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A RURAL SURVEY IN WEST AFRICA

Dorian LITVINE
Marie-Hélène DABAT
Laurent GAZULL

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Centre de Recherche en Economie et Droit de l'Energie
CREDEN – Equipe ART Dev – Université Montpellier 1
Faculté d'Economie, Av. Raymond Dugrand, C.S. 79606
34960 Montpellier Cedex 2, France
Tél. : 33 (0)4 34 43 25 04

The influence of proximity on the potential demand for vegetable oil as a diesel substitute: A rural survey in West Africa

by Dorian Litvine*[a], Marie-Hélène Dabat [b] and Laurent Gazull [c]

[*] Corresponding author

[a] University Montpellier 1, UMR ART-Dev; 73 avenue Jean François Breton, 34398 Montpellier Cedex 5; Tel: +33 689151574; Email : dorian.litvine@gmail.com

[b]CIRAD, UMR ART-dev, 73 avenue Jean François Breton, 34398 Montpellier Cedex 5, France; marie-helene.dabat@cirad.fr

[c] CIRAD, UR B&SEF, Campus international de Baillarguet 34398 Montpellier Cedex 5, France; laurent.gazull@cirad.fr

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Abstract

Bio-energy demand is known to be influenced by geographical origin and social equity. This paper aims to highlight the influence of the proximity between biomass production and energy consumption on the demand for alternative bio-fuels. In the context of Burkina Faso, we explore potential demand for vegetable oil (Jatropha Curcas) as a diesel substitute among engine owners. Survey data are based on a between-groups design: one group of respondents experiencing a local supply chain, while the other a global one. Results show that proximity has a significant effect on potential demand itself and on the formation and strength of beliefs regarding vegetable oil. In a local supply chain context, the demand is superior and seems to be guided more by a certain economic and technical rationality. Conversely, the prospect of a vegetable oil produced outside the village restrains demand and this latter is more determined by contextual factors and social interaction. Our analysis confirms that demand does not only depend on technical and economic factors such as price but also on the integration of the biomass production and processing in the socioeconomic life of local rural populations. Understanding demand construction and assessing underlying beliefs are key success factors for bio-energy projects.

Keywords: Demand study; local supply chain; fuel substitution; beliefs strength; preferences construction; vegetable oil; Jatropha Curcas; Social Psychology

JEL : D12; O13; O33; Q41; Q42; Q56; R2

1 Introduction[1]

Access to energy is considered to be one of the driving forces of development, and it is well-known that the production and use of energy leading to improved living conditions are necessary for achieving Millennium Development Goals (UNMP, 2005). Traditionally bio-energies are already widely used in developing countries (firewood, charcoal, agricultural residues, etc.). With the higher prices of hydrocarbons and aims to reduce greenhouse gases, modern forms of bio-energies (e.g. biofuels, crude vegetable oils, and biogas) have been developed in the last 10 years as being energy sources attainable by people with limited purchasing power. These energy sources also have the potential to contribute to reducing poverty.

Amongst these modern bio-energies, vegetable oils are of special interest and represent a local development potential for African peoples (Brittaine and Lutaladio, 2010; UNDPESA, 2007). Some vegetable oils like that extracted from the Jatropha Curcas may, by complying with certain technical conditions, be used as a substitute for diesel (Mondal et al., 2008; Misra and Murthy, 2010; Sidibé et al., 2010). In this field, issues of production potential and of the means to harness such potential have been the subject of much research (Ariza-Montobbio and Lele, 2010). However, in a sector dominated by the supply paradigm, few of these studies have really examined in detail individual preferences and choice mechanisms of rural fuel users, or the substitution process which may be generated by the introduction of a new product (Townsend, 2000). And, over and above economic factors, it is now known that psychological and socio-cultural aspects are key elements to be considered in determining energy demand. In this nascent and very controversial field of bio-energies, beliefs, perceptions and even socio-political positions condition people's demand and, in the end, the development of energy access projects (Upham et al, 2007; van de Velde et al, 2009; Verbeke, 2007).

As agricultural products, biofuels are not excluded from these new psychological, sociological and economic consumption driving forces. It is now acknowledged that bioenergy demand is more and more influenced by geographical origin, type of resource, equity and environmental impact (Raadal et al., 2012; Wicker and Becken, 2013). At the same time, a growing number of economic studies are taking an interest in the territorial dimension and the effects of proximity on innovations adoption process, sustainable production and local development (Massard et al., 2004; Sundkvist et al. 2001).

[1] Non standard abbreviations JO:"Jatropha Oil"; LC: "Local supply chains"; TPB: "Theory of Planned Behavior"; IS: "intention to substitute": IS; IA: "Intention to Adapt one's engine to JO".

