are net exporters and which play a crucial role in the European economy and, therefore, also in Catalonia's. For example, sapphire and xenon, which are crucial for the manufacture of chips, which in turn are crucial for the functioning of many companies, such as automobile manufacturers. For example, sapphire and xenon, which are crucial for the manufacture of chips, which are in turn decisive for the operation of many companies, such as automobile manufacturers. We have already mentioned several examples of material dependence on China. This geostrategic vulnerability is spurred by the fact that some of these materials are reaching their zeniths of market availability (Valero and Valero, 2021).

Renewable energies cannot replace fossil fuels in capitalism

The media, government and business discourse considers that energy problems will be solved by replacing fossil fuels and nuclear sources, which represent the overwhelming majority of energy sources used in Catalonia, with hyper-technological renewables[12] . The problem for capitalism is that the properties of solar energy (hydroelectric, wind, biomass and different uses of solar radiation), to which we could add geothermal and tidal energy, are almost antagonistic to those of fossil fuels for three reasons.

On the one hand, the highly dispersed nature of the enormous amount of solar energy which reaches the earth's surface must be considered. It follows that solar energies have a low EER[13] (de Castro and Capellán-Pérez, 2020), since a considerable amount of energy must be invested in concentrating solar radiation in its different forms. Similarly, this characteristic also means that this type of energy depends on a very intensive use of land, of ecosystem functions, in order to produce an apprecia-

12 When we speak of hyper-technological renewables and truly emancipatory renewables (as we will do later), we are referring to the techniques used to harness renewable energy and not to the types of energy themselves.

13 Energy Efficiency Rating. This is the quotient between the energy obtained and the energy invested in obtaining it.

ble amount of energy. This has serious consequences for the maintenance of good ecosystem conditions. For example, different movements are denouncing the macro offshore wind farm on the northern Costa Brava because of its significant negative environmental, social, economic and cultural impacts (Stop Macro Parc Eòlic Marí, 2023).

There is only one exception to this first element of differentiation: hydroelectric power plants. Here it is nature, through orography, that does the work of concentrating the energy. There is no equivalent to river basins in the case of direct solar radiation or wind. In any case, hydropower is only capable of producing quantities of energy comparable to fossil fuels if it is captured by large-scale power plants. And these, as we shall see, have their own corresponding limits.

The second property of solar energy which is not very compatible with the way capitalism operates is that it functions as a flow, not as a *stock*. This means that it is not storable in the same way that fossil fuels are. Moreover, these flows are irregular, follow circadian and seasonal rhythms and, even worse for capitalism, they are stochastic. As a consequence, the load capacity[14] of solar energy is low so it becomes necessary to install multiple collection plants in different places in order to make sure that when some do not produce, others do, thus compensating for the different variations. It also requires the use of storage batteries, which comes with high energy expenditure, as well as material and economic costs (Mills, 2019; Perdu, 2016). Biomass and hydropower plants (which make use of reservoirs) are a partial exception to the above picture, as they can function as *stock*, but always in significantly smaller quantities than fossil fuels.

The third limiting property of renewables for the functioning of capitalism is that, even at their peak, they would only be able to provide less than half of the energy that fossil sources currently provide (de Castro, 2023)[15] .

In addition to these structural problems with renewable energy, there are also technical problems. To harness renewable energy, we use high-tech devices that convert various forms of solar energy into electricity. These technologies face crucial limits if they are to replace fossil fuels. On the one hand, electricity accounts for only about 25% of energy consumption in Catalonia. The remaining 75% is not electrified. And not only that, it is actually very difficult to make this shift towards electrification. This is evident in the case of the petrochemical sector and, especially, the transport sector, which, as we shall see, is petro-dependent and would face enormous diffi-

14 The capacity or load factor is the quotient between the actual energy generated by the plant during a period (usually annual) and the energy it would have generated if it had been operating at full capacity.

15 Although there is scientific controversy on this, the precautionary principle would require the adoption of the lowest possible values indicated by rigorous studies.

culties in the case of a hypothetical electrification. The implications of the inability to sustain mass, rapid, long-distance transport for an internationalised economy such as Catalonia's are of enormous importance.

A second technical problem with the substitution of fossil fuel energy for renewables is that what we call "renewable energy" is not fully renewable. Fossil fuels are used to build the walls of dams, wind turbines or solar panels. From this perspective, one could say that hyper-technological renewables are an extension of fossil fuels. Even for electricity production, renewables depend on the existence of thermal power plants to sustain grid stability (Beampost, 2022).

Moreover, they require large quantities of materials. The high performance of hyper-technological renewables depends on elements that in many cases are scarce in the Earth's crust and are simply not available in the quantities required to sustain capitalism. This is the case of tellurium, indium, tin, silver, gallium or lithium (Capellán-Pérez et al., 2019). On the other hand, the lifespan of hyper-technological renewables is relatively short, 25-40 years in the case of wind and solar, and slightly longer for hydro. This makes them a very poor alternative because, when they break down, the availability of fossil fuels and minerals will have diminished considerably, making their reinstallation unfeasible for anything more than a small percentage of them.

Finally, a strong deployment of hyper-technological renewables implies a short-term increase in emissions (Nieto et al., 2019), as is only natural considering that they involve massive industrial deployment. This is unacceptable, because the United Nations has established an emissions reduction path of 7.6% per year as of now as an essential requirement to keep global temperatures below a 1.5°C increase compared to pre-industrial times (UNEP, 2019). This temperature increase is the threshold that would trigger the positive feedback loops that would cause climate change to escape any attempt at human control (Hansen et al., 2017).

Just as quickly as we need to tackle the climate emergency, we need to be addressing another, less visible but just as crucial emergency: biodiversity loss. Here, in fact, our margin is even smaller. If in the case of the climate emergency the development of hyper-technological renewables leads to improvements in the medium term, in the case of biodiversity preservation we cannot even say that. There is already a conflict between the deployment of hyper-technological renewables and the preservation of the environment if we consider the material extraction requirements that these imply (Sonter et al., 2020), and this conflict between harnessing energy to satisfy capitalism and defending life will continue to grow in the coming years.

Capitalism cannot be circular

In light of the above, if we are to maintain industrial metabolism, there seems to be no way out of the energy problem. And what about problems with sourcing materials? Public institutions are increasingly designing strategies, policies and projects to develop a circular economy within capitalism, but is it possible? To do so, it would have to be possible to replace the less abundant and/or more difficult to recycle elements with others of equal performance that can be reused indefinitely. This is not a minor problem, it is probably an insurmountable obstacle in the current system. Take for instance the average *smartphone, it* contains 50 different metals, including practically all existing rare earths (Valero and Valero, 2021). It is unrealistic to think that substitute materials with the same physico-chemical properties can be found for all those that begin to deplete, given the variety of elements used.

Recycling in itself also has limitations. On the one hand, there are the issues associated with technical difficulties and, on the other, the fact that the equipment is not designed for recovering the materials it contains. As a result, recovery rates are very low (Valero and Valero, 2021). But even if full - 100% - recycling were to be achieved, which is thermodynamically impossible, since the aim is a major expansion of hyper-technological renewables, this would imply a mining extraction rate almost equal to the current one (Hund et al., 2020).

Beyond these factors, there is a profound incompatibility between the idea of a circular economy and the functioning of capitalism. If we look at the material flows of the Catalan economy, the quantities and qualities of input and output that we described in the metabolic analysis point to two issues: its strong connection with the global value chains on which it depends, and the difficulty of incorporating the waste coming from this metabolism into processes which close cycles, since it is impossible to recycle what has been emitted, dispersed and accumulated. At best, it is possible to recycle what gets discarded (and for some products, not even that). This is particularly evident in sectors that tend to demand more materials, such as energy and construction. In conclusion, although the percentage of material flows that are recycled could certainly increase, and it is desirable for this to happen, a substantial metabolic transformation away from linearity and as close as possible to circularity would imply leaving capitalism behind and organising economic systems on other terms.

Sixth mass extinction of species

The sixth mass extinction of species in the history of life on Earth is underway (IPBES, 2022). One sign of this is that around 40% of insects are in danger of extinction (Sánchez-Bayo et al., 2019). Another is that the biomass of wild mammals is less than 25% of what it was during the Pleistocene (Díaz et al., 2019). Moreover, not only are species becoming extinct, but their populations are declining (Ceballos et al., 2017). The other hand of the same coin is that human activity has caused some species (rats, cockroaches, pigeons, seagulls) to progress in an undesirable way, and others in a desirable way (some 40 animals and 100 plants have increased exponentially thanks to domestication). Both dynamics express a profound ecosystemic imbalance. We will discuss below how this loss of biodiversity is being expressed specifically in Catalonia.

These life-destroying processes are closely linked to the fact that 10 out of 14 terrestrial habitats have experienced a decline in vegetation productivity, or to the finding that nearly half of terrestrial ecoregions are classified as being in an unfavourable state of conservation (UNEP, 2019). More importantly, there is the possibility that we have already passed the safe limit of biodiversity loss, at which point ecosystem degradation begins to progress in a way which cannot be halted (Newbold et al., 2016).

The main vectors of biodiversity loss are overexploitation (logging, hunting, fishing), industrial agriculture, urban development, the spread of invasive species and diseases, pollution, environmental modification (fire, dams, mines) and climate change (Maxwell et al., 2016; Díaz et al., 2019). Behind them all lies a common root: the normal functioning of our industrial metabolism.

This destruction associated with the functioning of industrial societies is in direct opposition to the conditions necessary to sustain life. Societies are eco-dependent, they need ecosystem functions to provide for them (food, water, medicines, etc.), to regulate planetary homeostasis (air and water purification, erosion regulation, pollination, climate regulation, etc.), and to sustain life itself (photosynthesis, soil formation, etc.), as well as many cultural elements (emotional health, spirituality, etc.). As a consequence of the sixth mass extinction, what we are seeing is a loss in the ability of ecosystems to properly articulate themselves and, therefore, a loss in ecosystem functions (Díaz et al., 2019). This has a direct and already visible impact on the sustaining capacity of the Catalan metabolism. One example is the loss of soil fertility.

Climate emergency

Climate change has a profoundly unbalancing effect on ecosystems, radically transforming the distribution, mobility, abundance and interactions of different living things. The impacts of climate chaos are already of such magnitude that it is impossible for global industrial capitalism to operate without experiencing continuous shocks: droughts, torrential rains, cyclones, salinisation of aquifers, fires, etc. (IPCC, 2021).

Although human activity, guided by our socio-economic system, is responsible for the greenhouse gas emissions which have generated the climate emergency, its future evolution may be dominated by an even more uncontrollable factor: the Earth-system itself. This would be the case in the event of positive climate feedback loops being activated.

One of the fundamental characteristics of the climate system is its complexity, which makes it behave in a non-linear way. This non-linearity is partly based on positive feedback processes, where effects amplify causes beyond a certain threshold, and which are effectively irreversible on a human timescale (Steffen et al., 2018).

An example of such processes is the melting of frozen regions, which is continuing to accelerate (Bevis et al., 2019). The most important effect of the disappearance of these large white surfaces and their replacement by darker ones (rocks, sea) is the decrease in the albedo effect[16] . The melting of ice leads to an increase in the absorption of solar radiation, which generates more temperature and thus more melting, and so it goes on. This is the logic of a positive feedback loop: something that, once started, it feeds itself. There are clear indicators that this loop may have already been activated or, at best, it is about to be activated (Lenton et al., 2019).

Another such loop is the thawing of permafrost. Permafrost is the permanently frozen soil found at a depth of 0-6 metres. These soils contain an amount of carbon similar to that which is currently present in the atmosphere in the form of CO_2 and CH_4 , both greenhouse gases, so their release would be another positive feedback loop (higher temperatures, more thawing out, more release of CO_2 and CH_4 and so on). This loop may also have been activated or is about to be activated (Campbell, 2019).

A third example is the vegetation-soil system. Through photosynthesis, vegetation fixes carbon which, to a large extent, is stored in the soil. But the capacity of tropical

16 Snow and ice surfaces reflect 90% of incident solar radiation, while open oceans or vegetated land reflect only about 10%.

forests to remove CO_2 generated by human industrial metabolism from the atmosphere is reaching its limit. A study of the Amazon and Central African rainforests shows that the amount of carbon they retain is decreasing. They reached their peak as carbon sinks in the 1990s. By the 2030s, the Amazon rainforest will reach saturation, unable to remove more CO_2 than it emits (Hubau et al., 2020). It would thus shift from a negative to a positive feedback loop. The same logic can be applied to crop growth, which is increasingly vulnerable to climate change (Ortiz-Bobea et al., 2021).

Against this background, it is particularly important to identify the thresholds that trigger positive feedback loops. While this is difficult to determine in a system as complex as the climate system, a growing body of research suggests that it stands at around a temperature increase of 1.5°C or less (Hansen et al., 2016). Hence, in order to prevent this from happening, the United Nations laid out the need to immediately reduce emissions by 7.6% per year(UNEP, 2019). A reduction that is historically unprecedented in terms of intensity, territorial extension (the planet as a whole) and time (by the end of the century, at the latest). For this to happen, it is necessary, but not sufficient, to leave most of the fossil fuel reserves we are aware of in the ground (Welsby et al., 2021). In any case, it may already be too late and some of the positive feedback loops may have been activated by now, which would trigger the activation of the others (McKay et al., 2022).

The potential impacts of climate chaos in Catalonia are very significant: droughts, increased heat waves and periods of extreme temperatures, greater intensity and frequency of forest fires and floods (DANAS, etc.), increased desertification and soil loss and increased mortality.

On that account, not only is a very rapid climate mitigation important, but adaptation measures, probably deep adaptation, are just as crucial and must be developed in parallel. This is one of the main focal points of the proposal we are making.

3. General Reflections Towards the Construction of a Roadmap for the Transformation of the Socio-Economic Model

We have discussed the catalan metabolic structure and the structural limits it has already begun to face which may severely compromise its viability in the future. In the remainder of this report, our aim is to construct a roadmap for several of the crucial sectors of the Catalan economy as part of an ecosocial project. However, before going into a detailed description of these sectoral transformations, we address some general reflections which frame said proposal.

In the 21st century, the question of labour has been dragging along with it a whole series of unresolved issues, with further elements having been added to the picture since. Among the old issues that have been exacerbated in this neoliberal phase is the social question: our economic system generates wealth at the cost of labour exploitation. This produces a constant pressure to degrade working conditions, which is reflected in the precariousness of life and in the inequalities in access to the goods and services produced. This asymmetry has grown in tandem with the expansion and deepening of commodification across the globe.

At the foundations of this social question, which makes any merely redistributive strategy insufficient, is the process by which the population as a whole is expropriated of its capacity to sustain life, to subsist, through the use of common resources. As pointed out by scholars writing on the ecofeminism of subsistence (Bennholdt-Thomsen and Mies, 1999), the condition for the functioning of industrial capitalism is the expropriation of material resources and of the autonomous capacity of human societies to organise their lives. These elements (common lands, rivers, resources, but also the capacity for conflict resolution, education or care) are monopolised either by the state, which uses them to grow and legitimise itself, or by the market, which puts them at the service of accumulation within a destructive dynamic. Industrial capitalism, in short, is antagonistic and incompatible with an autonomous organisation of subsistence.

A second unresolved problem is the inversion of means and ends. In capitalism, all social ends, from meeting human needs to responding to the climate emergency, can only aspire to be, at best, collateral results of the one real objective: the expanded reproduction of capital. This imperative means that the economy does not live up to its semantic root, that of the organisation of the household, and enters into a dynamic of accumulation which affects all important social decisions for the worse. It also deprives us of the possibility of collectively organising the use of resources as a result of a democratic reflection on how we want to satisfy our needs.

Last but not least, the third element is the androcentric nature of our economies. The functional assimilation of patriarchy by industrial capitalism has made it possible for the bulk of the work necessary for the reproduction of our societies - care work - to remain invisible, unpaid and to fall on women's bodies. This structural organisation of care work has an impact not only on women, for example in the form of enjoying fewer citizenship rights because of reduced access to employment, but also on society as a whole. We are currently experiencing a crisis of care, created by

the demands of work within a structure where the distribution of care work is patriarchal.

Alongside these unresolved problems of the 21st century at least one more has arisen in recent years: the industrial capitalist economies are coming up against the ecological limits of the planet. This clash brings with it a process of degradation of the basic goods on which any economic process relies, and thus leads to a contraction in production (Nieto et al., 2019). Although a Degrowth economy such as the one we are proposing would be capable of creating jobs in certain sectors such as waste management, public transport or food (González Reyes et al., 2019; Oteros et al., 2023), in general terms job creation, economic growth and ecological impact are currently highly coupled. In other words, without any change happening in the socio-economic sphere, the kind of reduction in our access to energy and materials, outlined in the previous chapter, would result in large-scale job loss (Antal, 2014; Bowen and Kuralbayeva, 2015; González Reyes et al, 2019; Nieto et al, 2020; Oteros et al, 2023). In a society where a large part of the satisfaction of needs is inseparable from the market and wages, this would make it very difficult for large sections of society to sustain their lives.

This fourth element, moreover, allows us to understand that the challenges facing industrial capitalism have implications that stretch far beyond human societies (which include the economic system). We are eco-dependent animals and therefore require balanced ecosystems that can perform all their functions in order to sustain our lives. Furthermore, our current social fabric requires a stable climate such as that which marked the Holocene (Hansen et al., 2023). However, biodiversity and ecosystem functions have steadily been eroded in recent decades by the workings of industrial capitalism. Indeed, in many places they are on the verge of collapse, if they have not already collapsed (Díaz et al., 2019). In other words, our current socio-economic model not only invisibilises the importance of biodiversity and care work in sustaining life, but it is also the driving cause of the destruction of nature. We can apply the same line of reasoning to the climate emergency, the unfolding of which is intimately linked to industrial capitalism (Malm, 2020). So, in actual fact, there is no real choice between maintaining employment or reducing production worldwide. This reduction on a global scale is bound to occur, either via the depletion of materials and energy, or via the generalised destabilisation of the web of life on which human societies, and indeed our economies, are structurally dependent.

In conclusion, meeting these four challenges requires a holistic socio-economic transformation. In capitalist societies, three main types of work can be distinguished: 1) employment, which is productive paid work contingent upon the reproduction of capital, 2) unpaid reproductive care work, which is essential to sustaining the system, and 3) unpaid productive work, often community driven. Our proposal for Degrowth consists of reducing the first kind of work at the expense of the other

two which have ecological, feminist and communalist approaches[17]. One element these share, and which breaks with the industrial capitalist paradigm, is that they understand work as a means to sustain our lives, and not as a tool for capital accumulation or for political power and domination.

Analysing the economy, and its social metabolism, through an ecological lens means integrating it within the logic of ecosystem functioning, on which we depend and which, observed with a forward-looking view, is much more powerful and resilient than industrial capitalism. If ecosystems function not on growth, but via focussing their efforts on closing cycles through solar energy, maximising diversity, and do so with high rates of cooperation (de Castro, 2019), human economies should try to follow suit. What this means for the transformations which the world of work must undergo, is that human societies must dedicate the bulk of their productive effort to the primary sector in accordance with the agroecological paradigm[18] , since neither the secondary nor the tertiary sector are capable of satisfying this essential closure of cycles, as we will see.

Ruault et al. (2022) argue that addressing the environmental crisis requires four transformations in the workplace:

→ Encouraging restoration work, keeping in mind that, if successful, these occupations will gradually disappear.

→ Incentivising occupations that care for and integrate with the environment and, in doing so, generate more jobs of a similar nature. This produces a positive feedback loop. Agro-ecological agriculture is an example. It is a decisive sphere of action.

