Lou camin de vida prouvençau, a Socio-spatial Constraint on the Implementation of Energy Transition

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ABSTRACT.— **The energy transition questions spatial patterns in light of current energy issues. It elicits reflection on the weight of existing socio-spatial structures deemed a constraint on the implementation of the energy transition. Controlling energy demands in the residential sector is one of the pillars of governmental discourse on the implementation of the energy transition. How do residential characteristics determine levels of consumption? The answer reveals energy characteristics differentiated according to space, which are specific to local circumstances and a specific way of living: the Provençal style of suburban housing, *lou camin vida prouvençau*.**

ENERGY TRANSITION, PERI-URBAN, WAYS OF LIVING

**** Literal translation of the "American way of life" in Provençal.***

RÉSUMÉ.— ***Lou camin de vida prouvençau*, une contrainte socio-spatiale à une mise en œuvre de la transition énergétique.*— La transition énergétique amène à interroger les modalités d'organisation des territoires à l'aune des problématiques énergétiques actuelles. Elle engage une réflexion sur le poids des structures socio-spatiales existantes comme un frein à sa mise en œuvre locale dont la maîtrise de la demande énergétique résidentielle est évoquée comme un pilier par les pouvoirs publics. Comment les caractéristiques résidentielles déterminent-elles un certain niveau de consommation ? Cette analyse révèle des caractères énergivores différenciés dans l'espace, propres à des contingences locales et un mode d'habiter particulier, l'habitat pavillonnaire à la provençale, *lou camin de vida prouvençau*.**

MODE D'HABITER, PÉRIURBAIN, TRANSITION ÉNERGÉTIQUE

**** traduction littérale en provençal d'« American way of life ».***

Introduction

The question of energy performance, between efficiency, sobriety and mastery of consumption, has become central to territorial planning (CERTU, 2012; Scarwell et al., 2015). Often implicit in numerous planning documents (Agenda 21, SCOT, and PLU), the energy dimension of territories is now addressed explicitly in the energy, air and climate regional schemes (SRCAE) and territorial climate energy plans (PCET). This integration of energy concerns in planning documents requires advanced understanding of how the organization of a territory determines the level of energy consumption.

* Literal translation of the "*American way of life*".

Energy consumption analysis allows for the reconsideration of territorial organization methods in terms of current energy issues. Research into existing spatial and territorial factors of this consumption raises concerns on the burden of existing socio-spatial structures. In effect, these factors can be considered a hindrance to an implementation of the energy transition and reveal the difficulty in providing national policy solutions at local and regional level. Support for control of energy demand in the residential sector is one of the pillars of governmental discourse on the implementation of the energy transition (MEDDE, 2015).

To what extent do residential features determine the level of energy consumption for households? In addition to studies carried out on energy-use characteristics of buildings (Maizia, 2007), recent research has shown how energy consumption is involved in a socio-material system of relations in which individualities and social norms are renewed (Zélem, 2010; Walker, 2014; Lévy et al., 2014; Zélem, Beslay, 2015). To occupy and inhabit a space, appropriating it, is a fundamental act of individual and collective identity building, an identity relationship to place which shapes specific residential behaviors (Carpentier, 2010), and resulting individual energy consumption practices. Nevertheless, restricting the research of domestic energy consumption determinants to the analysis of individual practices leads to underestimating the registration of individuals in wider socio-spatial structures. The notion of way of living can be considered both how individuals reside as their relationship to space that this housing type conveys, (spatious apartment, collective housing, detached house, suburban dwelling, etc.)(Stock, 2004) not to mention the physical state of housing and the morphological aspects of urban fabric. It is through this study of communal socio-spatial structures that we herewith approach ways of living.

This article focuses on spatial configurations of residential energy demand within a regional territory by showing how ways of living and their localization are explanatory factors for this demand, and how the energy issue is also part of a wider context of issues (planning, attractivity of territories, social inequality, suburbanization, etc.). In other words, the question is not about finding out *who* consumes, but *where* energy is consumed, and what this shows in the spatial organization of a territory.