Thus, in the energy field, increasing attention is being paid to projects with a local dimension and/or a sub-sector with a limited number of intermediaries (Bernard, 2010; Niez, 2010). In development literature and especially in that concerning poverty, the small-scale and local chains (villages or farms) are considered to be more efficient in combating rural poverty than chains intended for regional and international exports (FAO, 2009; Milder et al., 2008; Tomomatsu and Swallow, 2007). Indeed, in the face of uncertainties as to the structuring of supply chains and the future biofuels market, and wiser for the experience of large scale production notably in South America, many authors emphasize the risks of this type of organization (van Els et al., 2012). These risks include land grabbing to the detriment of the poor as well as profits taken by intermediaries to the detriment of rural producers (Cotula et al., 2008).

In small-scale projects which we will refer to as "local supply chains"[2] (abbreviated to LC in this article), production, processing and use of vegetable oil are carried out in a certain spatial and social proximity: energy-targeted crops are located near areas where the oil is used and sometimes near where it is processed. While such proximity is potentially conducive to more equity and greater efficiency in terms of local development, it leads however to production and technical constraints in a sector where economies of scale are common. Indeed, the geographical level of production and the size of processing plants directly influence the variability of raw materials, collection time, processing quality, availability of products and, in the end, supply organization as well as the economic and energy efficiency of the entire process (Fore et al., 2011; Wahl et al., 2009). Proximity also has a direct bearing on competitiveness or cooperation between players in the chain and, on the social relationships between producers, processors and users generally. The social dimension of proximity indicates the economic agents' adherence to a common sphere of representation, rules and behaviors (Torre and Gilly, 1999). Accordingly, proximity influences the construction of beliefs and expectations regarding Jatropha oil (abbreviated to JO) and, in the final analysis, their potential demand for substitution.

This paper aims to throw light on the relationship between demand and proximity, by proposing answers to the following two questions:

(i) Does the prospect of a local supply chain (abbreviated to LC) directly simulate the vegetable oil demand of rural populations?

[2] We prefer the term "local supply chain" to the term "small-scale project" to emphasis the notion of chain rather than project on the one hand, and distance rather than scale on the other.

(ii) Can such a relation be explained by the influence of LC on some constitutive elements of demand, and particularly individual beliefs?

We wish to contribute to this line of thinking by exploring potential demand for JO as a substitute for diesel in rural areas. We analyze this demand through a field survey in Burkina Faso, a west African country with a high production potential and where Jatropha production started in 2007 (Hanff et al., 2011; Tatsidjodoung et al., 2012; Dabat et al., 2012). We intend to focus on the components of potential demand for JO from the beneficiary populations, and to observe how such demand is created and expressed from a LC supply viewpoint. Few research studies prioritize such an analysis of individual beliefs and preferences enhanced with economic and psychological factors. This approach provides a better understanding of the preference construction process and its appropriateness to energy supply and, consequently the link between energy and development.

The paper is structured as follows: Section 2 summarizes relevant literature on energy substitution and local supply chains as well as economic and psychological concepts useful for examining preferences and demand. We also make a case for our empirical choices. Section 3 deals with both the methodology of the survey together with some technical issues. In section 4, we present the main findings of the study. Section 5 puts these findings into perspective. We conclude the article with some recommendations directed at promoters of vegetable oil development projects, decision-makers, and researchers working on surveys targeting decentralized energy demand.

2 Literature Review

2.1 Economic approaches to demand for energy substitution in developing countries

Interfuel substitution is an acceleration of the transition process from one energy source to another (Heltberg, 2005). According to energy ladder and fuel switching models, this transition is linear from traditional sources of biomass energy, such as firewood or agricultural residues, towards more modern liquid fuels such as diesel or biofuels (Barnes et al., 2004; Leach, 1992). Such a shift occurs almost automatically with an increase in household wealth.

These models assume that the main driving force of demand is the same for all: that is to say a more efficient cost effective energy. If this were the case, the rate of substitution would be above all conditioned by supply characteristics and consumer purchasing power. However, slowness in energy transition and the problems encountered by energy projects in many

developing countries seem to demonstrate that the supply-oriented economic approach does not sufficiently explain the energy demand and choice structure (Arnold and Köhlin, 2006; van Els et al., 2012). Recently, multiple fuel use models have made it possible to consider situations where the population uses several types of fuels and partially substitute it (Masera et al., 2000; Gupta and Köhlin, 2006). Other models see energy substitution as the selection and incorporation of a technological, social and economic innovation (Geels, 2004; Jacobsson and Johnson, 2000; Murphy, 2001). Thus, the orthodox view consisting of describing energy choices as individual decisions dependent on income level and supply seems to be broadening (cf. Heltberg, 2005; Murphy, 2001). This allows for a growing space for an in-depth analysis of demand, including socio-cultural and political preferences, everyday practices, social norms, impact on health and well-being, degree of trust, etc. (Gupta and Köhlin, 2006; Shove and Walker, 2010).

