Changing paradigm:
Thinking crises and their solutions 'outside of the box'

Second Part: Thinking outside the box - A solution to cut GHG emissions while reducing inequalities

If man cares about his survival as a species, he will have to learn how to free himself from the major paradigms that have been guiding him since the Age of Enlightenment
(Bruno Latour, 1947-2022)

1. Reminder

In the First part [read], it was shown that the systemic crises faced by the world are complex and intertwined, and that they are the result of very diverse social, economic, political, cultural, physical and biological processes that occur in an uncertain world. Besides, there is a growing fear that lack of aggressive and appropriate action could mean that these crises may threaten the perpetuation of humanity.

This situation raises the issue of what humanity is ready to modify in its way of life to last, crises becoming reasons for it to mobilize and engage in necessary and far-reaching changes [read]

The First part also took stock of the fact that mainstream economic thinking, simplistic and loaded with ideology and arbitrariness as it is, is unable to put forward credible, effective and fair solutions to these complex crises.

Using the example of the climate crisis, it was seen that, as often, it was thinking in terms of the economic value given to the elements involved, expressed in a price that can be "understood" by the market. This price is generally estimated through debatable methods that boil down the multidimensional complexity of reality into one dimension that is deliberately assumed to concentrate all available information in one figure for summarizing it. The reductionism resulting from this approach is appalling and occurs in a world where amazing amounts of data describing reality are being generated every day at a sharply increasing speed and where more and more sophisticated tools exist to analyse them [read].

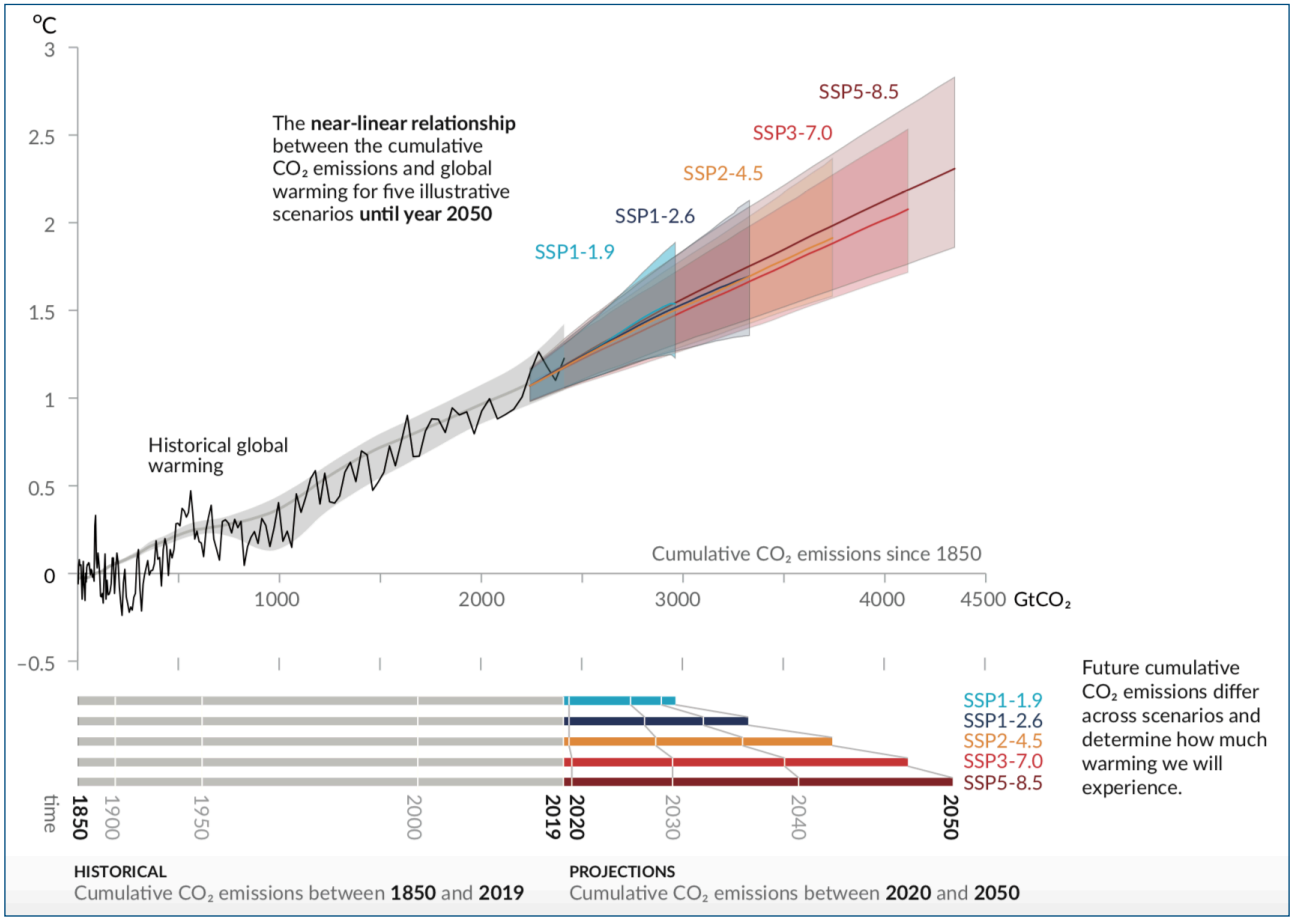
The conclusion of this first part was that there is an absolute need to find other solutions that are both effective and just (fair). This implied to think outside the box of mainstream economics and its simplistic framework, even if it meant being attacked by those that dominate it and will want to protect their turf.