→ Reconverting activities that are harmful to life and whose demand increases as biodiversity is depleted. One example is the production of chemical fertilisers. These are very dangerous, as they produce the illusion that we are not eco-dependent.

→ Reconverting activities that depend on good environmental conditions, but which are actually based on their exploitation. One example is intensive fishing, together with the banking services that support it. These occupations are self-regulating, since they will disappear without a healthy environment. However, we must intervene earlier.

17 We are aware of the tremendous challenges this entails. We are talking about changing metabolism and the economic system, which in turn requires radical transformations at the political and cultural level. These are changes that can only be carried out with a long-term, historical gaze. In this paper we lay out the horizons that we need to take into consideration, together with some policies that can help to achieve them, but we understand that this is not enough and that greater levels of concreteness are needed and, above all, practices that open up those scenarios which today seem, at times, impossible to realise, but which are not.

18 As with the transition to feminist, environmentalist and communalist economies described above, the reprimarisation of the economy, as a major transformation, must be understood as a long-term effort.

The feminist perspective on work contributes three elements to our project. The first is the necessary integration of production and reproduction into a single economic unit. The two must not be separated from each other, as they are inextricably linked. Moreover, reproductive work is a necessary condition for the existence of all productive work. The second element it contributes is the need to distribute these jobs between the different genders, breaking their current unequal distribution. And the third is the need to transform the current social valuation of work. Currently it is the productive tasks, and specifically those that are carried out at the control bridges, which enable the reproduction of capital and which receive the highest social value. However, from a point of view which takes into consideration our interdependence and eco-dependence, care work should be considered essential and, therefore, more valuable (Pérez Orozco, 2014).

Finally, the communalist view allows us to question the central foundations of industrial capitalism. On the one hand, the way in which fundamental social relations in capitalism are established through the market. Nowadays, most of the means through which we sustain our livelihoods can only be obtained by purchasing them on the market, and most of the population can only earn the necessary income by working for wages, because most people have no access to the means that would allow them to take charge of their subsistence democratically and communally. Wage labour is therefore the fundamental basis of the capitalist market. The population has to submit its priorities and desires to "getting a job" and is thus forced to be a co-creator and sustainer of industrial capitalism itself.

On the other hand, the main way out of this wage imperative is the infrastructure of state services. While in some important respects it is capable of reducing inequality, it still robs societies of the ability to manage their lives autonomously. Once again, it becomes a necessary condition and a vector for the extension of the destructive dynamics of industrial capitalism. Let us not forget that it is not possible to draw a clear boundary between states and capitalist markets, and that the former cannot be financed, and therefore maintained, without a continuation of capitalist growth and, consequently, of the destruction that comes with it.

Therefore, from a communalist point of view, the aim of a Degrowth economy is not simply to "dignify" the conditions of wage labour, or to sustain and expand public services. We need, on the one hand, to overcome the wage as the dominant social form of economic organisation. It is essential to advance social control of the means of production in a process of *de-marketisation* and to remove more and more activities from the market by decommodifying our lives. If industrial capitalism has advanced at the cost of destroying and parasitising the collective capacity to ensure subsistence, an emancipatory project must reverse this dynamic. This means defending and rebuilding the commons, allowing for a re-organisation of subsistence which not only evades mercantile dynamics, but which also re-appropriates all the capacity for autonomous decision-making that has been expropriated by the state.

We need to turn the territory, but also law, care and education into common goods that are once again in the hands of communities, so that they can detach themselves from the destructive dynamics of industrial capitalism and subject themselves to democratic decision-making (Almazán and Barcena, 2023).

By way of summary of the above and of what we will develop in the rest of the report, our proposal is articulated around several key ideas:

→ Reduction of material and energy consumption to ecologically viable levels. This reduction of the material sphere of the economy does not entail a reduction of the economy as a whole. Rather, the economy that cares for ecosystems and people would have to grow in volume and complexity. Our approach is to protect people and the web of life, rather than the capitalist economy.

→ Relocalisation and diversification of the economy. Putting an end to the logic of unequal development and extractivism that is currently driving the global economy (Brand and Wissen, 2021) requires relocalising economies so that people's livelihoods in a given territory are based on nearby resources. However, as we will argue later on, we also believe that there is no substitute for oil that would allow us to maintain the current model of mass transportation of people, goods and information over long distances and in short periods of time. In order for any given territory to cover the majority of social needs, this relocalisation would have to involve a diversification of economic activities.

→ Integration of social metabolism within ecosystem metabolism. A corollary of this idea is that, although we can assist and catalyse ecosystemic regeneration, nature can do it perfectly well without human involvement. Indeed, the bulk of the work is done and will continue to be done without human participation. The main ecological contribution of a Degrowth economy is not that it regenerates ecosystems, but rather, that it articulates an economy that does not destroy them.

→ Integration of production and reproduction into a single economic unit. What is more, from a point of view that assumes our interdependence and eco-dependence, care work must actually be considered the most essential and therefore the most valued form of labour.

→ Strong redistribution of wealth between and within territories along global justice criteria. When we talk about degrowth, we do so with an awareness of class, gender and colonial relations. In other words, the social groups that must decrease to a greater extent are the elites in order to give rise to societies that equalise their consumption according to criteria of sufficiency and sustainability.

→ Increasing people's economic autonomy. To this end, it is essential to advance a process of social *decommodification* and the construction of communalisms, allowing them to become the main hinge for the satisfaction of human needs.

4. Roadmap for Degrowth in Catalonia

Energy

As we have already pointed out, the current energy system is highly dependent on fossil fuels, which as well as being unsustainable and finite, are also imported. For climatic reasons, together with security reasons, this sector needs to move very quickly towards renewable energy, and away from fossil and nuclear energy. When we talk about renewable energy, we tend to think of hyper-technological renewables (large windmills such as those planned for the Gulf of Roses, solar plants, etc.), however we should broaden our perspective to consider truly renewable forms of energy that also have the benefit of being emancipatory (R^3E). These have the following characteristics.

Firstly, they are built with renewable energy and materials. Their design would be inspired by plants, which use solar energy through photosynthesis, including to pump sap to their leaves. The technique of plants is remarkable. They are self-constructing and self-repairing, they function at room temperature, they use materials which are abundant, they generate and sustain a web of life which allows them to essentially close their cycles of matter. In this way, the material base of the R^3E is biomass, together with abundant, easily recyclable materials which can be obtained by using renewable energies (such as iron), and which do not require purification processes (as granite does).

The second characteristic is that they constitute a direct form of work and produce heat, not just electricity. Some examples are solar panels used to heat water, or the energy produced through the burning of biomass, or windmills which produce work, etc. We need a development in engineering that can harness the knowledge generated over the last few decades to make a qualitative leap forward in the use of renewable energy compared to the pre-industrial periods and the first decades of the Industrial Revolution. Such could be the case for hydraulic mills for example.

From this perspective, the strong generalised electrification of the economy which is at the centre of current energy transition plans, and which also implies a significant material consumption and the burning of fossil fuels, proves to be a misguided strategy. But this general approach does not mean that electrification cannot and should not progress in some specific sectors to reduce fossil fuel combustion, for example in transport, via low-speed electric trains.

In the same vein, humans and other animals[19] will probably need to become key energy vectors again due to our multifunctionality. Crafts and agriculture are sec-

19 This opens up an essential line of reflection, which this work does not go into, about how to realise these interspecies alliances in a way that is symbiotic and not based on hierarchy.

tors that could drastically reduce their ecological footprint with the use of labour, while at the same time allowing for a re-encounter with the pleasure of communal and non-alienated work. Of course, this work, which is necessary to sustain society, would have to be shared equally between genders, territories and classes.

Thirdly, R^3E energy is harmoniously integrated into the functioning of ecosystems. Indeed, it relies on them, for without them it cannot develop. An example of R^3E is sailing, which uses the regular force of sea winds, more regular than land wind, to move boats around. Watermills use the potential energy in the downstream course of rivers, as well as the concentration of water at the bottom of the valley. Bioclimatic construction takes advantage of the sun, its orientation and its currents, for cooling and heating, making use of local materials. While permaculture and edible forests rely on ecosystem equilibriums to feed (provide energy for) people and many other living things.

The fourth element is the principle of "honourable harvest" (Kimmerer, 2021). This is a concept used by Native American populations, and which has two meanings. On the one hand, it means leaving something behind for other living beings. That is, not to hoard all the solar energy. Not even a large part of this energy, as it is indispensable for the functioning of ecosystems. On the other hand, the purpose of an honourable harvest goes beyond leaving for others, since it also encourages the expansion of life, for example by taking wood from the forests via thinning, which allows the regeneration of the tree mass and other types of plants, thus enriching the ecosystem.

An important implication of the principle of honourable harvesting for our societies is that it will not be possible to sustain the current level of energy consumption without hoarding large amounts of energy. Thus, socially speaking, a constant and abundant supply for essential infrastructure (e.g. a medical centre or a community refrigerator) would have to be prioritised, while all other energy uses would have to be coupled to natural rhythms. This is not to say that there can be no storage at all, for example via wood or hydro dams. However, in order to maximise the ability to secure supplies from these reservoirs, consumption would have to be minimised. Moreover, if biomass is to become the main source of heat, it will have to be used very sparingly, and forest areas will have to increase. While it is true that the forest area in Catalonia is considerable, we will make some added considerations further ahead.

The last characteristic of R^3E energy is the fact that it is community controlled. This includes control over use and over technology. It is the only way to allow for truly democratic and just societies. It involves techniques which are simple and local (manufactured with local material and energy), in other words humble techniques (Almazán, 2023). Distributed generation, for example, relies on smaller installations closer to where consumption takes place and opens up more possibilities for people to democratically control their resources. It also has the advantage of reducing

transmission losses (as it is generated where it is consumed), and is therefore a more efficient system, especially in the case of community installations as opposed to individual ones.

All things considered, we propose an energy transition based on three pillars:

→ Drastic reduction in consumption.

→ Deployment of R^3E energies for de-fossilisation and denuclearisation. This could be accompanied by a moderate and well-planned increase in small-scale, community-controlled, hyper-technological renewables, quite different from what was designed for the Gulf of Roses, and projects of the like.

→ Territorial rebalancing in energy production, so that Tarragona ceases to be a sacrifice zone, and Barcelona an energy sink. Furthermore, the plans for electricity interconnection via the Pyrenees by means of very high voltage lines must be pulled back. The alternative involves localised production and consumption systems based on short circuits.

The development of R^3E energies in Catalonia is limited, as can be seen in Table 1.1. Thermal solar energy accounts for only 1.1% of energy consumption in the domestic sector, biogas does not reach 1% in any sector, and biomass, the most developed, but which in many cases does not meet all the characteristics of R^3E, only exceeds 5% in the primary sector. In terms of electrical energy, renewable generation is almost entirely hyper-technological. In any case, there are other R^3E energy uses which are not represented, such as human physical labour, which is difficult to quantify. A technical development in this sense is essential in order to increase these percentages by means of a real technical substitution and a decrease in energy availability. An example is biogas, which could replace natural gas in Catalonia as long as a reduction in energy consumption is taken into account (Obercat, 2022).

With regard to how the sector is controlled, the commitment would be to create and develop non-profit renewable energy cooperatives, and to promote self-consumption, which is still limited in Catalonia, even for renewable energy, since it does not even reach 1% (Obercat, 2022). Some of these initiatives have grown a lot in recent years, especially renewable energy cooperatives, such as Som Energia. In addition, energy community projects are beginning to proliferate, whose aim is not only to carry out the renewable transition, but also to develop the fabric of relationships of mutual social support.

Finally, some administrations such as Barcelona, have taken measures which could facilitate the energy transition: partial public control of electricity production, reconversion (also partial) towards production based on hyper-technological renewables and public purchase of electricity from 100% renewables.

Material and waste

In the section on Catalonia's metabolism, we analysed the waste sector. The conclusions were that, although recycling rates have increased, most of the Catalan metabolism continues to depend on the sustained inflow of new materials, recycling rates are low and, in some cases, they are disguised by terms which hide the significant loss in properties that materials undergo during this process. Moreover, the main waste-generating sectors are industry and construction, well ahead of municipalities.

This sector must be articulated around the idea of a circular economy[20] . As its name suggests, the essence of this proposal is the closing of material cycles. This implies several basic requirements.

The first is to accept that human societies (indeed, any living thing) are incapable of closing cycles on their own. If they are to achieve this, their work needs to be interrelated with the rest of the ecosystem. This is the only way to match the biosphere's recycling rates, which are much higher than those of human metabolism: 99.5-99.8% for elements such as carbon, nitrogen or phosphorus (de Castro, 2019). Just as the human economy needs to take resources from biomes, it also needs to dump its waste upon them in order to recycle it. This means that the paradigm of the circular economy is not an industrial park closed in on itself, in which waste from some industries is used as a source for others, an undoubted a step forward, but rather it is an open production space integrated with its ecosystem.

In order for it to be possible for ecosystems to close cycles, waste must have at least two characteristics. First and foremost, it must be fully biodegradable or inert. In other words, the economy must stop producing hundreds of thousands of toxic and/or non-biodegradable products within a reasonable ecosystemic timeframe. Secondly, their production rate would have to be slow, coupled with the recycling capacities of ecosystems. For example, *a priori* it is not a problem for a pig farm to produce biodegradable waste (slurry). The problem arises when it does so at such a speed that it generates an imbalance in the ecosystems, preventing the closing of cycles. For waste to be produced at ecosystemic rates necessarily implies that resources have to be consumed at the same rates. In other words, a circular economy

20 We use this term despite the fact that we are aware that total circularity is thermodynamically impossible and that it is more correct to use the term spiral economy (Valero and Valero, 2021). We do so for two reasons, the first is because its use is socially widespread, which facilitates communication. The second is that, with the help of ecosystems, it is actually possible to come very close to closing cycles.

is necessarily an economy that uses few resources which must be biological or inert and integrated into the environment. Furthermore, it must do so slowly, adapting to circadian, seasonal, biological and geological rhythms.

The second key to making progress in cycle closure is to understand that these processes are only possible thanks to a continuous supply of external energy. As is evident, on our planet, this input comes from the sun, as discussed in the section on energy. Solar energy allows a small volume of goods to be transported over long distances. This has been the norm throughout human history until the Industrial Revolution, and there are no technical advances, beyond those which are dependent on fossil fuels, that can change this in the future, as we will argue in the section on transport. Thus, an economy which successfully closes cycles has to be structured around short circuits. Indeed, this imperative is rooted in the needs of a circular economy. Ecosystems have developed immense diversity in order to adapt as much as possible to different conditions, which has enabled them to close cycles. This diversity can be destabilised by the introduction of distant species (such as alien species) and foreign materials (such as high concentrations of heavy metals).

For the economy to be localised, it also needs to be diverse. Only in this way can it meet the multiple needs of people. Its success lies in the fact that its members are not hyper specialised and that there is close cooperation between the various productive units to achieve life-support for all people. Capitalism has shown that a market society is not an adequate way to organise this cooperation aimed at building livelihoods with social justice criteria. Autonomy-based economies, feminism and environmentalism contribute more interesting proposals and practices.

All this means that the bulk of the activity and energy in the productive sector needs to be concentrated on closing cycles and going far beyond the crucial closure of landfills and incinerators. This has a name: an agro-ecological metabolism, to replace the industrial one.

In Catalonia, food is the main industrial sector and, in urban areas, the largest fraction of waste in terms of mass is organic waste, which provides a good basis from which to start. However, it should not go unnoticed that the food sector is organised according to agro-industrial criteria with a strong presence of macro-farms, as was discussed in the section on food. Nor should it be ignored that most of the waste produced comes from the construction sector. This points, therefore, to the need for profound transformations: a contraction of the tertiary and secondary sectors (both industrial and construction) and the prioritisation of a primary sector organised according to agro-ecological principles.

An example of concrete policies which move in this direction at the urban level has been the efforts at the municipal level to enable the composting of organic waste. Community composters and door-to-door collection are useful and illustrative examples of the direction to take. Data in Catalonia shows that these methods help

achieve higher recycling rates and lower percentages of non-compostable waste compared to the use of organic bins (ACR, 2022). Grassroots involvement in this sector has the potential to play a central role, enabling the creation of networks which connect farmers with urbanites who exchange compost for food, for example, without the need for money.

To maximise the recycling of packaging, the best policies are deposit, return and refund (DRS) policies, as opposed to the current ones led by Ecoembes. Another possible measure would be a ban on plastics, starting with single-use plastics. Some progress on this front has already been made in different territories (bags, straws). The rest would need to be replaced as soon as possible by biopolymers, which would require a much more restricted use than what it is like at present.

Within this general metabolic framework, it would be necessary to recycle part of the existing infrastructure, as well as to resort to landfill mining. Aluminium, iron or copper can be obtained from landfill mining with much less energy expenditure and impact than is required with mines, especially open-pit mines. Moreover, the technologies required are generally simple (Lallana and Evans, 2022). The development of this sector, which requires moderate economic investment, can be led by non-capitalist cooperatives. To complement this type of policy, public maps representing business symbioses could be promoted, i.e. production networks in which the waste from certain processes is used as raw material for others.

The priority, however, is not so much recycling as it is reducing and reusing. For basic goods, policies of low prices or, better still, their decommodification should be promoted to guarantee consumption for the entire population. While prices for luxury goods should be kept exponentially high. This price control should not be left to the market but rather, it should be publicly and/or community regulated. Furthermore, practices such as planned obsolescence must be banned. But most importantly, the management of properties with right of use must be promoted to the detriment of private property. For example, a network of washing machines under right of use means that the producer company has an interest in ensuring that the appliances are durable and easily repairable.

As far as reusing is concerned, a second-hand economy already exists, and it should be promoted via measures such as tax incentives for non-profit cooperatives working in this field. The experience of Traperos de Emmaus in Barcelona is emblematic. In any case, this sector will be boosted by the context of a general reduction in production and imports.

Ecosystem restoration - forestry

Human societies are eco-dependent and therefore rely on ecosystems that can perform all of their functions. HOwever biodiversity and ecosystem functions have been steadily eroded in Catalonia in recent decades, to the point where they are on the verge of irreversible degradation, if they have not already reached that point. This is evident in at least 37% of Catalan habitats of Community interest. Generally speaking, the conservation of habitats is in unfavourable conditions (figure 4.1) and the trend is worsening, as in the period 2013-2018 the conservation status of some of these has evolved as follows: beech forests, -1.7%; Aleppo pine forests originated from colonisation, +15%; savannah grasslands on the sunny slopes of the maritime regions, -1.7%; lowland water margins, -1.7%; rainfed fruit trees, -3.3%; vegetation of saline coastal soils, -13.3% (Brotons et al, 2020).

