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Household work and energy consumption: a degrowth perspective. Catalonia's case study

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ABSTRACT

The present work contributes to bringing visibility to the part of social work that is referred to as unpaid work. This part of social work remains outside the market, but it is necessary to structure and maintain households, human relationships and communities and providing sustenance and care. It represents a flow of hidden subsidies to the economy mostly shaped, structured and experienced by women. Through an explorative case study in Catalonia, we relate the use of time in Catalan society with the relative consumption of energy. This research strategy allows us to see the dangers of substituting labour and skills from household-based production to the commodity-based economy in terms of an increase in energy demand in a context of the end of cheap oil. On the contrary, from a degrowth perspective we argue that the future adaptability might require policies reallocating resources towards the unpaid and the community.

1. Introduction

The report from the Commission for the Measurement of Economic Performance and Social Progress[1] drafted several recommendations, one of which was the need to "broaden income measures to non-market activities" (Stiglitz et al., 2009). This recommendation shows that even mainstream economists are beginning to place importance on non-market work done by households. Feminist scholars however highlight that unpaid work "still remain[s] unrecognized, undervalued and undercounted" (Antonopoulous and Hirway, 2010). The eco-feminist critique of economic thought is still valid: mainstream economics does not take into account the dependency and interdependency of life, i.e. the link connecting the social and natural world outside the market (McMahon, 1997; Jochimsen and Knobloch, 1997). Goods and services produced by the household and the natural world remain external and unaccounted for, and this generates a representation of society in which the embedded-ness and embodied-ness of humanity is hidden (O'Hara, 1997; Mellor, 1997). For decades, feminist scholars have shown that on the contrary unpaid work has importance for the whole economic system (Perkins, 1997; Picchio, 2003; Carrasco, 2003). Indeed, women's resistance and their struggle against their role to be reproducers[2] of labour-power have represented a major issue of feminist activists and scholars (Dalla Costa, 1995). Hence, analysis of unpaid work and its essential role in social reproduction[3] cannot disregard one of the main goals of feminists, i.e. to give visibility to unpaid work in the economic, social and political realms.

As a consequence, the first objective of this paper is to adumbrate social work that still remains outside the market. In fact, we believe that while unpaid work is necessary "to build and maintain homes and establish human relationships and communities"

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[1] The Commission has been created at the beginning of 2008 on French government's initiative, because of the broader concerns about the relevance of figures based on GDP as measures of societal wellbeing, as well as measures of economic, environmental, and social sustainability. The Commission was chaired by Stiglitz J.E., Sen A., Fitoussi J.-P. For more information:http://www.stiglitz-sen-fitoussi.fr/en/index.htm.

[2] We refer to reproducer as the subject responsible for the tasks of everyday existence, which guarantee the ability of the worker to show up at his job the day after. Much of this unpaid work has historically been the responsibility of the women, thus feminist economics are particularly interested in.

[3] We refer to the Marxian concept of social reproduction as the process that recreate continuously the condition necessary for economic activity to occur.

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(Perkins, 1997), the commodification of its goods and service has important consequences in social and environmental terms. In social terms, the commodification of unpaid work tends to cause a continual shift of labour and skill from household production to the market economy; while the expansion of marketization implies a more intensive use of energy (Cogoy, 1995), as the present works tries to show. We analyze the use of time in Catalonia across gender and age categories, presenting the main differences in time allocation between men and women. Through this analysis, we demonstrate the importance of household activities to maintain, in terms of time allocation, the quality of life in a prosperous region of Spain, such as Catalonia. The metre of reference is time rather than money, because the time needed for household work and care is not strictly reducible to monetary terms. For the economics of reproduction – maintenance and care – time has a different quality and is subjected to the pace of nature, i.e. to the rule of needs (Carrasco and Mayordomo, 2005). This framework is coherent with the most significant anthropological studies in which the degrowth paradigm is rooted,[4] such as the gift economy of Mauss (1990) and Godbout (1998), Godbout and Caillè (2002) the embedded economy of Polanyi (1944) the domestic mode of production of Sahlins (1974), and, finally, the anti-utilitarian logic of the general economy of Caillé (1991).

The second and more innovative objective of our paper is to explore possible implications, in energy terms, of making the unpaid work visible in the era of expensive oil (Caillé, 1991). Different pattern of unpaid work connect with different energy demands. An increased visibility of unpaid work can help the policy-maker to develop policies in favour of it, and thus also decrease the energy demand of the society and its consequent environmental impacts. In a period of crisis, in fact, the household overhead (unpaid work) increases, exacerbating the burden for women and resulting in a loss of wellbeing for them, as well as the whole household (Antonopoulous and Hirway, 2010). We believe that addressing the issue of unpaid work is fundamental in order to achieve degrowth in energy consumption as well as in monetary economic activities and in paid working time. Moreover, the study of this energy scenario cannot omit taking into consideration the change of household typologies that has characterized Spain as well as other European countries in the last decades. Traditional families (couples with children) have decreased and single parent households have increased (Ramos-Martin et al., 2009; Jarvis, 2011). With the exception of Ireland, all countries in Europe had, in 1995, an average household size of less than three persons, with a convergence of countries with bigger households in Italy, Portugal and Greece (EEA – European Environmental Agency, 2001). These demographic factors[5] have had an influence on household metabolism and imply more appliances and higher energy consumption, as well as more consumer expenditure, as studies on energy consumption in Dutch households have shown (Biesiot and Noorman, 1999). In European households, the relation between growth in expenditure and growth in energy consumption is direct (EEA – European Environmental Agency, 2001). On the other hand, different trends are emerging in Europe at the micro level, such as the co-housing phenomenon, which should be prioritized for further research (Jarvis, 2011); co-housing "shows how human beings can, to huge advantage, work among themselves by developing non-market relationship" (Lietaert, 2010). This has been the case with Scandinavian collective organization at the household level, which improves environmental quality through voluntary – or unpaid – citizen's participation (George, 1999). Some scholars have emphasized the importance of access to critical inputs such as water, sanitation, adequate care services and energy resources, because these infrastructural gaps are normally filled with unpaid work, which further exacerbates the burden of poor women (Antonopoulous and Hirway, 2010). Hence, the contrasting phenomena of single person household and co-housing have to be analysed to ensure that the future relative scarcity of energy and its increasing price does not imply an excessive burden of unpaid work for the poor household, and as a consequence, an impossible overload for women.