The objective of the second part is to move forward in this necessary undertaking and come up with a proposal more likely to contribute to a solution in the case of climate crisis.

2. Consequences of the non-negotiability of physical and biological processes: eh global carbon budget

The sixth IPCC report [read] takes stock of the latest scientific knowledge on climate and clearly claims that "Each 1000 $GtCO_2$ of cumulative CO_2 emissions[1] is assessed to likely cause a 0.27 °C to 0.63 °C increase in global surface temperature with a best estimate of 0.45 °C" [read p. 28]. In other words, this means that, whatever future technological development will be, any net emission of 1000 Gt CO_2 will cause a rise in global surface temperature by 0.45 °C (Fig.1).

Fig.1 Every tonne of CO_2 emitted adds to global warming



Source: IPCC, 2021.

The consequence of Fig,1 is that it is possible to estimate the maximum quantity of greenhouse gas (GHG) emissions allowed if the global temperature increase is to remain below a certain level. This is the available **carbon budget**.

Between 1850 and 2019, a total of 2,390 ± 240 Gt CO_2 of human origin was emitted, bringing about a rise of average temperature by 0.8 °C to 1.3 °C. Table 1 shows the quantities of future emissions corresponding to three levels of temperature increase (carbon budgets).

[1] Or of its equivalent from other GHGs, computed on the basis of the warming power of these other gases [read pp. 4-6]. For more details [read chapter 7].

Table 1: Carbon budget for 3 levels of global temperature increase

Approximate global warming relative to 1850–1900 until temperature limit (°C)	Additional global warming relative to 2010–2019 until temperature limit (°C)	Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$)		
		Likelihood of limiting global warming to temperature limit		
		17 %	50 %	83 %
1.5	0.43	900	500	300
1.7	0.63	1450	850	550
2.0	0.93	2300	1350	900

Source: based on IPCC, 2021.

The last line of the above table corresponds to the minimum commitment made during the Paris COP21 to hold "the increase in the global average temperature to well below 2° C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels" [read] coincides roughly with scenario SSP1-1.9 on Fig.1.

The level of 2 °C is the result of a negotiation. It determines the temperature not to be exceeded. It is, however, not negotiable, as it depends on physical processes that cannot be modified. It corresponds to the limitation of future cumulated anthropogenic GHG emissions to **900 Gt CO_2**, considering our current scientific knowledge and at constant natural emissions[2], and whatever future technological development will be (including technologies for carbon capture and storage as they are only means to limit emissions but do not have any impact on the physical processes involved in global warming).

The continuation of the past trend growth rate of emissions over the period 1990-2019 (+2.26% per year on average) would consume this carbon budget as early as in 2035, knowing that current GHG emissions are around 50 Gt/year.

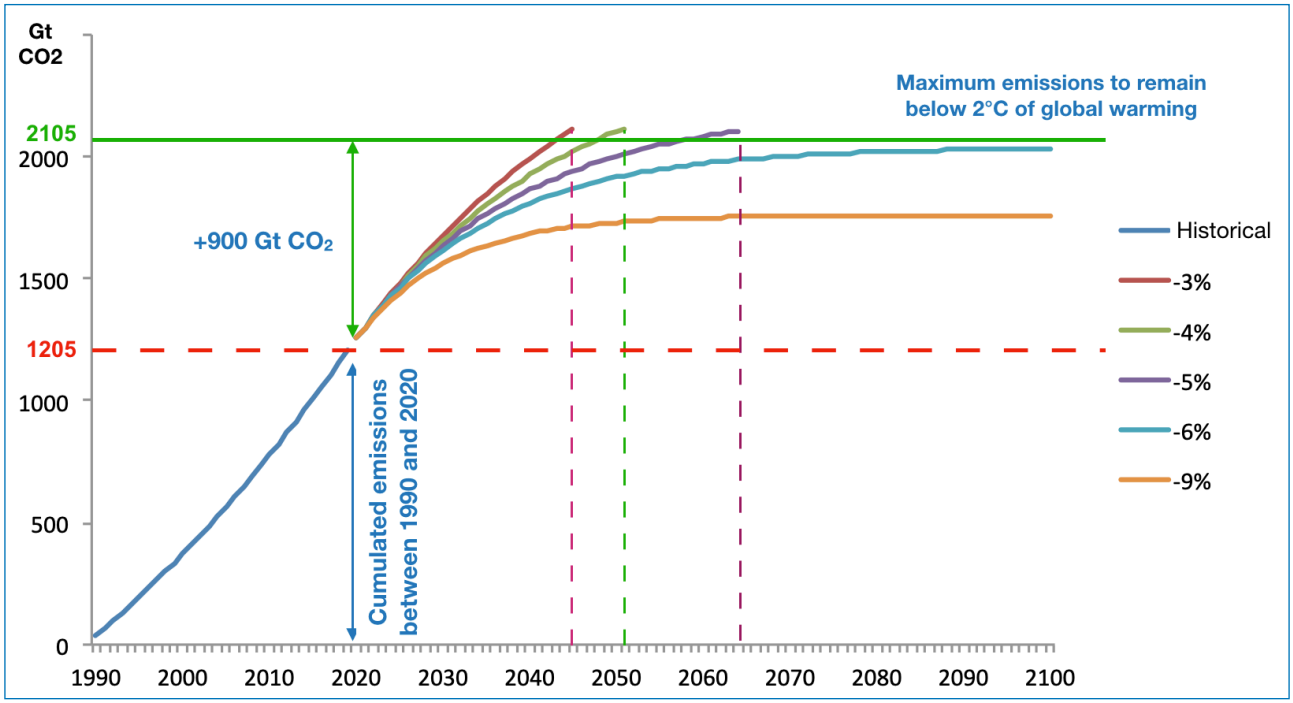
Fig,2 shows that, should it become possible to reverse the trend and bring down GHG emissions, this carbon budget would be eaten up respectively by 2045, 2051 and 2064, if the amount of GHGs emitted were to decrease by 3%, 4% and 5%. It is only if the emissions are cut by more than 6% per annum, that the cumulated anthropogenic CO_2 emitted would stabilize below the critical threshold of about 2105 Gt CO_2 allowing to limit the average global temperature increase to 2 °C above pre-industrial levels.

