On the way to a post-carbon society: Assessing the personal carbon footprint of French social milieux to develop targeted intervention strategies

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Abstract

Achieving a massive reduction of CO_2 emissions depends not only on technical energy efficiency, but also strongly on changing patterns of consumption. Policy makers and science often fail to consider the great variety of modern societies, addressing a standardized uniform being called "the consumer". In this paper we take the strong segmentation of the French society into account, applying the Sinus Milieus® approach developed by the marketing company Sociovision. These (currently 9) quantifiable social milieus are defined along social values, aspirations, lifestyles and socio-economic conditions. We will analyze the carbon footprint of those Milieus, identify the consumption areas with the highest footprint and subsequently suggest appropriate "intervention strategies" for each Milieu.

Each Milieu is represented by one or two typical profiles, created on prominent characteristics such as the type of housing, frequency of long distance travels, or food preferences. The personal carbon footprint related to each profile is calculated with the Bilan Carbone Personnel® tool which was developed by the French energy agency ADEME. It is subdivided into 4 main categories which account for different kinds of parameters: (1) domestic consumption (2) transportation (3) food and (4) goods and services. First results show that the personal carbon footprint varies greatly from one Milieu to another and from one field of consumption to another, particularly regarding transportation.

Given those strong differences between Milieus and consumption areas we will subsequently suggest low-carbon "intervention strategies" that are targeted to the specific characteristics of different Milieus. Typically, such measures can be communication (e.g. campaigns), regulation (personal carbon allowances), financial incentives (e.g. feed-in tariffs), the promotion of collective action (e.g. community initiatives) and changes of "choice infrastructures" (e.g. attractive public transportation).

Introduction

In the fight against climate change both technical innovations and more sustainable consumption patterns are needed. With regard to the latter, studies suggest that changing daily routines such as reducing the heating temperature in homes and low- and medium size investments (e.g. purchasing an A++ refrigerator) might save up to 15 to 20 % of energy in US and European households (Gardner and Stern 2008; Kok et al. 2007). However, changing people's behaviours appears to be a tremendous challenge for policy makers and practitioners. Indeed, despite constant energy efficiency gains, final energy consumption has been rising since 1990 and has started only recently to decrease marginally[1] – evidence that points to "rebound effects" and urges us to discuss volumes of energy consumption rather than merely energy efficiency improvements (Calwell 2010, Jackson 2010, Wilhite and Norgard 2004). Thus, it is fair to say that, compared to the technological

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1. http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsdpc320&language=en

challenge – which is certainly also far from trivial – the challenge of changing Western consumption patterns is an even greater one.

Today, a lot of efforts and money are spent in awareness raising campaigns and other behavioural change programs to address this problem. However, too many of them lack a clear theoretical foundation, do not sufficiently draw on previous experience and fail to develop a clear strategy of who might be targeted by what measures (Dahlbom et al. 2009, Behave 2007). Consequently, a lot of behavioural change programs are still inefficient (Greer 2009). Indeed, one of the main weaknesses seems to be an insufficient differentiation of social groups. Very often policy makers, and, to a certain degree, also researchers, tend to assume standardized, uniform beings performing similar behaviours and reacting in a similar way on a suggested intervention measure. For instance, they would argue that "consumers" are not sufficiently aware of "green" solutions and hence need to be better informed on sustainable consumption patterns. However, many opinion polls (BMU 2008, ADEME 2008, European Commission/European Parliament 2008) show that most Europeans have a rather good level of knowledge on climate change issues and the environmental impact of their behaviours. Obviously those peoples' "attitude-knowledge-action" gap cannot be targeted with even more information and a better understanding of the reasons of their non-sustainable behaviours is necessary. Similarly, experience shows that energy consumption in buildings with the same technical efficiency coefficients varies considerably (Uitzinger 2004), which again points to the high importance of differing citizen groups and appropriate intervention strategies to address this variation. Energy consumption patterns vary across time periods, cultures and nations (Shove 2003, Gram-Hanssen 2008, Wilhite 2008), but also between different segments within a given society.

Given such evidence Dahlbom et al (2009: 89) conclude that:

a more detailed segmentation, allowing for the tailoring of activities to specific segments of a target group, is still underdeveloped. Specific target groups should be carefully selected so that activities can be specifically set for the behavioural changes that are requested of a specific group, rather than sticking with a scattergun approach.

We share this assessment and suggest in this paper to develop intervention strategies based on the carbon footprint of French Sinus® Milieus which are adjusted on a yearly basis by the market research company Sociovision. These (currently nine) quantifiable social milieus are defined along social values, aspirations, consumption practices, aesthetic preferences and socio-economic conditions.

Subsequently, we will first briefly review the history of lifestyle and social milieus typologies, with a special attention being paid to the Sinus® milieu typology. In the second part we will present the ADEME *Bilan Carbone*® tool and explain methodological difficulties that arise when transposing data on consumption patterns from the Sociovision database into carbon footprint "profiles". Nevertheless, first results demonstrate the potential application of the suggested methodological approach, showing substantial differences between the Milieus (part 3). Based on this finding, we argue in the last part that policy makers should target the high consumption areas

of each social milieu and develop intervention strategies that respond to the particular characteristics that, in their totality, make the very nature of a distinct social milieu. Depending on the social milieu, appropriate interventions will vary, ranging from information and communication measures to regulation, financial incentives, community action or infrastructural measures.

Lifestyle and social milieus approaches

Typically, social inequalities have been conceptualised in hierarchical models that describe societies as being divided into powerful, wealthy social groups on the one hand, and economically deprived, dependent social groups on the other hand. Karl Marx and his distinction of an exploited working class and a reigning class of capitalists is still today the most prominent description of early industrialised societies.