The paper is organized in four parts. In the next section, we explain the reasons why we have chosen Catalonia as a case study; we introduce the methodological tool we have used in our research, that is, MuSIASEM, a new system of accounting of flows and funds; and finally we present the main variables and the data sources. Section 3 shows the results of time use analysis in Catalonia, enriching the analysis of unpaid and paid work, linking it to the energetic metabolic pattern of Catalonia. Section 4 discusses possible energetic scenarios of making the unpaid work visible in the era of the end of cheap oil. Section 5 draws some conclusions.

2. Methods, variables and data source

2.1. Case study

Working on case studies is a well-established research strategy in social sciences (Platt, 1988; Yin, 1989; Eisenhardt, 1989). Our case is an explorative case study; in fact, the main topic of the present work is very new in time use literature. While the amount of research conducted with time use analysis is huge,[6] none of these studies have focused on the possible implications of the end of cheap oil (Ramos-Martin et al., 2009), and the consequent change in the energy pattern, on society's unpaid work. Because of the lack of data on this topic we can only explore the possible impact on the energy demand if the allocation of time between unpaid and paid work changes. We will respond to the question: if paid market services become no-market household services again, how will the energy demand be affected? By answering this question, we will test, in the context of the emergent paradigm of degrowth (Martinez-Alier et al., 2010), if proposals such as work sharing (Schneider et al., 2010) might be feasible in practical and not only in theoretical terms.

Our unit of analysis is Catalonia, a region in the northeast of Spain. We chose Catalonia as our case study for two reasons. First, several studies on time use are available for that region, and at different administrative levels. In particular, since 2004, the government of the Catalan capital, Barcelona, has developed studies, conferences and urban policies on time use in the cities through the Time and Life Quality Program. None of the several

[4] The degrowth was defined by Schneider et al. (2010) as a "voluntary, smooth, and equitable transition to a regime of lower production and consumption. It has different intellectual sources.

[5] These demographic patterns have also social consequences; the most worrisome is the tendency towards the social isolation of the single person households (Jarvis, 2011).

[6] We list here just some of them: gender analysis of standard of living in industrialized (Picchio, 2003) and less industrialized countries (Antonopoulous and Hirway, 2010); eco-feminist studies on the unpaid work (McMahon, 1997; Jochimsen and Knobloch, 1997; O'Hara, 1997; Perkins, 1997; Pietilä, 1997); studies which aim to obtain the correct mix of qualitative and quantitative analysis of time activities in a critical gender perspective (Carrasco, 2003; Carrasco and Mayordomo, 2005); the cross-countries analysis in the allocation of time exploring gender convergence in domestic work and leisure pattern in different regions of the world (Kan et al., 2011; Gimenez-Nadal and Sevilla-Sanz, 2011; Fisher and Robinson, 2011); analysis on the trends in the valuation of households' unpaid work (Hamdad, 2003); papers on the different application of time-use data to diverse subjects (Joyce and Stewart, 1999); the importance of unpaid work to reach the millennium developments goals (UNDP, 2005a).

interesting publications[7] about time use in the city, however, makes references to the connections between time use and energy consumption. The second reason for choosing Catalonia as a case study is related to the data and studies on energy metabolism at the regional level, which are not readily available for other regions. The paper of Ramos-Martin et al. (2009) is in fact the only one to have produced a relevant dataset and outcomes, and it will allow us to integrate the energy pattern with the allocation of time use at the administrative scale.

2.2. Methodology

The Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM) approach is built upon the seminal idea of Georgescu-Roegen's bioeconomics. The MuSIASEM approach makes Georgescu-Roegen's fund-flow model operational across i) scales (individual, household, local, regional, national, international), and ii) non-equivalent descriptive domains (economy, society, environment) (Giampietro, 2000a, b; Giampietro et al., 2006, 2008). It is a new system of account based on flow–fund representation of extensive and intensive variables. Extensive variables characterise the size or extent of a system; for example, Total Human Activity represents the size of the population expressed in 1 h. Intensive variables represent a qualitative characteristic per unit of fund element intrinsic to the system, for example Exosomatic Metabolic Rate Societal Average represents the intensity of energy use per hour of human time available to the society, measured in joules per hour.

In the present work we use MuSIASEM because its powerful pre-analytical vision allows us to account for time use across gender and integrate this with the energy metabolic pattern of Catalonia.