Thus, it is easy to understand how urgent it is to turn around this trend. The later this will be done - or the more slowly this will be achieved - the higher the rate of decrease of GHG emissions will have to be, in order to respect the carbon budget that will help avoid disastrous scenarios shown on Fig.1 and that have already been described shortly elsewhere on hungerexplained.org [read p. 4].

The goal to remain within a carbon budget of 900 Gt (and thus decrease the emissions of GHGs by more than 6% per year) is clearly a **physical objective** that must be achieved to keep global warming below 2 °C above pre-industrial levels.

[2] Natural emissions vary, however, particularly depending on changes in meteorological conditions and their period of presence in the atmosphère may evolve according to circumstances [read].

Fig.2 Historical CO_2 emissions and their projections into the future



3. Disaggregating the global carbon budget into national carbon budgets: enforcing a change of behaviour

At COP21 and during the following months and years, signatory countries of the Paris Agreement worked out their commitments that, in most cases, took the shape of Nationally determined contributions (NDCs) in which 164 out of the 191 signatory countries (covering 93% of emitted GHGs) specified the efforts they intend to undertake for reducing their emissions and adapt to climate change. These contributions are supposed to be updated every five years.

In 2021, the Framework Convention on Climate Change (FCCC) of the United Nations evaluated these commitments as insufficient for preventing an increase of GHG emissions by 4.5% in 2025 compared to 2019, and 5% in 2030 compared to the same year [read], which, according to scientists, would put the world on track for a temperature rise by 2.7 °C [read].

Most frequent approaches adopted by countries involves taking measures in priority areas such as energy, transport, land use, construction, but also agriculture, waste management and industry, the full package being supported by activities aiming at strengthening capacities [read].

This implies that for the population of these countries, the visibility of the emission reduction objectives will remain limited, as what they will experience in everyday life will be the measures decided by government that are often perceived as constraints and obstacles to freedom. This gives a negative image to the combat against climate change. From this point of view, the carbon tax has become quite emblematic, and now even more the price of energy that surged following the invasion of Ukraine by Russia and sanctions taken against the invader.

In case efforts were made to associate people to the definition of measures to combat climate change, as was the case with the Citizen Convention for the Climate in France, they produced a long list of measures of which most were never enacted, in particular because they would not have been welcome by the population as they included many bans, obligations and taxes [read].

Instead of imposing solutions that are often pet measures of those who propose them (travel by train, bicycle or scooter rather than by air or private automobile, eat vegan instead of meat, reduce the heating and wear turtle necked jumpers and sweaters rather than overheating offices and homes, etc.), it would be preferable, to heighten chances that the needed change of behaviour will take place and be accepted, to leave everyone free to make a well-informed choice of his or her preferred solutions.

It is possible to adopt an **alternative approach** that consists in changing people's behaviour while preserving for all their freedom to choose what to modify in everyday life, as long as the overall objective is achieved. It is an approach that **makes citizens really responsible** by starting to **translate in everyone's life** what the big global GHG emission reduction objectives mean in concrete terms, while given them the **freedom of choice** on what each and everyone will do to contribute responsibly to the efforts made by all.

4. The proposal

4.1. Computing household GHG emissions

What already exists

There are an increasing number of websites, firms and specialized bodies that offer to help you to compute your GHG emissions [read]. In France, most are geared to businesses, as it has become compulsory by law for companies with more than 500 employees, local authorities with more than 50,000 inhabitants, public organizations and government offices to carry out this computation every 3 or 4 years (depending on the type of entity), since 2010.

While businesses are supposed to make this estimate (in France, in 2018, 40% were doing it, compared to 35% in 2017) and use it to improve their performance and communicate with their potential clients, it is not clear whether these computations and their results - that are public - are checked, analysed and exploited in any way at national level [read in French].

There are also a number of websites where it is possible to estimate the emissions of a household [read]. In general, the user is asked a series of questions on travel, consumption (food, clothes, housing, energy, appliances, water, leisure, etc.), waste management and others, and the software uses the answers to make an estimate of the GHGs emitted.

In some cases, useful indications are given for comparing various types of behaviour or goods from the point of view of the GHG emissions that are associated to them [read in English and in French].

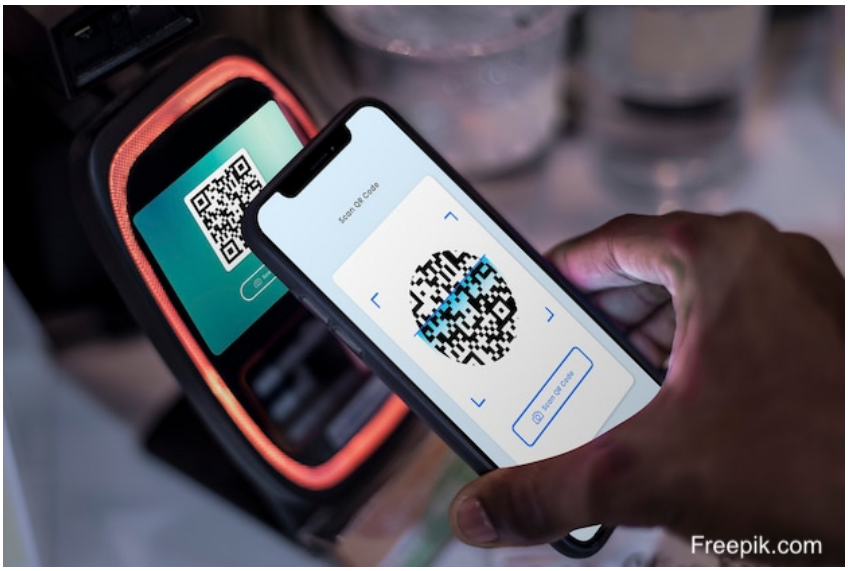
The main weakness of what exists is that estimates are made on the basis of what the user declares.