However, a couple of developments in the course of the last two centuries have brought about a segmentation of modern western societies that can't be grasped anymore with those classical hierarchical models (cf. Gallego-Carrera et al. 2009; Schuster 2003). The growing importance of services and the parallel partial de-industrialisation affected traditional working class identities; the expansion of education systems led to a professional diversification; the globalisation and new information and communication technologies entailed a "disembedding" (Giddens 1991) and a re-definition of local social reference structures. The growing average income of broad parts of societies allowed for a multiplication of choices of consumer goods and leisure time activities. Emancipation challenged traditional role models and enhanced the freedom of choice of women to pursue professional careers. All together, those mega-trends impacted on the modes of social distinction that no longer fit into the classical top-down models of social structuring.

Hence, social sciences developed new models for describing the differentiation of modern Western societies. Going beyond classical "vertical" segmentation criteria such as power, status, income or educational level, more attention was paid to peoples' value orientations, their aesthetic preferences, and their everyday consumption practices that were not only understood as means of satisfying needs but also as symbolic acts indicating an affiliation to certain social groups. Social distinction was no more merely conceived of in terms of classes, but in terms of "lifestyle" and "social milieu" typologies. Typically, those new models did not deny the continued importance of socioeconomic vertical criteria of social segmentation, but added a horizontal "expressive", value-based dimension to the classical hierarchical dimension. In this sense, they are combining macro-structural and micro-individual perspectives.

In particular, French and German sociologists have been advancing the discussion on those new concepts of differentiation (see for a detailed overview Linder 2008, Gallego-Carrera et al. 2009 and Otte 2005). French sociology has been strongly influenced by Pierre Bourdieu's work (1979) on *habitus* which is connected with various forms of capital – economic, social and cultural capital. A person's habitus can be regarded as a sort of systematic, interrelated arrangement of expressive characteristics in terms of taste, communication patterns, gestures,

consumption preferences, etc. According to Bourdieu, the habitus of a person depends on the availability of the three different capitals which are related to social affiliation. German academic discussions have been strongly shaped by Gerhard Schulze's distinction of five social milieus (1992) that are based each one on a distinct dominant esthetical pattern ("Alltagsschema"). Schulze argues that people nowadays organise their daily practices not according to an instrumental logic and clearly defined, shared objectives but according to aesthetic preferences (Gallego Carrera et al. 2009: 11). Some years later Spellerberg (1996) identified in her empirical study 17 lifestyle types, among them 8 occurring in Western and 9 in Eastern Germany. Her typology resembled Schulze's distinction of dominant esthetical patterns, but allowed for a finer segmentation of the German society.

The intentions to develop energy-related lifestyle/social milieu typologies are scarce (however see Hinding 2002, Sauer 2010, Wippermann et al 2009, Thogersen and Olander 2002). In Germany, the most cited study in this context today is still Prose and Wortmann's work (1991) of energy consumer types in the city of Kiel in northern Germany. This complex empirical work was based on a large set of items and specifically targeted to energy consumption questions – a reason why their promising approach was recently replicated in a study by Schulz et al (2010) on the cities of Stuttgart in Western Germany and Leipzig in Eastern Germany.

All in all, there is a growing bulk of academic literature on lifestyle and social milieu typologies, which better grasps the social segmentation of today's western societies than classical models of stratification. Yet, none of those typologies was continually updated – which can be explained by the complexity and the high costs of such empirical studies[2] – and many of them are limited to a precise population such as a particular city and may hence not be necessarily transferable to other places, even within a given country. In addition, there have been only few attempts to adapt lifestyle approaches to energy topics. Those assessments are particularly true for the French case which is the target country of our paper. We suggest addressing this research gap by analysing the energy consumptions of French Sinus Milieus® with the French Bilan Carbone® tool. In the following chapter we will give a short overview over this typology and discuss its assets.

The Sinus Milieus® Typology

The Sinus Milieus® typology was originally developed in Germany in the 1980s by the German company Sinus-Institut. Beginning from 1990s, the French market research company Sociovision[3] started developing a French typology of social milieus and, together with its German partner, also typologies for 15 other European countries, the US, Canada and China (Sinus-Sociovision 2009: 21). Every year this French typology is updated, based on a representative survey of 2000-2500 interviewed persons (aged 15 and older)

who are selected by quota sampling. This quantitative study is complemented by numerous extensive qualitative interviews to confirm the Milieus types that are determined statistically with a cluster analysis. Thus, different from some other typologies, the Sinus Milieus® are validated both qualitatively and quantitatively.

Currently, the French society is "grouped" into 9 homogenous milieus (see Figure 1[4]) which are arranged on a classical, vertical, socioeconomic dimension and a horizontal modernity axis, situating social milieus between traditional and postmodern value orientations and daily practices. By combining structural criteria on the one hand and expressive-normative orientations on the other hand

> the Sinus-Milieus® describe coherent universes of life, of values, behaviours, which structure consumption as well as political and civic life. They enable us to perceive people in all the richness of their life context, and their attitudes to work, family, leisure, money and consumption.[5]

The Sinus Milieus® represent "real" systematic differences that are perceived by the people themselves and are thus a very good empirical ground for developing targeted interventions strategies, or, in the words of the company, they are a "useful approach to make the socio-cultural segmentations operational"[6]. If policy makers wanted to increase the effectiveness of intervention strategies they might hence develop measures which are responding to the very nature of a milieu, its typical practices, value orientations, aesthetic preferences, but also its socioeconomic conditions of life. Depending on the policy area and the milieu, different measures might appear appropriate.

Two further advantages are crucial for us for making use of the Sinus Milieus®. First, the Sociovision database also contains extensive information on the energy uses of the Milieus. This is essential for the calculation of the carbon footprint in selected consumption areas (using the Bilan Carbone tool) which will then be the starting point for the suggestion of targeted intervention strategies. Second, the Sinus Mileus® model is a dynamic, historical one and is adapted based on new social developments. The Sociovision trend research also enables the company to conceive scenarios for the future evolution of social segmentation. This trend research takes evolutions into account, which are germinating, but not yet manifest in the Milieus structure. The scenarios are also helpful for the question of intervention measures, as they inform us on the growing or diminishing of, existing social milieus and new emerging milieus, thus giving us hints on which milieus are particularly important in terms of sustainable energy consumption.