2.2 Complementary use of psychological concepts in the study of demand

Supply-oriented energy choice approaches often examine demand via expenditure and energy use surveys, employed to size up production and distribution systems (Bernard, 2010; Niez, 2010). Potential consumption is estimated on technical and economic criteria, principally on equipment endowment and the consumption units' level of wealth. However, these approaches show significant limitations when examining energy needs and estimating ex-ante demand, particularly when the new and alternative energy source is not very established, unknown and associated with controversies as in the case of Jatropha Curcas. For similar reasons, the economic models of energy transition and choices have been gradually broadened to include social, contextual and organizational variables. In fact, demand for energy is born of an interaction between the individual and his social and psychological environment. Accordingly, there are numerous barriers confronting the process of adopting alternative fuel. In deciding whether or not to use JO, the consumer has to manage internal conflicts, inertia born of habit (Maréchal, 2010), social and moral pressures as well as technical obstacles, particularly when JO is produced within spatial and social proximity. Such barriers are even greater in the case of Jatropha which is the subject of growing controversies and views that generate negative expectations and influence behaviors (Pohl, 2010).

The growing link between Economy and Psychology in the study of individual preferences and choices allows this reality to be investigated by proposing to supplement economic variables with cultural, cognitive, attitudinal and behavioral data. These data include values,

beliefs, perceived barriers, social norms and interactions, routine factors, perceived efficiency, etc. In the examination and estimation of preferences and demand, these combined approaches often yield better results than economic analyses alone (DellaVigna, 2009; Fischer and Hanley, 2007; Kahneman and Tversky, 2000; Kotchen and Reiling, 2000), particularly in the case of energy (van den Bergh, 2008; Kotchen and Moore, 2007; Leitmann 1989; Litvine, 2010; Litvine and Wüstenhagen, 2011; Maréchal, 2010; Stern, 2011; Wiser, 2007).

A belief may be defined as a mental representation vis-à-vis JO (quality, output, etc.) and related elements (Jatropha crops, etc.), on which the individual bases his evaluations[3]. Part of Social Psychology literature formalizes the causal chain, ranging from beliefs regarding JO/Jatropha for instance to actual substitution. This chain depends on the number of salient beliefs, i.e. beliefs accessible to memory, that can be mobilized to formulate a response and make a decision (Ajzen, 1991; Ajzen and Fishbein, 2005). An individual who has formed many salient beliefs about the new fuel should have preferences and an intention to substitute that are more accessible to memory and thus more stable or stronger[4] (Fazio et al., 1989; Miller and Peterson, 2004; Schwarz 2006). One way of evaluating this phenomenon consists in calculating the time taken by respondents to answer questions relating to these concepts (response latency, cf. Fazio, 1995; Mulligan et al., 2003). Being stronger, these concepts should govern future action even more. Discounting strategic behaviors, the respondents' statements should be clearer and more coherent (Ajzen and Sexton, 1999; Fazio, 1995), with greater variability in the answers. It is thus possible to better use such statements in estimating demand, and even deduce the propensity to actually substitute with JO.

The theoretical and empirical works cited examine the conditions necessary for an increase in the number of salient beliefs regarding the substitution with JO as well as their accessibility to memory: (i) information and knowledge of the individual[5] ; (ii) frequency with which the individual expresses his beliefs and attitude towards substitution[6]; (iii) direct experience or a certain contact with JO (and Jatropha crops). Within this theoretical framework, by

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[3] A belief associates an object with attributes, and an action with consequences or outcomes. A belief depends on two indices: its value (degree to which the individual values/desires the attribute) and its strength (the probability with which the individual thinks he can effectively observe the attribute).

[4] Several authors analyze the construction process of individual preferences, considering that the later can be non-formed, ambivalent, ambiguous, or unsteady (cf. Lichtenstein and Slovic, 2006). A similar analysis in psychology concerns the beliefs (cf. Schwarz 2006).

[5] Beliefs and attitude are developed during the information acquisition process relating to an action. Any new information may change the retained structure: existing beliefs change and new ones are formed (cf. Ajzen and Sexton, 1999; Ajzen and Fishbein, 2005). There are a few studies on energy-related beliefs (Farrow et al., 2011; Litvine and Wüstenhagen, 2011; van de Velde et al., 2009).

[6] An attitude may be defined as a "*psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor*" (Eagly and Chaiken, 1993). This global judgment is function of three components: affective (based on feelings/emotions), cognitive (based on information/knowledge) and conative (directed toward behavior/action). Attitude toward substitution is defined as the individual's overall evaluation of performing the behavior. It is derived from the sum of beliefs formed in relation to the substitution act within the framework of the three dimensions cited.

facilitating coordination between players, communication and contact points with the production/consumption process, the LC organization should stimulate the development of beliefs and preferences concerning JO. The LC could thus have an impact on the level of potential demand and its expression within a survey context. Our methodology aims at emphasizing some of these steps as summarized in Figure 1.