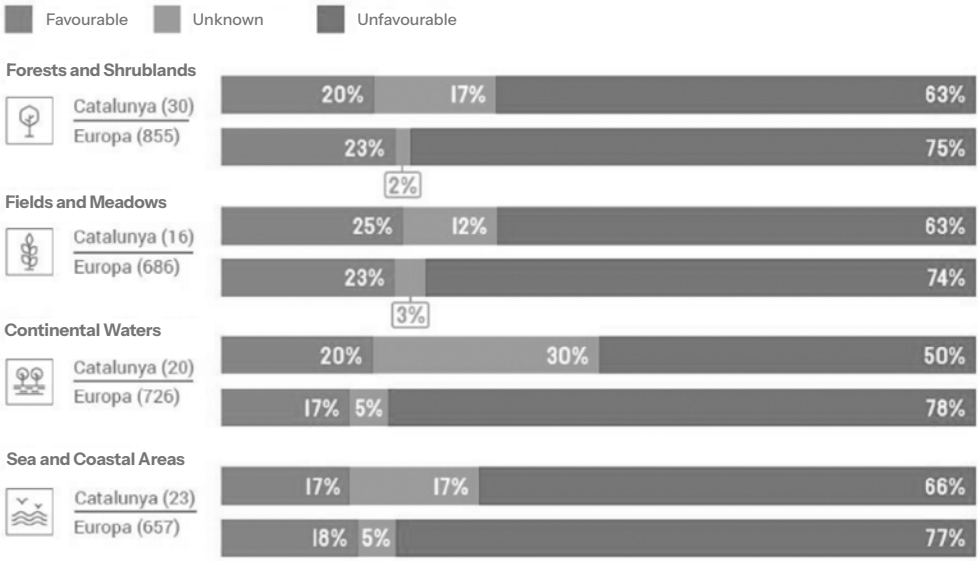

Figure 4.1: Conservation status of habitats of Community interest in Catalonia and the European Union (Brotons et al., 2020).

Accordingly, populations across all environments are declining, especially in inland waters and agricultural and grassland environments (figure 4.2). There has been a 25% reduction in vertebrate and invertebrate populations between 2002 and 2019 (Brotons et al., 2020).

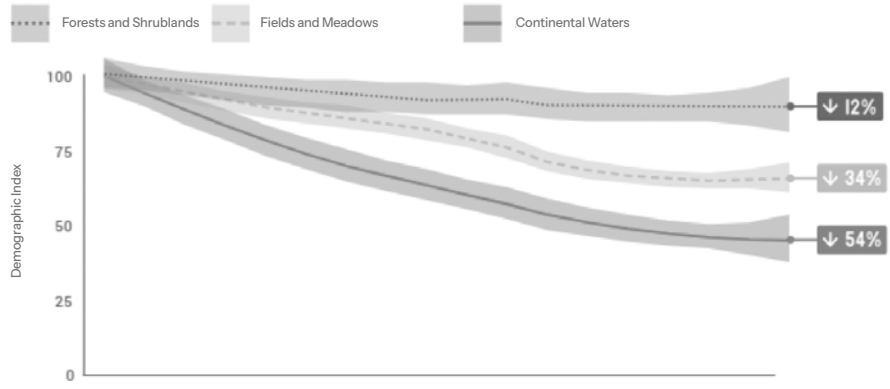

Figure 4.2: Population trends in forest and shrubland, agricultural and grassland environments, and inland waters (Brotons et al., 2020).

Change in land-use is the main direct cause of biodiversity loss. This is followed by climate change and the expansion of alien species. In 2019, 1,625 alien species were recorded in Catalonia, 190 of which are considered expansive. They are increasingly pervasive: 204 more species arrived between 2013 and 2019. (Brotons et al., 2020). Behind these three vectors is the capitalist and industrial socio-economic model. The fact that almost 10% of the hours worked in Spain result in the destruction of biodiversity is revealing. In addition to this, for a further 44%, although it depends on the type of work, most of the time there is an impact on biodiversity. In contrast, working hours that contribute to the preservation of the web of life do not even reach 1% (Oteros et al., 2023). The percentages are likely to be similar for Catalonia.

A sustainable economy is one which is embedded in the metabolism of ecosystems. The starting point is that more than half of the working hours in Spain do not have a direct relationship with ecosystems, they are not carried out directly within them. Only a small percentage of these hours (around 5%) have this direct relationship with biodiversity. This, combined with the fact that at least two thirds of working hours in the Spanish economy are aimed at satisfying basic needs (Oteros et al., 2022), means that a change in lifestyle is necessary in order for economic activity to stop causing a loss in biodiversity. It also means that all economic activities that are not necessary for subsistence must be brought to an end. We do not have analogous data for the Catalan economy, but it is reasonable to assume that the figures are similar.

Among the different ecosystems, all of which are necessary for global balance, forests are among the most directly useful for the human economy. Things are not looking good in this sphere, as more than 80% of the Catalan forest species included in the European directives are at risk or do not have viable prospected populations

(Brotons et al., 2020). 21.2% of Spanish trees are damaged, mainly by drought (IEPNB, 2023), which has led to a reduction in their biodiversity and an increase in their vulnerability to fire due to their homogeneity (Palau, 2022; Oteros et al., 2023). Contributing to this vulnerability is the fact that of the three main processes that consume plant biomass (decomposition by microorganisms, herbivory and fire), only the first remains functional in many areas. The scarcity of the other two has led to a historically unprecedented increase in biomass, which in the context of deteriorated ecosystem conditions and poor management can lead to large forest fires fuelled by climate change (Palau, 2022).

Forestry use corresponds to 62% of the Catalan surface area, 7 points higher than the Spanish average, and it is growing. The percentage of land devoted to artificial use is also higher than the Spanish average, 6% compared to 3%, while agricultural use takes up a proportion of the territory 11 points below the average, 31%. Almost 80% of the forest land is wooded forest, the vast majority of which is made up of dense forests (MAPAMA, 2017).

The following stand out, in order of extension: Aleppo pine forests, Holm oak forests, European Red Pine forests, oak groves of Downy and Portuguese Oak, and Black Pine forests, which together, account for almost 60% of the wooded area and 52% of the timber stock. Of the dense woodland area, 51.5% is coniferous, 36.0% broadleaved and the remaining 12.5% is mixed forest (MAPAMA, 2017).

The formations with the greatest tree diversity are the oak groves of *Quercus robur* and/or *Quercus petraea*. They are not among the most prevalent, which shows ample room for improvement. With regard to shrub and/or bush species, the formations which hold the greatest value are the Aleppo pine forests, where more than 80% of the surface area has at least ten different species (MAPAMA, 2017).

In Spain, the percentage of forest area with the FSC seal, the only one that guarantees the sustainability of forestry exploitation, only reached 1.9% of the total area in 2020 (IEPNB, 2023), so it can be deduced that in Catalonia as well the percentage will be very low.

Faced with the urgency of the ecosystem emergency, restoring highly degraded territories is essential. Ecological restoration aims to recover the structure, composition and functioning of ecosystems prior to their deterioration, while at the same time seeking to re-establish their capacity to adapt to changing conditions, their resilience, and recovering their pre-disturbance functions and biological complexity. This sector also includes damage limitation operations, such as fire prevention and suppression.

Humans can help in this regenerative work, but in reality it is the ecosystem as a whole that holds the real regenerative capacity. Thus, though it should not be disregarded, human action must focus on catalysing and facilitating ecosystem activity.

In many cases, this means allowing things to happen rather than intervening. The proposals for re-naturalisation go in this direction.

The most common interventions are reforestation and planting of shrubs and herbaceous plants, the reshaping of topography (e.g. to limit erosion), the removal of expansive alien species that may cause ecological damage, and maintaining sustainability fertility in degraded soils. Further measures are needed to maximise climate resilience, prioritising biomimetics, such as coastal wetlands or the prioritisation of more drought-resistant species. Land must also be freed up for non-human life through projects such as green corridors and protected areas. Table 4.1 lists some key measures for renaturation.

Process to be restored	**Preferred action**	**Alternative or complementary actions**
Forest maturity	No intervention (no silvicultural work).	Clearings in reforestations. Converting undergrowth into high forest. Generation of dead wood.
Fire	Non-intervention (monitoring of natural fires).	Prescribed burns. Monitoring of anthropogenic fires.
Scavenging	Non-intervention (facilitating colonisation by keystone species).	Reintroduction of key species.
Herbivory Predation	Non-intervention (facilitating colonisation by keystone species).	Reintroduction of key species. Taxonomic substitution. Functional substitution (livestock, hunting).
Hydrological and coastal dynamics	Demolition of water retaining structures.	Recovery of water flows. Functional restoration of wetlands and dune systems.

Table 4.1: Ecosystem restoration measures (Palau, 2022).

The fact that fires play an ecosystemic role does not mean that their excessive proliferation (each ecosystem has a frequency and type of fire associated with it) and strength cannot be controlled (Pausas, 2017). Therefore, the means by which they are kept under control remain key. They need to be robust, as climate change generates conditions for enabling the large spreading of highly destructive fires.

In this restorative line, the reforestation of land, where this makes ecological sense, must play a central role. In a sustainable economy, forests are crucial. They are strategic providers of goods such as timber, fuelwood, resin, food and cork. The central importance of forests and other ecosystems such as pastures in a transition scenario also lies in their capacity to fix carbon, contain the effects of extreme climatic phenomena, preserve biodiversity, attract and generate rainfall, and moderate erosion. Thankfully Catalonia has a significant forest mass and a deficit in food production, so the expansion of forests does not need to be a priority.

Beyond reforestation, it is necessary to promote sustainable forestry. This could be done via silvicultural practices aimed at ensuring a sustainable use of resources and promoting the resilience of forest areas. These can be included within the framework of maturity forest management and adaptive forest management, which includes close-to-nature forest management. Another sustainable silvicultural practice is silvopastoralism for fire prevention. These are all models that lead to greater structural and specific diversity of forest areas and thus greater resilience. They base forest management on the functionality and heterogeneity of the forest system, without aiming to apply one-size-fits-all recipes. The maintenance of a forest mosaic with different stages of maturity and compositions allows for a multifunctional use of the forest, both for timber resources (wood and firewood) and non-timber resources (cork, resin, food for humans and animals, medicinal plants, etc.).

There is also the need to manage young forest formations, which have developed in recent decades as a result of the abandonment of traditional timber, firewood and pasture harvesting. They are very homogeneous and dense forest areas, with a high vulnerability to decay, forest fires, pests and other extreme events related to climate change.

All this will not be achievable without the involvement people committed to their environment. For this reason, rural repopulation is necessary with measures that promote services of all kinds and that, above all, include policies of access to land in order to articulate a strong agro-ecological primary sector. Within these measures, community organisations that are responsible for land stewardship are decisive. In 2019, there were 63 land stewardship organisations in Catalonia (all non-profit), 42 of them private and the rest public. They articulated 700 initiatives (447 private), most of them (63.6%) of less than 10 ha and only 16 of more than 500 ha. In total, they covered 1.2% of Catalonia. They are mainly focused on forest land (69.60%), followed by river and wetland areas, agricultural or livestock areas, by the sea and on the coast (Esnatura, 2020). These are initiatives that should be expanded.

Food and water

The primary sector, be it agriculture, livestock or fisheries, has been transformed over the 20th and 21st centuries towards increasing industrialisation, intensification of production and internationalisation. Small-scale family production, with local processing and marketing circuits, has been greatly reduced. Some have been abandoned and others have been taken over by larger and larger companies. As for work, wage-dependent labour is increasing under ever more precarious conditions, while on the economic level, there is growing dependence on investments and agrochemical consumption. Finally, in terms of the environmental dimension, soil and water depletion and pollution are increasing. In addition, the intensification of agricultural and livestock production is having a profound impact on biodiversity: the extensive fields of technified monocultures and the overexploitation of water and land have deteriorated natural ecosystems and agrosystems which used to support a high level of biological diversity. An example of this is the 34% reduction in the population index of species traditionally present in agricultural ecosystems and grasslands (Brotons et al., 2020).

Furthermore, the food industry today is reliant on processes of refrigeration, conservation, freezing, packaging, transport, storage, logistics, sales in large supermarkets, etc., which are managed according to the logic of profit maximisation. This has meant that they are subject to very high energy and material requirements, both because of the operation of the industrial processes on which they depend, and because of their close link with the transport sector.

The number of farms in Catalonia has fallen by 18% from 1999 to 2020 and, in the same period, the agricultural area employed has decreased by 5%, indicating that the land has been concentrated in fewer hands (Idescat, 2023n). This downward trend in the population working in the primary sector over the last 20 years has in fact been going on for over a century. There are currently 53,000 people left inhabiting the countryside and they are ageing. In 2022, agriculture, livestock and fishing was the sector which employed the fewest people: only 1.51% of the employed population and the gender divide was very stark: 5 times fewer women were employed than men (Idescat, 2023ñ). In fishing, the situation is similar to the rest of the primary sector and, although there is a greater number of smaller gear vessels, large trawlers and purse seiners account for 88% of catches (Idescat, 2023o). Aquaculture has increased considerably in recent years, but with the same productivist logic, which has similar consequences to intensive livestock farming in terms of the use of resources, animal treatment and pollution.

Currently, half of the value generated in agriculture is concentrated in the hands of large corporations or limited companies. In order to increase their profits, they increase the surface area of their farms, increase technology, use machinery and inputs, and employ mainly migrant labour of sub-Saharan origin with very precarious contracts (Aldomà, 2022).

The primary sector contributes 0.65% of Catalonia's Gross Value Added, but if the agri-food industry is taken into account, the figures are considerably higher. The processing industry multiplies the turnover of the primary sector by 6 and almost doubles the number of people employed. Added to this is the ancillary industry. In total, the agri-food sector in Catalonia, primary and industrial, amounted to 43,088 million euro in turnover and employed 177,031 people, i.e. 5% of the employed population in 2020.

Production is largely dedicated to exports. In the last 10 years, exports have grown by around 30% in volume and 65% in value, reaching 14,848.93 million euro in 2022. 14,848.93 million in 2022. But the figure for food imports is no smaller, standing at more than 14 billion euro (PRODECA, 2023a). The high volume of imports generates an ecological footprint in other territories, which bear the impacts of industrial food production and which are usually found in peripheral countries. This is the case for grain production in Brazil and Argentina. Moreover, this dependence on imports causes strong fragility which compromises Catalonia's food security.

The enormous interconnection that globalised capitalism has brought about in global food markets has meant that for us to be able to consume food, it has to go through a long chain of processing, packaging, transport and distribution. These profuse global production and consumption chains are one of the most vulnerable aspects in the face of any type of crisis, and especially in the face of scenarios of fuel shortages and/or increases in fuel prices, especially diesel (Turiel, 2021).

Companies and the Catalan government advertise the competitiveness of the local agro-industry based on the intensive pig farming business and its export. Pig farming accounts for 80% of all livestock farming in terms of production volume, and a large part of that, 62%, is exported, mainly to China, but also to European countries such as France and Italy. Catalonia is the second largest producer of pork in Europe and the tenth largest in the world (PRODECA, 2023b). Industrial pig farming has serious environmental impacts, both within Catalan borders and beyond (Actis, 2024): intensive use of antibiotics (Porcher, 2021), feed made from imported grains such as soya, brutal animal treatment, among other consequences, including those related to water, which we will address below.

Greenhouse gas emissions associated to agriculture and livestock farming amount to 12% (Oficina Catalana del Canvi Climàtic, 2022) and have increased by 5% in the last ten years. In relative terms, if we look at emissions from livestock farming on a national scale, Catalonia is responsible for 30% of greenhouse gas emissions

(Greenpeace Spain, 2021). In addition to the above, there is the pollution of soils and aquifers by nitrates from the huge deposit of slurry (excrement, urine and water): more than 80% of groundwater has excess nitrates caused by industrial livestock farming and agriculture (Pareja, 2022).

The contamination of aquifers is even more serious considering the sharp reduction in water availability that is already occurring due to the accelerating effects of global warming. In 2022, 2023 and 2024 there have been water restrictions on both agriculture and water supply for the population. The water crisis should force the government to take structural decisions for adaptation to the reduction of water in watercourses and aquifers due to rising temperatures. The surface area of irrigated land and intensive livestock farming needs to be considerably reduced, as they consume 72% of this resource in Catalonia (#Noenraja, 2023).

In order to analyse more precisely which water uses should be reduced, we need to determine who holds the water licences in Catalonia. Currently, agriculture is granted 366 million cubic metres per year; industry, 307 million; hydroelectric production, 102; domestic use, 92; recreational use, 63; livestock, 42; and public irrigation, 19 (Palà and Aznar, 2014).

Concessions for agricultural use are mostly in the hands of individuals (36%) and irrigation communities (34%). The company with the largest volume of extraction is Casa Nova de Sallent SL, based in Vic (15.4 million cubic metres)[21] . Fortianell, Gurisat SL (1.8) or Balade SL (2.9 for agricultural use and 0.6 for recreational use) also stand out (Palà and Aznar, 2014).

For industrial uses, the most significant examples are: the metallurgical company Celsa in Castellbisbal (30 million cubic metres per year), the brewery Damm in El Prat de Llobregat (26), the chemical and textile company Plastiverd, also in El Prat de Llobregat (21), the paper company Barcelona Cartonboard in Castellbisbal (16), Aguas Industriales de Tarragona, which supplies water to the petrochemical estate in Tarragona (13.2) and ICL Iberpotash, an Israeli company that operates the salt mines of Súria and Sallent (12.8) (Palà and Aznar, 2014). The partial use of recycled water (e.g. Aguas Industriales de Tarragona and ICL Iberpotash) is what allows these industries to be more viable from this point of view compared to other aspects.

In terms of recreational use, the most important examples are the El Delfín Verde campsite in Torroella de Montgrí (4.4 million cubic metres) and Port Aventura. These are followed by some thirty golf courses: Club de Golf de Pals (1.9), Club de Golf Terramar (1.8) and the Real Club de Golf del Prat (0.7) (Palà and Aznar, 2014).

21 Its licence is also for recreational and domestic uses.

Finally, as for livestock farming, the first company is Gurisat SL, followed by Desarrollo Inmobiliario Agrícola SA, La Fageda, Casa Tarradellas and Fundació Especial Antiga Caixa Manlleu (Palà and Aznar, 2014).

On the basis of this analysis, it is not only irrigated land and extensive livestock farming that need to be reduced, but also some industrial and recreational activities.

The primary sector and the agri-food industry stand at the antipodes of the eco-social parameters for operating within the biophysical limits of Catalonia. In the context of declining access to cheap and abundant hydrocarbons, they will find it very difficult to continue following an industrial, mercantile and petroleum-dependent logic. The sharp reduction in available water, which is already occurring, points to the need to reduce its agricultural and farming use. It is therefore essential to carry out its transformation in line with the parameters outlined by agroecology (Rosset and Altieri, 2018) and food sovereignty (Via Campesina, 2003). Firstly, it is necessary to reject the model which has been implemented and supported by the Common Agricultural Policy, which is geared towards productivity. Instead, it is necessary to strengthen an agricultural metabolism that is much smaller than the current one, oriented towards local consumption and not export, which guarantees the right to food with the least possible use of water and without synthetic fertilisers or phytosanitary products. Circular waste management is also necessary. Furthermore, a transformation of this scale must take into account the relationship between agriculture and livestock farming and biodiversity, in order to enhance the latter rather than destroy it.

The goal of agroecology is to rely on synergies between species and thus avoid the need to use synthetic chemicals to regenerate soils, fertilise crops and combat pests. This type of framework frees food production from its dependence on imported inputs such as fertilisers and plant protection products, which immediately reduces vulnerability to trade shocks and price fluctuations. Its territorial approach builds on the needs of farm workers and ecosystem defenders to find solutions that enable healthy food production while protecting important wildlife habitats. Moreover, proposals such as biodiversity cultivation place a central importance on the defence and promotion of the seeds of local varieties of plants, together with building of opportunities for more resilient and territorially adapted production, as well as the stewardship and promotion of biodiversity in cultivated areas. A change in diet would have to go hand in hand with this change in production. The consumption of distant products would have to disappear and meat consumption would be drastically reduced.