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2. This shortcoming is addressed by Otte (2005) who, based on an evaluation of numerous German studies and a theoretical model, suggests a limited number of 10 items enabling researchers to replicate reliable lifestyle typologies with reasonable efforts of time and money.

3. http://www.sociovision.com/index.php

4. Note: in this paper we are unfortunately not able to describe in detail all of those milieus. Furthermore, the carbon footprint analysis which is presented below was realized for 3 further milieus that are not yet shown in this figure. These are emerging milieus which today represent only marginal parts of society but will gain in importance until 2025.

5. http://website.sociovision.fr/sociovision/page?rep1=SM&rep2=Group&nom=pr inc-sm-uk

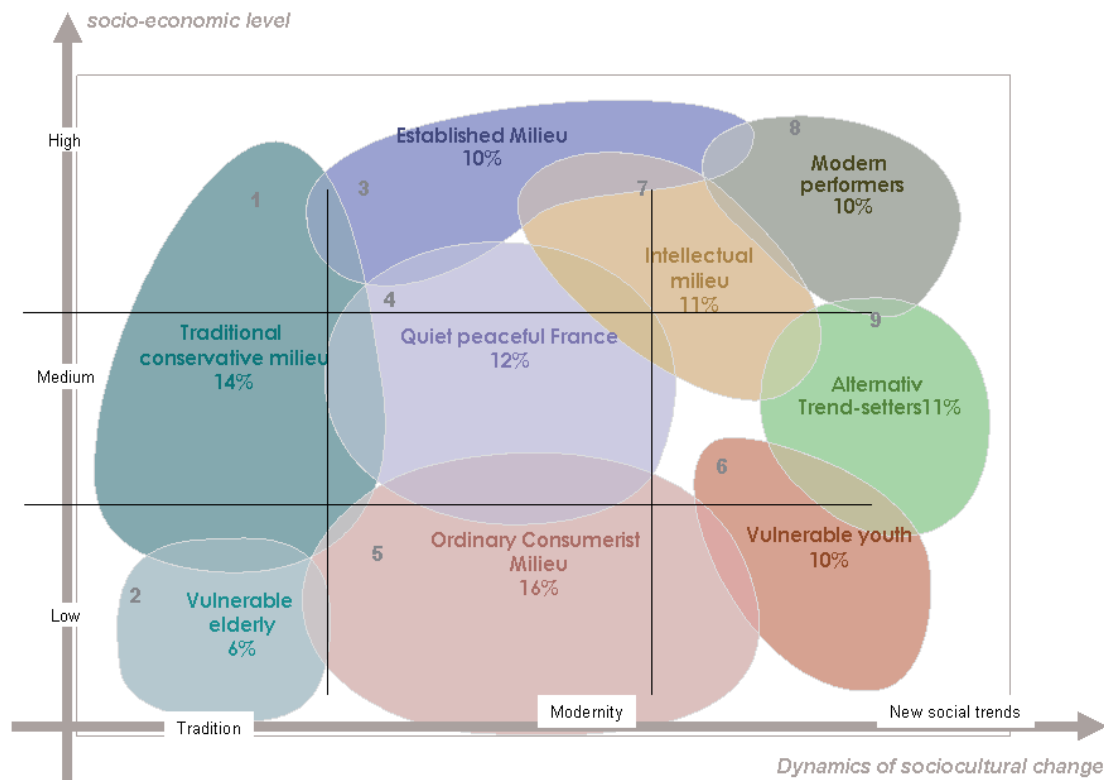6. http://website.sociovision.fr/sociovision/page?rep1=SM&rep2=Group&nom=pr inc-sm-uk

Figure 1: The Sinus Milieus® 2010; Source: Sociovision.

Analysing the Carbon Footprint of French Sinus Milieus®

Bilan Carbone® is a methodology developed by the French Energy Agency (ADEME) to assess the greenhouse gases emitted by different kinds of entities: tertiary and industrial businesses, administrations, municipalities and territories. The tool *Bilan Carbone Personnel®* (BCP) was specifically developed to calculate the carbon footprint of individuals.

The carbon footprint assessed by BCP relates to individual persons. Shared commodities such as the occupancy of an accommodation or the use of a vehicle are consequently divided by the number of users. In addition, the emissions that are taken into account are only those that refer to personal lifestyles. In other words, the emissions for professional reasons (business trips, etc.) and those related to the use of public goods and services (road infrastructures, healthcare facilities, etc.) are not included. Last but not least, BCP follows a life-cycle approach. As a result, parameters such as the geographical origin of food products or the embodied energy of construction materials are included in the calculator.

BCP has the form of an online questionnaire made of about 75 questions evenly distributed into four main categories.

1. **Domestic consumption** *("logement")*: space heating, domestic hot water, cooking, electric appliances, construction, equipment, furnishing, interior decoration and refurbishment.

2. **Transport**: by car, motorcycles, plane and public transports (electric and fossil fuel).

3. **Food** *("alimentation")*: meat and fish, dairy products, fruit and vegetables, drinks and alcoholic beverages.

4. **Consumption of goods and services** (*"consommation"*): clothing, computer hardware, electronic devices and other consumables, household-waste sorting, expenditures in services (insurances, telephony …) and leisure (holiday stays …).

In average, these four consumption areas account for proportions of carbon emissions that are roughly similar. Figure 2 shows an extract from BCP results for the average personal carbon footprint in France, indicated in kg C on the figure (1 kg C equals 3.7 kg CO_2).

The current average footprint in France is of around 10 t CO_2 per capita, of which 2.2 t are captured by carbon sinks (forests, etc.). The emissions per capita should drop to about 2.6 t CO_2 i.e. about 640 kg CO_2 per distinguished category to reach a sustainable level. This theoretical threshold is indicated on Figure 2 by a horizontal red line. This fourfold challenge of reduction which represents the transition from current footprint levels to a sustainable level constitutes France's aim to be reached by 2050 (MINEFI & MEDD 2006).