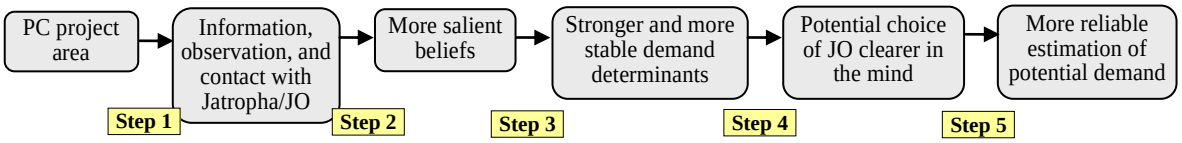

Figure 1 – Presumed influence of LC on the potential demand for JO: development of salient beliefs

3 General approach and survey data

3.1 Context of study

One of the world's poorest countries, Burkina Faso is landlocked in the Sahel region of West Africa and has limited natural resources. In a country where only 5% of households have access to electricity and where there are strong disparities between urban and rural areas, energy access is necessary for improving the living conditions of rural populations (Dabat et al., 2012). In 2009, the Government created a biofuel development strategy with a view to replacing hydrocarbons such as diesel with JO (Djerma and Dabat, 2012; Ouedraogo, 2010). One of the main lines of this strategy sought to support the development of a LC-type decentralized production (Tatsidjodoung et al., 2012). Despite a proactive policy, Jatropha production is still in its infancy in that area (90,000 ha announced though probably closer to 10,000 ha). However, some pilot projects have been developing Jatropha plantations since 2007-2008 and are already producing a small quantity of JO with the aim of supplying a decentralized electricity network and, in time, providing the local population with this alternative fuel. In this context, a study aiming at a better understanding of the determinants of rural demand in Burkina Faso gains in relevance.

3.2 Approach retained for examining potential demand for JO as a substitute for diesel

Given the difficulty in finding areas where we can observe an effective demand for JO and an operational market, our study focuses on the expression of potential demand. Thus, instead of providing an objective estimation of demand, we are rather seeking to examine how this latter is created and expressed. Such an approach requires working on contextual aspects of the

decision process and being able to deduce the respondent's interest in JO from their statements. We organize these factors based on the Theory of Planned Behavior (Ajzen, 1991), an action model that has proven its efficiency in analyzing energy-related decisions (Abrahamse and Steg, 2009; Litvine, 2010; Litvine and Wüstenhagen, 2011) and one that has already been applied in developing countries (Baker et al., 2007; Godin et al., 2008; Vermeir and Verbeke, 2008).

In this model abbreviated to TPB, substitution with JO is the outcome of three categories of beliefs concerning the act itself. These beliefs form three large variables explaining the deliberate intention to substitute which is, in the second stage of the model, the main determinant of the effective act of substitution. The first category of beliefs are the expected consequences of substituting with JO produced from local Jatropha crops (*behavioral beliefs*), which may be aggregated to form the attitude towards substitution with JO. This overall evaluation leads the respondent to be broadly favorable or unfavorable to the action itself. The second category includes all the facilitating/restraining factors making substitution easy/difficult (*control beliefs*), which may be aggregated to form the explanatory variable called perceived control over substitution: The respondent uses JO if (a) he is technically able to do so and if the decision depends mainly on him (external control); (b) he thinks it is easy to do so (perceived difficulty); (c) he has sufficient information and ability to make a profitable choice (internal control). The third category includes important referent individuals or groups that the respondent expects to approve (or disapprove) of his own potential switch to JO (*normative beliefs*), which may be aggregated to form the subjective norms: The respondent uses JO if (a) it enables him to comply with what he perceives to be the expectations of the important others (injunctive norms); (b) these referent individuals/groups are also using JO, this being common practice (descriptive norms); (c) he perceives that his effort is efficient and useful to attain a desired goal (self-efficacy).

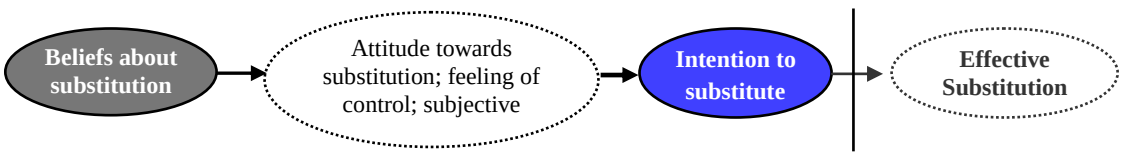

Figure 2 – Causal chain going from beliefs to effective substitution (simplified TPB model)

The intention to substitute (abbreviated to IS) provides important information on potential demand. This variable includes a notion of commitment which leads the individual to respond more in accordance with his attitude and plan of action (cf. Ajzen, 1991; Ajzen and Fishbein, 2005). In our approach, potential demand is characterized by two additional variables.