The burden of inherited socio-spatial structures

The spatial tracks of societies are the result of spatial constraints, choice, regulations, conflicts and negotiations between different social groups. It is the systemic outcome of interactions between individual and collective strategies which organize and modify space in the full complexity and diversity of social actions. The shapes of the built spaces are the lasting consequences of structured spatial tracks (orderly or disorderly), also named socio-spatial structures. They are the result of free or restricted individual strategic decisions (employment area accessibility, housing location, etc.), of regulations and collective strategies (planning, development, local urbanism plan, etc.), and of interactions between different social groups (socio-spatial segregation). The socio-spatial structures possess a high inertia and in return restrict social and spatial interactions (land ownership dynamics, transport networks, etc.), as well as their own potential for change and for evolution. They illustrate the *path dependence* perspective (Pierson, 2000). This concept conforms to a situation where past decisions indicate a given direction incurring ulterior dynamics following the same trajectory. It has found its way into geography and into the study of energy transitions. The spatial dimension of *path dependence* in sustainable transitions has, among other things, been highlighted by Ron Boshma and Ron Martin (2010) and recently reaffirmed by Teis Hansen and Lars Coenen (2015, p. 6) who recall that "according to Martin (2010, p. 3), the combination of historical contingency and the emergence of self-reinforcing effects, steers a technology, industry or regional economy along one path rather than another." In effect, the evolution of territories has been sustained by former choices favoring technologies founded on fossil fuels (Unruh, 2000; Bridge et al., 2013). The costs of breaking free from this model have increased over time; both in the *irrecuperable* costs of company space structuring (built environment, networks, infrastructures), as well as the cultures at the place of consumption, reflected in expectations and standards concerning the cost and reliability of energy supply, or simply social practices associated with energy consumption. Energy transition convenes a revaluation of the form, function and value of certain socio-spatial structures, in particular those of urban and suburban spaces. Further attention given to energy efficiency has rekindled debate on urban morphology, city density and their energy-consuming effects (Newman, Kenworthy, 1989; Massot, Orfeuil, 2007; Wiel, 2009). A number of reports prescribe densification and compactness in order to minimize energy spending and maximize the accessibility of places. A compact city would theoretically reduce distances for individual travel, promoting public transportation and decreasing greenhouse gas emissions (Orfeuil, 2008). Today this issue is widely studied (Pouyanne, 2004; Desjardins, 2011; Le Néchet, 2011, 2015), but it however remains difficult to affirm with certainty that modification of urban morphologies can drastically reduce energy consumption (Dupuy, 2002; Chabrol, Grasland, 2015), especially since the calculation of "grey[1]" energy associated with the arrangement of urban forms defined as *sustainable* (compact and polycentric forms) is nonexistent, although research is expanding to integrate grey energy into energy audits (Pourouchottamin et al., 2013). The costs associated with restructuration of built environments and networks to achieve these models are difficult to estimate.

These models equally conflict with social and residential practices reflecting cultures in the place of consumption as well as their specific ways of living affecting energy consumption. Recent studies have shown the influence of housing uses and practices on residential energy consumption. Jean-Pierre Lévy et al. (2014, p. 52) has demonstrated that on a national scale variability in consumption levels related to population profiles and specific housing aspects. Their results have shown the interest to refrain from reducing consumption analysis uniquely to building attributes and call for expanding measurement indicators of residential energy consumption. The proposed analysis in this article responds to this appeal on a regional scale. Furthermore, the impact of the suburban way of living on energy consumption is now well established (cf. literary revue proposed by Xavier Desjardins and Marie Llorente en 2009). There is abundant literature on this subject, both to demonstrate the impact of suburbanization on petrol consumption, and to evaluate the energy impact of individual housing, or even to show that "suburban living is yet to be challenged by the energy issue in the eyes of those who reside there" (Desjardins, Mettetal, 2012, p. 56). However, these studies obscure consumption variability within different suburban forms. Suburban living covers different forms both in terms of housing type and in terms of practices and representations.

This article therefore follows on from studies examining the determinants of residential energy consumption. It proposes to develop a regional approach to this phenomenon based on reproducible quantative methods, which firstly, distinguishes

1. "Grey" energy is energy spent in the upstream phase of material manufacturing and more widely industrial products: conception, extraction, transformation, transport. It can cover from 50% to 75% of the total energy of a product.

several categories within the same way of living, and secondly, integrates social and cultural geographic specificities of a specific territory.

Socio-spatial structural types and energy consumption: energy-consuming suburban areas

The Provence-Alpes-Côte d'Azur (PACA) region is an ideal environment for the treatment of this problematic. Third metropolitan region in terms of energy consumption, this region is equally subject to supply difficulties owing to its location at the end of the national electric grid. There, energy demand management therefore amounts to a huge challenge, particularly in the housing sector, which represents 30% of energy consumed. This region is equally the scene of strong metropolization dynamics that make it a priviledged observation space of structures and suburban dynamics.

The proposed analysis articulates in three stages. The first verifies the existence of a statistical relationship on a regional scale between energy demand and housing stock attributes. The second shows how residential features are distributed within the regional space and contribute to defining space types. The third examines the variability of residential energy consumption between identified space types and characterizes the energy-consuming aspects of each of them in a mapping design.

Energy demand on housing place: a combination of residential factors

The aim in this section is to explain the intercommunal variations of energy consumption linked to the residential sector, starting with a set of variables describing certain qualities of household population (size), housing (type, age, heating equipment) and municipal territory (Housing units per square kilometer of built-up area[2]) (table 1). A multiple regression step by step model[3] has been implemented as follows. The energy consumption of the residential sector from 2010 by municipality (base Energ'Air regional observatory for Energy, Climate and Air in the PACA region (ORECA PACA)[4] relative to the number of housing units per municipality (INSEE 2010 housing base) corresponds to the variable to be explained. The explanatory variables are calculated from the INSEE 2010 housing base in the municipality. The avantage of this data is to offer a unified communal base that facilitates statistical

2. The built-up area has been calculated from BDTOPO 2010 of l'IGN.

3. 3. The calculations have been performed with the free software TANAGRA (Rakotomalala, 2005), see http://eric.univlyon2.fr/~ricco/tanagra/fr/tanagra.html.