2.2.1. Time use categories

We structure the use of time in Catalonia across gender and age categories. Then, we analyse the main differences in time allocation between male and female. We also show the importance of household activities to maintain a certain level of life quality (the one of an industrialized society) in terms of time allocation. If the household sector produces economic benefits through unpaid work, time allocated to it is a metre of reference. Because our use of MuSIASEM is limited to account for time use in Catalonia, we will not explain its whole grammar and variables but we will limit ourselves to define a set of typologies of "end uses" of human activity (HA). For the variables related to the energy the reader can refer to Ramos-Martin et al. (2009).

Our fund variable, Total Human Activity (THA), measures the total amount of hours of a system in a year.

$$\mathrm{THA} = \mathrm{Population} * 24\ \mathrm{hours} * 365\ \mathrm{days}.$$

For the purpose of our analysis we divide THA in different typologies of human activities, such as:

- Physiological Overhead (PO): the amount of hours allocated to sleeping, eating and personal care,
- Unpaid Work (UW): the amount of hours allocated to household chores (cooking, home maintenance, caring for kids and other family members, clothes maintenance and creation, shopping and other services, home administration, gardening[8] and animal care, construction and reparations) to voluntary work and meetings.
- Paid Work (PW): the amount of hours allocated to work in the market,
- Study (ST): the amount of hours allocated to school (ST_s), university (ST_u), and free learning
- Transport (TR): the amount of hours allocated to mobility,
- Leisure and Entertainment (LE): the amount of hours allocated in leisure and entertainment.

The requirement of congruence implies that:

$$\mathrm{THA} = \mathrm{PO} + \mathrm{UW} + \mathrm{PW} + \mathrm{S} + \mathrm{TR} + \mathrm{LE} \quad (1)$$

Equation (1) should hold for the whole society and for the individuals.

To develop the energy analysis we will refer to the flow variable Total Energy Throughput (TET), i.e. the total primary energy used in an economy in one year, measured in joules [J]. Its ratio with THA generates the indicator Exosomatic Metabolic Rate – societal average – (EMR_{sa}), i.e. the energy consumption per hour of human time available to the society, measured in joules per hour [j/h].

$$\mathrm{TET/THA} = \mathrm{EMR_{sa}} \quad (2)$$

The calculation of this benchmark (Table 1) at different level of the socio-economic system allows comparison among different sectors.

2.2.2. Age categories

To characterize the population we define five age categories as shown in Table 2, where the correspondence between our categories and the official ones are visible. The information of the use of time in Catalonia is based upon the information presented in IDESCAT (IDESCAT, 2003), which indicates the allocation of time across sex and age categories.

2.2.3. Data and assumption

2.2.3.1. Time use analysis. Data on time use comes from a time use survey (TUS) developed by the Catalan Institute of Statistics (IDESCAT, 2003) and refers to the 2002–2003 year. The main objective of this survey is to provide information on distribution and timing of all activities of the population throughout the day. The TUS is part of an annual program of statistical activities, and belongs to the project for harmonizing the European survey on the use of time, which aims to ensure comparability of results at the international level.

Based on these statistics on the use of time, we proceed to calculate the time allocated to different activities across age categories and sex. For the age categories older than ten years we use the information provided by IDESCAT (2003). On the other hand, we either make some assumptions on the use of time of people below ten years old, or we look for information in other data sources. In order to obtain their time use, we made the following assumptions.

- We assume that people below 10 years old allocate half of their time to Physiological Overhead ($PO_{0\ to\ 9} = THA_{0\ to\ 9} * 0.5$).
- We obtain the number of students under 10 years old from the Statistical Yearbook of Catalonia containing basic statistical information about Education in Catalonia (IDESCAT, 2007). We assume that school students allocate 6 hours/day, 5 days/week and 36 weeks/year to study.
- We consider that people younger than 10 years old do not work.

[7] Looking at the website of Barcelona city council dedicated to time use the reader will find several studies plan and dossiers, such as time use and citizenship, time use and health, time and culture, time use and mobility among others.

[8] The time dedicated to gardening is irrelevant in our case study.

Table 1
Calculation of EMR benchmarks at different levels.

Level *n*	$EMR_{SA} = \frac{TET}{THA}$		
Level n − 1	$EMR_{PW} = \frac{ET_{PW}}{HA_{PW}}$		$EMR_{HH} = \frac{ET_{HH}}{HA_{HH}}$
Level n − 2	$EMR_{PS} = \frac{ET_{PS}}{HA_{PS}}$; $EMR_{AG} = \frac{ET_{AG}}{HA_{AG}}$; $EMR_{SG} = \frac{ET_{SG}}{HA_{SG}}$;		…
Level n − 3	…;	$EMR_{SGnoTr} = \frac{ET_{SGnoTr}}{HA_{SGnoTr}}$;	$EMR_{pTr} = \frac{ET_{pTr}}{HA_{pTr}}$; $EMR_{HHnopTr} = \frac{ET_{HHnopTr}}{HA_{HHnopTr}}$; $EMR_{uw^*} = \frac{ET_{uw^*}}{HA_{uw^*}}$

Legend: SA (Society Average); PW (Paid Work); HH (Household); PS (productive sectors); AG (Agriculture); SG (Service and Government); SGnoTr (Service and Government without Transport); pTr (Personal Transport); HHnopTr (Household without personal transport); uw* (unpaid work worst scenario).

- We assume that people younger than 10 years old do not allocate time to Unpaid Work (i.e. they do not carry out household chores).
- We consider that parents transport people younger than 10 years old (i.e. the younger than 10 do not allocate time to mobility).
- We consider that they allocate the rest of their time to Leisure and Entertainment. That is, for age category 0 to 9, LE =- THA − PO − ST. [9]

2.2.3.2. Exosomatic metabolic rate analysis. The energy data come from the study by Ramos-Martin, who kindly gave us the whole dataset that he and his colleagues developed for studying the Catalan energy metabolism (Ramos-Martin et al., 2009).