Constructing citizen profiles representing the Sinus Milieus®

APPLIED METHOD

Table 1 shows an abstract of the database constituted by Sociovision with field surveys. The table presents the distribution of home floor areas for each Milieu (columns "M1" to "M12") and in average (column "total"). In this example below, the share of interviewed persons living in homes with floor areas of 61 to 120 m² is similar to the French average (first column "total"): for all Milieus it ranges from 50 % to 70 %. The
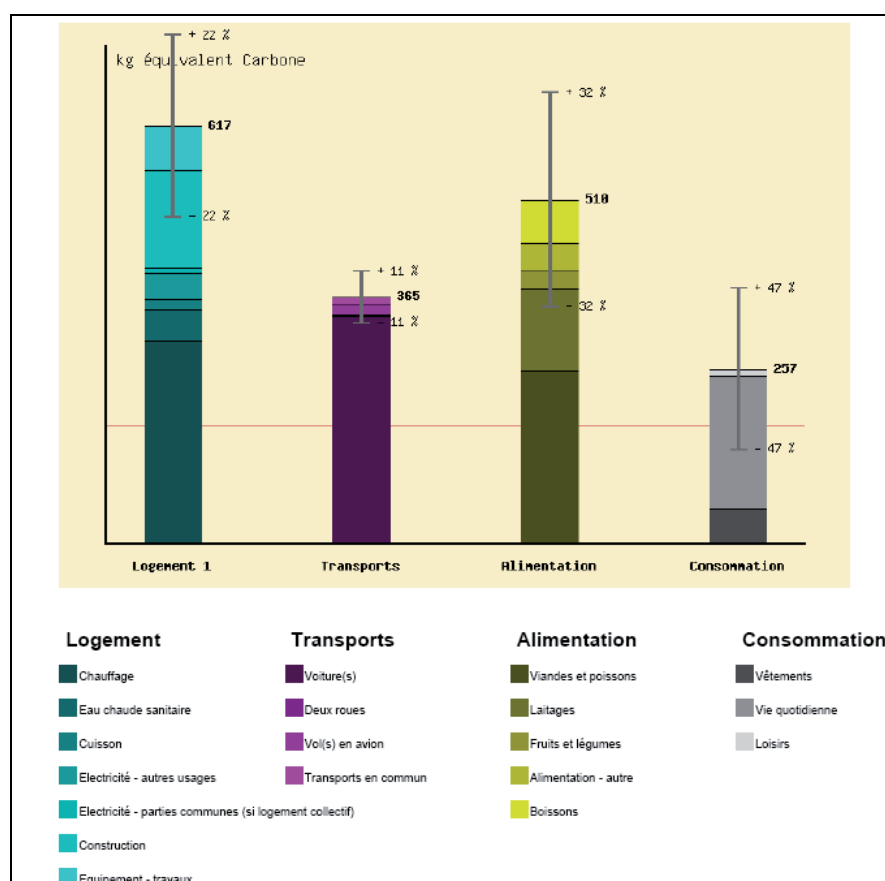
(Source: Bilan Carbone Personnel® / *ADEME)*

Figure 2: Detailed average personal carbon footprint in France using Bilan Carbone Personnel®.

Table 1: Example of data table for 9 current and 3 emerging milieus (Source: Sociovision).

What is the floor area of your main home? (%)												
	Total	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**	**M12**
< 30 m²	2,5	3,6	2,9	2,6	1,5	0,7	3,0	1,0	1,5	3,0	3,4	6,7	3,5
30-60 m²	15,8	17,9	14,4	17,5	13,4	10,7	14,1	14,9	15,1	24,3	12,0	26,7	15,3
61-90 m²	31,9	32,2	27,8	30,5	32,3	30,3	36,2	34,8	33,9	29,9	23,4	31,0	34,8
91-120 m²	28,5	27,0	36,0	28,2	36,4	25,5	28,0	28,1	26,3	22,4	33,7	20,2	27,5
121-160 m²	12,4	8,3	13,7	11,3	12,0	16,1	14,1	11,1	11,3	16,7	15,9	7,5	10,6
> 160 m²	6,5	8,7	4,8	6,4	3,4	12,7	2,7	7,3	11,8	2,4	8,3	5,5	3,6
(Don't know)	2,5	2,2	0,4	3,6	1,0	4,0	1,8	2,7	0,0	1,3	3,3	2,4	4,7

share of the smallest (less than 60 m²) and the largest (more than 120 m²) homes is minor compared to the medium-sized homes (from 60 m² to 120 m²). For these marginal shares, the variations from one Milieu to another are worth a few percentage points and do not influence the average floor areas per Milieu much. Yet some of these variations are particularly meaningful as they are sometimes very high e.g. worth a factor 10 between the Milieus M5 and M11 for the homes smaller than 30 m².

To cope with the loss of such information, we developed profiles selecting single values instead of weighted average values and pointing out the particularities of each Milieu compared to the others. These profiles were created according to a horizontal comparison of the tables: instead of choosing the average value for each Milieu we constructed our profiles based on the highest value of a given category. In the example (Table 1), the Milieu M5 is the one where the occurrence of large accommodations (> 160 m²) is the highest (12.7 % vs. 6.5 % for the French average). Similarly, the Milieu M11 is the one where the occurrence of small accommodations (< 30 m²) is the highest (6.7 % vs. 2.5 % for the French average). For three Milieus, some particularities that were observed did not corroborate well. Hence two profiles instead of just one were created. In the end, we consequently came up with 15 profiles for the 12 Milieus.

The main limitation to this approach is that **the profiles are not fully representative of the Milieus anymore**. The profiles and the calculated footprints are based on a discrete selection of values which is not necessarily representative of the Milieu. In the example above, the selected floor area for the Milieu M11 represents only 6.7 % of the individuals within this Milieu. In particular it is important to note that the carbon footprint of the French society cannot be calculated by multiplying the footprint of each profile by the share of each Milieu. Nevertheless, this way to build up profiles has several advantages:

- The profiles are comprehensible as they show concrete characteristics that can be exposed in the form of storytelling (see example below); as a result, their consistency can be easily discussed.