4. http://oreca.regionpaca.fr/

Table 1/ Residential and energy consumption factors in Provence-Alpes-Côte d'Azur: questionings

Explanatory variables	Questionings
Household population in 2010	Impact of the number of inhabitants per household
Housing units per square kilometer of built-up area	Impact of housing density relative to built-up area
Secondary residences and vacant housing	Presence of a built-up area yet seasonal or inexistent energy demand
Type of residence (house or apartment)	Impact of housing and semi-detached housing areas
Status of occupants (owners or tenants)	Impact of life cycle and social condition
Heating equipment (individual, collective, electric, etc.)	Impact of heating method
Construction period *	Impact of older buildings and construction standards

* before 1949, between 1949 and 1974, between 1975 and 1981, between 1982 and 1989, between 1990 and 1998 and between 1999 and 2005.

treatments and mapping as part of a regional analysis, with explanatory variables integrating both morphological (built) and material (equipment) aspects as well as social (occupant type). They allow for the questionnings presented in table 1. Additionally, this open access data allows everyone to replicate our analysis, verifying, refusing or completing it. A first model implemented from raw data presented important biais (size effects, colinearity, and unstandardized coefficient correlation of 0.999…). This is why all used variables here are relative, with the aim of limiting econometric bias.

The multiple regression carried out is globaly pertinent (R2 = 0.8352 and fit R2 = 0.8333). The Fisher test concludes the global significativity of the model as well as the significativity of the variable coefficients. The model correctly reconstitutes energy consumption per dwelling for the greater majority of municipalities: 94% between them are residue situated in the interval +/- 2 standard deviation. Residues are in adequation with normal law, which validates the use of a regressive model.

The results of the model show that energy demand within dwellings depends on a combination of residential factors. They confirm results presented recently by Jean-Pierre Lévy et al. (2014) on a national scale. The model also evaluates the weight of each variable on energy consumption. Table 2 presents the attributed coefficient value for each variable in the equation obtained, and corroborates the hypotheses associated with respective effects of different variables of socio-spatial structure. The variables are ranked in order of diminishing importance according to their weight during the selection process of variables by partial correlations (Rakotomalala, 2005; Dodge, 2007). The model confirms that residential energy demand falls within a

Table 2/ Combination of residential factors and energy consumption in Provence-Alpes-Côte d'Azur: Results of multiple regression mode

Variables	Regression coefficient	Hypotheses
Constant	-0.31	
Share of owner-occupied housing	0.02	Indicative of a new
Housing density per square kilometer of built-up area	-0.02	La densité de logement impliquerait une consommation plus faible
Share of tenant-occupied housing	0.00	The housing density would imply a weaker consumption
Share of housing built before 1949	-0.00	Older buildings would be less energy-consuming (stone, thick walls, etc.)
Household population	0.12	The more people, the higher the consumption (hot water, appliances, etc.)
Share of housing units with individual central heating	0.00	Individual heating would be more energy-consuming
Share of housing units built between 1999 and 2005	0.01	Recent housing would be more energy-consuming. Non-compliance with RT 2000 standards
Share of housing wih collective central heating	-0.01	Collective heating would be more energy-consuming
Share of apartment-oriented housing	0.01	An apartment would not necessarily imply a weaker consumption
Share of house-oriented housing	0.01	A house would not always imply a higher consumption than an apartment
Share of housing built between 1990 and 1998	0.00	Important phase of suburbanization, poor quality housing

Sources: according to Insee, Energ'air, BDTopo Ign; Maximin Chabrol, 2015.

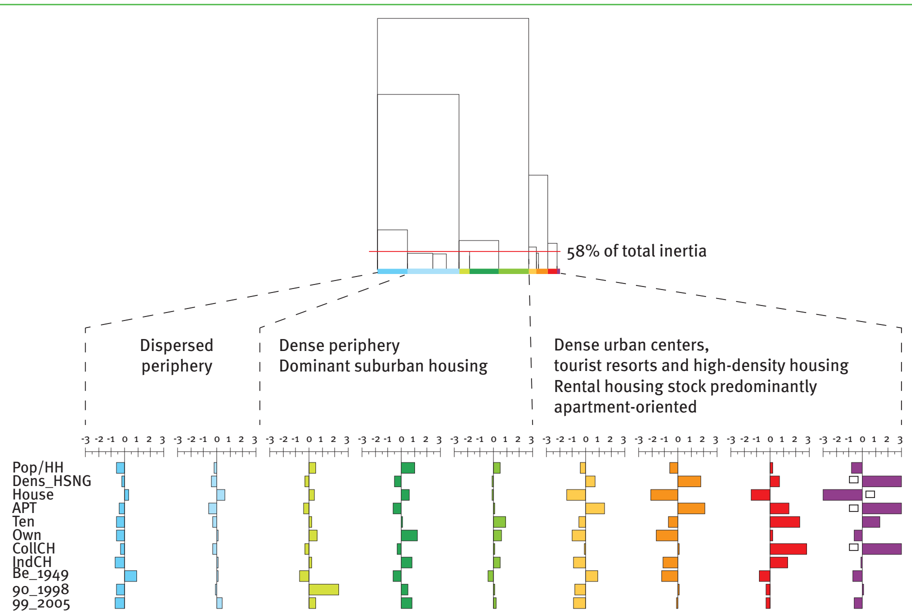
socio-material combination of factors. The two variables that weigh the most on the level of energy consumption are the owners' share, reflecting social conditions and/or a position in the specific life cycle, and housing density characterizing the organization of built-up areas.