Crossing the three variables allows for a better understanding of the decision process while minimizing statement biases (Litvine, 2010). The willingness to pay (abbreviated to WTP) is supposed to reflect the respondent's preferences and the value he attaches to JO. Recent studies have estimated the WTP for cellulosic biofuel (Farrow et al., 2011; Solomon and Johnson, 2009), but very few have assessed a population's WTP for vegetable oils. Moreover, a positive WTP is not sufficient for explaining a choice (cf. Ajzen et al., 2004; Litvine and Wüstenhagen, 2011). This variable may be easily over or under-estimated, particularly when it concerns goods sensitive to strategic attitudes and statement biases (Carson and Groves, 2007; Green et al., 1998). To further reduce these potential effects, we will also consider the Intention to Adapt one's engine to JO (abbreviated as IA). This variable is less overestimated than IS as it involves more money, time and technological elements[7].

In this "belief-demand-substitution" approach, our data collection protocol aims at exploring some beliefs influencing the potential demand and evaluating the effect of LC-based production. To do this, we compare two scenarios[8]. Firstly, "LC respondents" are in a district experiencing a local LC-type project of Jatropha production/JO use[9] and where fuel is intended for local use (rural electrification to begin with). In the other hand, "non-LC respondents" are in a district producing Jatropha, but where the oil seeds are often bought by an external operator in order to produce and use JO outside the district. In the "LC respondents" scenario, the population is in direct contact with JO, more informed and aware of the prospect of consuming it locally, perhaps even more involved in the project. Thus, although there is no JO yet sold to the populations, the LC scenario subjects the respondents to a dynamic cognitive process which should influence their belief as in the diagram presented under section 2.2: direct experience and contact with JO and Jatropha crops, signals and information, local debates and discussions, and even observation of use (demonstrations and/or samples).

3.3 Survey data and sample

The data presented here are based on a "face-to-face" survey, carried out in spring 2011, and questioning 164 engine owners in 6 rural districts of Burkina Faso: 3 "LC respondents"

[7] 90% of the sample have a positive IS but only 73% have a positive IA (n=156). 75% of the sample with a positive IS say they are not willing to buy more JO than diesel, while for IA the figure is just 60%. IA seems then more conservative than IS (less strategic responses).

[8] Both populations have similar initial conditions, which are socio-economic correlates such as material wealth, education, age, and gender. We note only a higher material wealth for 2 villages (type of construction of the concession, livestock, durable goods, number of available hectares).

[9] In none of the surveyed projects oil was processed locally, by necessity of economy of scale. The seeds are processed elsewhere and the oil is brought back to be used locally. However, some projects are currently working on setting up a local or cooperative press.

(n=100) and 3 “non-LC respondents” (n=64). The sample was made up of small owners of diesel engines (grain mills, water pumps, power generators and plough tractors) or any people making decisions relating to fuels or engine maintenance. Our observation was limited to static engines which, with more or less significant modifications and assuming specific technical conditions, may consume JO as a substitute for diesel (Mondal et al., 2008; Misra and Murthy, 2010; Sidibé et al., 2010).

The survey methodology combines qualitative and quantitative approaches. After a period of consultation and field observation, we carried out 26 semi-structured interviews. Results were used for exploratory purposes, and for supplementing and calibrating the quantitative questionnaire[10]. After filtering response anomalies and outliers, we obtained 164 voluntarily-filled questionnaires, representing about 27 observations per district and an average coverage rate of nearly 90%. There was no sampling method used for our study as all the owners present during the survey were requested to participate.

The quantitative questionnaire consists of 8 main parts: general information about the respondent; information about the economic activity (engine and others); diesel-related constraints; degree of construction of preferences for Jatropha and JO; beliefs about the LC-proposed JO (from local Jatropha crops); potential demand for JO; socio-economic profile and technical engine information. This questionnaire was inspired by households energy use surveys in the southern region (Leitmann, 1989) and was developed in accordance with the principles of the Survey Methodology literature, in a bid to optimize the survey mechanism (cf. Groves et al., 2009). We paid a special attention to identify and minimize the effect of statement biases[11]. Each respondent was attributed a "statement bias index" created by cross-checking 6 variables, and used to correct the 3 demand variables.

The willingness to pay for JO was estimated using the contingent valuation method, and in a sequential manner to help respondents form/express their preferences: those not able to state an acceptable price in an open-ended format were subsequently invited to choose a payment card per price range[12].

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[10] Our scales were based on Likert’s model in compliance with the psychometric rule of the Theory of Planned Behavior (Ajzen, 2002). They have 4 points to facilitate answers and minimize the centrality bias which was salient. The "does not know" and "does not wish to answer" response options were foreseen, but were not automatically proposed by interviewers to avoid them being used as a refuge.