- The profiles are contrasted with each other, thus making obvious the specificities of each Milieu and allowing for a wide range of carbon footprints.

- The intervention strategies (see chapter below) will draw on action levers that are representative of the considered Milieus (affinity to economic incentives, ecological orientation, community orientation…). Hence this working step is not affected by the method of creating profiles for the carbon footprint.

The difficulty lies in choosing a set of hypotheses for each profile that remains realistic and coherent:

- Realistic: although the profiles are conceived as artefacts of the related Milieu, the chosen hypotheses need to reflect the social reality and be justified by the databases on hand.

- Coherent: some characteristics are interdependent and need to be cross-checked. For instance, the type of housing (one-family house, flat in multifamily house…) is connected with the floor area of the homes; the ownership of a car with the number of kilometres travelled by car during the year; the heating system with the building type and its age; etc.

EXAMPLE OF PROFILE: "VULNERABLE ELDERLY"

To clarify our methodology we will tell a short story which illustrates the hypotheses made for the profile representing the Milieu "Vulnerable Elderly" ("*Précaires âgés*"). Sociovision (2011) describes this Milieu as one counting an overrepresentation of retired people with low educational and income levels. They have a defeatist and resentful attitude towards modern society and consider the current economic system as responsible for their problems. Their value system is conservative with a strong devotedness to their children. They live a simple life and consume basic and functional products. Their leisure activities do not create social networks: they mainly read tabloids do crosswords puzzles, play the lottery and other gambling games and watch TV classics such as everlasting soap-operas (*The Young and the Restless*, etc.) and game shows (*Wheel of Fortune*, *The Price is Right*, etc.). The media enable them to keep in touch with the outside world but they reject topics that reinforce their feeling of social, economic and intellectual marginalisation.

The profile developed for this milieu considers a retired, 65 year-old woman whom we will call Marie Durand. Mrs.

Durand has a primary education and receives a net monthly income of €900. She lives alone in a small town (less than 20,000 inhabitants) in the countryside in the East of France, in a terraced house close to the town centre. She is the owner of this house where she used to live with her husband and kids. The house was built between 1915 and 1948 and has four main rooms with a total living space of 95 m². The heating system is a central oil boiler with a wood stove in the living-room. Mrs Durand is not very mobile, spends most of her day (weekday and weekend) at home and only goes out for everyday needs (food shopping, etc.). To do that, she uses a small car (4 HP) powered with unleaded gas. She never does long journeys by car and does not travel by train or plane either.

She is aware of some environmental issues and tries to make her own contribution for environmental protection. For instance, she sorts her household waste carefully. However, her low income compels her to go for the cheapest products. As a result, she buys only few green products such as green-labelled products or organic food. Nevertheless, she strives to support local economic structures and jobs. Thus she prefers food products from local agriculture and is willing to occasionally pay a little more for products made in France. She eats slightly less meat than the average (mainly pork), rarely drinks juices or soft drinks but eats more fish than the average. She never buys bottled water.

At home she pays special attention to her energy and water bills; she makes sure not to waste water or energy (turns off unnecessary lights and appliances on standby mode). Her home is much less equipped in appliances than the average, especially regarding electronic and computer appliances, but these appliances are old and rather inefficient.
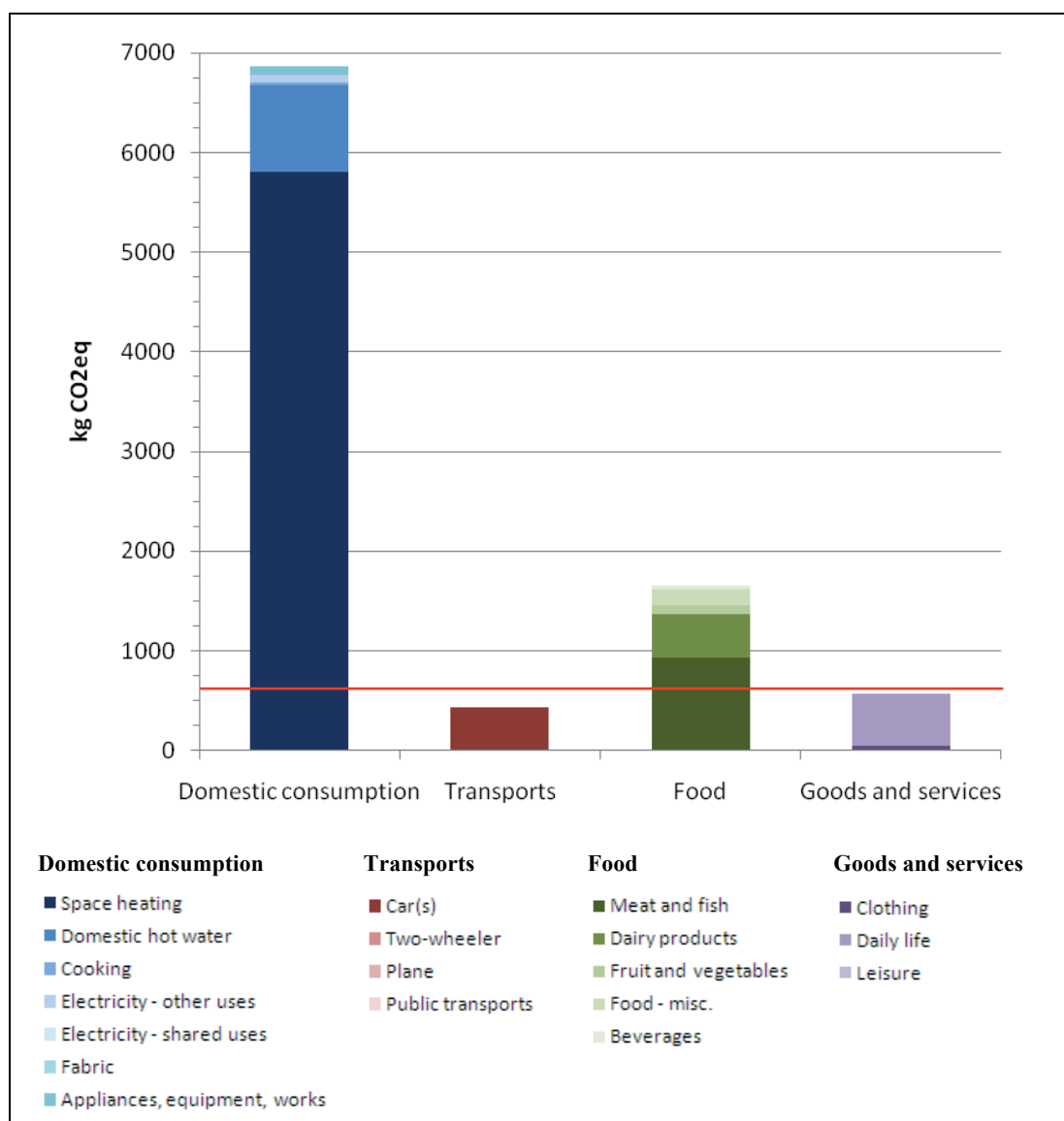
Results