Furthermore, the value of coefficients confirms some obviousness, like the impact of household size on energy consumption. It also confirms the results of earlier findings, those concerning density in particular, but also findings of the Parisian Workshop for City Planning which showed that pre-war construction is not as energy-consuming because "construction methods generate few thermal bridges and glazing surfaces remain low" (APUR, 2007, p. 17). The model also questions the impact of thermal standards since the share of recent housing seems to increase consumption.

Although this model confirms the existence of a statistical link between residential energy demand and housing stock aspects, it fails to mention the impact territorial spatial organization can have on this consumption. In addition, an analysis of the spatial distribution of these aspects appears essential at this stage of the study.

Identification of socio-spatial structural types

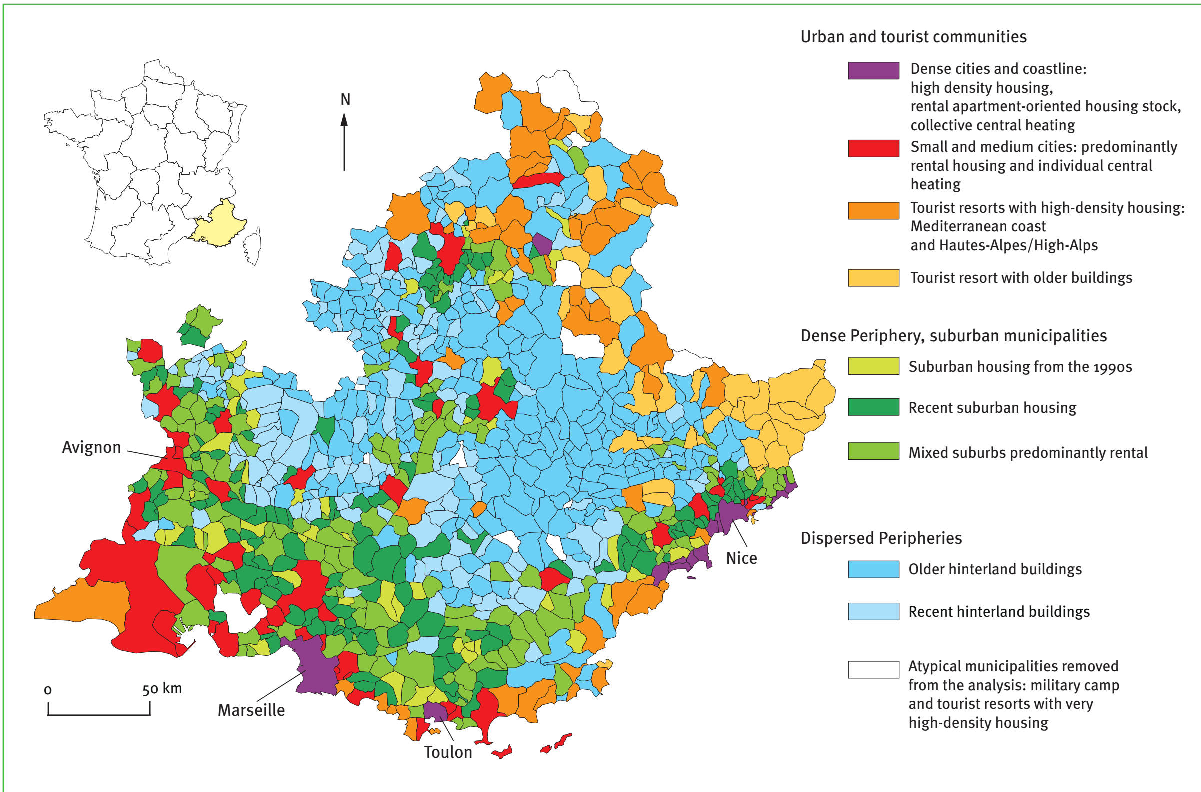
This combination of residential variables is not allocated randomly in regional space. It structures this regional space in coherent subsets from a geographic and territorial specificity standpoint, highlighting the affiliation of municipalities to space types. A hierarchical cluster analysis (HCA) makes it possible to differentiate between these spaces and formulate a typology. The classification obtained clearly distinguishes three major groups constituted in subcategories (fig. 1 and 2).



(Population/Household, Density_Housing, House, Apartment, Tenant, Owner, Collective central heating, Individual central heating)
Each bar represents the distance from each class average to the overal average.
This distance is shown as a number of standard deviations for each variable.
□ : bar divided approximately three standard deviations.

Sources: According to Insee and BDTopo Ign.
Conception and creation: Maximin Chabrol, 2015.