Data on mobility, the calculation of the energy and the time spent in personal transportation (personal travelling and commuting), come from two main sources. The first one is "Time Use and Mobility" (Miralles-Guasch, 2006), i.e. a dossier ordered by the municipality of Barcelona that discusses the specific reasons for travel, the time spent travelling and the means of transport used in the city; the second source is "Survey on the Daily Mobility in Catalonia", i.e. a survey promoted by the Authority for Metropolitan Transport and the Department of Territorial Policies and Public Infrastructure of the Generalitat of Catalonia, whose main objectives is to analyse the daily mobility of Catalonia residents (EMQ, 2006).

Data on energy consumption are available for several years, but not disaggregated at a lower level of analysis than the household (n − 1); while data on time use are available at a lower level of analysis, but not for each year. For these reasons, if we want to develop a reliable analysis, we need a series of coherent assumptions that we follow.

- We assumed that the time use data (IDESCAT, 2003), and personal mobility data (Miralles-Guasch, 2006; EMQ, 2006) have not changed along the time series of energy data (Ramos-Martin et al., 2009).
- Due to the lack of detailed household energy statistics and because most household activities are carried out at the same time, we cannot attribute exactly the energy consumption to each activity,[10] either unpaid work (i.e. cooking energy), or leisure time (i.e. television consumption), or personal care (i.e. hairdryer consumption). Thus, we plausibly assumed that EMR_{HH} (which includes personal transportation) results an average of power peaks (i.e. travelling time) with power minimums (i.e. when sleeping), and consequently household chores, that require domestic appliances, consume at a rate in between these extremes.
- For a better comparison between unpaid and paid services we need to calculate the EMR_{SG} and the EMR_{HH} without considering respectively the metabolic rate of the transport sector and of personal transport. For this reason it's worth noting that energy consumption in transport refers to 50% for the transportation of goods, 25% to commuting to and from work, and 25% to personal transportation (which includes leisure travelling and household tasks requiring some kind of transportation, i.e. shopping, driving kids to school, etc.).[11]

  In accordance with the above assumption we calculate (Table 1, level n − 3):

  I. the EMR of the service and government sector, with the exclusion of the energy intensive activity of transportation of goods − EMR_{SGnoTr};
  II. the EMR of personal transportation − EMR_{ptr}
  III. the EMR of households, not accounting for personal transportation $EMR_{HHnopTr}$
- Since we have only the aggregate value of household energy consumption (n − 1 level), for the calculation of the rate of energy consumption of unpaid work (n − 2 level), we could assume that it is proportional to the fraction of unpaid work time dedicated to household work − about 12% of THA − (Giampietro et al., 2008). This will generate a very low metabolic rate for UW and it will not account for the fact that the household activities are carried out at the same time, as noted above. So we have decided to create a worst-case scenario where all the energy consumed in the household is allocated to UW (Table 1, Level n − 3).

  I. The EMR_{uw^*} represents the highest rate of the UW, assuming that any other activity in the households such as sleeping,[12] studying, watching television, etc. does not imply any energy consumption.

  Hence, the discussion of our results will be based on the assumption that household chores (unpaid work), that require domestic appliances, consume at a rate in between two extremes: the law level of $EMR_{hhnopTr}$ and the highest level of EMR_{uw^*}.
- Finally, we have to highlight that by comparing an hour of household service with an hour of service delivered in the PW sector, we will lose the different qualities of them. For the purpose of this study it is not so important; indeed, the present study aims to compare quantitatively the unpaid and paid work and their implication in energy consumption, thanks to an explorative case (as explained in Section 2.1).

[9] We recognize that perhaps for poor and/or single parents households this assumption could be not valid.
[10] The energy consumed divided by the time allocated to certain activities.
[11] Ramos-Martin's personal communication.
[12] Note that even when people sleep, there is some consumption of energy in the household, for example the fridge is on during the night too.

Table 2
Age and time-use categories in this analysis and by IDESCAT (2003).

Categories	Our categories	IDESCAT categories (interviewees are older than 10)
Age	<10 10–24 25–44 45–64 >65	n.a. <25 25–44 45–64 >65
Use of Time	• Physiological overhead (PO) • Paid work (PW) • Study (ST) • Unpaid Work (UW) • Transport (TR) • Leisure & Entertainment (LE)	• Personal care • Work • Education • Home and family + Voluntary work & meetings • Movements and not specified uses of time • Social life & entertainment + Sports & open air activities + Hobbies and games + Media.

3. Results

3.1. Time use in Catalonia

Aggregating the data at the Catalan level according to the different time categories, half of Total Human Activity results in physiological overhead (PO = 48.1%); studying (school and university) represents 2.3% of total time; transportation and commuting result in 5.1% of time use while 22.8% of time goes to leisure and entertainment. Total market work is 10.8% (PW), while unpaid work (UW) accounts for 10.9% and originates mainly from the households (Fig. 1).

When the data are split across gender categories, there are relevant distinctions: men allocate more time to sleeping and personal care (PO) than women (48.3% versus 47.8%); more time for studying (2.4% versus 2.1%); and more for commuting (5.4% versus 4.9%). Men also have more leisure time than women (23.9% versus 21.8%). This is possible since men work much less than women (19.9% versus 23.4%, summing up paid and unpaid work) (Fig. 2).