[11] The main biases in stated preference surveys are: (i) the hypothetical aspect of substitution; (ii) the impact of ambivalent, malleable or non-constructed preferences; (iii) strategic attitudes such as "assistance"; and (iv) value distortions

[12] We applied elements specific to surveys in developing countries (Alberini and Cooper, 2000). The open answer not given is replaced by the mid-point of the selected bids range (Cameron and Huppert, 1989; Green et al., 1998). Thus, WTP is considered as a continuous variable. Price ranges has been determined based on preliminary interviews, and the WTP format we used is justified by the fact that (a) JO is the diesel alternative which has an established market; (b) respondents are familiar with decisions concerning fuel, with multiple qualities; (c) the survey protocol intended to reduce the belief that JO is more likely to be supplied the larger the sum of the WTP responses given (Carson and Groves, 2007). We systematically proposed the "0F" and "*does not know/does not wish to answer*" response

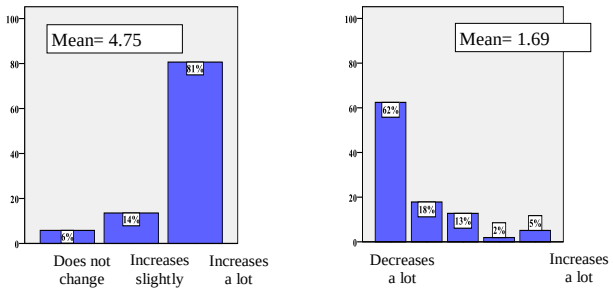
4 Main results

In section 1 we report the direct relationship between LC organization and the potential demand for JO as a substitute for diesel. The nature of this relationship is then studied in greater detail by examining how LC influences the chain ranging from beliefs to the intention to substitute. This process has an impact on the structure of demand that we will highlight by comparing the explanatory models of the three demand variables.

4.1 The direct relationship between LC organization and potential demand for JO

According to the respondents the intention to substitute (IS) varies depending on JO supply conditions: "*Let's imagine scenarios for JO rural production and use. Would your intention to use JO change in the case where…*". Nine hypothetical situations likely to arouse or decrease interest in JO were then presented. These situations are assimilated to control beliefs that depend on the perceived difficulty/ease of the substitution act. According to the majority of the respondents themselves, LC organization is a situation that strongly stimulates their IS ("*Jatropha is grown locally (village or district) and the produced JO is sold locally*").

Conversely, if Jatropha is grown locally but JO is sold outside the district, 80% of the sample said that this would restrain their demand (Figure 3). Furthermore, when we asked respondents to classify the factors most stimulating their IS, about 20% of them ranked LC organization first, thus making it the second most cited factor after oil quality (Table 1). At the same time, the fact that JO supply is organized in a non-LC context is the main restraining factor for about 11% of the sample, coming just after irregular JO availability (around 15%).



LC context – Local Jatropha crops and JO use ***Non-LC context - JO sold outside the district***

Figure 3 –Does the intention to substitute vary in a LC context? (n=157)

Table 1 – Classification of factors according to their impact on the intention to substitute (self-evaluation)

options. 4 outliers have been withdrawn from the sample (respondents who had a non-void value but declared "0F" for other reasons, i.e. protesters or "false 0").

These descriptive data concern only IS. It is also interesting to examine the impact of LC on other expression vehicles of demand. As Table 2 shows, location in a LC project area significantly increases potential demand whatever the variable considered. LC respondents express higher demand than non-LC ones and claim a willingness to pay more for JO (ΔM=26F*). They also state a greater intention to use JO (ΔM=0.44**) and to adapt their engines accordingly (ΔM=0.38**).

A LC context seems to encourage owners to use and to adapt their engine(s) to the proposed alternative fuel. There is clearly a link between the fact that the respondent is located in a LC project area and his demand level. This link is very significant, but seems nonetheless to partially transit through other factors. In effect, the binary variable "LC respondents/non-LC respondents" is not significant when competing with other variables in an regressive model of demand. This result ties up with our theoretical hypothesis, according to which LC organization influences not only the level of demand, but also its determinants, notably beliefs about JO.

Table 2 – Comparison of the level of potential demand between "LC respondents" and "non-LC respondents"

4.2 Detailed “LC-demand” link: the development of demand along the “belief-action" chain

In this section, we examine how a LC context may impact the causal chain ranging from beliefs to the intention to substitute. The LC supply organization modifies the level and strength of demand determinants, and then influences the structuring of demand (intergroup explanatory models).

4.2.1 The effects of proximity on the level and strength of demand determinants

With reference to "belief-action" models, Figure 1 and Figure 2 summarize the chain process whereby LC organization impacts on the formation of preferences and beliefs and hence, indirectly influences potential demand. The descriptive data and statistical tests summarized in Table 3 show us that the first step of the chain is verified: LC respondents are more aware about Jatropha and JO than non-LC respondents. As a matter of fact, a greater proportion of LC respondents have heard about Jatropha (97% LC against 80% non-LC) and have received information from at least 3 sources (radio, meetings, home visits, etc.). These differences influence the number of salient beliefs in each group as well as their heterogeneity (steps 2 and 3 of Figure 1). As shown in Table 3, LC respondents spontaneously cite more behavioral

beliefs, suggesting that they have more salient beliefs. However negative beliefs are on average greater in the LC districts and with a lower response time, meaning they are more accessible to memory. Therefore, when we add up positive and negative behavioral beliefs, LC respondents have an overall less favorable attitude towards substituting with JO. This suggests a more balanced evaluation, less biased towards the positive pole as is the case with non-LC respondents. Thus, LC respondents seem to expect more undesirable effects linked to the production and use of JO.