Figure 3 presents Mrs Durand's personal carbon footprint. Although the total level of the footprint is not much higher than that of an average French person, its distribution per category (domestic consumption, transport, food, consumption of goods and services) shows great differences.

Mrs. Durand is living alone in a house where she used to live with spouse and kids. As a consequence, a large heated floor area is used by this single person (95 m² vs. about 40 m² per capita for the French average). In addition, the house is old and poorly insulated. Last but not least, the combustible used for heating (heating oil) is particularly carbon-intensive. Compared to the French average where about a third of housing units are heated with relatively low-carbon electricity[7], the carbon footprint due to space heating in this profile is considerable. Even though it is assumed that most of the home appliances owned by Mrs. Durand are outdated (older than 10 years), the low equipment rate of her home results in a rather marginal footprint caused by appliances, as compared to the rest of the footprint.

The footprints for the consumption of goods and services and for transport are lower than the sustainable threshold rep-

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7. Because of the large share of nuclear energy and hydropower in its electricity mix, France is one of the European countries with the lowest carbon content for the electricity generation. One third of homes in France are heated with electricity, which represents as much as half of the total number of electric homes in Europe.

(Source: own figure using Bilan Carbone Personnel® *results*)

Figure 3: Detailed personal carbon footprint for the "Vulnerable Elderly" profile.

resented by the red line on the graph. In the case of goods and services this low level can be explained by the narrow intensity of Mrs. Durand's consumption: she only makes functional purchases and has been living in an equipped home for years. Her narrow transport footprint is due to her low mobility even though she uses a car for all of her travels. Finally, her food-related footprint is relatively high, mainly because of a sizeable consumption of meats. In addition, her food purchases are mainly imported products from conventional agriculture which are cheaper than green products.

In conclusion, intervention strategies in the case of Mrs. Durand should primarily aim to reduce the level of emissions related to the domestic consumption, and particularly space heating. The high level of consumption is above all related to the very poor building standard of her home and the oil-fired central heating system. In contrast, regarding transport and the consumption of goods and services she is already displaying a sustainable level of consumption.

Conceiving appropriate intervention strategies

Given the considerable differences between the consumption categories, one might conceive measures that target the carbon intensive consumption areas and address the socio-cultural particularities of each Milieu. Those particularities can be framed within the models of behavioural changes developed by different disciplines. There is a huge bulk of literature on changing unsustainable behaviours, coming traditionally from psychology and economics, and, more recently, also from sociology and anthropology. It would go beyond the scope of this paper to review in detail the debate on this topic (see for broad overviews Breukers et al. 2009, Bartiaux 2008, Abrahamse et al 2005, Huber et al 2010, Ehrhardt-Martinez 2008 and Jackson 2005). Yet, we try to take the findings of those different disciplines into account and assume that all of them provide important insights on the topic of behavioural changes. Figure 4 sums up key aspects that come into play for the realisation of energy-consuming behaviours and behavioural changes. It combines both, micro-individual aspects such as individually variable perceptions, and
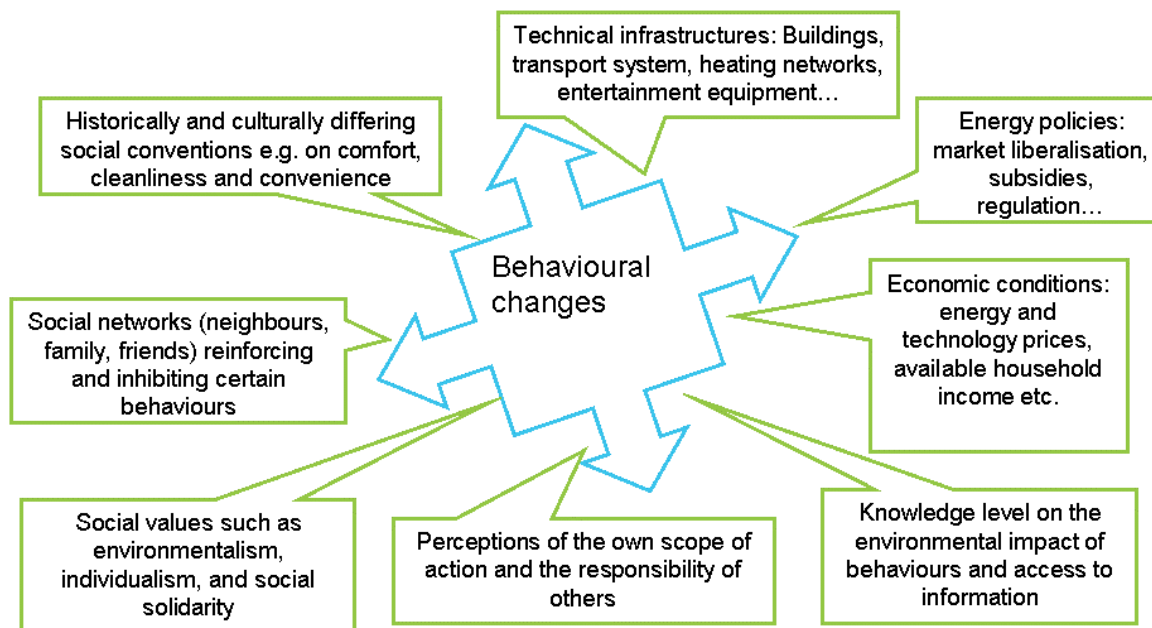
Figure 4: Intervening factors for behavioural changes.

value orientations and structural elements such as a socially defined ways of doing things, infrastructures surrounding us and energy policies setting a frame for our actions. We assume that for each Milieu this setting will be different, and consequently, the intervention strategies that are applied to it must also be chosen with regard to the specific conditions[8].