For private individuals who make these estimates voluntarily, it takes time and some effort. This limits the number of households who are ready to do this task to the most motivated among them. The data used only gives a partial description of reality. They are probably not very precise and not so reliable. This diminishes the usefulness of this effort and the level of confidentiality of both the raw data collected and the results obtained remains unclear. However, this activity may be of use for the household to get an idea of its GHG emissions and, possibly, to modify the behaviour of its members.

As it is now, this arrangement does not appear to be so useful to monitor GHG emissions at national level or to conduct serious policy analysis and formulation work.

What could be done

A growing share of expenditures incurred by households is made through cashless payments using credit cards, telephone, facial recognition, cheques, transfers, etc., particularly in rich countries and China.[3] Moreover a large number of governments implement policies and programmes aiming at reducing cash spending and encouraging cashless payments. This will increase the importance of the latter.



Some countries are even considering a cashless economy which is supposed to have a lot of advantages [read]. In Africa, for example, telephone payments are strongly promoted in rural areas of some countries [read].

These cashless payments leave digital traces in the financial organizations used by the buyer and the seller. In addition, in many cases, the detail of what is purchased (the nature of the good, the quantity purchased) is recorded by shops that have information on the origin of the food (as product tracing develops more and more). This makes it feasible, in an increasing number of cases, to know what technology was employed and the associated GHGs emissions (indirect GHGs) [read pp. 5-6].

[3] In the US, the proportion of cash payments dropped from 31% to 26% between 2016 and 2019 [read]. In Europe, this trend accelerated since the beginning of the pandemic [read]. In Russia, cashless payments were multiplied by 7 between 2012 and 2019 to reach a value greater than total consumption. They are extremely high in China, but remain low in most middle- and low-income countries, particularly in India where they weigh only around 10% of total consumption. Among rich countries, Japan is an exception with only 20% of payments being cashless [read].

In a growing number of countries, these data are already available but disseminated in different locations. Interconnecting these data would allow to build a mass of information from which it will be possible, with the help of artificial intelligence, to estimate GHGs emitted by a particular household. Imperfect at first, this estimate will improve with time, as cashless payments develop and cover an increasing share of purchases, and as the tracing of goods and the estimate of GHGs emissions associated to each product get better. On this last point, efforts will be required to enhance the generation of reliable data making the distinction among goods according to the technology used to produce them and their geographical origin.[4]

4.2. A GHG account to level inequality

Principle and implementation

By using the system for computing household GHG emissions functions, a GHG account can be created for the household[5], following the model of a bank account, where all the household GHG emissions will be recorded real time by category of activity, so as to inform its members.[6] They will include both direct and indirect emissions (see Box).

Opposite to the emissions that are captured in debit of the account as and when the household consumes, there will be an initial credit that corresponds to the maximum GHG emissions the household is supposed to generate, as well as entries to account for possible GHG fixation activities (e.g. planting of trees).

Emissions will be debited real time from the objective, so that each household will know at any time if he is on an emission trajectory that is compatible with its objective.

The objective of the household - the initial credit in the GHG account - makes the link with the national GHG emissions objective from which it is derived. The computation method is relatively simple and follows the principles below:

- for the first year, the total of the household objectives is equal to their total emissions during the preceding year, multiplied by the rate of decreased fixed for the country, in conformity with commitments made;

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[4] Connected devices recording various data are expected to reach 75 billion by 2025 [read], while the data volume produced every year in the world is projected to be multiplied more than 5-fold between 2018 and 2025 [read].

[5] An alternative could be to create an account by **taxpayer**, which could facilitate the operationalization of this tool.

[6] The creation of a GHG account for households amounts to create a new way to measure value, some kind of a numeraire for which it becomes possible to manage an account, to debit and credit it and assess the balance. This proposal can be placed somewhat in the line of suggestions made earlier by scientists and ecologists to establish an energy value theory that is not determined by social preferences but grounded in physical reality [read]. In this particular case, by taking GES emissions as a unit of account, the scope is broadened beyond energy, in the strict sense, to include other sources of GHGs.

- the household GHG accounts are classified in several categories on the basis of their emissions during the previous year;[7]
- each category is given a rate of variation of its emissions for the current year. It will correspond to an increase for the categories emitting less and to a more rapid decrease for those emitting more, the rates being determined so that the aggregate objective for all households coincides with the rate of decrease fixed for total national emissions (see a fictitious example in Table 2).[8]

Table 2 Fictitious example of a scaled reduction of household GHG emission objectives

Household category	Definition relative to the national emission average	Rate of variation of GHG emissions applied
1	less than 50% of the average	10 %
2	between 50% and 80% of the average	0 %
3	between 80% and 120% of the average	-6 %
4	between 120% and 150% of the average	-15 %
5	greater than 150% of the average	-25 %

A similar GHG account can be designed for businesses, local authorities, public organizations and government offices, but their use raises more complex issues than for households, as these organizations are much more heterogeneous.[9]

Informing and enhancing the capacity of GHG account holders

The creation of GHG accounts will have to be supported by an information and capacity development programme for their holders, households as well as others.