When the data are analysed across gender and age (the five age categories characterized in Section 2.2.2) other relevant results become evident.

Fig. 3 shows different profiles of time allocation across age categories and sex, and confirms that men work more in the market (on average 3.16 h/d for men versus 1.85 h/d for women); while women do more UW (on average 3.99 h/d for women versus 1.60 h/d for men). Summing up PW and UW for all categories, women work on average 1.09 h/d more then men. As a consequence, compared to men, women have to sacrifice at least 1 h a day of personal care or leisure to guarantee the social reproduction of Catalan society.

Yet some degree of change is visible looking across different generations. The results show a major contribution of young men to the unpaid work. The overall contribution to unpaid and paid work narrows to 0.6 h for the age category 25 to 44; women allocate to paid and unpaid work 8.2 h/d while men 7.6 h/d, a difference financed with a half-hour a day less of leisure time than men. It is worth noting that this age category bears an enormous amount of workload and could not likely sustain an increase in working hours.

Gender disparity in total working time becomes more evident with older age categories: women work on average 1.2 h more than men in the age category 45–64 (7.8 versus 6.6 h/d), and 2.6 h more in the age category older than 65 (5.3 versus 2.6 h/d, i.e. the women do double the household work every day).

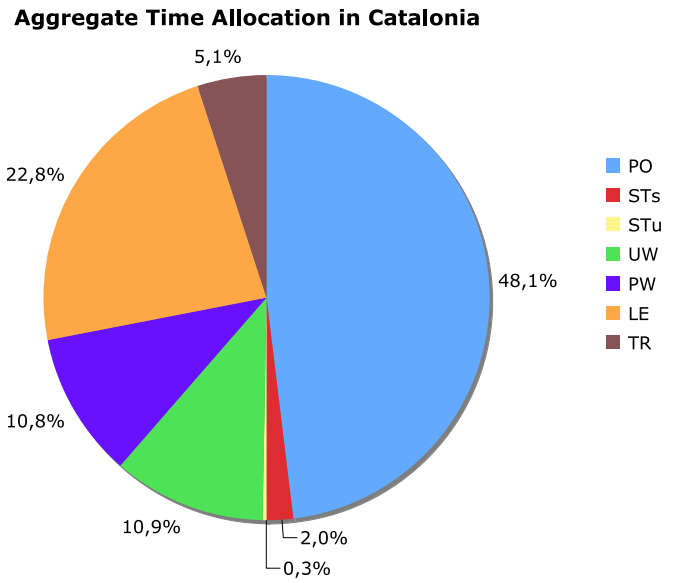

Fig. 1. Percentage of hours/year allocated in Catalonia to the defined time categories.

3.2. Energy consumption for unpaid work, for paid work and for commuting

In this subsection we are concerned with the rate of energy consumption for several activities in Catalonia. We analyse the energy consumption per hour of service at home versus the energy consumption per hour of service in the PW sectors.

Before presenting the energy implications of a change in paid and unpaid work pattern in Catalonia, some considerations are needed. Reducing the amount of human activities allocated to household tasks implies either shifting these tasks to the PW sectors, i.e. buying similar services in the market (thus increasing the energy demand in the market sectors), or changing the use of appliances at home to reduce the time needed for certain tasks (thus increasing the EMR_{HH}).

Having said that, we can now move on to the results. The average growth of EMR_{SG} is 1.98%, passing from 68.38 Mj/h in 1990 to 73.95 Mj/h in 2010. On the contrary since 1990 the EMR_{HH} has increased quickly due to a boom in the consumption of household appliances and personal transportation, passing from 1.64 Mj/h to 3 Mj/h[13] of 2010 (Table 3), with an impressive average growth rate of 16.3%. Still the EMR_{HH} – 3 MJ/h in 2010 – it is more then 25 times less intense than the EMR_{SG}. From these preliminary results we cannot conclude simply that each service developed at home allows the society to save that large amount of energy. For a precise comparison, in fact, we should compare each service done at home with its exact correspondent in the market. Since this comparison is not possible for the lack of data at this level of detail, the best we can do is to remove transport consumption from the service and government sector as well as from the household and then compare the two again ($EMR_{HHnopTr}$ versus EMR_{SGnoTr}). The EMR_{SGnoTr} passed from 16.41 Mj/h to 23.12 Mj/h, in twenty years with an average rate of growth almost equal to 9%. In the same period, $EMR_{HHnopTr}$ passed from 0.99 to 1.94 Mj/h with an average rate of growth equal to 18.32%. It is important to highlight that, even if the difference between EMR_{SG} and EMR_{HH} is higher than the

[13] This is so because there are large portions of time spent in households that consume very law rate of energy, for instance when sleeping, which accounts for roughly half of household time.