Socio-economically, agroecology can be used as a strategy to rebuild local food cultures and community structures that have been destroyed by the industrialisation of the primary sector. The aim of this proposal is to reduce long global production and distribution chains, in order to economically reorganise the sector around local markets and short supply chains. The idea is to build territorialised food systems that can

improve access to fresh food, ensure higher remuneration for agricultural activity (alleviating rural poverty), and reduce fragility and vulnerability in situations of crisis. Furthermore, a commitment to small-scale farms, to the reappropriation of land and knowledge, to the promotion of local seeds, etc. are essential conditions for the goal of rebuilding a subsistence that puts life at the centre, promotes a living rural world and replaces market logic with autonomy. As far as fishing is concerned, the transformation needs to go in the same direction, limiting activity to small-scale fishing, thus reducing extraction in order to promote the health of marine populations.

All these transformations, as we have already seen in previous sections, have to be accompanied by a reflection on the consumption of energy, water and material they would in scenarios of lower availability. It is therefore essential to reduce the presence of large machinery and focus instead on the recovery of animal traction, extensive grazing and an increase in jobs with decent working conditions, among other things. Indeed, food production has the potential, in scenarios of decline, to become one of the driving sectors of work and of a transformation that can result in a revitalisation of rural spaces, an economic reconstruction based on material and economic autonomy, and the extension and defence of wild and cultivated biodiversity.

The premise for achieving all of this is determined, together with other factors, by the current extent of organic farming[22] in Catalonia, which has increased considerably: it has multiplied sevenfold since 2009, although it is still a minor percentage at 15% of the total agricultural area. 87% of the surface area of this type of agriculture is devoted to permanent pasture and open-air woody crops, which means that it provides little food variety and does not focus on the basic foodstuffs for a healthy diet. Since 2009, the number of farms has increased fourfold, the most numerous being those dedicated to livestock farming (Idescat, 2022b).

Upscaling agro-ecology is key to disputing the space for industrial agriculture and its wholesale marketing channels. One of the ways it does so is by articulating small and medium-sized projects to jointly tackle transport, storage and marketing. The Xarxa d'Economia Solidària is working in this direction and has social networks in Sant Andreu, Sants, Sant Cugat, L'Hospitalet, Alt Pirineu i Aran, Ripollès, Garrtoxa and Sabadell. Another example is the Xarxa per la Sobirania Alimentària de Catalunya Central and the cooperative Arran de Terra, which aims to boost agro-ecological projects. There are also projects which despite being small scale have a strong inspirational capacity, such as Mas Les Vinyes. As far as land control is concerned, the Emprius Foundation is a pioneering project that aims to recover plots of land and put them into communal right of use for agro-ecological expansion.

22 Organic farming is not the same as agroecology. While the former refers only to farming models, the latter is a socio-economic system that pursues justice and sustainability. For this reason, the penetration of agroecology in Catalonia is actually lower than that of organic farming.

Industry

The Catalan industrial sector is centred on the food industry (18.1% of total turnover and 16.3% of employment in industry), manufacture of motor vehicles (13.0% of turnover and 7.9% of employment), chemical industry (12.5%, 7.7%), production and distribution of electricity and gas (9.7%, 1.3%) and manufacture of metal products other than machinery and equipment (5.7%, 10.8%), as can be seen in table 4.2. Economic importance is strongly correlated with employment in the food sector, with its most unsustainable branches accounting for the largest share in terms of percentage.

	2019	**2020**	Percentage of the total in 2019
TOTAL			
Number of establishments	37,869	37,099	
People Employed	492,624	483,470	
Volume of Business	148,795	130,916	
Extractive industries and oil refining			
Number of establishments	203	208	0.5
People Employed	3,478	3,379	0.7
Percentage of women in the workforce	12	12	
Volume of Business	5,826	3,355	3.9
Food industries			
Number of establishments	3,384	3,524	8.9
People Employed	80,272	80,681	16.3
Percentage of women in the workforce	40	40	
Volume of Business	26,975	26,399	18.1
Manufacture of beverages and tobacco industry			
Number of establishments	871	831	2.3
People Employed	10,309	9,863	2.1
Percentage of women in the workforce	28	28	
Volume of Business	3,114	2,465	2.1

	2019	2020	Percentage of the total in 2019
Textile, leather and footwear industries. Clothes production.			
Number of establishments	4,286	4,187	11.3
People Employed	32,254	31,039	6.5
Percentage of women in the workforce	55	55	
Volume of Business	4,557	3,960	3.1
Wood and cork industries, except furniture; basketry			
Number of establishments	1,722	1,626	4.5
People Employed	7,740	7,583	1.6
Percentage of women in the workforce	19	19	
Volume of Business	1,017	917	0.7
Paper and graphic arts industry			
Number of establishments	3,405	3,351	9.0
People Employed	29,539	28,331	6.0
Percentage of women in the workforce	30	29	
Volume of Business	5,853	5,386	3.9
Chemical industries			
Number of establishments	1,053	1,059	2.8
People Employed	37,824	37,542	7.7
Percentage of women in the workforce	36	36	
Volume of Business	18,543	16,596	12.5
Manufacture of pharmaceutical products			
Number of establishments	154	156	0.4
People Employed	23,587	23,646	4.8
Percentage of women in the workforce	47	48	
Volume of Business	7,166	7,279	4.8
Manufacture of rubber products and plastic materials			
Number of establishments	1,195	1,178	3.2
People Employed	23,783	24,018	4.8
Percentage of women in the workforce	32	32	
Volume of Business	5,400	4,999	3.6

	2019	2020	Percentage of the total in 2019
Industries of other non-metallic mineral products			
Number of establishments	1,022	991	2.7
People Employed	11,534	11,813	2.3
Percentage of women in the workforce	18	18	
Volume of Business	2,884	2,671	1.9
Metallurgy			
Number of establishments	297	305	0.8
People Employed	6,774	6,688	1.4
Percentage of women in the workforce	14	15	
Volume of Business	3,758	3,157	2.5
Manufacture of metal products, except machinery and equipment			
Number of establishments	6,662	6,346	17.6
People Employed	52,986	51,513	10.8
Percentage of women in the workforce	18	18	
Volume of Business	8,504	7,561	5.7
Electrical, electronic and optical material and equipment manufacturing			
Number of establishments	1,295	1,301	3.4
People Employed	24,677	23,855	5.0
Percentage of women in the workforce	32	32	
Volume of Business	6,116	5,663	4.1
Manufacture of machinery and ncaa equipment			
Number of establishments	1,713	1,739	4.5
People Employed	28,798	28,173	5.8
Percentage of women in the workforce	18	18	
Volume of Business	5,362	4,915	3.6
Manufacture of motor vehicles, trailers and semi-trailers			
Number of establishments	405	396	1.1
People Employed	38,845	36,655	7.9
Percentage of women in the workforce	25	25	
Volume of Business	19,403	14,730	13.0

	2019	2020	Percentage of the total in 2019
Manufacturing of other transport materials, except motor vehicles			
Number of establishments	180	177	0.5
People Employed	2,840	3,076	0.6
Percentage of women in the workforce	20	20	
Volume of Business	611	596	0.4
Furniture manufacturing and various manufacturing industries			
Number of establishments	3,615	3,534	9.5
People Employed	18,112	17,794	3.7
Percentage of women in the workforce	38	37	
Volume of Business	2,366	2,057	1.6
Repair and installation of machinery and equipment			
Number of establishments	3,491	3,392	9.2
People Employed	18,998	19,127	3.9
Percentage of women in the workforce	13	14	
Volume of Business	2,217	2,094	1.5
Production and distribution of electricity and gas			
Number of establishments	1,766	1,660	4.7
People Employed	6,518	5,580	1.3
Percentage of women in the workforce	29	27	
Volume of Business	14,456	11,999	9.7
Water supply; sanitation and waste management			
Number of establishments	1,150	1,138	3.0
People Employed	33,756	33,114	6.9
Percentage of women in the workforce	24	24	
Volume of Business	4,658	4,109	3.1

Table 4.2: Number of establishments, people employed, percentage of women in the workforce and turnover of industrial branches in Catalonia in 2019. Prepared by the authors based on Idescat (2023e). Data in millions of euros.

It is a heavily male-dominated sector. Only in the textile and footwear industry are there a similar number of women and men working. In all other areas inequality is very high (table 4.2).

The industrial sector is the second largest consumer of energy, after the transport sector. This consumption has been roughly stagnant since 2009, after the sharp drop it experienced between 2007 and 2008 as a result of the crisis. In 2019, 35.9% of this consumption was electrified, the rest was thermal, and the use of natural gas stood out (48.6% of the total). The bulk was concentrated in the chemical sector (29.0%), food (18.0%), cement manufacture (10.6%), paper and cardboard (9.0%) and metal transformation (8.4%) (Institut Català d'Energia, 2023c).

In terms of trade, in 2021 Catalan industry had a deficit, measured in monetary terms, compared to the rest of the world. This deficit was mainly built up by industries highly dependent on technology (pharmaceuticals, electronics, IT), with medium-high reliance on technology (chemicals, electrical materials and equipment, machinery, vehicles) and medium-low (rubber, plastics, metal products, non-metallic products and metallurgy). The only positive balance was for industries low on technology (foodstuffs, textiles, footwear, wood, paper). This is shown in table 4.3. In other words, among the potentially more sustainable branches of industry, which are the most susceptible to development, Catalonia is a net exporter, which leaves little room for growth. In any case, a finer analysis would be required. First of all by analysing the trade balance in physical rather than monetary terms, and this data is not available. Secondly, by analysing in more detail each of the sub-branches (textiles, food, furniture manufacturing, etc.).

	2019	**2020**	Percentage of the total in 2019	Percentage compared to the total branch sales in 2019
TOTAL				
Sales in Spain	96,086	82,882		
Sales to the rest of the European Union	35,714	33,147		
Sales to the rest of the world	16,994	14,886		
Extractive industries and oil refining				
Sales in Spain	5,526	3,150	5.8	
Sales to the rest of the European Union	206	144	0.6	
Sales to the rest of the world	94	60	0.6	
Food industries				
Sales in Spain	19,690	18,646	20.5	73.0
Sales to the rest of the European Union	4,847	4,279	13.6	18.0
Sales to the rest of the world	2,437	3,472	14.3	9.0

	2019	**2020**	Percentage of the total in 2019	Percentage compared to the total branch sales in 2019
Manufacture of beverages and tobacco industry				
Sales in Spain	2,410	1,905	2.5	77.4
Sales to the rest of the European Union	412	303	1.2	13.2
Sales to the rest of the world	292	257	1.7	9.4
Textile, leather and footwear industries. Clothes production.				
Sales in Spain	2,601	2,308	2.7	57.1
Sales to the rest of the European Union	1,449	1,223	4.1	31.8
Sales to the rest of the world	507	427	3.0	11.1
Wood and cork industries, except furniture; basketry				
Sales in Spain	807	700	0.8	79.4
Sales to the rest of the European Union	150	156	0.4	14.8
Sales to the rest of the world	59	61	0.3	5.8
Paper and graphic arts industry				
Sales in Spain	4,266	3,989	4.4	72.9
Sales to the rest of the European Union	1,114	909	3.1	19.0
Sales to the rest of the world	472	488	2.8	8.1
Chemical industries				
Sales in Spain	10,501	9,186	10.9	56.6
Sales to the rest of the European Union	4,796	4,595	13.4	25.9
Sales to the rest of the world	3,244	2,814	19.1	17.5
Manufacture of pharmaceutical products				
Sales in Spain	3,493	3,429	3.6	48.7
Sales to the rest of the European Union	2,409	2,526	6.7	33.6
Sales to the rest of the world	1,263	1,323	7.4	17.6
Manufacture of rubber products and plastic materials				
Sales in Spain	3,305	3,023	3.4	61.2
Sales to the rest of the European Union	1,633	1,522	4.6	30.3
Sales to the rest of the world	461	452	2.7	8.5

	2019	2020	Percentage of the total in 2019	Percentage compared to the total branch sales in 2019
Industries of other non-metallic mineral products				
Sales in Spain	2,203	2,055	2.3	76.4
Sales to the rest of the European Union	420	422	1.2	14.6
Sales to the rest of the world	259	193	1.5	9.0
Metallurgy				
Sales in Spain	2,027	1,591	2.1	53.9
Sales to the rest of the European Union	1,335	1,116	3.7	35.5
Sales to the rest of the world	395	449	2.3	10.5
Manufacture of metal products, except machinery and equipment				
Sales in Spain	5,964	5,344	6.2	70.1
Sales to the rest of the European Union	1,830	1,537	5.1	21.5
Sales to the rest of the world	709	678	4.2	8.3
Electrical, electronic and optical material and equipment manufacturing				
Sales in Spain	3,302	3,084	3.4	54.0
Sales to the rest of the European Union	1,713	1,618	4.8	28.0
Sales to the rest of the world	1,101	960	6.5	18.0
Manufacture of machinery and ncaa equipment				
Sales in Spain	2,650	2,406	2.8	49.4
Sales to the rest of the European Union	1,432	1,404	4.0	26.7
Sales to the rest of the world	1,279	1,103	7.5	23.9
Manufacture of motor vehicles, trailers and semi-trailers				
Sales in Spain	5,744	3,622	6.0	29.6
Sales to the rest of the European Union	10,115	9,647	28.3	52.1
Sales to the rest of the world	3,544	1,460	20.9	18.3
Manufacturing other transport materials, except motor vehicles				
Sales in Spain	275	267	0.3	45.1
Sales to the rest of the European Union	211	232	0.6	34.5
Sales to the rest of the world	124	96	0.7	20.4

	2019	2020	Percentage of the total in 2019	Percentage compared to the total branch sales in 2019
Furniture manufacturing and various manufacturing industries				
Sales in Spain	1,477	1,313	1.5	62.4
Sales to the rest of the European Union	579	495	1.6	24.5
Sales to the rest of the world	309	248	1.8	13.1
Repair and installation of machinery and equipment				
Sales in Spain	1,935	1,799	2.0	87.3
Sales to the rest of the European Union	124	137	0.3	5.6
Sales to the rest of the world	157	157	0.9	7.1
Production and distribution of electricity and gas				
Sales in Spain	13,617	11,225	14.2	94.2
Sales to the rest of the European Union	796	749	2.2	5.5
Sales to the rest of the world	43	24	0.3	0.3
Water supply; sanitation and waste management				
Sales in Spain	4,285	3,831	4.5	92.0
Sales to the rest of the European Union	134	124	0.4	2.9
Sales to the rest of the world	237	153	1.4	5.1

Table 4.3: Imports, exports and trade balance of the industrial sector in Catalonia in 2021. Prepared by the authors based on Idescat (2023f, 2013g). Data in millions of euros.

In 2019 the potentially more sustainable branches sold mainly in the Spanish market and not to the EU or to the rest of the world: food industry (73.0%), textiles, leather and footwear (57.1%), wood and cork (79.4%), paper (72.9%), furniture (62.4%) or production and distribution of electricity (92.0%). In contrast, the most harmful branches had a lower percentage on the national market: chemical industry (56.6%), metallurgy (53.9%), manufacture of electrical and electronic equipment (54.0%), vehicles (29.6%) (own elaboration of the percentages based on Idescat, 2023e). This means that, in addition to their impact during the production process, there is also the added impact of transport on their commercialisation.

In general, the international movement of goods in this sector of the economy is particularly noteworthy. Catalonia imports a large quantity of industrial goods as well as exporting them. This can be noticed across all of its branches. On some occasions, the imported and exported goods are of the same nature (cars are imported

and exported, for example), but on other occasions they are complementary goods (medicines are exported for one type of illness and imported for another, or chemical products are imported which are then used for the synthesis of others which are exported).

After this brief review, it is clear that it is not easy to build a unified roadmap for a sector that is as diverse as it is central to the economy. A solid proposal aimed at building an eco-social alternative to this economy requires a more intense process of research, classification and mapping of its different branches. However, there are some fundamental elements that any sectoral roadmap for Degrowth must take into consideration: diversification (what is produced), relocation (where it is produced and consumed), reduction (how much is produced), and the use of renewable materials and energies integrated into ecosystem functioning (how it is produced).

The first aspect to highlight is that the sector as a whole, including the potentially sustainable part of it, is articulated within global value chains, which makes it very fragile in the face of the scenarios that are unfolding. As we have discussed, the type of global capitalism to which these branches of activity are linked requires a constant and abundant flow of (fossil) energy and (non-renewable) raw material in order to function properly. However, this flow is being disrupted for biophysical and geopolitical reasons, to the extent that industrial companies have begun to close or shut down due to the lack of certain materials, disruptions in supply chains or the increased costs of access to energy. Any of these eventualities is very damaging, as it short-circuits the highly international trade of these branches of activity and hinders their ability to enter global flows of goods. Thus, a first unavoidable aspect of this reconversion is the construction of economic autonomy in a relatively short period of time if economic and social stability is to be safeguarded. Manufactures must be produced to satisfy the needs of the human beings living in the territory without, at the same time, compromising the integrity and diversity of the fabric of local and global life.

The manufacturing sector also generally uses tools with highly technological components that are dependent on non-renewable energy and materials. This is why there has to be a transition from complex technologies to humble techniques (Almazán, 2023) that are decoupled from fossil metabolism, are smaller scale, simpler and, therefore, less impactful. Since the new economy must be based on R^3E energies, it follows that the technical heart of the new manufactures should be mechanical energy mills, small iron foundries, textile workshops, food industries, etc. In other words, techniques that can be powered by solar energy and materials that are found nearby in abundant quantities, easily purified when necessary, and recyclable. A corollary is that there may be a development in the electrification of industry, but as a secondary and moderate development.

This would apply not only to the tools which are used to make objects, but also to what is actually made. There is a need for a kind of technical design that prioritises the strength and durability of instruments and tools. Such techniques are inherently more democratic because of their lower complexity, as they are more easily appropriable and can be manufactured without requiring capital-intensive industrial networks.

All this would imply a shift in the industrial sector towards artisan manufacturing, more intensive in human labour, less demanding of energy, less productive and more predisposed to the development of cooperative projects that do not require heavy initial capital investment or large expropriations, although the latter could also occur, opening the door to self-managed enterprises by those who work in them.

Within the manufacturing industry we can distinguish between two large blocks: those sectors that could fit, after a process of reconversion, into a Degrowth economy and those that would necessarily have to be downsized.

Potentially sustainable sectors

Among the potentially sustainable branches, the main activity of the Catalan industrial sector stands out: food. It requires a major reconversion, as it is markedly industrial in nature, as exemplified by the significance of macro pig farms. Furthermore, technical changes would also be necessary, for example, the drying mechanisms used for products such as rice, among many others, would have to be rethought. As it is an export-oriented branch of industry - although this figure is strongly influenced by the industrial meat sector[23] - a reconversion alone would not suffice, instead a reduction in absolute terms would be necessary, though this would not be the case for certain foodstuffs. In any case, we have already dealt with the food sector in the section of this report dedicated to it, so we will not go into it any further here.

The necessary reconversion of the textile industry can serve as an example for other branches. Firstly, since the early 2000s, global clothing production has doubled, driven by a reduction in the number of times garments are used: some are discarded after only 7-8 uses (CMF, 2021a). This leads to a first important conclusion: the textile sector is totally oversized. Indeed, Catalonia is a net exporter. It is therefore un-

23 In 2019, it accounted for 42.0% of sales outside of Spain (own elaboration based on Idescat, 2023e).

likely that it will need to increase its production capacity to satisfy domestic demand while applying criteria of fairness and sustainability.

But this is not the only issue. Synthetic fibres, particularly polyester (85% of all synthetic fibres worldwide by 2030 if current trends continue), represent more than two thirds (69%) of all materials used in the textile industry, and this figure is expected to reach almost three quarters (73%) by 2030. Globally, the production of these fibres already requires more oil than the annual consumption of the Spanish state. In the case of Zara, a brand which is part of the Inditex group[24], 64% of the garments it sells contain some type of synthetic fibre, with precisely 45% of the fibre which makes up this proportion of garments being synthetic (CMF, 2021a, 2021b).