This will require clear explanations of the function and mode of operation of the account, as well as the provision of information to guide holders in their choices on the way to reduce their GHG emissions. Indeed, rather than banning or imposing activities, norms or taxes, as is usually the case - although in a generally soft and ineffective manner - (which gives arguments to those who talk about punitive ecology), the GHG account must be a tool that leaves freedom to holders on how they intend to cut their emissions: is it by changing their travel means or by reducing their leisure travel? Is it by changing their diet, lowering the level of heating or air conditioning? Is it by insulating their home? Is it by increasing the life cycle of their clothes and of their domestic appliances, etc.?

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[7] For this, emissions will have to be adjusted to account for the household size, so as to make them comparable and avoid penalizing systematically larger households.

[8] A fairer system, but more complex and less transparent, would be to compute a specific rate of variation of the objective of individual household as a function of its level of emissions compared to the national average.

[9] An account designed on the same model could also help to better manage our impact on water resources.

Information provided should simultaneously offer options to reduce GHG emissions[10] - this is essential for holders not to feel cornered and obliged to make changes that are unacceptable for them, when alternatives exist - and give estimates of GHG emissions saved by a possible change so that holders may estimate the impact this would have on their GHG account.[11]

This material could be proposed as brochures, online documents or through information and training workshops. In this way, instead of being ruled, passive and "pedagogized" individuals, citizens will become responsible and active in the combat for the climate.

Box: Direct and indirect GHG emissions

The GHG emissions recorded in the GHG account comprise both direct and indirect emissions.

Direct emissions consist in those generated by the account holder while consuming specific products (firewood, gas, heating oil, fuel for automobiles, etc.).

Indirect emissions consist in those emissions that were necessary to produce and deliver the goods that the account holder uses (vehicle, various appliances, food, clothing, etc.).

In the case of durable goods purchased by the account holder, GHGs included will be distributed over the product lifetime by applying the depreciation technique used in financial accounting.

Indirect GHGs are often overlooked when the combat against climate change is discussed by political leaders. For example, during his television interview on 26 October 2022, while promoting electrical vehicles, President Macron forgot to say that the decrease of direct GHG emissions resulting from replacing conventional by electrical cars does not make the latter clean vehicles. Indeed, their production causes GHG emissions that are actually higher than for conventional cars. The Greenly website estimates that an electrical urban car emits the emissions 12.3 tonnes of CO_2 eq. during its lifetime, of which 10.2 tonnes for its manufacturing and 2.1 tonnes for its use, this latter amount varying depending on the way electricity is produced. This is, of course, much less than the 33.2 tonnes emitted by an equivalent conventional urban car [read in French]. This is confirmed by CIRAIG, a Canadian expert centre, that estimates that during its lifetime, "After accounting for 300,000 km of travel, electric vehicles have 55% to 80% less impacts than conventional vehicles" [read]. However, they also have other types of ecological impacts, in particular the intensive use of some natural resources (rare earth elements), generate the problem of battery recycling and that of the development of civil nuclear power with its dangers (as illustrated by the Fukushima tragedy and recent event in Ukraine), the nuclear waste that it generates, the impact it has on the environment (e.g. the warming of river water used to cool down reactors) and the illusion of independence it creates [read in French].

Remark: due to the way they are constructed, it is not possible to aggregate the GHG accounts of households and businesses to obtain a national emissions account, as there would be double counting of emissions. Indeed, GHG emitted by businesses during the production and delivery of goods consumed by households are also accounted as indirect emissions in household accounts (e.g. GHGs emitted by farmers during the production of the food consumed by the household or during the manufacturing of the telephone or the vehicle used by the household).

[10] Lack of alternatives was certainly one of the main reasons why the "Yellow jackets" movement started in France, end 2019.

[11] In the near future, an impact simulator of changes envisaged could be built in the GHG account.

Support to the GHG account holders

The use of financial instruments, criticized when they were believed to be a panacea in the First part of this work, may, however, prove useful and even crucial in some cases.

Indeed, insulation of homes, purchase of new “cleaner” means of transport as well as other changes of behaviour aiming at reducing GHG emissions, may call for investments that could be inaccessible for low-income households. Subsidized loans, combined, if necessary with subsidies, may prove indispensable.

A sizeable programme of financial support to households will be required to facilitate taking decisions going into the right direction.

What happens if a GHG account runs a deficit?

For the proposed system to be effective, capacity strengthening and incentives/support are not sufficient. There is also a need for measures in case the account runs a deficit, i.e. when the GHG emissions credit has been exceeded.

In the system as it is designed, a situation of excess GHGs will most frequently occur for households found in the richest categories who emit more than the average amount of GHGs emissions and who have to reduce them [read].

A financial measure could therefore be used in this case, inspired on what has been done for a decade with water in some municipalities, a distinction being made between essential water, useful water and convenience (luxury) water [read and listen in French]. A tax could be levied by tonne of GHG emitted beyond the credit provided at the beginning of the year, the amount charged varying with the size of the excess emission.

In the case of France, considering that the average emission per person was 11.5 tonnes in 2018 [read in French], a particular amount could be envisaged if the excess is below 3 tonnes/household member, and a much larger amount (double? triple?) for each tone beyond this threshold. These figures are only provided here to illustrate the instruments, but this will require a more careful and in-depth analysis on the basis of the results of the first year of use of the GHG account. The money thus collected would be reinjected into the programme of combat against climate change, particularly in support of the poorest households. Other types of penalization could also be designed.