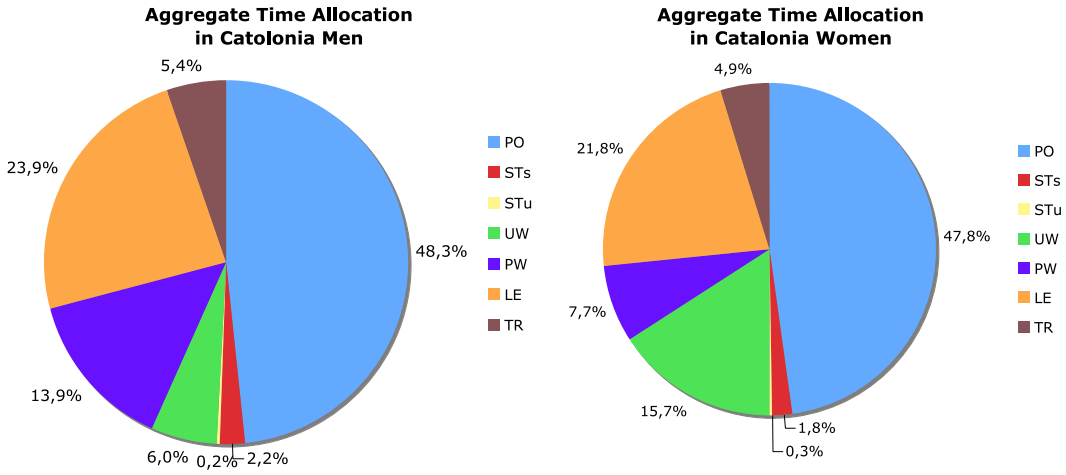

Fig. 2. Percentage of Hours/year allocated into time categories across gender.

one between EMR_{SGnoTr} and $EMR_{HHnopTr}$, the latter is still very high; as a matter of fact, EMR_{SGnoTr} is almost 12 times higher than $EMR_{HHnopTr}$. Scaling down from the level n − 1 to level n − 3 in the household sector it is easy to note a decrease in the value of the metabolic rate − EMR_{HH} 3 versus $EMR_{HHnopTr}$ 1.94 Mj/h in 2010 − but a higher rate of growth for $EMR_{HHnopTr}$ (18.32%) if compared to EMR_{HH} (16.3%), where the former represents the increase in the use of appliance at home clearly. On the other hand, comparing the level n − 2 with level n − 3 for the service and government sector, we note that the intensity of this sector is very much lower when we do not consider the transport − 23.12 Mj/h for EMR_{SGnoTr} versus 73.95 Mj/h for EMR_{SG} (Table 3), even if the rate of growth of the latter is lower then of the former − 2% versus 9% − showing that the demand of energy for service is increasing rapidly in the last decades, although we do not include transport.

Looking at these results, it is clear that the intensity of energy use at home is several orders of magnitude lower than the service and government, the sector where similar services to the unpaid work are delivered.

Only if we build a worst-case scenario, according to which all the energy consumption of the household is consumed during the time dedicated to unpaid work, does the intensity of energy used at home for unpaid work result to be similar to the one of service and government, when the transport is excluded (Table 3 column EMR_{uw^*} versus EMR_{SGnoTr}).

The EMR_{uw^*} is calculated to have an extremely high upper limit for the metabolic rate of unpaid work. It is calculated on the absurd hypothesis that all the energy consumed in the household is because of unpaid work; it implies that for all other activities, such as physiological overhead, leisure, transport and study there is no consumption of energy. On the contrary, we know that personal transport is indeed a very intense activity (Table 3, Column EMR_{pTr}), and that personal care, leisure and study demand energy; for example, we need hot water to have shower, electricity to watch television or play video games, light for studying late in the afternoon. Moreover, another great part of energy is used for lighting/heating/cooling indoor environment, which might be lower at night, while resting, but is important for personal care, for having a comfortable living space for rest, study, leisure and in part, for household chores.

The above considerations strengthen the results obtained: the exosomatic metabolic rate of PW is higher than the exosomatic metabolic rate of UW. Even if the value of the latter can fall in a very wide range, going from the $EMR_{HHnopTr}$ − 1.94 Mj/h in 2010 − to the EMR_{uw^*} − 24.51 Mj/h in 2010, it is very much more probable that it will be close to the lower limit.

4. Discussion

Stiglitz, Sen and Fitoussi (Stiglitz et al., 2009) highlighted the use of GDP as a misleading indicator of wellbeing, and warned policy makers about implementing policy based on this presumption. However, giving up the compulsory up-thrust of economic growth as the primary objective of national government is regarded as heresy (Victor, 2010). Thus, the "business as usual" think only presumes the same suggestion for the P.I.I.G.S.[14] European countries in order to face the economic crisis, i.e. they need to increase their GDP growth rate.

The GDP paradox goes on. Despite criticism of GDP as a social welfare and progress indicator, its role in economics, public policies, politics and society continues to be influential (van den Bergh, 2009). Even if we can agree with van den Bergh (2007) on the proposal of abolishing the GDP indicator, we do not believe that just being relaxed about GDP growth, or echoing a plea for a-growth, "i.e. being indifferent or neutral about economic growth" (van den Bergh, 2010a, b) will solve the paradox of our capitalistic society. It is not enough, indeed, to be neutral; the "a-growthist" person is more an a-theist than an agnostic (Kallis, 2011). S/he is against "the religion of the economy, growth progress and development" and wants to change the founding imaginary of westernized society (Degrowth, 2010).

Regrettably, the plea for the monetization of UW is part of the same economic imaginary. For some feminists, to gain the right dignity for UW, has been calculating the monetary value of it, showing its impressive value. Indeed, what Pietillä (Eisenhardt, 1989) identified as free economy represented the 35% in 1980 and 37.5% in 1990 of Finland GNP. Results in line with several studies that estimate the value of unpaid work between the 33% and 55% of GDP (Degrowth, 2010) or between 20% and 60% of it (Antonopoulous and Hirway, 2010); the latter highlights the fact that applying the same logic of efficiency of PW to the UW would be important to the economic growth. Contrary to Antonopoulous and Hirway (2010), we think that both the definition of GDP and its use

[14] It is the name given to Portugal, Italy, Ireland, Greece and Spain when the debt crisis of these countries started to emerge at the end of 2008, just after the subprime crisis in the United States.