Some types of fibre obtained from vegetable products are increasingly being used, although still to a much lesser extent. Among these is viscose, which Inditex uses extensively, obtained from cellulose. However, most of the viscose marketed globally is currently obtained following a highly polluting chemical process (CHF, 2017). Conversion is therefore not only a matter of abandoning fossil raw material, it is also about using natural raw material in non-polluting methods.

Another option is to recycle polyester, but global recycling rates are falling rather than rising: while the percentage of recycled polyester for clothing in 2019 stood at 14%, current trends put it at 7.9% in 2030. Overall, less than 1% of clothing is recycled into new clothing (CHF, 2021b).

Of course, all these ecological impacts are associated with social impacts in the form of poor working conditions and degradation of living conditions. Again, Inditex stands out (Álvarez, 2017; Ribeira, 2017).

This small development in the analysis of the textile sector needs to be applied to other sectors, such as furniture manufacturing. Here, too, a significant amount of raw material is used: although natural raw material such as solid wood could be used, this only happens in a minority of cases, having been replaced by materials that require polluting products. A shift in the choice of raw materials we employ must be accompanied by a commitment to durability and repairability, as the amount of available wood which can be used while safeguarding ecosystem balances is limited. Another important element to consider is that the amount of renewable energy that this branch of production will likely require is high. Therefore, the process towards a conversion in this sector would primarily involve the use of wood to replace furniture which cannot be repaired.

The manufacture of medicines, which is significant in Catalonia, is more complicated, as it is probably one of the areas where supporting an industrial fabric would

24 In Tordera Inditex has its central services for Massimo Dutti, Bershka and Oysho, which include management, design and commercial activity.

be advisable. This should nevertheless be diversified, since despite large exports, which yield high profits, there are also imports. Many of the products imported are different from those exported and do not serve the same medical purposes. In any case, a reduction in the use of medicines would make sense. This requires a transformation of the health care system, where prevention is placed at the forefront. Similarly, changes in many eco-social conditions (working, ecological etc.) would result in a decrease in the use of chronic medication, such as anxiolytics or treatments for non-communicable diseases (diabetes, cancer, asthma, etc.), which would reduce their impact. The trend should be towards medical self-sufficiency within a general commitment to community healthcare, and without renouncing public healthcare.

Another example in this area would be paper and cardboard. These are necessary products, but in considerably smaller quantities than current consumption, especially considering that Catalonia sells significant quantities abroad (Idescat, 2023e). Moreover, the paper industry needs to shift towards methods that are less harmful to the environment.

The last case of industrial activities that are necessary and feasible is the wood, cork, basket and esparto grass industry. It is not very well established in Catalonia, which leaves room for growth in this area.

Inherently unsustainable sectors

Most or all of the other industrial activities will have to be reduced within a Degrowth horizon. In some cases, very significantly. Their socio-ecological impacts cannot be assumed, but it is also unlikely that their current volume can be sustained in the medium term in the context of the current systemic crisis, nor that they can be reconverted in any appreciable way.

The branches of activity which, after food, account for the highest turnover and employment can be summarised as follows: the manufacture of motor vehicles and the chemical industry. These industries are clearly oversized in order to cover the already unsustainable domestic consumption of their products, even considering the negative net export balance. In these sectors there would therefore be a significant impact on the economy and on employment, and consequently on the industrial sector as a whole. However, insofar as these are high impact activities, their reduction would have a considerable positive ecological effect. One concrete example of this impact is their highly intensive energy use and the fact that they are closely tied to the consumption of fossil fuels, especially gas.

The steel industry is a clear example of the difficulty of sustaining certain branches of industry with renewables:

→ Huge amounts of biomass consumption would be needed to replace fossil raw materials with plant based raw materials[25].

→ Some industrial processes can be electrified, but others cannot. One of the main ones is the chemical reduction of minerals. This would require charcoal.

→ Although it is possible to build sufficiently powerful furnaces with renewables, for example to produce steel, they do not exist in a commercial form, as they are not competitive[26]. In other words, they require heavy investments and perform worse.

The fact that these sectors are shrinking does not always mean that they have to disappear. For example, the technical capacity to manufacture steel, cement or lime using biomass and materials abundant in the environment has existed for millennia and in some cases, such as cement, they have performed very well (Seymour et al., 2023). Therefore, a Degrowth society would not need to renounce these and other similar materials, but it would need to renounce their use in the current quantities and with the degrees of purity that many high-tech industrial applications require.

Another example is ammonia, which is crucial in the manufacture of fertilisers and other products. Ammonia is obtained from atmospheric nitrogen and hydrogen. The latter comes mainly from natural gas. But hydrogen can also be obtained by electrolysis of water using solar energy (so-called "green hydrogen"). As long as we are talking about relatively small quantities of ammonia, this chemical industry would have a role to play in a Degrowth society.

A third case would be the manufacture of soaps, detergents and other cleaning products, which can also be produced with low impacts by using oil and caustic soda (NaOH). Soda is also the basis for other products, such as paper. There are different methods for obtaining soda. The most commonly used today is chlor-alkali, but historically it was produced by treating sodium carbonate (the most common alkaline substance known and which has been used since antiquity) with calcium hydroxide

25 Several examples: The charcoal required to produce the same amount of ferroalloys used in 2005 globally would be 2,438 t/year, a substantial part of annual production (Garcia-Olivares, 2015). The charcoal required to sustain annual global steel production requires the use of 1.8 million hectares (Heinberg and Fridley, 2016). Supplying the entire current chemical industry in Germany with biomass would require half of the country's entire arable land (Bringezu et al., 2007).

26 Electrification of the steel industry would require four times its current electricity consumption (CAN Europe, 2022).

(obtained by adding water to the result of the calcination of limestone). This is a process that would fit within the parameters of green chemistry.

Finally, the automobile industry, within the context of general degrowth, could also undergo a reconversion towards other means of transport. Some examples are the use of trains, destined to become the backbone of land transport, ships, which should undergo a major reconversion in order to be powered mainly by sail, electric buses, bicycles and other industrial branches, such as R^3E techniques. The electric car, as we will discuss in the section on transport, is not an option.

Ownership, territorial distribution, employment and wealth distribution

In this sector, a correlation between high technological levels and socio-ecological problems reappears: the most complex industries are not only the most unsustainable, but also those where there is a greater concentration of companies, as can be deduced from the number of establishments in each of the industrial branches when compared with the number of jobs in these branches in Catalonia (table 4.2). Moreover, the trend towards concentration is increasing, driven by the higher productivity levels of these corporations. This is another central challenge of a Degrowth transition. It will be difficult to achieve a humble and solar industry if we maintain profit-making as a priority for productive spaces. For this reason, the social control of production must be encouraged and implemented. This can be achieved, among other factors, via the creation of a cooperative economic structure and by the generalisation of alternatives to investment (including expropriation).

From a territorial perspective, the industrial sector is concentrated in Barcelona. The articulation of short commercialisation channels, typical of the Degrowth economy, where production and consumption are brought closer by limiting intermediaries and transport, requires the de-industrialisation of some regions (Barcelona) at the expense of a sustainable and limited re-industrialisation of the rest of the territory.

One final consideration is that such a transition would supposedly result in a negative net balance in terms of working hours (González Reyes et al., 2019; Oteros et al., 2023). This makes the process even more difficult. This does not mean carrying out fossil deindustrialisation is a matter of choice. This will happen at the global level to a greater or lesser extent as a result of the ecological crisis, and in all likelihood Catalonia will not be among the few areas in the world which can be "saved" from this process, as it holds a semi-peripheral position with respect to the global centres of power. The key question is what level of protection will people working in the in-

dustrial sector experience in this transition. Therefore, in addition to diversification, relocation, reduction, and the use of renewable material and energy that are integrated into ecosystem functions, the distribution of work is crucial. This means both the aspects of distribution (with measures such as bringing forward the retirement age, reducing working hours, etc.) and of wealth (expropriation of companies, maintaining the purchasing power of employees, etc.).

Transport

Presenting a roadmap for the eco-social transition of transport requires thinking about a generalised reorganisation of the Catalan economy, as its main sectors are heavily dependent on fossil fuelled transport. The manufacture and sale of cars, intermediation, retail trade and agri-food production are inserted in global production and distribution chains which are able to move thanks to hydrocarbons. In addition to a strong reduction in the transport of goods and merchandise, there would have to be a generalised reorganisation in the way people move about in Catalonia, which currently is based on the private vehicle.

At the beginning of this report, we pointed out that the transport sector was at the forefront of energy consumption in Catalonia, with 45.1% of the total. Let's take a closer look at the sector to understand the socio-ecological implications of these figures.

If we exclude paraffin for aviation, fuel oil for shipping, electricity, which is mainly used in the railway sector, and a smaller proportion of the diesel used in the latter two sectors, road transport accounts for the remaining energy consumption, which is mainly produced by diesel and petrol, and represents the vast majority of it (Figure 4.3). In any case, it is also worth highlighting the intense air traffic, which accounted for 22% of the energy consumed by the sector in 2019 in the form of paraffin (ICAEN, 2019). It should not be forgotten that Barcelona airport is the second largest in terms of air traffic in Spain. In 2022, it amounted to 41.6 million people, 71% of whom took international flights (Aena, 2023). The figures thus reflect an intense movement mainly related to international tourism, which is experiencing strong growth: in 2022, more than twice as many international passengers were registered compared to the previous year, although this figure is biassed due to the end of the COVID-19 pandemic.

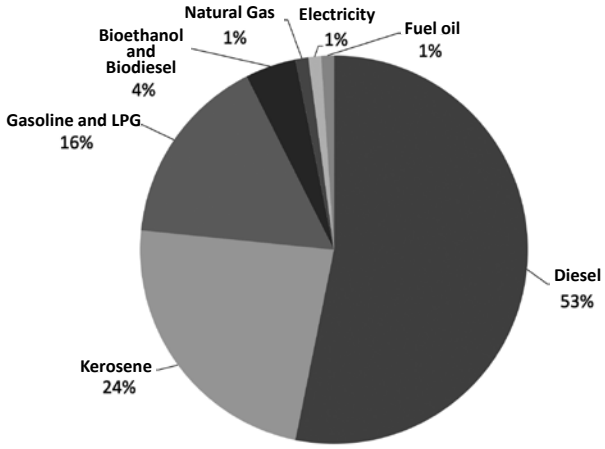

Figure 4.3: Distribution of energy consumption by fuel type in transport in Catalonia in 2019 (ICAEN, 2019).

In addition to the hegemony of road transport, there is a second factor to which attention has been drawn on several occasions: the transport sector is absolutely petroleum-dependent, which exposes it to a very fragile situation in the face of a declining availability of hydrocarbons. The sum of diesel, petrol, paraffin and LPG (all petroleum products) accounted for 94% of energy consumption in 2019 (Figure 4.3). Biofuels, which are also associated with oil consumption in current industrial frameworks, accounted for 4% and electricity, mainly railways, for the remaining 1%. Consequently, one of the largest emitters of greenhouse gases in Catalonia is transport, responsible for 29% of emissions (industry is the leading emitter, with 30%) (Oficina Catalana del Canvi Climàtic, 2023).

Reforming the transport sector therefore involves focusing on road transport. To do this, it is necessary to understand its physiognomy. In 2021, Catalonia stock totaled 5,366,768 vehicles, 82% of which were used for private transport (passenger cars and motorbikes), as can be seen in Figure 4.4. These figures show that private travel is heavily motorised. The same is reflected in the motorisation index, which reached 738.74 cars per thousand inhabitants in 2020 (Observatori de la Mobilitat de Catalunya, 2020).

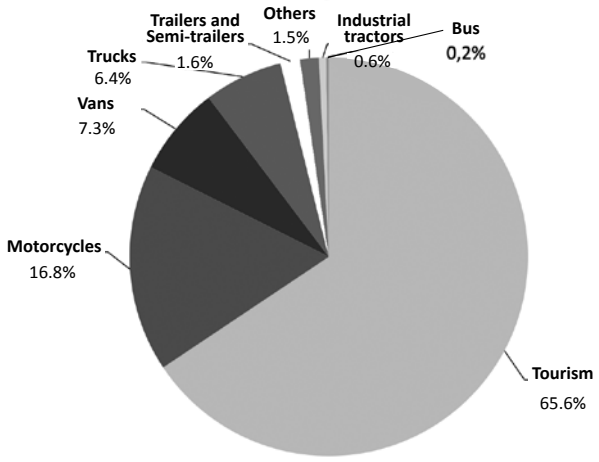

Figure 4.4: Catalan vehicle fleet in 2021 according to vehicle type (Observatori de la Mobilitat de Catalunya, 2021).

However, high motorisation coexists with the fact that most journeys in Catalonia continue to be made on foot. In 2020, this mode of transport accounted for 51.2% of the total. It was followed by journeys by private car (35.0%), by metro and train (6.6%), by bus (4.3%) and, lastly, by bicycle (1.7%). Moreover, this mobility has a marked gender bias. Women more often move on foot than men (55.7% compared to 46.7%) and less by private car (28.5% compared to 41.5%). It is also worth pointing out that journeys made for personal reasons account for the bulk of daily movements (71.8%) (Observatori de la Mobilitat de Catalunya, 2020).

The diagnosis for the transport sector suggests that a Degrowth transformation should focus on two areas: private vehicles and their uses, and air transport associated with international tourism. As we will analyse in the section on tourism, the material and energy-consuming nature of this activity, as well as the amount of infrastructure and waste it generates, especially international waste, require a drastic reduction and reconversion. This commitment is also a matter of social justice, since tourism has strong socio-environmental impacts and is enjoyed by a small percentage of the world's population, those with the greatest purchasing power.

In the case of private vehicles, necessary measures include replacing driving with walking, where possible, or with electrified collective mobility (train) and sustainable individual mobility (bicycle). In the light of current data, collective transport by bus, metro and train needs to be further expanded and decoupled as far as possible from fossil fuels, which continue to sustain bus transport to a large extent. Rail, on the other hand, has a high level of electrification, so it would be desirable to develop the conventional format in order to increase its expansion across the territory.

Such far-reaching changes in mobility can only be achieved with transformations in urban planning which promote the proximity of housing, employment and leisure.

The reduction in number and distance of hydrocarbon-driven trips must also include freight transport. For this to be possible, a spatial rearticulation of production, distribution and consumption is needed in order to increase their proximity. In this sense, it will be necessary to expand and diversify local productive capacity in the areas we have already analysed, such as food and industry.

Transforming petro-dependent transport means changing one of the pillars upon which economic globalisation and the creation of cities is based (González Reyes, 2020), as it enables movement across long distances, in short times and of large masses of energy and materials. In conclusion, we need to reduce long-distance transport, increase electrified collective transport and dismantle the current fossil logistics system in order to give way to a degrowth, localised, primarised and small-scale economy. This would entail a partial de-urbanisation and a strong ruralisation of life, with a decentralisation of population, productive capacities and services.

Construction and housing

In Catalonia, more than 10% of dwellings are empty and, if we add those used only sporadically, the figure rises to 19%, according to the census carried out in 2021 (INE, 2023). Moreover, the occupation ratio is only 2.2 people per house. This data suggests that there is no need to build more housing in a context of low demographic growth. Therefore, new development projects that are pending approval and those that have been approved but not yet built should be halted and reversed. Housing construction should focus on improving energy efficiency. In terms of public buildings, the picture is the same, with vast port, airport and road facilities that do not require more transport infrastructure. The only exception is an increase in conventional railways, which would be desirable, in order to cover a wider portion of the territory, something which we have already mentioned in the section on transport. As it is not possible to absorb the whole of the construction sector with the work of improving energy efficiency in housing and the extension of the railway alone, we find ourselves with a clearly oversized sector that must be reduced.

The reason for boosting energy efficiency via residential retrofitting is that the building stock's use phase accounts for more than 80% of its associated emissions (Steibert et al., 2019). On the other hand, 61% of emissions are attributed to residential consumption, while the remaining 39% is attributed to institutional and commercial buildings (MITECO, 2022). The main areas of intervention to be developed are those aimed at increasing the energy autonomy of homes: good insulation, installation of solar panels, solar cookers, use of plants as a coolant, bioclimatic architecture, etc. In addition to these, others are needed to ensure adequate living conditions in the face of greater difficulty in accessing goods: reuse of greywater and rainwater in toilets, setting up energy communities, community gardens in homes, etc.

Emissions associated with air conditioning should be reduced by at least 50% in the decade 2020-2030 (González Reyes et al., 2019). Therefore, even whilst adopting measures to increase energy efficiency and the renovation of buildings, achieving these figures must involve moderating the air conditioning of rooms (less heating in winter and less air conditioning in summer), which implies profound changes in culture and daily practices. In winter, priority should be given to heating people (using braziers, for example), or to heating certain rooms (bathrooms when showering), and not all spaces and not all the time. In summer, instruments such as fans should be preferred. This reduction in the energy used for air-conditioning should also be applied to workplaces and shops to a similar extent.

In this transformation, one aspect to consider in Catalonia is that the real estate sector and speculation on the price of housing are central to the economy. Any im-

provements in the neighbourhood, the buildings or the houses can lead to a substantial increase in price according to the logic of the real estate market. Energy rehabilitation financed with European public funds is already revealing this reality: it is estimated to increase the value of real estate by 35% (Torres, 2022). The social consequence is that tenants and people with lower purchasing power will be removed from their homes if they cannot assume these price increases. The solution does not lie in preventing the improvement of housing and neighbourhoods, but rather in regulations, policies and social mobilisation aimed at restraining the market.

Whenever new housing construction is necessary, sustainable construction criteria would have to be applied. This type of building is defined by the fact that its design, execution and operation reduces or eliminates its negative impacts or generates positive impacts on the climate and the state of ecosystems:

→ Use of non-toxic, recyclable or reusable materials with a lower life cycle impact, such as wood, stone, adobe or straw.

→ Reduction of energy and water consumption, which includes bioclimatic orientation, energy efficiency, water reuse, energy generation and municipal solid waste treatment (e.g. composting).

→ Reuse and recycling of construction waste.

Inclusion of elements favouring biodiversity, such as green roofs and shelters for different animal species.

The construction of new housing and renovation would take place mainly in rural areas. This is the territory that needs to be revitalised within a Degrowth socio-economic framework. In urban areas, on the other hand, urban land would be reclassified as undevelopable land. But the issue will not only be to reduce the amount of urbanised land, but to also ruralise urban areas, turning cities into food production areas, especially for fruit and vegetables. To do this, it would be necessary to invest in the decontamination and decompaction of urban soils, which would be transformed into living soils. In this way, they would not only fix carbon, but would also be able to absorb rainfall, including torrential rains. Such measures would also limit the urban heat island effect.

As with rehabilitation, sustainable construction is expensive, and thus unaffordable for the majority of society. In order to facilitate universal access to housing, regulatory and cultural changes are necessary, including: mobilisation of public housing stock, *squatting of* empty homes by people who lack housing, prioritisation of the population with lower incomes in access to new sustainable construction housing and, especially, promotion of the right of use model. This allows housing to be owned by cooperatives, where the community's members have the right of use over their homes. This logic displaces the market (ownership and rental housing) and

the state (public housing) from housing management to put it at the service of the common good.

With regard to the construction of transport infrastructure (road, rail, ports and airports), we have already outlined some proposals. Planned public works should be halted, specifically the expansion of ports and El Prat airport, and a moratorium on the construction of new infrastructures should be implemented, to then go on and initiate a programme of reduction of infrastructures that are unviable in the de-growth framework (airports, motorways, for example) just as infrastructure would need to be repaired due to wear and tear.