For the year that follows the year when there has been an excess emission, the objective assigned to the household would be computed by applying the rate of reduction to the objective of the year of the overshooting, and not on the basis of the actual emissions.

The same principle works in the case of a household with GHG emissions lower than the objective of a year.

4.3. Advantages and disadvantages of the proposed system (discussion)

The proposed system has advantages and disadvantages of which it is important to be aware from the start to be in a position to take necessary action to maximize the former

and reduce the latter as much as possible. Some arguments “for” and “against” are briefly discussed below.

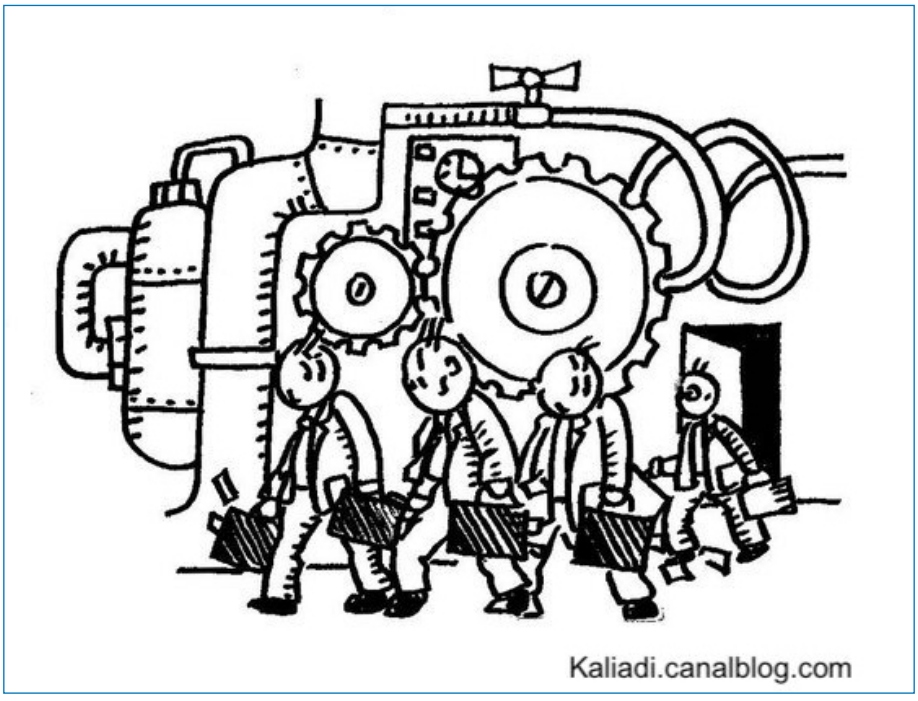
Arguments “for”

Most of them have already been mentioned earlier:

- The system leaves a precious area of freedom and responsibility for deciding to the population. It is only the objectives that are fixed every year, science-based and reflecting each country’s commitments. Most of the choices to be made on how each household will achieve them is done, in full responsibility, by the households themselves who are informed and trained on the way to reduce GHG emissions.
- The effort to combat climate change is distributed among countries according to their commitments. At country level, the more a household emits GHGs, the more it will be encouraged to cut them. Combatting climate change will therefore have an inequality-reducing effect, contrarily to the conventional financial solutions [see First part]
- The technology needed for creating and managing the GHG account is available. It is now necessary to translate it into easily usable tools by the population. It should be possible to test it in most OECD countries and in a few others, including China, where the required conditions are in place (importance of the share of cashless payments made in total consumption, strong development of digital tools, in particular product tracing, and availability of databases on GES emissions).

Arguments “against”

- “This is another labyrinthine system!” The system will be criticized for being too complex and demanding data that are not necessarily collected or available as they belong to private businesses. There are many examples of such projects that never led to any results (see for instance the Aramis project, in France here and here, in French). Moreover, there is a risk of excluding part of the population who does not have access to Internet and does not own the equipment required for checking their GHG account. It is not applicable in a large number of middle- and low-income countries.



Discussion
If the choice is between a simple, unequal and ineffective solution (carbon price - see First part), inaction and a relatively more complex solution that reduces inequality, is effective and help to stop fossil-fuel dependency, is there really room for hesitation?

Evidently, there will be a need to draw lessons from other complex projects that failed: avoid opacity and excessive sophistication; well inform the population to get their commitment (explain and refrain from being "pedagogic", as that would mean that the people are regarded with contempt as infantile); test through pilots while avoiding, however, to wait too long before applying it on a full scale as time is a constraint as shown on Fig.2.

A likely exclusion will essentially hit the poorest groups of population who will in their quasi totality part of categories that will not have to reduce their GHGs. They could be supplied with simple devices and connections for them to check their account, on the model of what was done to develop payments by phone in poor countries.

As regards data availability, the data exist already in great part and it is more a matter of having access to it and process it in order to build the accounts. There will, however, be the need to strengthen the legal framework so that businesses provide access to them, and so that all the protection required will be ensured to preserve their confidentiality and non-use for purposes other than that of the system.

- The proposed system is dangerous and intrusive, as it centralizes massive household data in the hands of authorities. This is a potential threat to freedom. It will never be accepted by the population of most countries as it will be considered to pave the way to an Orwellian kind of totalitarianism [read]. There are good reasons to fear authoritarian actions such as the control from a distance of the use of electrical devices[12] and, with time, an evolution towards an "ecological dictatorship".