Fig. 1/ Dendrogram profile of spatial typology classes of housing stock in Provence Alpes-Côte d'Azur



Sources: According to INSEE and BDTOPO IGN.

Conception and creation: Maximin Chabrol, 2015.

Fig. 2/ Spatial typology of housing stock in Provence Alpes-Côte d'Azur by Ascending Hierarchical Classification

The first group assembles urban communes and tourist communes. Different combinations of variables shape the profiles unique to subgroups:

• Dense major cities (Marseille and Nice) and built-up cities along the Côte d'Azur coast are characterized by a ratio of very high-density housing per built-up area and a predominantly rental apartment-oriented housing stock, equipped with collective central heating;

• Small and medium cities differentiate from the former subgroups, by less typical density housing and a markedly greater presence of individual central heating installations;

• Tourist resorts with a ratio of high-density housing per built-up area along the Mediterranean coast and in the High Alps;

• Tourist resorts of low density with older buildings.

A second group assembles suburban municipalities, space qualified here as dense periphery, divided into three categories:

• Suburban municipalities mostly characterized by single detached housing constructed in the 1990s;

• Suburban municipalities characterized by a high proportion of landowners, mostly recent suburban housing predominantly with individual central heating;

• Suburban municipalities of mixed suburban housing stock (without a predominant housing type or a construction period) but with a more apparent rental trend.

A last group assembles the hinterland towns which can be identified in two categories relative to the period of construction:

• Hinterland towns with older buildings (before 1949);
• Hinterland towns with recent buildings (early 2000s).

Explanatory part of socio-spatial structural types in energy consumption

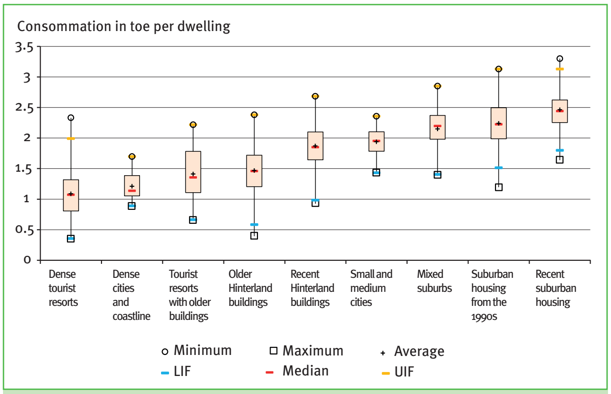


Fig. 3/ ***Box-plots*** **of consumption per dwelling by space type**

A variance analysis shows a significant difference in the energy consumption per dwelling between the groups defined by the typology. It indicates that the energy demand of housing depends partly on the affiliation of municipalities with one of the identified space types. The mean energy consumption per dwelling is higher in the suburban categories than in the other space types. Moreover, it is twice higher in recent suburban housing than in dense cities. The relation between the variability of classes and total variance is equal to 0.60. This means that the difference between the identified categories accounts for 60% of the total variance of consumption per dwelling. A diagram of the distribution of consumption per dwelling in each space type in the form of box plots make it possible to assess this relationship (fig. 3).

The observation of central values (median, mean, and interquartile range) shows the actual trend of energy demand for housing to be higher in suburban municipalities. The maximal values as well as those of the third quartiles are also the highest for the three suburban area categories.

Energy-consuming intensiveness of socio-spatial structural types

Whereas the previous analysis has shown that the level of energy consumption for municipalities depends partly on their affiliation with a space type, the most energy-consuming intensiveness should be identified within these subsets. A correlation matrix of energy consumption per dwelling and the residential variables within each space type clarifies the variables determining a higher or lower level of consumption. Although certain variables are highly representative of space type (cf. fig. 1), it is not always the latter that weighs the most on the description of the level of consumption. In effect, while urban municipalites are characterized by a high proportion of apartments, it is very well the share of detached houses which makes their consumption vary (r = 0.74). A high density housing ratio per built-up area universally implies lower energy consumption. Among the variables associated with less energy-consuming behavior, it is noted that a high proportion of secondary homes in the most attractive tourist resorts of the region (Cassis, Isola, etc.), both on the Cote d'Azur and in the high mountain areas (64% on average, can go above and beyond 90%) are attributed a lower energy consumption. These spaces are therefore not particularly energy-consuming as the demand is seasonal, which incidentally can pose other problems especially in terms of electrical load management in high season. The tourist resorts with older buildings consume more because of annual demand. The share of owners, the size of households and the proportion of housing constructed between 1999 and 2005 are determining variables. The dispersed periphery presents a greater mix of determinant variables among which the share of owners is the most crucial, supplemented by the existence of individual electric heating and the proportion of housing constructed between 1999 and 2005.

An energy-consuming way of living: "lou camin de vida prouvençau"

The energy demand of housing in suburban areas is clearly determined by a way of living quintessential to the residential habitat. The share of ownership and individual heating and/or electric heating installations are determinant variables common to three categories of suburban space. Although the first two of these categories are characterized by a large proportion of recent housing, it is the housing constructed in the 1970s and 1980s which contributes to increased consumption. In the mixed suburban category, the housing constructed in the early 2000s would equally increase the energy-consuming nature of these areas.