For instance, coming back to the example de Mrs. Marie Durand, some typical characteristics of the "Vulnerable Elderly" Milieu should be taken into account for designing intervention strategies that match the particular situation of the Milieu. People from this Milieu live quite isolated in their homes with very small social networks. Many of the Vulnerable Elderly have experienced unemployment and poverty in their life which resulted in a feeling of exclusion from modernity and a widespread scepticism towards today's economic and political system and their representatives. The only people they trust in are individuals in similar precarious situation with whom they show solidarity and their children with whom they maintain very close relationships. Finally it is important to bear in mind that a large share of the Elderly Vulnerable citizens has retired and has only a quite low disposable income.

With this setting in mind one might conceive appropriate intervention strategies. Overall, we distinguish five fields of measures: information and communication (1), community approaches (2), regulation (3), financial incentives and disincentives (4), and finally, infrastructural measures (5) (Figure 5; for a comprehensive overview on different policy options see Adell et al 2009).

1. **Information and communication** measures are a classical category of intervention strategies. Typically, they target the knowledge component of human behaviour (e.g. insuf-

ficient knowledge on the advantages of passive houses), peoples' value orientations (e.g. highlight the environmental benefits of passive houses), or in some cases also social conventions (e.g. questioning conventions in ventilation practices to adapt them to passive houses). Information campaigns, feedback instruments such as smart metering systems, face to face energy advice services or labels for household appliances are typical instruments in this category. Studies indicate that personalised and frequent feedback, combined with elements of social comparison and/ or some kind of reward are rather effective instruments, at least in the short run (Abrahamse et al. 2005, Darby 2006; Save@work4homes 2009, Rettie and Studley 2009 Bartiaux et al. 2006: 143)

2. **Community approaches** are somewhat similar to information and communication measures and will usually also include elements of them, however their philosophical approach is different. Rather than focusing on individuals in isolation from society they are trying to make use of the power of social interaction. Individuals are not "targeted" in the classical sense, but they are included in the conception and implementation of change measures, and active participation is a key element. The "transition town" movement can be considered as a community approach - which has experienced already some media coverage - but there are numerous other small community engagement groups emerging in many places. Recently the high potential of such approaches has also been discussed by scholars (Heiskanen et al. 2009; Middlemiss 2008; Middlemiss and Parrish 2009; Kenis and Mathijs 2009; Maloney et al. 2009). Governments, above all those at the local level, might support this kind of community movements with expertise, the provision of spaces or promotion activities.

3. **Regulation** is among the most powerful instruments that governments have at hand to push forward developments. However, regulatory instruments are often also the most

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8. For reasons of ongoing work we are not yet able to present thorough results but at the time of the eceee summer study our work will have progressed and we will come up with more detailed examples. Thus in the following our reflections have a rather illustrative character.
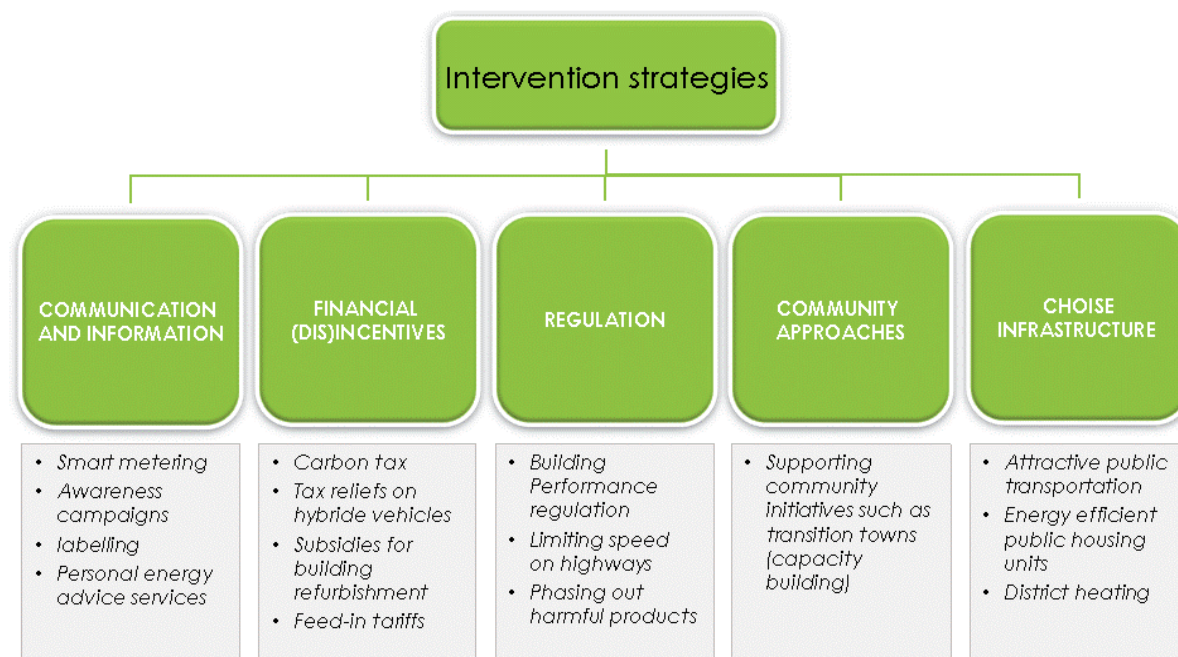
Figure 5: Intervention strategies.