Tourism

Tourism is a structurally unsustainable sector, both in environmental as well as social and employment terms, and must therefore be drastically reduced in the scenario of metabolic contraction proposed in this report. In the case of the Catalan economy, this entails a major reconversion, as it represents 12% of GDP and 13% of jobs (Grau del Cerro, 2023). It is a highly precarious sector, where more than half of those employed earn a salary below €1,000 and where the degree of temporary employment is high. This precariousness is much higher among women, whose salaries are 36% lower than men's (Observatori del Turisme a Barcelona, 2023a).

After the halt during the COVID-19 pandemic, once mobility restrictions were lifted, this activity has grown very rapidly, almost recovering its previous rate. In 2022, the region had 34.63 million tourists, 43% from abroad, followed by Catalans, representing 42%. The rest were from Spain. In economic terms, international tourism is more important than local tourism, accounting for 78% of spending (Generalitat de Catalunya, 2023).

In terms of environmental impact parameters, international tourism is the most damaging due to emissions from long-distance transport (Rico et al., 2019). Therefore, it is where cuts must be concentrated, up to around 95% in the decade 2020-2030 (González Reyes et al., 2019). This is a major economic transformation for Catalonia, as 8 out of 10 tourists in Barcelona arrive by air (Observatori del Turisme a Barcelona, 2023b). On top of this more arrive at the port of Barcelona via cruise ship. Consequently, large infrastructures such as the port and the airport cannot continue to expand, and a planned reduction should be initiated within a short period of time (Zero Port, 2023).

The negative effects of the current model of tourism in Catalonia are reflected not only in its contribution to the ecological emergency and job insecurity, but also in its high water consumption. It is estimated that a tourist at a beach resort can consume 300 litres of water per day, more than double that of a resident. Swimming pools, landscaping, kitchens, laundries and other facilities are responsible for this consumption. In Barcelona, 12% of the city's water consumption goes into tourism (Montlleó et al., 2019). These figures are not sustainable in the short term, as has been observed in recent years, when high temperatures and reduced rainfall have extended water supply restrictions to the entire population. Even if it were to have been an episode of drought, global warming will make these conditions more frequent.

Moreover, construction associated with tourism is one of the main causes of environmental conflicts in Catalonia, mainly located on the coast (Riu, 2020). This

is the case of attempted urban development operations in the Empordà (Begur, Cadaqués) and on the Costa Brava (SOS Costa Brava, 2023).

On the other hand, the touristification of cities has resulted in an accelerated increase in housing prices, the commodification of public space and a shift towards commercial activities specialising in tourism. One of the greatest examples of the social impacts this generates is Barcelona, where there has been an expulsion of the low-income resident population towards an increasingly far away periphery.

In short, the sector must undergo a profound reconversion in two respects: first, the reduction of the tourist industry to adjust to the biophysical capacity of the territory where it takes place and, secondly, the restructuring of the sector to guarantee it does not destroy ecosystems or neighbourhoods, and that it favours decent working conditions for all those employed. International tourism, which has a greater environmental impact, should be prioritised in the reduction plan through measures that limit it considerably and that cannot be circumvented by those with greater purchasing power.

The reconversion of the most touristified areas requires the participation of the local population and trade unions, both to control the sector and to plan its transformation. The oversizing of the tourism industry has led to it exerting a great influence over large parts of the public administration, which is put at its service. This trend must be reversed and overcome by a process of truly collective control of the territory and its uses, at the service of the local population and the specificities of each territory.

One indicator could be the percentage of tourists in relation to the local population, ensuring that livelihoods are not distorted (e.g. with rising rents, cultural changes or high economic dependency). In the case of tourism in cities, priority should be given to the regulated sector, since the unregulated sector (especially through platform rentals) is generating very strong gentrification processes. On the other hand, with rural tourism, which tends to be less regulated and based on the rehabilitation of abandoned dwellings, the process may be the opposite. On the labour front, control and reform of the sector would address job distribution with a reduction in working hours and ensuring salaries allow people to make a decent living, particularly women, who are more precarious.

Productive diversification towards localised economies is fundamental to dismantle the tourism monoculture of some territories and to ensure the possibility of sustaining the needs of the population while reducing the socio-economic impact that the reduction of tourism may have (Meana Acevedo, 2016). The reconversion of the sector to adapt to biophysical limits requires travel to be limited to short distances and public transport. Thus, the tourism ranking should see local tourism in 1st place (within a few kilometres), 2nd regional tourism (tens of kilometres) and 3rd interregional tourism (hundreds of kilometres). Since the sustainability of the sector re-

quires hyper-mobility it is necessary to promote long stays and a diversified offer for visitors once they reach their destination, in order to reduce the number of different stops on a holiday, favouring fewer instead. Proximity tourism implies a transformation in the imaginaries and subjectivities that currently reward speed, elitism and social privilege (Fernández Miranda, 2011).

With regard to accommodation, the use of resources should be limited according to their availability in the territory, and to this end, low-end accommodation should be prioritised. Although more luxurious accommodation creates more employment and economic activity than less luxurious accommodation, its high environmental impact (higher energy and water consumption, greater waste generation) is not acceptable in a context of systemic crisis and is socially incompatible with a Degrowth project. Tourism should therefore be encouraged to move towards regulated, low-end establishments (hostels, lower-range hotels, campsites).

The social and solidarity economy could play an interesting role in the reconversion of tourism, but experiences are very limited in number. However, if the concept of tourism is understood as the need for leisure, relaxation, enjoyment, health and learning, initiatives outside of the logic of profit accumulation can more easily be considered (Izcara et al., 2023). This concept could be challenged through projects that question capitalist tourism and are based on opposing values.

Mining

Mining is one of the activities with the greatest impact on the environment and, therefore, on people. The production of potassium salts by ICC Iberpotash in the Bages region, with the social struggles, environmental degradation and public costs it has generated, is a representative case (Taula del Llobregat, 2023).

Mining extraction can be divided into four main subgroups: non-metallic mining (which includes construction, ornamental materials, and others such as salt or industrial minerals), metallic mining, quarry products (cement, limestone, sand-gravel, gypsum, marl) and fossil fuels. As can be seen in Table 4.4, non-metallic and quarry mining predominates in Catalonia, which are largely destined for construction. In addition, there is residual extraction of fossil fuels and none of metallic minerals. Potash and other industrial rocks are important in terms of value (MITERD, 2023).

Energy products	7,065,222
Metallic minerals	0
Non-metallic minerals	154,250,375
Quarry products	123,294,084

Table 4.4: Types of products extracted by the mining sector in Catalonia in 2020 and valuation in euro (Idescat, 2023i).

The mining sector is most significant in Barcelona, both in terms of employment and economic activity (table 4.5), but it is present throughout the territory (figure 4.5).

	Barcelona	**Girona**	**Lleida**	**Tarragona**	**Catalunya**
Employed population	1,911	508	371	642	3,432
Hours worked (thousands)	2,489	317	174	712	3,692
Electricity consumption (MWh)	255,484	17,792	2,451	17,871	293,598
Fuel and energy consumption (M€)	26,69	2,97	2,04	4,99	36,69
Production value (M€)	223,67	20,32	11,43	37,32	292,74

Table 4.5: Employed population, working hours, energy consumption and production value of the mining sector in Catalonia in 2020 (Idescat, 2023h).

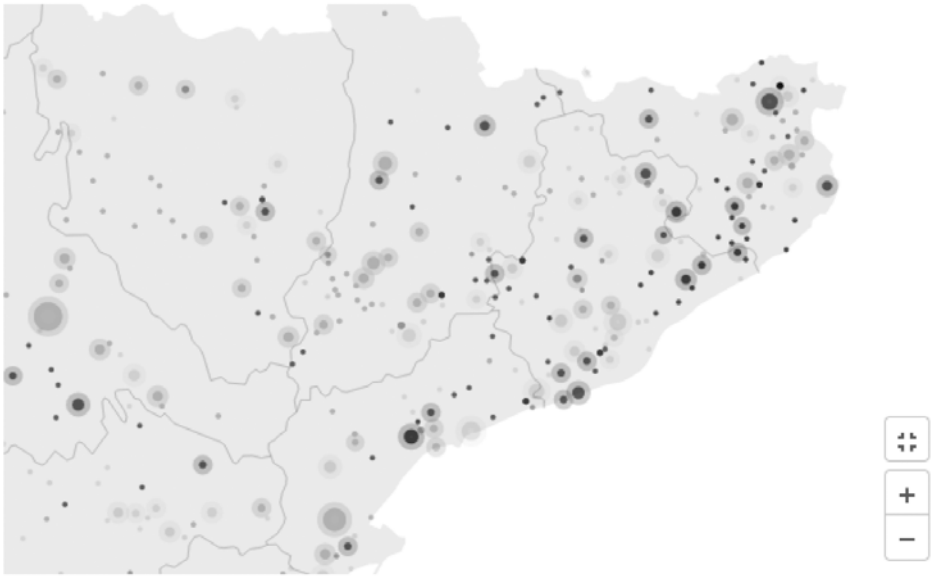

Figure 4.5.: Mining operations in Catalonia (Pérez, 2023).

This data should be understood in the context of the Catalan economy's metabolism, which is characterised by a structural material deficit, especially in fossil fuels and metallic minerals; a significant international trade of goods, which implies a weak economic autonomy; and a predominant reliance on non-renewable elements for its material consumption (minerals and fossil fuels).

In such a context, mining must undergo a process of drastic import reduction. This requires decreasing dependence on fossil fuels and shifting towards a kind of technology that is less centred around the use of metallic minerals and rare earths.

Furthermore, the extraction paradigm must be shifted towards forms of secondary mining, based on the recycling and reuse of minerals already used in previous production processes. To make this possible, it is essential for manufacturing to be oriented, right from its initial design, towards the incorporation of recycled materials, and to favour the separation and recovery of the original materials at the end of their useful life cycle. This is an important shift as it requires the manufacturing of equipment containing significant quantities of the different minerals in order to

favour their recycling, even if this results in a reduced functionality of these items, to name one example.

In Spain, Lallana et al. (2023) have analysed the requirements of different key metals for the development of electric mobility and hyper-technological renewables. The scenario with lower mineral demand includes different types of measures:

→ Measures to increase electrification using renewable energies:

- Increase in wind turbines: from 28 GW in 2020 to 90 GW in 2050.
- Increase in PV panels: from 12 GW in 2020 to 111 GW in 2050.
- Total substitution of combustion vehicles by electric vehicles by 2050.
- Increase in electricity infrastructure: growth needed to sustain the changes described above.

→ Measures for waste disposal, reuse and recycling:

- Second use for 25% of batteries.
- Extending the lifespan of photovoltaic panels and windmills: from 20 to 30 years.
- Extending the lifespan of electric vehicles from 10 to 16 years.
- No increase in battery size: keeping it to 55 kWh batteries.
- Accelerated increase (by 2030) in recycling rates of windmills, panels, batteries, cars and adjacent infrastructure: going from a 57-80% current collection rate (depending on technologies) to 80-90%.

→ Measures for degrowth:

- Decrease of the private car stock: from 25 to 9 million in 2050.

All of these are Degrowth policies, since it must be taken into consideration that the demand for minerals is notably greater in electric vehicles than in hyper-technological renewables. Therefore, despite the increase in mills and panels, the decrease in vehicles allows for a reduction in the total consumption of silver, cobalt, nickel, dysprosium and neodymium, while maintaining approximately stable (with a certain downward trend for most metals) the consumption of aluminium, gold, copper, lithium and manganese, whereas only palladium and platinum show a very strong growth. In addition, 67% of the cumulative demand for minerals could be covered by recycled materials up until 2050.

From a global justice perspective, the measures would allow Spain to consume between 51% and 39% of the "fair share" (0.6% of the world's reserves, the same percentage as Spain's global population) of lithium and nickel and more than 100% in the case of cobalt. These percentages do not take into account the demand com-

ing from other sectors of the economy, which in some cases represent the largest source of consumption. For example, in the case of copper, this transition scenario would consume 44% of the "fair share" of global reserves, but if the demand from the rest of the economy were to be included, this percentage would be considerably higher. This indicates that there are global justice conflicts concerning a higher amount of metals than is immediately apparent. Moreover, this is from an anthropocentric point of view and does not consider the impacts of this extraction on other living beings.

In conclusion, even with measures as ambitious as those planned, a reduced deployment of hyper-technological renewables and electric cars would be necessary in Spain. In the case of Catalonia, which has no active mines for any of these minerals, the adjustment would have to be greater.

Therefore, these measures are based on pairing reduction (of extraction and use) and recycling. Some more concrete actions to be applied in this sector are as follows:

→ Reduction of extractive mining activity in the territory. Impose a moratorium on underwater mining projects, ban open-cast mega-mining and limit open-cast mining to aggregate quarries only. Limit the concession of extractive activities exclusively to cases where it is demonstratively impossible to obtain the minerals from waste recycling and when there is a real social need for them (not associated with sustaining the industrial capitalist system).

→ Ensure that the planning and adoption of policies related to mineral raw materials and primary extraction projects involve the participation of potentially affected local communities (inside and outside Catalonia).

→ Formalise the rights of nature in the legal system, as a framework to prevent exploitation that threatens ecosystems. In the same vein expand land stewardship experiences by deepening citizen empowerment.

→ Exploration of techniques such as phytomining. Phytomineralisation or agromining is still under development. It uses accumulator plants to bioconcentrate high levels of metals in their shoots in order to remove them from the substrate, while obtaining the mineral for later use. The basic technique is simple, involving growing accumulator plants in metal-rich, industrially contaminated soils, harvesting the biomass, incinerating it and recovering the metals or salts.

→ Regeneration of ecosystems degraded by mining operations.

→ Modify product design, mandating by rule the elimination of planned obsolescence, facilitating repairs and guaranteeing replacement supplies and instructions. To achieve this, expanding the right-of-use model as opposed to private ownership is crucial.

- → Design should also focus on maximising the recycling process and mineral recovery. Increase mandatory collection and recycling rates, especially for products containing strategic minerals. Ensure the recovery of critical minerals, avoiding their disposal as slag in unsuitable recycling processes. Prioritise that the functional properties of recovered minerals are maintained in the recycling process.
- → Opt for the use of humble techniques (Almazán, 2023) that use abundant materials, even if they produce a lower yield, instead of critical minerals, whose scarcity or shortage could impede the production of the necessary products.
- → Create public companies and, above all, encourage non-commercial initiatives that promote the recycling of minerals beyond the capitalist criteria of profitability.

Digitisation

Since 2020, Catalonia has held fifth place in terms of digitisation in the European Union, behind Finland, Sweden, Denmark and the Netherlands. This assessment is made up of five areas of analysis: connectivity, human capital, internet services, technological and digital integration and digital public services. For each of them, in 2022 Catalonia climbed up in the ranking compared to the previous year (European Commission, 2022). On top of this is the fact that Barcelona is one of three cities in the world which hold the main events of the Mobile World Congress, an annual gathering of some 100,000 people organised by the GSMA. This business organisation is currently headed by the chairman of Telefónica and brings together more than 750 operators and more than 400 companies in the mobile telephony sector, i.e. it acts as a global manager for the sector. The Mobile World Congress is attended by manufacturers of mobile phones and of the infrastructure needed to sell their products (GSMA, 2023). Below are some of the facts that make this leadership position possible.

In the period 2022-2023, 33.6% of companies with at least 10 employees sold via e-commerce. In 2007, the figure was 15.9% (Idescat, 2023j). As can be seen in table 4.6, the degree of digitalisation is high.

	Companies of 10 people or more	**Companies with less than 10 people**
Computer	99.6	88.6
Internet connection	98.9	84.4
Use social media	68.6	31.1
Purchase of cloud computing services	41.8	12.4
Website	84.8	30.9
E-commerce shopping	45.2	24.4
They sell via e-commerce	33.6	14.6

Table 4.6: Digitalisation of companies in Catalonia in 2022 (Idescat, 2023j).

In the Catalan society, ICT use is very widespread, as shown by the fact that in 2022 85.6% of the population had a computer, 97.4% had access to the internet, 99.8% had a mobile phone, 96.8% had used the internet at some point (and 95.7% in the last three months), 77.5% had made electronic purchases (and 57.1% in the last three months). Moreover, all the figures are on the rise (Idescat, 2023k).

This is possible, among other factors, thanks to a significant broadband expansion across the territory, which even in the areas where connectivity is lowest it still is present in over 90% of households, as shown in Figure 4.6.

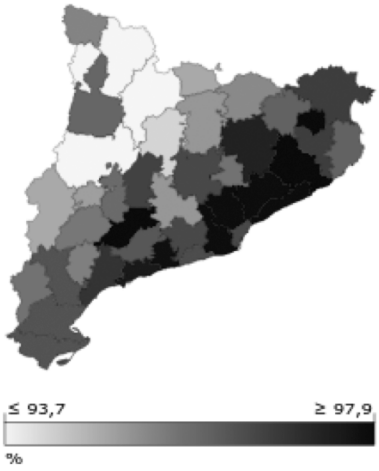

Figure 4.6: Households with broadband by counties in 2021 (Idescat, 2023l).

Turnover in the digital sector in Catalonia in 2021 was significant, led by ICT services (8.5 billion euros), wholesale trade of equipment (6.75 billion euros), telecommunications (4.2 billion), manufacture of electronic components and circuits (1 billion), data processing and web portals (850 million), and software publishing (500 million). The companies that provide the equipment and infrastructure are much further behind: repair of computers and communications equipment (200 million), manufacture of computers and telecommunications equipment (100 million) and manufacture of electronic products (50 million) (Idescat, 2023m), showing how little real sovereignty Catalonia has in this area.

Barcelona is also achieving growing preponderance as a telecommunications *hub.* This is explained by its geographical location, with high connectivity to the rest of the world via undersea cables, various 5G initiatives and a dense network of data centres in the capital (DatacenterDynamics, 2023; Gispert, 2023). Currently, there are 15 data centres in the city (Gispert, 2023), but this configuration is set to change, with major investment announced for the construction of data centres in Cerdanyola del Vallès in Parc de l'Alba (50 MW), Edged Energy in L'Hospitalet de Llobregat

(16 MW), Interxion in Sant Adrià de Besòs (15 MW), Edgeconnex in Viladecans (8 MW) and Adam in Cerdanyola del Vallès (4 MW). With these future data centres, it is estimated that the electricity capacity available in Barcelona will increase fivefold in the coming years, from the current 17 MW to 84 MW (Martín, 2022), although the sector is considering the possibility of even greater increases, reaching 124 MW in 2026 (DatacenterDynamics, 2023). The impact on employment will be moderate since, according to the sector, each data centre requires the work of some 50-60 people and the plan is not even to increase the net number of data centres, but rather to concentrate power in strategic centres by closing others (Gispert, 2023).

All this is not irrelevant from an environmental perspective. In order to analyse this impact, it will be necessary to look beyond the Catalan territory, as the internet only makes sense as part of a global dynamic. Data centres and submarine cables are the determining infrastructures (95% of intercontinental traffic runs through submarine cables) which enable the internet to exist.

Data centres are located in urban areas, close to the major places of consumption. These centres are oversized, since making sure the network is resilient means creating redundancies in the storing of information, which implies a constant growth in storage capacity, also spurred by the rise in consumption (Pansera et al., 2023).