The two classes that consume the most are highly indicative of that which could be considered "*lou camin de vida prouvençau*", the translation adapted in Provencal dialect from "American way of life". In the municipalities, individual housing is organized in residential areas constituting wide-ranging Provencal style villas with swimming pools. This is obviously a modern version of the Provencal housing model, a far cry from the farmhouse in the olive grove or from the cluster village preserving the searing heat. Some of these municipalities are constituted almost entirely of dispersed residential areas around an original hamlet sometimes made up of one or two buildings. Both these types are highly representative of the ideal property ownership of rather affluent populations, but where there lacks means to identify specific socio-professional categories from a statistical perspective. In theory, it can therefore include as much executives and retired persons as civil servants or business leaders. *Lou camin de vida prouvençau* conforms well to the southern Provencal version of the residential housing model. "The detached house is what can be called a house, in high social backgrounds. It is most often a mode of production: the owner of a plot of land for development "has it built" by a company" (Roux, 2013). However "suburban home ownership is not just a 'default' or constrained choice. It expresses profound social aspirations" (Jaillet, 2013). This model, today common to home ownership in PACA region couples with solar tropism and the attractiveness of the metropolises Aix, Marseille and Nice to constitute a way of living which we consider here as *lou camin de vida prouvençau*. This relative proximity to natural areas (image bearers of a pleasant living environment in the South), as well as the proximity to some major economic centers allows for this comparison with the American model of private home to "exemplify the assumption of private home ownership surrounded by a garden, located in proximity to a natural environment and linked (often by motorway) to economic zones or consuming areas" (Ghorra-Gobin, 2013). This way of living is therefore a model among others. In this respect, it differs for example from the coastal tropism of Cote d'Azur, and concerns only a fraction of suburban areas.

The third category of suburban municipalities (mixed suburban areas with rental trends) also responds to this "*lou camin de vida prouvençau*" desire, but seems to be more concerned with the middle class. Housing is less dispersed and arranged in more compact allotments until it is reaching at times a built continuity. Swimming pools are a rare occurance and the living spaces are smaller.

We can assume that the level of income has an influence on the energy consumption within housing. A high level of income can involve larger housing surfaces as well as the presence of energy-consuming installations (air conditioning, appliances, swimming pool, etc.). Living standard indicator measurements make it possible to understand the differentiation between types of the same category (cities and tourist municipalities, dense periphery and dispersed periphery) rely substantially on this aspect, particularly for the three suburban categories.

The combination of average net income of taxable households by municipality, of average net income of non taxable households by municipality, and the proportion of non taxable households in the total of households makes it possible to obtain an overall indicator of the level of wealth constructed in the following way:

• If the average net income of taxable households per municipality is superior to the 3rd quartile regionally and which the proportion of non taxable households is lower than 50%, it is assumed that the municipalities have a significantly high level of wealth.

• If the average net income of non taxable households per municipality is lower than the 1st quartile regionally and to which the proportion of non taxable households is superior by 50%, it is assumed that the municipalities have a significantly low level of wealth. This indicator clearly differentiates the subsets formerly identified (fig. 4).

Among the three suburban categories, the one that consumes the most is a category of significantly high wealth. It is composed of more than 60% of municipalities' significantly high level of wealth and accounts for only 1% of municipalities' low level of wealth. It concentrates 62% of all the rich municipalities concerned. The level of wealth also opposes the two tourist municipality categories, as well as the two types of dispersed periphery.

This analysis is indicative of the diversity of ways of suburban living which manifests a strong individualization of relationships to space and of a socio-spatial heterogeny beyond which a certain number of regularities and collective logics can be observed (Cailly, Dodier, 2007).

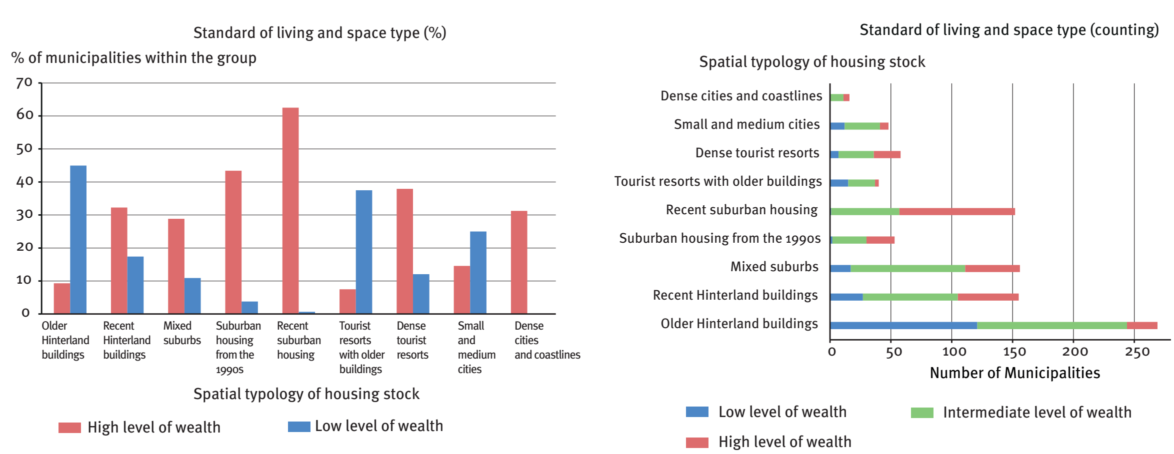


Fig. 4/ Level of wealth and spatial typology of housing stock in Provence Alpes-Côte d'Azur