Discussion
It is paradoxical not to agree to give access to the authorities of existing data for a good purpose, while they are voluntarily handed over through cookies, in particular, to big private digital firms that have been using them freely for their commercial activities[13].

It is obvious that centralization and use of data for constructing and maintaining GHG accounts must respect privacy and has to be implemented under the control of an independent body and along clear rules. The details of individual accounts must be accessible only by their holders and to the independent body, following what is being done for a bank account. This is far from the Orwellian "Big Brother".

[12] Recently, there was a rumour in France fearing that the Linky electric metre could be used for controlling from a distance electricity consumption by households during this coming winter.

[13] It is only recently (2018) that the General Data Protection Regulation (GDPR) offer a framework for the use of data in Europe. Similar initiatives exist or are planned in other countries (such as, for example, the CLOUD Act of 2018 in the US).

The proposed approach is less a threat to freedom than a set of compulsory rules, bans and taxes defining or orienting citizens' behaviour in the context of the combat against climate change and of the energy transition, as it leaves freedom to the household to decide how they prefer to manage their GHG emissions for achieving the objective they have been assigned, and choose which alternatives they want to adopt. Fulfilling the objective is the only obligation for the account holder. Controlling energy consumption from a distance is in total contradiction with the approach of responsibility proposed.

Inaction or ineffective action, if it continues, might actually lead to the establishment of a really freedom-restricting political regime that could evolve into an "ecological dictatorship" when the crisis will become difficult to manage. It is precisely to avoid such a shift that is totally contradictory to the principle guiding it, that this system is proposed here.

- The system will probably never have all the data required to make a really good estimate of the GHGs emitted by a household. At best, it will cover 70% to 80% of GHG emissions and will therefore not offer an accurate picture of reality.

  Discussion.
  It is indeed true that, even after several years of operation of the system, it will not provide a perfectly exhaustive picture of the situation. However, the proposed tool will be a considerable improvement, compared to what exists now. Succeeding in managing properly the 3/4 of emissions by giving the responsibility to the people will already be a remarkable achievement in the combat against climate change. A proper investment in data collection and analysis will further improve the system.

- The tools required for the operation of the proposed systems are not yet available.

  Discussion.
  True. But the decision to put this system into operation will have to be followed by a considerable effort to develop these tools (establishment of the accounts, GHG estimates, computation of emission objectives, etc.), and the needed information and support material for guiding decisions by account holders (including, for example, tools to simulate the impact of certain changes in behaviour).

- People will never accept this system that many will fail to understand. This will just add another constraint to those people already have to face!

  Discussion.
  It is indeed a risk, but it is important to remember that for a sizeable part of the population, this will change nothing to the everyday life, as it emits less than the national average and will therefore not have to reduce their GHG emissions. In fact, it will be in a position to benefit from subsidies and subsidized credit to improve their housing or purchase more energetically efficient devices.

  On the contrary, the approach will almost only affect the most favoured population groups who are also those who are responsible for most GHG emissions. Rightly so! They are the ones who will have to reduce their emissions in line with the legal framework that will be established. Those who will not respect it, will be charged penalties defined by law (see p. 10).

The system will also help to resolve the absurd and counterproductive opposition between “end of the month” and “end of the world”. It will do that the energy transition, supposed to be regressive by nature, according to Gollier (see First part), because of the share of energy in the budget, will become progressive.

For the system to be well accepted by the majority of the population, it will be indispensable to organize an intense information and explanation campaign.

Let’s not forget that the alternatives are, either a severe climate crisis, or a solution that will impose more expensive energy and the obligation to abide by rules without any possibility of choice. For the richest, the preference is obvious as they can pay without any consequences for them, but for the modest households, this will be impossible and it would mean unbearable restrictions.

- It is useless to launch the system in a few countries only, as it will not solve the climate crisis. Without international agreements and coordination, this will only lead to spending large amounts of money that could be used for a better purpose, and it will put those countries who adopt it in difficulty, as they will be less competitive.

Discussion.
It would indeed be preferable if the systems were adopted everywhere. It is quite improbable, however, and there will always be countries that will not use it but who will benefit from its impact in terms of climate change mitigation.

Its adoption by OECD countries, China and India, who represented in 2019 respectively 28%, 24% and 7% of global GHG emissions, would have a huge impact on the climate, much more than the ineffective measures currently applied, that have been unable to reduce GHG emissions that are still continuing to increase.

Using this system would have considerable consequences on consumption in countries that adopt it. Changes in consumption would also impact production, producers being encouraged to make goods the production of which creates less GHG emissions (and is les energy consuming), if they want to keep their customers. With time, these businesses will be better equipped and will acquire a competitive advantage on those who, in countries who do not adopt the system, will have made no effort to improve their technology. In adopting countries, on the contrary, faced with consumers who select goods that have generated less GHG emissions and having to achieve their own reduction objectives, private firms will adapt more quickly than what is generally believed. Just see what is happening now[14].

In fact, this will even occur in those countries that have not taken up the system, simply because their businesses will adjust in order to be able to continue to sell to OCDE countries, China and India who are the main centres of consumption in the world. Efforts made in those countries that accelerate their climatic transition will therefore most probably have positive consequences in the rest of the world.

- Will implementing the proposed system not automatically create a recession, cause inflation and a decrease in living standard in those countries that will adopt it?

Discussion.
Rather than a recession, the implementation of the proposed system will trigger an in-depth transformation of the economy. Because of the modification of the structure of consumption (and possibly a reduction of its total volume) and of the improvement of the energy efficiency of production, a reorientation of the economy will occur that, for some time at least - during the most profound changes -, could have a negative impact on growth. But this is not absolutely sure.