The internet generates about 3.7% of global CO_2 emissions, with a 4% annual growth in its energy intensity (Freitag et al., 2021). Most of this consumption (45%) is in data centres, followed by communication networks (24%) (Belkhir and Elmeligi, 2018). This data does not include the internet of things, cryptocurrency mining, or the rise of artificial intelligence, which is highly energy demanding (Hao, 2019). All this infrastructure (electronic equipment, fibre optics, motherboards, etc.) is also manufactured with programmed obsolescence, which further increases energy and material consumption.

The impacts at the social level are no less important. First of all the internet traffic is controlled by large corporations, since Google, Facebook, Apple, Amazon, Microsoft and Netflix generate 57% of the world's traffic (Pansera et al., 2023). But they increasingly control not only the traffic, but also the infrastructure. In 2012, Amazon, Google, Meta and Microsoft owned only one long-distance submarine cable. By 2024, they will own more than 30. This number includes projects such as Google's Equian cable, which will connect the entire coast of West Africa, or Meta's 2Africa cable, which will encircle the entire continent and branch out to the Persian Gulf states, Pakistan and India, serving 3 billion people. Ownership of the cables allows companies to determine what data goes where and at what speed (Blum and Baraka, 2022). On top of this, the production of the components needed for this industry, starting with chips, is centralised in the hands of a few companies in a few places on the planet, such as Silicon Island (Taiwan) or Silicon Paddy (China).

Digital companies have made their way into more and more aspects of human life, encompassing and colonising previously unmarketised personal time and space. As Cembranos (2022) concludes, ever more functions are being performed through screens, for example: finding one's way around, shopping, making medical appointments, establishing relationships, maintaining relationships, entertaining oneself, valuing the world and oneself socially, training, consulting, organising, informing, reading, writing, drawing, planning holidays, building self-esteem, solving problems, looking at the clock, calculating, remembering, imitating, etc. Moreover, the screen accompanies people wherever they go and is designed to make them want to look at it more and more often (Peirano, 2019).

ICTs allow for and result in an extension of the working hours to encroach on the whole day and an unprecedented ability to control employees. At the same time, these technologies facilitate the existence of "collaborative platforms", which provide access to a weak labour force that is not unionised and therefore more easily exploitable.

Moreover, the internet is an unprecedented data mining tool. This data does not only concern tastes, travel, contacts, etc., but also payments through banking intermediaries (credit cards, telephones, etc.) which act as another control mechanism, since transactions that were previously anonymous now become known to financial centres and can be potentially blocked. Thanks to this data, for the first time in history, a few companies have a global ability to alter, maximise or silence issues in the public sphere.

In practice, the possibility to avoid using mobile phones is no longer there, as this implies desocialisation and withdrawal from state resources and the labour market. They have become a radical monopoly. Illich (2012) defines radical monopolies as things which start off as an option (such as using the car to go shopping) and end up being an obligation (due to the degradation of public transport and the distancing of centres of consumption). Reversing these monopolies is very complicated, because they are rooted in a whole physical infrastructure that has already been built, they have powerful economic interests behind them and construct a world-view that makes it difficult to contemplate alternatives.

Furthermore ICTs have the power to enable citizen control by the state (phone tapping, facial recognition cameras, face and fingerprint databases, camera networks, etc.). Not to mention the fact that the internet has enabled global financialised capitalism, another great engine of wealth and power concentration.

In conclusion, ICTs are not favouring a more eco-social world, but quite the opposite. That is why organising to oppose their spread and, above all, the radical monopolies they have created, must be a priority today. If we want to build autonomous livelihoods, we have to reverse the current situation in which it is increasingly difficult to

exercise rights and access services, in short, to sustain life, without the help of digital mediation.

It is also true that *low-tech* internet projects do exist and have proven to be feasible alternatives for small local communities in various parts of Europe and countries of the global South. They have demonstrated the technical feasibility of installing internet systems that rely solely on renewable energy sources and have a much lower energy intensity, which makes them more resilient to shortages. Moreover, their installation, maintenance (except for major equipment breakdowns), management and ownership of the infrastructure can be directly controlled by the users. This is the case for Guifi.es, which serves all kinds of individuals, companies, administrations and universities in the Catalan Pyrenees region, with more than 37,000 nodes having been installed.

The ease and accessibility of installation, low energy intensity, and relatively low capital and material costs go with the downside of navigation being quite frequently intermittent (due to the solar and wind energy sources that power them) and of the connection being limited to web pages hosted on local network servers, as well as the impossibility of connecting to the WWW (World Wide Web) without collaborating with state entities or telecommunications companies. Consequently, it can only be used by communities that only need minimum connection and communications capacity for local use, such as, for example, medical teleassistance where there are no health centres within walking distance, messaging networks for administrations and other municipal services (schools, libraries, fire brigades, social assistance, etc.).

However, as much as these models may be socially and energetically more desirable, they are strictly speaking not entirely compatible with a Degrowth horizon. Fundamentally, because it does not avoid depending on computers, and therefore on their manufacturers and impact. Hence, in order to reduce the resources we dispose of in line with criteria of justice, we have to think of ways to gradually de-digitalise, limiting the use of existing equipment for tasks such as archiving under community management. Thus, the exchange of information across longer distances would have to rely on a combination of courier road transport (letters, parcels), radio and cable telephone, either in public stations (such as telephone booths) or in private homes. All this implies a shift from the heavily individualised paradigm of today's digitisation to a more communal reorganisation.

5. Strategic Proposals

In this last section we will suggest some trade union strategies and lines of action to carry out the suggested transformations. But first, some clarifications are necessary.

The first is that there is no instruction manual for building just, autonomous, egalitarian and sustainable societies. Thus, what follows are not absolute certainties, but rather ideas which may inspire a collective debate that must never end, nor is this to say that this is what we should be devoting most of our time and energy to. This proposal is intended to contribute to the fermenting activity within which the diverse debates coming from many different social sectors and struggles can germinate.

The second aspect to be made clear is that this is not an exhaustive compilation of strategies to be pursued, it only collects a few of them. They should be complemented by other forms of action.

Ideas to consider when building strategies

Before going into a more practical argumentation of different strategic proposals for implementing eco-social trade union transformations, let us dwell on some general elements.

Holistic view

We are facing a world of multiple interconnected crises that cannot be solved in a unidimensional way, but rather must be addressed in a global way. Thus, any proposal for transformation must simultaneously address all of the vectors which generate social inequality and are responsible for the breakdown of life. We do not support a political proposal to pursue a smooth transition in privileged territories, such as Europe, at the cost of creating territories and populations of extraction and sacrifice and/or attempts to solve the climate crisis without considering the energy, material and ecosystemic crises. Let us not deceive ourselves, the *sine qua non* of the maximum expansion of hyper-technological renewables is an extractivist and colonial world order, the only one capable of maintaining a stable, cheap and abun-

dant supply of the kind of resources necessary for a high-tech economy, including a steady-state one, in the enriched territories. It will never be universalised to include places that are latecomers to the green and digital transition. These territories, because of their subordinate economic situation or because of a generalised increase in the price of raw materials (especially minerals), will be deprived of the possibility to launch a process of green modernisation (Almazán and Riechmann, 2021). This is why this proposal is radically unfair.

A political proposal committed to remaining open to development must combine the desirable and, at the same time, the feasible. The feasible collides with two limits: the physical-ecosystemic and the social limits. Of course, the latter is a much more malleable limit than the former and, for this reason, strategies must concentrate on modifying societies rather than ecosystems. Let's leave aside the prospects of relying on resources in the earth's crust (for example, for the development of electric vehicles) or on transition timelines which are increasingly unlikely to occur and which, in any case, the principle of precaution would force us to discard.

Faced with the lack of time: radicalism is the answer

The collapse of this system is already happening and is in its early stages (Fernández Durán and González Reyes, 2018; González Reyes and Almazán, 2023), as shown by the increasing difficulty to sustain the globalised production and consumption chains or the breakdown of the political framework which allowed for institutional stability in the West and, in general, in the world. But even if this change were not already underway, it would mean that we have time for a slow transition. If we want to make room for any chance of not exceeding the thresholds that trigger climate and ecosystem degradation processes, we have to act now, very drastically and very fast. For example, the reduction in global emissions by the end of the century must almost double that achieved during the collapse of the USSR. And not just in a specific territory and for a few years, but globally and until the end of the century, at least (UNEP, 2019).

Therefore, since there is no time to spare, we cannot implement a two-step transition: first the "easy" work and then the "hard" work. Some strands of the environmental movement commonly suggest that hyper-technological renewables are bridging technologies towards truly sustainable renewables, and make the process of change more socially and economically acceptable. But we no longer have two bullets. At best, we have one, and therefore we cannot afford to waste time, as well as material resources and energy, on technologies that will probably be obsolete in three decades' time. In doing so, not only will we build a very fragile and unstable

scenario, but alongside that we will have increased emissions in the short term as a consequence of the industrial reactivation that such deployment requires (Nieto et al., 2019); we will have consumed the material resources and fossil energy necessary for a transition suited to the set of the challenges we face; and we will have worsened socio-ecosystemic degradation, especially thanks to the mining boom that hyper-technological renewables require (Sonter et al., 2020). In short, if we are really serious about the fact that human beings are eco-dependent animals and that we cannot therefore continue to destroy the web of life, we need to recognise that we cannot have faith in this kind of two-step transition, but rather that we need to make a single-movement transformation: Degrowth. Doing the "hard" (and just) thing from the beginning: a reduction of global material and energy consumption, a transformation of the metabolism towards an agro-ecological and localised one, and a radical distribution of wealth.

In the same vein, another consequence of the fact that we are living through multiple emergencies is that, just like for any situation of emergency, we cannot make small incremental changes, because there is usually no time for them and because they are insignificant in such a context. At a time of emergency we push for radical changes. So we need to focus on policies which go to the root of the problems. Not because they will necessarily succeed (and probably not in the short term), but because they send the right message and demonstrate coherence. To make radical policies is not just to adopt a radical discourse. In fact, the most important thing is not necessarily discourse, which may even be counterproductive in some contexts, but rather what matters are radical practices which embody that discourse.

When we speak of radical policies we do not mean "storming the Winter Palace", but rather enacting changes, in many cases small, but which transform or at least aid the transformation of structural elements of the system. Radicality does not stand in contradiction with forcing the powers that be to implement epidermal changes in the policies that regulate the system. The radical view ensures that processes of change, which are necessarily tortuous, contradictory and unpredictable, do not lose their anti-capitalist north and focus their efforts on substantial transformations.

Inability to control and manage change

Another underlying fact is that we cannot construct a "programme" that will then unfold by comprehensively organising the course of events. Human beings have a limited capacity to understand complexity, which implies that our ability to control, and to direct, complex systems is even more limited (Meadows, 2022). Moreover, we are living through a historical moment characterised by non-linearity, which results in a succession of unpredictable exceptional phenomena (today a war in Ukraine and another in Palestine of geopolitical proportions, yesterday a supply crisis, the

day before yesterday a pandemic, tomorrow a food or migration crisis or a revolution...). The decline of a social order is a chaotic process in which small disturbances can produce big changes. At such a time, our means of controlling things diminish even further.

We will not experience a "new normal", but rather a constant exceptionality: a sequence of unforeseen phenomena with a strong capacity for socio-ecological transformation. But let's not only think of "negative" exceptionalities; there may also be "positive" ones. Therefore, it is strategically important to pay close attention to these phenomena and to have the capacity to act quickly in order to take advantage of the effects, using them as levers for a Degrowth transformation.

Going a little deeper, there are two types of exceptional events: those which we foresee, such as a particularly strong cold front on the Mediterranean coast, and those which we cannot even imagine, such as the 15M movement. In the case of the first, a policy of anticipation and a systematic application of the precautionary principle would be necessary. Faced with the second, the strategies are necessarily different. It is important not to attempt an exercise in anticipation, which is probably destined to fail, but rather to manage the consequences of these events.

Managing consequences requires working with a paradigm of improvisation rather than planning. Or, perhaps better said, of control. One of the central abilities for good improvisation is knowing where one is heading and identifying some milestones to be reached in order to get there. Another is the ability to recognise when policies represent dead ends. Therefore, our proposal should not be understood as a roadmap, which would be impossible to implement, but as a working guide. We have tried to provide guidelines, in many cases with a certain level of detail, which serve the purpose of outlining a general direction for the transformations that should be implemented on the basis of the Catalan economic reality.

Managing the consequences of unforeseen exceptional events also requires varied abilities and capacities as well as a degree of flexibility. These are two central elements in the strategies to be put in place. The state undoubtedly holds capacities in terms of laws, budgets and administration, but it lacks flexibility. It is too large a structure, too bureaucratised, anchored in inertia and dependent on the reproduction of capital. Thus, diminishing the state's capacities and placing them in the hands of smaller, more flexible community structures, may actually aid resilience.

Following the work of Taleb (2011), we can identify more strategies aimed at consequence management. One is to maximise the principle of redundancy. In the web of life, this is a basic tool for guaranteeing safety, which accompanies the interconnection of diversity. Redundancy is manifested in the multi-functionality (the non-specialisation) of people and organisations.

Another way of dealing with the exceptional circumstances is to prioritise the small, because the large and the complex are fragile (Kohr, 2018). It is true that the small

can also be fragile, but if it breaks down, its impacts will be limited. One example of how the largeness of our society results in its fragility is that of banks being "too big to fail". In a similar sense, when Meadows (2022) says that in order to work with complex systems we should place "responsibility in the system", he is largely referring to the need to avoid centralising decisions, getting different parts of the system to take responsibility for them instead, he is saying that power should be dispersed. In any case, this does not detract from the fact that, at least in the short term, institutions at the macro scale are also needed.

Our society is obsessed with innovation, but in times of severe hardship it may actually be much wiser to pursue the opposite. It is better to opt for things that have been working for a long time and are more likely to be optimised. For example, we have long-established agricultural techniques that allow people to feed themselves without degrading the environment, such as peasant farming, so efforts to develop new GM plants are not only unnecessary, but also dangerous (Ecologistas en Acción, 2022).

In any case, the fact that we cannot control complex systems does not mean that we cannot influence their evolution. To do so, we have to think systemically. That is, if systems are made up of feedback mechanisms, our measures will have to work in the same way: dynamic policies that change with the conditions of the system. For example, adopting the Gini index to tax the rich, so that as the measure for inequality in wealth distribution in a society decreases, wealth taxes decrease accordingly.

Triage time

Since we are living through a time of great instability, since we lack time and our capacity for control is limited, our strategic options will often have to adopt the logic of the lesser evil (González Reyes, 2020). We are in an era marked by triage, faced with the choice to accept the best among the bad options, as the ideal ones are no longer on the table. Of course, policy making is much more difficult in such times compared to moments in which optimal solutions are feasible. While in the latter case choices may be guided by wishful thinking, the former will inevitably be defined by fear. In the face of this fear, our responsibility is to transmit, and above all to build, hope and a desire for emancipation, because only another emotion and a yearning can help to overcome it.

Another implication of living in times of triage is that even though we do not consider neither the state nor capitalism to be options which can lead us to resilience and justice, at certain points we will have to devote a lot of energy to forcing state or market transformations which might make sense. Again, these may not be transformative options, they may not even lead to gradual change, but they are the lesser

of the two evils. Choices in a time of triage must be guided by two simple criteria: that they open the door (or at least do not close it) to emancipatory policies and that they do not worsen the socio-ecological situation.

Considering we have been following the same path for some time now, and taking into account the ultimate implications of our eco-dependency means that the priority must be to sustain ecosystem balances, because without the health and correct functioning of terrestrial, marine and freshwater ecosystems human life is unviable. To this end, at the very least, it is essential to not prolong the present ecocidal system in ways that may sustain it a little longer in time. One example of this would be the heavy expansion of hyper-technological renewables.

But we are not only eco-dependent, we are also interdependent. Therefore, the degradation of social ties is a very bad way of satisfying our needs. In actual fact, any emancipatory political project is based on a dense social fabric, which is all the more difficult to build the more it is broken. Or, to put it another way, we do not believe that the more social degradation there is, the closer we will be to mass rebellion ("the worse it gets, the better"), but rather the opposite: "the worse it gets, the worse it is".

Therefore, we do not propose to sacrifice the human side for the sake of nature. We do not propose that preserving the web of life can serve as a justification for expanding exclusion, poverty or inequality. We face a very difficult challenge, which is to try and guarantee good human lives that do not require as their condition of possibility a permanent ecosystemic degradation and subordination of other human lives, as is currently the case.

In other words, what we are suggesting is that we need to aspire to the good of the whole, of the system, rather than any of its individual parts. Not least because there is no salvation of the parts without the whole. Two basic priorities emerge from this: ecological healing, and recognising and strengthening interdependence in order to meet human needs universally. Everything else would be secondary. This "everything else" includes many things, such as the preservation of an anthropocentric and androcentric cultural heritage, raising wages in sectors such as the automotive industry, and so on and so forth.

The three major transformation actions

The strategies of emancipatory trade unions can be grouped into three main blocks:

→ Confronting socio-ecological degradation. For example, the trade union struggle against toxic substances in industrial and agricultural production, or for better working conditions.

→ Creating eco-social cultural frameworks. In this respect, the local "ateneos" (self-organised cultural centres), which have built a working-class culture which is able to confront the hegemonic one, would serve as an example.

→ Building ways to satisfy people's needs which are universalizable (fair) and resilient. From soup kitchens to cooperatives to forms of mutualism. In other words, what has been a central element of workers' activity for decades.

These strategies have been implemented in very different ways at different historical moments. What would they look like in the current context, what kind of actions make a Degrowth transformation viable?

A general observation to make - before diving into the details - is that in a complex and diverse society, the vectors of transformation have to be multiple, so it is necessary to employ all three of these strategies, by using a variety of tools for each of them. At the same time, this does not imply placing the same importance on all of them, as we will discuss. We believe that at this time the construction of communalisms is essential and must be the central goal.

Confronting socio-ecological degradation

The thrust of the strategic choice for confrontation is that, in a society built on relations of subjugation and different types of inequality, confronting the different structures of oppression and the interests of those who benefit from them is a part of social change that no emancipatory perspective can ignore.

The aim of confrontational processes is to change power relations by equalising, distributing or abolishing them. Confrontation can take different forms and be part of different strategies, which can feed into each other: violent/non-violent, legal/illegal/alegal, mass/individual, etc. Strategies which can be applied at micro, meso and macro levels.

Struggles against oppression and injustice have historically demonstrated a high capacity for social mobilisation. This is because indignation is an important activator of human action. It is also because it is the simplest (it does not require great skills in its most rudimentary forms) and best known (because it is the most widely practised) form of transformation, and is therefore the most effective way to bring together the largest number of people.

Short-circuiting capital

In our current context, the main agent of socio-ecological destruction is capitalism through the market and, to a lesser extent, the state. The former must therefore be the determining focus of our action. This action must involve hindering or blocking the means of reproduction of capital. Not in any random way, but through targeted actions which open up eco-social policies.

The production process, i.e. the workplace, is the multiplication site of capital. Taking action from an anti-capitalist perspective in this space can take many forms. For example, through trade union struggles whose focus is the appropriation of the means of production and their reconversion within eco-social parameters, or the reduction of the company's surplus value via a reduction in working hours without diminishing wages. Another example, in this sense, are the struggles that reduce

productivity across entire sectors[27]. This can be achieved in different ways, but largely it involves technical simplification, since machinery is the determining factor in the increase in productivity. A third example would be to reduce inter-capitalist competition through protectionist measures for the benefit of the population rather than local capital. A final form of action that can be taken is that of anti-extractivist struggles, which not only help global socio-ecological preservation by stopping further damage, but, in a context of decreasing material and energy availability, they also pull the brakes on the machines of capitalism. Or the struggles which halt urban development and large infrastructure operations to prevent the expansion of predatory sectors such as real estate, tourism, transport and energy.