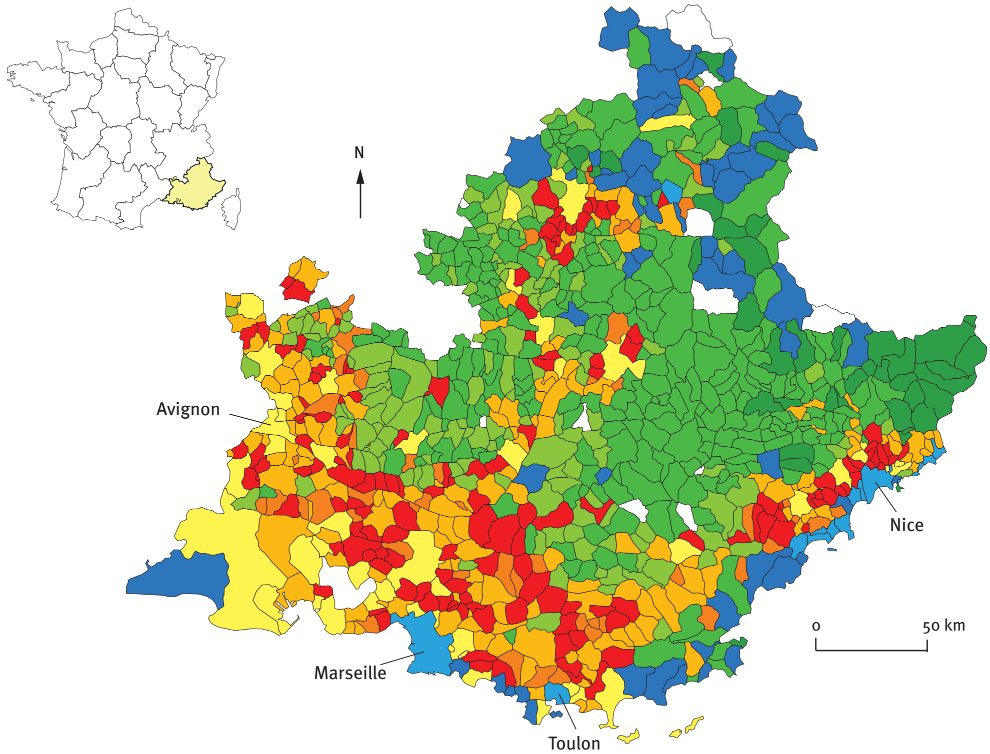
Spatiality of energy-consuming intensiveness, a basis for considering the integration of the energy issue into planning documents

Crossing typology of residential housing stock with the energy consumption per dwelling, and the investigation as to the level of wealth and the housing type, can lead to the mapping of energy-consuming traits of housing in PACA region (fig.5). In all the identified categories, the municipalities which consume the least constitute either a significant proportion of secondary homes, or high density housing per square kilometer of built-up area. The presence of secondary homes indicates by definition seasonal consumption; the presence of apartments involves often much smaller living spaces and in terms of housing density, favorizes the mutualization of services such as heating or hot water for sanitary use. The study shows that Marseille and Nice metropolises are not particularly energy-consuming. After all, they concentrate the bulk of regional energy demand in terms of volume. Additionally, strong internal disparities, both in terms of the level of wealth and in the aspects of residential housing stock, do not enable a variability distinction at this scale level regarding energy consumption. There is, therefore, a great deal of incertitude that an infra-urban study could perhaps diminish.

However, as part of a regional policy for energy management in PACA, all attention seems to be placed on the areas of urban sprawl. The way of living characterized by access to single-family home ownership, also equipped with individual heating, appears to be a factor of increased energy consumption.

The construction periods also reflect on the compliance, usage and impact of construction standards and in particular those of thermal regulations. Thermal regulations (TR) go back to 1974 following the oil crisis of 1973 (TR 1974, TR 1982, TR 1988, TR 2000, TR 2005, TR 2012) (Collet, 2011). The construction periods which emerge as deciding factors of increased energy consumption in our study, according to the concerned space type, are those occurring from 1974 to 2005 (1975-1981, 1982-1989 and 1990-2005). In these conditions, it is difficult to accept that these regulations had a decisive influence. Energy consumption of housing does not respond solely to heating needs, and energy-consuming intensiveness can not be measured in terms unique to heat loss. The undertaken analysis also questions situations of precariousness facing energy. Although the issue of energy precariousness is above all an issue of social precariousness, financial capacity for energy access remains an essential component of the quality of life. Median spatial categories of our analysis (suburban middle class, small and medium cities, dispersed periphery and tourist resorts at a low level of wealth) are areas of potential energy precariousness. These areas concentrate the majority of municipalities at a low level of wealth.