On the other hand, social norms and interactions are more salient among LC respondents. The later are more likely to have the feeling that people they deem important would approve of them using JO (injunctive norms). Furthermore, they take less time to give an answer concerning other villagers' opinions about Jatropha, and are more convinced that these villagers talk about JO and have switched to it (descriptive norms). LC respondents also have a greater feeling of control over the actual substitution: they perceive few external barriers (external control), which also makes the action appear less difficult (perceived difficulty). Finally, in a LC area preferences seem to be more constructed, since only 20% of LC respondents are unable to spontaneously state the maximum price they would accept to pay for JO, whereas in the non-LC context the percentage is 40%. Such a situation may be considered to be the sign of non-constructed or ambivalent preferences (Bateman et al., 2002; Haab and McConnell, 2002).

Table 3 – Impact of LC on demand determinants and their accessibility to memory (only significant differences)

In the end, spatial and social proximity of LC organization leads to a greater anticipation of negative consequences, but stimulates social norms in favor of substitution and reduces its apparent difficulty. This contributes to strengthening and/or constructing preferences for JO. As shown in step 4 of Figure 1, these elements should increase the accessibility level of the behavioral intention. Indeed, Table 2 shows that LC respondents express their IS more rapidly and spontaneously than non-LC respondents[13]. According to research on *response latency* (cf. Fazio, 1995; Mulligan et al., 2003), IS may thus be more accessible to memory for LC respondents, in other words stronger and better formed.

4.2.2 The effects of proximity on the construction of potential substitution demand – regressive models

[13] We verified group resemblance based on socio-demographic criteria, although other variables capable of showing different initial conditions between groups were not tested (self-selection bias).

The descriptive findings we have just presented about the effect of LC organization on demand construction may be further developed through comparative regressive analysis. Table 4 summarizes three exploratory models, one for each demand variable, and compares "LC respondents" and "non-LC respondents" groups: model 1 explains the Intention to substitute (IS) within the framework of the Theory of Planned Behavior (TPB); model 2 explains the Intention to Adapt engines (IA); and model 3 predicts WTP based on the contingent valuation method[14]. In the three cases, we apply the continuous linear model with a stepwise selection of variables, introduced by similar-type groups (TPB variables and beliefs, economic variables, technical factors, etc.).

The 13 measured LC behavioral beliefs, namely the positive/negative expected consequences from growing Jatropha in the district and using locally the produced JO, are summarized via 4 factorial axes[15] explaining 74% of overall variance: beliefs linked to the economic well-being of the village (axis 1: autonomy, dynamism, local solidarity); beliefs linked to the technical benefits of JO (axis 2: engine noise, output, efficiency); beliefs linked to the negative impact of Jatropha on the district (axis 3: land issues, food competition and health risks); beliefs showing risk and fuel-change aversion (axis 4: waste of time and energy in changing fuel, habit inertia, engine risks and JO efficiency).

The 9 control beliefs measured, namely situations that encourage or restrain substitution are summarized via 3 factorial axes explaining 65% of overall variance: assurance of JO quality and participation in a demonstration of JO use (axis A); LC organization of JO and the existence of a collective local project using JO (axis B); engine risks caused by JO, which is moreover not readily available and is unknown to villagers (axis C).

Table 4 – Explanatory models for the potential demand variables by comparing LC and non-LC respondents

Table 4 shows that 5 out of 6 models are quite relevant (see Fisher's stat), with an explained variance ranging from 27% in the case of WTP to 59% in the case of IS[16]. Compared to other studies of energy or environmental behaviour, this is a good result[17]. Determinants are

[14] For respondents that did not state a maximum WTP (open reply), we considered the median of the price range chosen (payment card).

[15] We applied an exploratory factor analysis using principal axis with an Oblimin rotation. This method summarizes statistical information while allowing for the implicit relationship between original variables (correlated factors).

[16] For IS and IA models, we apply the standardized coefficients (β), which are more efficient when explanatory variables have different formats. We retain the non-standardized coefficients (B) for the WTP model to allow for elasticity calculations.