Therefore, the eco-social transition necessarily requires strong trade union struggles. However, not just any labour struggle. For example, disputes that only seek wage increases, especially in sectors that already enjoy relatively good working conditions globally, do not represent significant progress in the current context.

A second space for the reproduction of capital is the appropriation by dispossession of the wealth generated outside of the market, but which then becomes integrated within it. If the key to Globalisation has been the expansion of capitalism in both territories and lives (encroaching into more aspects of our existence), resistance has to pass through a contraction of the global market and a decommodification of our lives.

As far as the decommodification of lives is concerned, we will explore that in the last section, which deals with communalisms. As for the world market, since sustaining massive global trade without abundant, cheap, good quality oil is impossible[28], many of the globalising policies we are currently resisting will become irrelevant. For example, free trade and investment agreements have been crucial policies in the second half of the twentieth century, but they will likely become less important as the twenty-first century progresses and the availability of fossil fuels begins to diminish markedly. Whereas in the last century anti-globalisation struggles, when dragged out, were more likely to end in defeat, in the 21st century protracting these "20th century" struggles may be a good strategy, as it would mean swimming along with the tide.

A third sphere for the reproduction of capital is the exploitation of nature's "labour" (Naredo, 2006; Moore, 2020), and its conversion into capital. Here again, anti-extractivist struggles must be placed at the forefront of our strategy. However, this re-

27 It is important to tackle the whole sector, otherwise it will lead to the closure of one company alone, which does not transform anything structurally.

28 Global trade may continue to exist, but it will be neither as massive, nor as fast, nor as distant, which will make the economy more localised and dilute the influence of global commodity flows on local economies.

sistance should not only be deployed in the territories where extraction takes place, it should also be directed at the technologies, companies and institutions, and/or the capital which enable such extraction. This opens up fields of action which relate to the many resistance struggles against current forms of colonial exploitation, constituting a hybrid resistance made up of struggles at the peripheries and at the centre. Some examples are the harassment (media, legal, income, etc.) of multinationals, campaigns which denounce the financing of extractivist projects by investment banks and private banks, or struggles for the abolition of odious and illegitimate debt used as a lever to force extractivist policies in the peripheries.

The rise of fascism

Strategies to curb new forms of fascism or authoritarianism will involve making them ineffective by building cultural frameworks and by securing eco-social needs - some examples of these will be addressed below below - but also by employing firewalls on the streets and within institutions.

How do we defend ourselves against fascism and, not only that, how do we do it without building new forms of authoritarianism, as for example the USSR did? First of all, in a polarised framework we have everything to lose. Firstly, because those who tend to have the most power are those who hold the highest positions in the hierarchy and therefore enjoy military, media, political and economic power. But even if this was not the case, the logic of polarisation is that of violent confrontation, the law of the strongest. It is not that of feminist emancipation and therefore not that of eco-social emancipation. Striving for the destruction of the enemy can only lead to a hierarchical order, no matter who wins (Ormazábal, 2009).

The logic of encounter, even with our fascist neighbours, does not imply allowing for aggression[29]. Nor does it mean renouncing conflict. It means having a sustained strategy for the de-escalation of tension, in which we protect ourselves. Responding to violence by decreasing the degree of violence. One implication of this is that defending oneself and attacking are not the same thing. The EZLN's action (Zapatista Army of National Liberation) is relevant here. Moreover, in the face of aggression, it is also possible to flee, call for help or resist peacefully. Another option would be to change the framework, for example to move to another part of the territory, if possible, or to take the conflict to a different level.

29 The category of aggression can be very broad: a verbal insult launched from the rostrum of the Parliament, organised physical violence in the street, police repression, a fake news campaign on social networks, etc. Each requires a different type of response that goes beyond the scope of this report.

A second strategy to defend ourselves against fascism is to build broad fronts within institutions and society. Not just broad fronts, but active broad fronts. The majority of the population will probably not embrace fascism, but they may be sufficiently complacent with it for it to hold a lot of power. We have to avoid this. But these fronts will inevitably be very heterogeneous. To be precise, they include the actors who have laid the foundations for the rise of fascism. The most significant example of this is social-liberalism, represented by the PSOE, but which stretches much further than the PSOE itself and has a wide reach within society.

Can we weave such alliances while avoiding nurturing the foundations of fascism? Probably not, at least not entirely, but this is one of the cases where we will have to opt for the lesser of the two evils. We will have to manage these alliances well enough for them to be able to politically, culturally and economically support eco-social proposals. Keeping one eye on fascism and the other, constantly, on building alternatives. Or, to put it another way, the construction of broad fronts does not mean the construction of homogeneous fronts, and diluting the radical perspective on the change which has to happen, but rather a coexistence, necessarily conflictive and tense, with diversity. Knowing how to find each other in that which unites us, without denying and confronting what separates us.

A final point to acknowledge is that the rise of fascism is slowed down by changing the contexts which favour its growth. Beyond constructing ways to satisfy social needs, which is key and will be discussed below, there is more we can do. Processes of resistance have their ebbs and flows. To simplify, we could say that there are two types of peak moments, when strong mobilisations occur: those that have political objectives and those that lack organised responses to aggressions. An example of the latter are the outbursts of hatred in working-class neighbourhoods expressed in the destruction of the infrastructure of these same districts and attacks on their own people. Outbursts of hatred that do not focus on political objectives can be the perfect breeding ground, in turbulent times such as these, to socially justify the need for reactionary authoritarian measures. Thus, in heated moments of social mobilisation we should ensure that resistance has clear eco-social political aims and confronts fascism, rather than serving as an excuse for its growth.

However, these heated moments which we are going to see will in many cases be outbursts of hatred, or struggles that bring together a broad social eclecticism, including fascist or proto-fascist sectors, with an equally heterogeneous and even contradictory political agenda. An example of the latter was the French “yellow vest” movement. How do we act in such situations? It is something that will necessarily have to be taken case by case, because the circumstances will be different every time, but in general terms we believe that we will have to tend towards gaining more support and participation.

In the case of outbursts of hatred, participation is difficult for those who are not part of the leading groups, which in many cases fall heavily along identity lines (racial-

isation, ties to a poor neighbourhood, etc.). It will have to involve empathy and of promoting this empathy among the rest of society, generating channels of communication in which to express proposals, while at the same time being open to receiving visions, which in many cases will be loaded with criticisms towards our approaches. Moreover, in these outbursts there are usually entities that mediate or serve as spokespersons, such as churches. Could trade unions with a presence in the neighbourhood, such as tenants' unions, play this role, thus helping to defend and politicise vulnerable people?

Interacting with the second type of revolts, those that are more eclectic in terms of their social composition, does allow us to actively participate in them more easily. This kind of participation shows that we are among those who struggle (without leaving behind our socio-ecological foundations) and suffer. A kind of participation which is accompanied by the will to make this movement something transformative in eco-social terms. The latter does not mean embedding ourselves in movements in order to focus our efforts on the working groups dedicated to the political demands, but rather it involves loyal and organic participation in the set of tasks that make it possible to sustain the mobilisation. Working side by side and, from there, engaging in dialogue, which is an act of communication and, at the same time, of listening.

Articulating eco-social cultural frameworks

It is clear that social change requires new cultural frameworks. Or in a broader sense, new imaginaries. Changing them requires affecting the area of desires, techniques and institutions. As historical studies show, such as Thompson's (2012) on the working class, changing social imaginaries means setting in motion a transformation of civilisational scale.

Moreover, the revolution is not achieved on a glorious day, but in the lead-up. It requires the elaboration and expansion of a new definition of what is important, what is the priority, what is possible, what is valid, which is set not only by ideas, but lays in the whole of sensitive experience and in the constitution of our material world (Fernández-Savater, 2020). This includes values, perceptions of the world, feelings of belonging, or the information that defines and constructs a particular view of reality.

Exploiting shocks

Any major cultural transformation, if it relies solely on internal dynamics and strength, will be slow and will span over generations. However, we do not only rely on internal forces (which are indeed limited). All the awareness-raising work that different social movements have attempted to carry out is happening all at once in the heat of ongoing socio-environmental transformations, such as, for example, the intensifying effects of climate change. This process is likely to increase. We need to be able to swim with the current to take advantage of the *shocks* that are occurring and will occur. This is what can allow us to make qualitative leaps in a short period of time, taking into account the tremendous plasticity of human beings. Collectively understanding that we are living through a civilisational emergency is decisive in order to focus all human capacities on the preservation of life and not on the reproduction of capital. When we do reckon with this state of emergency, societies are capable of taking difficult and arduous paths.

To give an example, during the 2020 lockdown due to COVID-19, a broad social consensus was reached relatively easily and quickly on several strong ideas closely related to the Degrowth imaginary that only a couple of months before seemed totally inconceivable: i) People's health can be placed above the reproduction of capital. ii)

The services that we understood essential, except for military and police services, are very similar to those proposed by Degrowth. iii) We experienced how our happiness does not depend on consumption, but on having quality relationships with our loved ones.

Moreover, in complicated scenarios such as those that are on the way, dignified survival will require the creation of communities of mutual support. In such contexts, it becomes easier to learn, with interactions increasing and with the social environment giving meaning to learning. This too catalyses change.

However, this strategy faces multiple difficulties. The first is that the cultural learning acquired in moments of *shock* often wanes when social inertia is restored, even if only partially. On the one hand, because this inertia is strong and, on the other, because it is associated with exceptional moments, not with those perceived as "normal". Therefore, we need to strengthen them, and one line of work would be to reinforce the emancipatory social learning that takes place during the different *shocks*. The awareness-raising work which is usually done beforehand would instead occur afterwards.

The second challenge is that the political right too is using *shocks* in order to design and impose its project of social order. To do so, they use their control of institutions, the economy and the media. Above we referred to the emancipatory imaginaries that opened up during the 2020 lockdown. Undoubtedly, this was not the only thing that happened. For example, ideas of social control by the state were also reinforced. Though contradictory, the right-wing upholded the idea of "freedom". What it actually meant was the freedom to exercise the privileges enjoyed by people in the upper echelons of global society. Taking over the banner of freedom is not just any old thing, for it is a basic human need and an engine of powerful social change. It is not something we can afford to lose.

A third challenge linked to harnessing *shocks* for emancipatory transformation is that when they are sudden they tend to catalyse mutually supportive social processes (Solnit, 2009). However, in actual fact, the collapse of this social order is not occurring in the form of a grand destruction. It is a slow process in terms of life (lasting decades) which will see many *shocks* and, at the same time, will experience gradual and irregular processes of degradation of the existing order. In such a scenario, the spontaneous growth of mutual support is more complicated and, in contrast, the anti-social logic of every man for himself gains ground. In view of this, we propose taking advantage of *shocks* to strengthen mutual support and try to preserve it through the processes of degradation of the sluggish current order.

Another factor that makes sudden *shocks* give rise to mutually supportive relationships is that in them hierarchies are diluted, the established order is broken, and people gain power over their lives. There no longer exists an entity which can save us, and so we collectively set out to save ourselves. Again, this is not to be expected

in gradual processes, in which elites would play their trump cards to maintain hierarchies. That is why the commitment to disperse power in the organisations and socio-economic projects that we defend and promote is a decisive strategic choice, because this is what reproduces the conditions which foster mutual support and individual responsibility. In other words, it involves a decisive commitment on the part of trade unions to the construction of cooperative models within the solidarity, feminist and ecological economy, and to the project of building autonomy. This is not something that is alien to the history of the labour movement, it is one of its hallmarks.

Changing habits

When it comes to how we construct our cultural parameters, in recent years the importance of controlling the media has gained prominence on the left. In contrast, we argue that what contributes most to our current cultural system is not the macro narratives (important though they are), but our everyday lives, starting with wage labour, the central axis around which an important part of the satisfaction of our needs orbits.

Practices are determining. We do not act as we think, but rather we think as we act. We adapt our values to fit what makes our daily-life practices gratifying, so as not to experience strong cognitive dissonance. In other words, if competitiveness and individualism are rewarded in our jobs (and they are rewarded because it is the way in which jobs are preserved), the majority of the population adopts these values to a greater or lesser extent. Moreover, attitudes are strongest when they are the result of personal experience (Fazio and Zana, 1981). Thus, the dispute at the cultural level is largely a dispute at the level of social practices: the practices we promote are more important than the discourses we project. This has a lot to do with the construction of ways to satisfy our needs and their capacity to be adopted by social majorities. Furthermore, individual changes are determinant for collective changes (which does not mean that they are sufficient), among other things because they empower us in our lives (González Reyes, 2021).

The importance of focusing on practices also lies in the fact that, from a communicative perspective, relating to each other through practices rather than discourses dilutes the barriers we put up in front of ideologies that are not our own. This also addresses the common issue of a greater fear of the policies addressing collapse than of the collapse itself (when it is perceived as distant and indefinite) (Heras and Meira, 2016).

For all these reasons, the commitment to athenaeums (cultural associations), social centres and the like is a determining factor in the processes of change.

Building communalisms

Of the three strategies of social movements (confronting power, articulating cultural frameworks and building alternatives) we believe that in the current context the third is the one on which we should focus our efforts. In the previous sections, we have already unpacked arguments that show how decisive the construction of alternatives to capitalism and industrial metabolism is. But beyond those, there are at least three more reasons which make this strategy important.

The first is that some of the possible future scenarios are frightening and we need to fear them, as they can damage us to extreme extents. However, while that fear is important, we must be able to confront it with mechanisms that help us feel secure so that we can perform at our best as societies and not embrace false lifelines for salvation, such as neo-fascism or green capitalism. In this way, the development of eco-social policies involves generating security. There are different elements that can contribute to this task, but a decisive and probably irreplaceable one is to build resilient means to satisfy our needs.

A second reason to focus efforts on building alternatives is that it is very costly and difficult. Of the three broad strategic lines (confront, educate, create) it is the most complicated. It requires a very wide range of skills and a lot of collective life energy.

Finally, while confrontational and cultural strategies widen the field of possibilities for change through force and persuasion respectively, it is creative strategies which actually populate that field. Without functioning alternatives, not ideas but realities, just, democratic and sustainable worlds are simply impossible. For example, social struggle can force a state to draft a transformative green economy law. On a cultural level, it can generate conscious people who create demand for this economy. But it is creative strategies which build the cooperative fabric capable of responding to this window of opportunity and this new consumer sensibility.

We therefore set out some ideas on how to build communalisms.

Abandoning capitalism

Our political proposal is articulated around the transition from "market" societies to societies "with markets" and/or "with regulated markets". In other words, the market should only be an attribute, not the centre, of the economy. This requires the creation of economic and social autonomy.

Some of the factors that build such autonomy are:

- → Ecological sustainability: closing material cycles by reducing the need for external inputs, use of local renewable energy and materials, incorporation into the ecosystemic metabolism by supporting the economy within it, etc.
- → Low specialisation or, in other words, varied economic activity.
- → "Basic allotments", which allow for an autonomous food supply.
- → Frugality and sufficiency.
- → Weaving of mutual support networks with other production and financing units.
- → Sufficient size, perhaps a few hundred people.

In order to articulate societies "with markets" and/or "with regulated markets", economic units (companies, although they would no longer be called that) must produce not for the purpose of sale, but for the purpose of use. They would sell their surplus on the market, not produce for the market. Only in this way can the market become a fair cooperation mechanism. Important markets must be regulated via collectively generated rules and regulations that respond to the basic (and felt) needs of the population. A fair economy understands that not all human needs are met equally: some products and services are subject to a more deregulated market (clothing), others to one that is more controlled in order to ensure universal access (food) and others that are simply left outside of the market (education).

In the area of transit, we need to decommodify social relations, just like the labour movement has done historically by succeeding in (partially) taking public services out of the market and allowing for wages to be (partly) separated from the market through collective bargaining. For example, a community garden which is productive for self-consumption would also have these characteristics. So would a house under right-of-use or an energy community.

Replacing capitalist money with social currencies and demonetisation are also a defining element of a non-capitalist economy. This is work which has to be done in parallel to the rest.

Finally, we need to move from wage employment to real and socially necessary work. To do this, more and more activities would have to be removed from the market, in a process of *desalarising* the population. This would require unifying production and reproduction into the same entity. One model for this could be the integration of childcare management into the normal working of cooperatives, for example by placing shared parenting spaces in workplaces.

Putting communalism into action

Where do we start? Communalisms can either arise with this identity from the beginning or they can establish themselves as so along the way. For example, projects with a welfare focus (such as a soup kitchen) can be the basis upon which they may be constructed. Some aspects which give these projects potential are: i) They are based on needs perceived by people. ii) They show the limitations of the State and the market in satisfying these needs and, in contrast, they make social articulations and their importance visible. iii) They are based on practice, which is more powerful than reflection as an agent for education. iv) They demonstrate collective power; that things can be done. (v) They focus on needs and not on employment, thus displacing the social centrality of the latter.

For this type of initiative to be truly emancipatory, at least two elements are necessary. One is for the users to become actors. In other words, these projects must evolve in the direction of self-organising. The other is that they must move from redistribution (of food in this case) to real production (of food). In other words, they must build social autonomy.

Secondly, although the construction of these eco-social need-satisfaction tools must have a totalising ambition, we are still far from this being possible. The process is not black and white, but rather a gradual scale in which progress can be made through social autonomy. A more realistic path is that of recovering spaces necessary for life. First of all the simplest ones, such as food, and then other more complex ones, such as housing, but always allowing for different itineraries for people. These can be seen as sectoral initiatives with points of intersection and synergy.

The idea would be to create hybrid spaces. For example, productive urban gardens open to all residents or ecological school canteens in poor neighbourhoods. The idea is not to build productive units with defined boundaries, but rather units that intersect with one another, so that one person can take part in several at the same time, thus increasing their autonomy.

Communal self-management is very costly in terms of time and effort on the part of those who carry it out, which is why we must ensure enough energy is dedicated to guaranteeing its sustainability. To this end, a central idea is that the construction of communalisms must be a place for fostering joy and a sense of belonging, as this is what allows us to endure long and complex processes. Community work (when well managed) gives rise to the joy and satisfaction of being part of a collective project. However, apart from allowing these feelings to arise spontaneously, it is necessary to take care of them. It is not only necessary to leave space for festivities and celebrations, but also to actively promote them (Hernández, 2022). A good dose of active hope is also necessary. That is to say, hope rooted in action, not naïve hope with

no basis. This requires placing importance on the progress made, and sharing our successes among each other.

In a context of emergency and lack of time, it is also crucial to swiftly set in motion the necessary leaps of scale and replicability. This is something that collective self-organisation processes are capable of doing, but which can be carried out more quickly via the catalytic effect (funding, regulations, policies) of state institutions. But we need to pay attention to differentiate between the roles of the different actors. In the best case scenario, the state could act as a catalyst for change, it could be forced to guarantee resources and frameworks, but it cannot drive it. Moreover, at a certain point, conflict with the state will be inevitable (González Reyes and Almazán, 2023).

The state is a space of contestation on the macro scales where it is already playing a role. For example, we can build primary and preventive health care systems with increasing degrees of communal self-organisation, without this being at odds with demanding the maintenance and social control of public health care, especially for its most complex areas, such as hospital care. In this dispute, the legal extension of the commons is a determining factor.

Finally, undertaking change requires that our close community considers it necessary, because the construction of meaning and desire are collective endeavours. This construction is very complex, but a perceived sense of usefulness and feasibility are decisive. From this perspective, let us start with those community projects that respond to felt needs and that can bear fruit relatively quickly. It is very important that we are able to see the benefits in our lives by satisfying our needs and generating emotions that reinforce their meaning, such as joy, belonging and hope.

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