The energy transition intended to manage energy consumption involves the reconsideration of the spatial way of living especially prolific in the PACA region, that of access to ownership and to the modern Provencal villa, "*lou camin de vida prouvençau*". Energy consumption is indicative of how space is being used. It is not only the agglomeration of people which leads to high energy demand, but also a way of living in a private individual space, a fashioned allotment in a space dominated by detached housing. Current willingness to reduce urban sprawl is increasingly incorporated into regional development policies, but are these a posteriori interventions really effective against the amplitude of this phenomenon? It is questionable as to the real capacity for action of public authorities faced with a now long-standing territorial dynamic, whose resulting regional organization has become a constraint. This raises



Demande énergétique des logements croissante (↑)

	Type d'espace	Caractères énergivores	Caractères peu énergivores
Modèle du *lou camin de vida prouvençau*	Périurbain à haut niveau de richesse (rouge)	Habitat pavillonnaire haut de gamme, faible densité de logement, chauffage individuel, logements construits entre 1975 et 1981	Forte densité de logement au km² bâti Part d'appartements Part de résidences secondaires
Modèle du *lou camin de vida prouvençau*	Périurbain à haut niveau de richesse (orange)	Habitat pavillonnaire des années 1990, faible densité de logement, chauffage individuel, logements construits entre 1975 et 1989	
Espaces d'une précarité énergétique potentielle	Périurbain des classes moyennes	Habitat pavillonnaire de type lotissements groupés, chauffage individuel, logements construits entre 1975 et 1981, et entre 1999 et 2005	
Espaces d'une précarité énergétique potentielle	Petites et moyennes villes	Maisons individuelles et chauffage individuel	
Espaces d'une précarité énergétique potentielle	Périphérie diffuse des classes moyennes et bâti récent	Chauffage individuel et chauffage électrique	
Espaces d'une précarité énergétique potentielle	Périphérie diffuse à faible niveau de richesse	Chauffage individuel et chauffage électrique, logements construits entre 1999 et 2005	
Espaces d'une précarité énergétique potentielle	Stations touristiques à faible niveau de richesse et bâti ancien	Chauffage individuel et logements construits entre 1999 et 2005	
Fortes disparités internes et demande irrégulière	Villes et littoral à forte densité de logement	Maisons individuelles, logements construits entre 1982 et 1989	
Fortes disparités internes et demande irrégulière	Stations touristiques à haut niveau de richesse et forte densité de logement	Maisons individuelles et chauffage individuel	

Communes atypiques extraites de l'analyse

Conception et réalisation : Maximin Chabrol, 2015.

Sources : D'après l'Insee, Energ'Air, BDTopo IGN et DGFiP.

Fig. 5/ Energy-consuming aspects of ways of living in the Provence Alpes Côte-d'Azur

the issue of the degree of freedom for developers in the progress of territorial frameworks. Does regional development not only accompany or at best monitor and control territorial dynamics?

Besides the last thermal regulations, the energy transition is the occasion to reconsider the planning and territorial organization models, from a longterm perspective. To dampen the offer of a model of living conflicts with demand of a population wishing to aquire land for construction purposes, and subsequently fosters a form of residential economy favorable to local finances of municipalities. So if an infraregional declination of energy transition and a breakdown of its objectives in local planning documents seems possible, the recognition of territorial specificities will be the necessary condition, firstly in their definition and secondly in their effectiveness.

Conclusion and prospects

All the energy transition complexity not only lies in the thematic multiplicity that it deals with (building, transport, energy production, etc.), but also in the spatial and territorial complexity which regulates and determines it, such as the organization of people in space. The usage of space and ways of living determines overall behaviors of energy consumption. A regional analysis makes it possible to identify these behaviors. It prevents the identification in regional space of individual behaviors guided by choice or constraints of belonging to a social category, even if relatively homogenous groups have been asserted in our analysis. A more detailed study in terms of scale for the same energy-consuming space type would probably allow for the differentiatation of the population categories able to adopt individual strategies integrating the energy issue, categories for which the very concept of strategy is inconceivable given the severe constraints that access to housing and employment represent.

This analysis also indicates the burden of territorial dynamics such as urban sprawl, the expansion of suburban areas, the deferral of the population round the urban area periphery and solar tropism. The degree of liberty in the evolution of territorial structures is questionable. Faced with forces generated by intrinsic territorial dynamics, what is the real room for manoeuvre of territory stakeholders and individuals in integrating the energy dimension into planning strategies or individual residential strategies?

Challenging inherited socio-spatial structures can involve high material costs associated with urbanism and spatial planning, but the social cost is just as important because re-examining the socio-spatial structures requires reviewing ways of life and consumption. Consideration of spatiality in the energy transition study suggests that this does not fall within a policy-making process detached from the locations, because the spatial dimension of territories, the rules of spatial interaction and organization models, are also elements which can disrupt, restrict or determine implementation of energy transition policies.

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