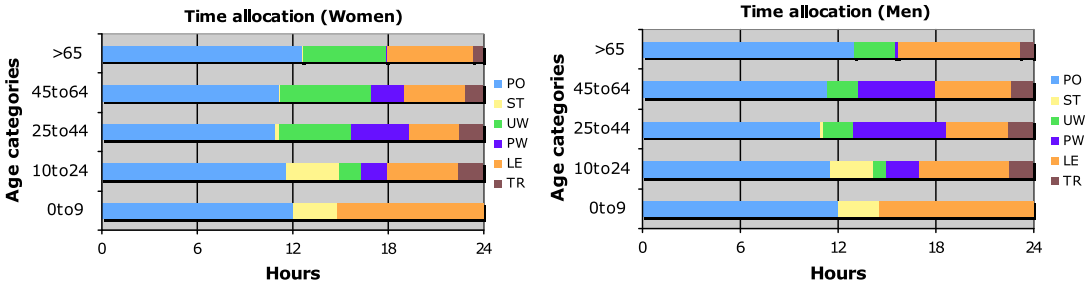

Fig. 3. Time allocation by age categories and sex.

should not expand, firstly because of the above criticism - namely, its reliability as an indicator to drive policy suggestions and improve the wellbeing of the people. Secondly, we believe that the logic of work in the household context, as well as in other non-market contexts, is not based on self-interest; rather this work must be understood and analysed within the context of an anti-utilitarian logic (Mauss, 1990; Godbout, 1998; Godbout and Caillè, 2002). The UW also produces things not available on the market and that cannot be purchased by money, such as the feeling of being important for somebody, closeness, encouragement, recognition and the meaning of life. For these reasons, and in line with some critical feminists (Carrasco, 2003; Carrasco and Mayordomo, 2005), we have decided to develop comparisons between unpaid and paid work using hours as the unit of measure, in the belief that we can give visibility to unpaid work and avoid reducing it to monetary terms. Indeed, our case study shows several pieces of evidence about the relevance of UW.

The first piece of evidence stemming from the time use analysis in Catalonia is that UW is equally important as PW to guarantee the Catalonian standard of living, in terms of hours. From a time use point of view, it means that the Catalan quality of life depends upon the goods and services provided by unpaid household work as much as on those goods and services provided by the labour market. Hence, the present work confirms the importance of non-market activities as it has been argued for decades by feminist scholars (Antonopoulous and Hirway, 2010; McMahon, 1997; Jochimsen and Knobloch, 1997; O'Hara, 1997; Perkins, 1997; Picchio, 2003; Carrasco, 2003; Carrasco and Mayordomo, 2005; Pietilä, 1997), and only recently recognized by mainstream economists (Stiglitz et al., 2009). It confirms also that women work more than men not only for the UW, but also if we sum up unpaid and paid work (Carrasco and Mayordomo, 2005; Fisher and Robinson, 2011).

Recent studies have shown cross-national trends of a slow gender convergence in terms of paid and unpaid work, i.e. a decrease in men's PW is coupled with an increase in UW and a decrease in women's UW is coupled with an increase of their PW, even if domestic work is still divided between feminine and masculine tasks (Kan et al., 2011; Gimenez-Nadal and Sevilla-Sanz, 2011). Our research confirms[15] an effort towards a gender convergence by the young generation (25–44 years old) in terms of unpaid and paid work. On the other hand, it highlights that the work burden for women of the same age categories (25–44 years old) is almost unsustainable, with their 8 h/d for each day of the year. They have to sacrifice 1 h/d of leisure or personal care if you compare them with their coetaneous men (Carrasco and Domínguez, 2002). Thus, a simple re-allocation of PW to UW would be practically impossible for some women, and it will certainly lower their quality of life if the gender convergence does not accelerate. In fact, the marketing dream of buying "convenience consumption" such as microwaves ovens, washer and driers, food processors, disposable napkins and plates, and purchasing child-care to reduce the time of UW is no longer credible. It has been demonstrated, in fact, that this has produced a paradoxical result. Not only did it not reduce the amount of UW – more or less the same from 1920 to 1990 in USA – but it increased the intensity of it, because technical progress generates new activities and new standards (Campanelli, 2003).[16] The final result is not only a consequent rise in the stress for unpaid workers (Campanelli, 2003), but also a huge increase in the demand of energy for domestic sectors, in which the number of appliances has tremendously increased. The trends of household typologies in the previous decades, from large families towards one person or single parent family, show a qualitative change in the composition of domestic compartments. It has implied an increase in energy demand incommensurate with an increase in the efficiency of appliances (Ramos-Martin et al., 2009). Our results show a very high rate of growth of the energetic metabolic rate of households once personal transport is not taken in account – $EMR_{HHnopTr}$ 18.32% from 1990 to 2010; it confirms that the qualitative change in the typologies of family can boost the demand of energy. Our results show that, if the single household will become the prevalent typology in the future, energy demand will grow very quickly. Because of the basic energy demands by every household, and because this typology asks for PW service once the overload of UW for a single household is no longer sustainable in terms of time, we must recognize that the majority of households have high support needs (Jarvis, 2011). For these reasons if, on the one hand, the extreme utopia of marketization realizes the abolition of every work in the household and allows the increase of GDP, on the other hand, it will cause a continuous shift of skill from household to the market (Cogoy, 1995), an increase of social isolation and the diminishing of reciprocal welfare because of the new prevalent single household typology (Jarvis, 2011). Moreover, our results show the increase in the single household does not eliminate the burden of women to carry out unpaid work, and further, it increases the demand of energy in society.