politically contested and, in our democratic, liberal societies they have to be justified from the background of restrictions of personal freedom. Yet, for speeding up the process to low-carbon societies they might be in the end the most efficient tool that requires strong and charismatic political leaders to make them acceptable to society. For instance, in the energy field, energy performance building standards might be tightened, certain products might be forbidden (as recently conventional light bulbs), or the driving speed on highways might be limited. Some databases contain numerous examples of evaluated regulatory measures that were successfully and efficiently implemented[9]. These will be an important source of information for our suggested intervention strategies, together with recent monitoring reports on successful energy efficiency policies (WWF 2010; Höhne et al. 2009; Adell et al. 2009; Tews 2009).

4. Similarly, **financial instruments** have a potentially high impact on households' behaviours, as shown e.g. by the very successful feed-in tariffs for renewable energy based energy generation that were implemented in various European countries. In addition to such "carrots" governments can also introduce financial "sticks" affecting individual energy uses. Taxes on fuel consumption might be applied, as controversially discussed in French politics ("taxe carbone"). Products might be charged with a carbon tax depending on the CO_2 emissions that were incurred during their production and transportation. The databases and reports mentioned on regulatory instruments contain also numerous good practices on that category that might inform the project for suggestion of intervention strategies.

9. See e.g. http://www.isisrome.com/mure/selection1.asp, http://www.iea.org/text-base/pm/?mode=pm

5. A last category of intervention strategies concerns the **infrastructures** surrounding people and directing them by their presence, shape and quality towards sustainable or unsustainable behaviours. In their recent book "Nudge" Richard Thaler and Cass Sunstein (2009) highlight the potential of an attractive "choice architecture" that leads individuals to good choices by design. This basic idea appears well transferable to the energy sector. For instance, in the transport sector a dense and wide-spread system of public transportation with frequent services and modern and clean vehicles is likely to have more impact on inhabitants' transport practices than many broadly designed awareness raising campaigns.

Coming back to Mrs. Durand representing the "Vulnerable Elderly" Milieu and her high carbon footprint in the field of domestic consumption, policymakers may choose among those 5 categories of interventions to tackle her emissions at home. As Mrs. Durand does not have the financial means to refurbish her home towards ambitious energy standards - even in a framework of strong subsidies or very attractive loans - any measures to incite deep renovations will be hardly effective. However, one possible option that appears more feasible might be to replace the oil fired heating system by biomass heating. Three main levers appear promising in the case of Mrs. Durand. First, given her restricted budget, the economic attractiveness of the intervention instrument is a key factor. This challenge might be tackled with an attractive grant for the replacement of the old oil-fired heating system. Second, Mrs. Durand lives very isolated and is very skeptical towards the elites of our current political and economic system. Hence, any intervention program must be communicated to her by persons on the local level that she trusts in and who have access to her. For instance, local authorities could attract voluntary retired persons having a similar socio-economic background as Mrs. Durand and train them to become energy advisors specialized in promoting energy efficiency and emission re-

ductions to retired people. Third, program designers might benefit from the very high personal affection between Mrs. Durand and her children and might include them as target group. For instance, those could be provided with a sort of inter-generational soft credit that would cover the rest of the necessary investment. In the short run, Mrs. Durand would benefit from lower heating costs; in the long run the children will benefit from their investment, too, as they will eventually inherit their mother's house.

Conclusion and perspectives

The first results presented in this paper show the relevance of the Sinus Milieu segmentation for an environmental analysis and targeted intervention strategies in the field of sustainable development. The critical methodological point consists in developing profiles with single values rather than average values. This makes disparities between Milieus obvious and results in a wide range of carbon footprints.

However, this approach needs to be refined and complemented. In particular, a prospective work will be performed in the course of the "Milieus Urbains Durables" project. Due to certain megatrends (e.g. sustained individualisation of lifestyles, growing creative and innovative capacities, raising concern for environmental protection, increasing social inequalities), we distinguish three possible scenarios: one baseline scenario as business as usual; another one assuming the rise of a greener society based on the current economic model and a new "green deal" and, finally, a second green scenario which assumes radical changes in the way our daily life and consumption patterns are organised. Depending on which megatrends become prevalent, the likelihood of each of the scenarios will vary.

Each scenario comes with a distinct milieu segmentation. The relative share that each Milieu will represent in the French society varies according to the scenario. Furthermore, while some new Milieus will emerge, some existing Milieus will merge with other Milieus with similar value systems or slowly disappear. These are evolutions that need to be assessed to develop smarter intervention strategies targeting growing Milieus and those that have a strong impact on the others.

To conclude this paper we want to stress that our project does not deal with normative questions that will certainly arise for the implementation of intervention strategies. The fight against climate change requires ambitious and convincing political leaders, but also an intense debate within our societies. There are numerous previous examples of intervention strategies that appeared absolutely necessary for cutting carbon emissions from a scientific-technical point of view, but which failed to achieve legitimacy among citizens. This is because potentially conflicting social and political objectives such as protecting personal freedom, supporting vulnerable households, preventing the economic downturn of some industry sectors, or cutting public debt were not sufficiently discussed. In the long run, the low carbon society can only be achieved if the legitimacy of certain intervention strategies is shared among large parts of society, and this can inevitably only be achieved through processes of negotiation between different social stakeholders, participative policy approaches and a broad public discourse.

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Glossary

ADEME: The Agence de l'Environnement et de la Maîtrise de l'Energie is the French Energy Agency.

BCP: Bilan Carbone Personnel® is a tool developed by the ADEME to assess personal carbon footprints. It is used in the frame of our project to assess the carbon footprint of each social milieu.

C: carbon (molar mass: 12 g/mol)

CO2: carbon dioxide (molar mass: 44 g/mol)

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