There is no particular reason why the envisaged solution should generate inflation. Rather, as investments improve the energy efficiency of the economy and create new sources of energy, the price of energy could be pushed down which, in turn, would have a dampening effect on other prices.

It is not evident that the proposed solution would cause a reduced average standard of living. Rather, it will certainly diminish inequality, and this should improve the standard of living of the poorest households, while lower it for the richest, as they will be the ones who will be called to make the greatest effort leading to the transformation of the economy.

- Experience shows that, despite repeated warnings by scientists and the UN, political leaders do not have the will to act decisively against climate change and the world is on track towards a catastrophic warming of almost 3 °C of the average global temperature, while most people continue to live as usual. There is therefore little chance that the GHG accounts proposed here will ever exist. How can we create the conditions for a real awareness and decisive action to resolve the crises that threaten us?

[14] It is interesting to note that with the surging gas prices, businesses have reacted in an extraordinarily quick way. Some have already decreased substantially their gas consumption (up to 50% in some cases) by changing source of energy or diminishing/abandoning some of their activities. (Élie Cohen, economist, during “C dans l’air”, programme of the French television channel France 5 - 6/10/2022.)

Discussion.
This is the several billion dollars question and a formidable challenge to take up! Many still nurture the desperate hope to continue living as in the past, and they like to bury their head in the sand, refusing to see reality. This would be a disastrous attitude. Scientific data gathered by the IPCC and everyday experience of heat, fires, droughts and their associated tragedies are proofs that action is needed now.

Varied movements, particularly by youth, have not yet succeeded in generating everybody's commitment to attack the root of the problem and solve the web of crises that threaten humankind. Political leaders limit themselves to referring to the problem, often hiding cynically some of its most disturbing implications.

Only a greater mobilization can create conditions leading to a real political [read] and citizen's will to act with a good chance of success.

5. To conclude

Humanity is confronted with complex and intertwined crises that threaten its perpetuation in acceptable conditions. The climate crisis is one for which the main mechanism is known since Arrhenuis' work in the late 19th century [read]. It is, however, only with the IPCC's publications and the multiplication of extreme meteorological events that some declarations were made on the need to try and mitigate climate change and adapt to the new conditions it creates.

Orthodox economists operating in the framework of mainstream economics have made proposals that consisted in giving a price to anthropogenic carbon. This solution, unbearable for the poorest, is painless for the richest and it has had no real impact on GHG emissions that continue to increase, directing humankind towards a situation where global heating with so intense that it will make living conditions more and more difficult.

There is therefore a need to escape from the straightjacket of mainstream economics to explore new possibilities, outside the box, so as to take into consideration parameters of the physical and biological reality [read]. This is the objective of the article presented here, and of the proposal it puts forward. It should also help transform ruled and passive "pedagogized" individuals into informed, responsible and motivated citizens active in the combat against climate change. This solution is certainly not a panacea, but its implementation would create the commitment of the whole population to combat against climate change. It would only lead to results if it can lean on a set of support measures for action and adherence by all.

The ecological emergency is already on, and it is characterized by several intertwined dimensions (climate, natural resources - biodiversity, water, land, forests -, energy, food, and health), exacerbated by social, economic and geopolitical crises, while our political leaders tear themselves to threads on issues such as migrations, public finance, the number of needed civil servants, etc., like the bishops of the Council of Nicaea in the 8th century debating on the sex of angels as the Ottomans were at the gates of the city!

The time has come to take decisive action. For the proposal made here to become fully operational, there will be a need to mobilize intellectual, technical, political and financial resources, without further delay, because, as shown on Fig.2, time is pressing. Its

application will not be easy, but difficulties met are nothing compared to those that a continuation of sluggish action would generate. New ideas might be frightening, but very much less than disaster resulting from inaction. It is only if everyone does get involved that the right balance of power can be created so that appropriate action is taken.

It would, however, be an error to believe that the climate crisis will be solved while other systemic crises continue. The intricacy of the crises makes that the isolated resolution of the climate crises is an illusion. They must all be tackled simultaneously by a package of tools and measures. For this, new solutions will have to be imagined and implemented that will be found if there is no hesitation to think outside the box.

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(November 2022)

To know more:

- USEPA, Household Carbon Footprint Calculator, US Environmental Protection Agency, (online).
- IPCC, Summary for Policymakers. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA,2022.
- IPCC, Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press, 2021.
- Kartha, S., Kemp-Benedict, E., Ghosh, E., Nazareth, A. et Gore, T.. The Carbon Inequality Era: An assessment of the global distribution of consumption emissions among individuals from 1990 to 2015 and beyond. Joint Research Report. Stockholm Environment Institute et Oxfam International, 2020 (en anglais).
- Paris Agreement, 2015.

Selection of past articles on hungerexplained.org related to the topic:

- Changing paradigm: Thinking global crises and their solutions ‘outside the box’ - First part: When dealing with complex and intertwined crises, mainstream economic solutions prove ineffective and generate more inequalities The case of the climate crisis, 2022.
- Private economic power in food systems and its new forms, 2022.
- Climate is changing,… food and agriculture too, 2021
- The digital revolution in food and agriculture - Exciting promises, mixed results and risky bet, 2021.
- Income inequality impacts on the level of greenhouse gas emissions and on vulnerability to the consequences of climate change, 2020.
- Opinions: Condemned to utopia ? Climate and democracy: changing our paradigm to preserve the climate and our future by Materne Maetz, 2020.
- Opinions: Back to reality - Reflections around the COVID-19 crisis by Materne Maetz, 2020.

- Life plagued by human madness: we must change our paradigms, objectives and values, 2019.