On the contrary, with a degrowth perspective what is relevant are other emerging trends in household typologies, for example, co-housing, which "lessen[s] the burden of every day life" (Lietaert, 2010) and contributes to a more equal distribution of UW inside the household, speeding up the gender convergence and implementing important degrowth social policies of work-sharing (Schneider

[15] Even if the analysis is not a time series analysis, we can read some trends look at the different generations present in our dataset.

[16] On the other hand we cannot forget that the lack of infrastructure that provide access to critical inputs such as water increase the number of hour (3 h/d) of unpaid work needed in the household (Antonopoulous and Hirway, 2010; UNDP, 2005b) but this is not the case for Catalonia.

Table 3
Evolution of the Catalan EMR (Mj/h) at different levels.

Year	EMR									
	SA	PW	HH	AG	PS	SG	SGnoTr	pTr	HHnopTr	uw*
1990	13.13	159.30	1.64	119.74	268.35	68.38	16.41	25.46	0.99	13.40
1995	14.56	180.09	1.98	116.95	348.70	77.10	19.06	31.15	1.18	16.18
2000	17.76	176.01	2.59	180.69	315.27	80.22	19.99	40.07	1.57	21.16
2005	18.37	167.33	2.80	178.21	331.14	75.06	22.48	41.27	1.75	22.88
2010	19.60	180.36	3.00	156.37	416.33	73.95	23.12	42.20	1.94	24.51
	Level n	*Level* n − 1		*Level* n − 2			*Level* n − 3			

Legend: SA (Society Average); PW (Paid Work); HH (Household); AG (Agriculture); PS (productive sectors); SG (Service and Government); SGnoTr (service and government without transport); pTr (Personal transport); HHnopTr (household without personal transport); uw* (unpaid work, extreme scenario). Own elaboration from Ramos-Martin et al., 2009.

et al., 2010). Co-housing can improve the general quality of household time as well as it can help in saving energy, in fact: a) the sharing of activities can reduce the time dedicated to household chores and some other tasks, for instance cooking for a large number of people, but not every day, saves working time; b) the sharing of space can reduce energy, because for example one large kitchen replaces several smaller ones. The possibilities for time and energy saving and for increased socialization and improved living quality are many; Cattaneo and Gavaldá (2010) have shown that highly self-sufficient communities produce not only immaterial services, but also some food and most of the equipment necessary to maintain a household and a lifestyle with high living standards.

Other studies confirm the same conclusion, in fact co-housing saves 31% of space, 57% electricity and 8% of general goods when you compare it with standard household (Williams, 2008) contributing to the reduction of energy demands, it means slowing down the rate of growth of $EMR_{HHnopTr}$.

5. Conclusion

The Catalonia explorative case study has allowed us to draw some conclusions, confirm the results of the literature on time use analysis and show the importance of combining time use studies with energy analysis. We have decided to develop comparisons between unpaid and paid work using hours as the unit of measure in the belief that we may give visibility to unpaid work this way and avoid reducing it to monetary terms. The importance of unpaid work for the whole society is still important, the industrialized Catalan region needs the same amount of paid and unpaid work to produce and reproduce itself. Catalan women do the main part of it, even if a slow convergence is visible for the younger generations such as the 25–44 years old. Women in these age categories are subjected to an incredible burden of work when you sum up paid and unpaid work.

The energy demand in Catalonia is increasing quickly and a very relevant part of it is caused by the domestic sector. This is caused mainly by the qualitative change in household typologies – one single household and single parent family – and because of an increase in the use of appliances in the hope of reducing the unpaid work charge, an illusion fuelled by the "convenience consumption". The very low exosomatic metabolic rate of households if compared to the one of service and government sectors suggests that the re-allocation of some services and goods from the market to the household can contribute to a decrease in the energy demand of the future.

These theoretical possibilities are also sustainable in social terms if two qualitative changes speed up in the society: 1) at household level the work sharing, which can guarantee the gender convergence of the unpaid workload that is otherwise an unsustainable burden for young women to bear alone; 2) at the neighbourhood level, an increase in the household typologies of co-housing, which can diminish the demand of energy without increasing the workload in the house.

The current solutions to the debt crisis in Europe, i.e. cutting the welfare spending to help the financial market and to re-launch the GDP growth, are proving the worries of the degrowth thinker to be true. Indeed, the current crisis could provide a justification for "more of the same" growth policies disguised as innovative green proposals. The Catalan government could mistakenly follow the same route as the governments of European nations when it decides which kinds of polices will sustain the quality of life in the region. To avoid this, we hope our findings will draw the attention of Catalan policy-makers, above all, the ones that have been developing time use studies. While they have noted the increasing importance of care activities because of the ageing population, up until now, it seems they have not recognized that, in an energy scarce future, it is likely that most of those services will have to be supplied by consuming energy in synergy with household and small local communities work. We suggest that by implementing studies on time use and energy that Catalan institutions may perceive that it is better to avoid new urbanism proposals of "smart growth". In fact, for most cases beneath the façade of ecological planning is the economic growth paradigm that inevitably boosts the energy demand. On the contrary, if policy-makers want to guarantee a sustainable future in Catalan society, they should recognize the importance of listening and responding to grassroots practices; for example giving economic incentives to co-housing and to renovations that create shareable space and appliances.

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