[17] Most TPB studies explain between 20% and 40% of the variance of pro-environmental intentions (cf. Litvine and Wüstenhagen, 2011). In the southern context, Heltberg (2005) obtains Peusdo R^2=0.34 explaining cooking energy choices in Guatemala. Godin et al. (2008) get R^2=0.74 in a study about condom use in West Africa. Baker et al. (2007) obtain R^2=0.37 in a study about new technologies

different between the two groups for the three explained variables, with few common factors (controlling for initial sub-sample differences, see footnote p.). Potential demand thus seems to be constructed differently in the LC and non-LC areas. First of all, LC organization (axis B of control beliefs) is associated with a high demand among non-LC respondents, whereas for LC respondents this axis is significant for none of the three explained variables. This may be due to the fact that respondents in a project area already feel involved in a LC context, thus nullifying the effect of this factor in a multivariate model.

This analysis also supports that of "belief-action" since behavioral beliefs clearly influence the potential demand of LC respondents, which is not so for non-LC respondents. IS is sensitive to beliefs concerning the impact of JO on the community (axis 1 and 3), while IA or WTP are influenced by beliefs linked to the technical properties of JO, and to the risks and difficulties related to changing to an alternative fuel (axis 2 and 4).

Another important finding is that the decision process among LC respondents seems to be guided more by some economic rationality. The three demand variables are superior in higher socio-economic groups[18]: the wealthiest production units are more willing to substitute diesel with an uncertain and potentially more expensive alternative fuel. This basic economic rule, while not verified among non-LC respondents, is necessary for validating the measured WTP. LC respondents' answers are also determined by key technical and economic factors: JO quality and the wish to participate in a demonstration of JO use (axis A of control beliefs), the inverse relationship between price and fuel quality or even the unavailability of diesel. They have a much longer term vision in respect of their IA and WTP, taking into account the increase in major expenses for engine maintenance and average diesel consumption. IS is also positively linked to the intention to seek information about JO, a variable providing an accurate signal about the potential action (Litvine, 2010).

Conversely, potential demand among non-LC respondents is more determined by contextual factors and social interaction: the interviewer; the willing to use JO in order to comply with what they think is the expectation of important others (*injunctive norms*); and also the negative opinions about Jatropha. A LC respondent has a much stronger feeling that important others would approve of him using JO, but a non-LC respondent mainly wants to comply with this norm, which influences his own potential demand. The non-LC respondent's potential demand is also superior when he insists on seeing JO in the village and

implementation in Saudi Arabia. Even if surveys estimating WTP for energy choices mostly use a referendum eliciting format, they usually get a R^2 ranging from 15% to 40% (cf. Achtnicht, 2011; Banfi et al., 2008; Litvine, 2010; Solomon and Johnson, 2009).

[18] Three groups have been defined based on a Multiple Correspondence Analysis coupled with clustering on several variables: education, age, gender, and material wealth (number of engines, type of construction of the concession, livestock, durable goods, and number of available hectares).

trying it first (free sample). Yet this variable has been compiled from various answers highlighting an important "assistance bias", that is a strategic statement tailored so as to obtain something in return from the survey team. Finally, it is worth noting that the huge number of local people growing Jatropha has a negative influence on WTP, probably as a result of losing the advantage of being the first mover in what is perceived to be a cash crop.

5 Discussion and recommendations

5.1. Discussion of our findings

Our discussion will focus more on the interpretation and impact of our findings than on their comparison to similar work. Few studies have put local chains (LC) and energy demand in perspective, or have mobilized a method of examining rural demand similar to that which we propose.

The combined qualitative/quantitative survey approach, and the comparison of the sub-samples depending on whether they belong or not to a LC project area, have allowed us to study in detail the impact of LC on the construction and expression of potential demand for JO as a substitute for diesel. In accordance with our hypotheses, this demand is superior in a LC context, be it is the willingness to pay for JO, the intention to substitute JO for diesel or the intention to adapt engines. Conversely, the prospect of a vegetable oil produced outside the village restrains potential demand. When we examine the “beliefs-action” chain, the fact of belonging to a LC zone also has a significant effect on the formation and the strength of beliefs regarding JO produced from Jatropha planted locally. This chain influences the main determinants of intention as described in the Theory of Planned Behavior in that they are more accessible to memory and have a much greater impact on demand construction. This phenomenon leads us to expect a stronger correspondence in the LC areas between the intentions stated in the survey and effective substitution (Litvine and Wüstenhagen, 2011), in the event of JO being available for purchase.

Another possible interpretation of our findings could be that the IS statements are more biased among the LC respondents. Indeed, today LC projects are often the enterprise of private-sector players, industrial or NGO, that actively strive for their project to succeed and for future targets to be in favor of JO. We could think then that actions aimed at showing the importance and advantages of the project favorably bias LC targets’ answers. Yet, even if these answers are prompter they are not more positive than for the other targets: LC targets expect more negative effects from the production of Jatropha and possible JO use. The fact of belonging to the observed LC areas makes the targets more distrustful and more in a position

to express such wariness, which is an indication of a generally more severe evaluation of JO supply projects. We have also shown that the potential demand of LC targets is constructed more on technical and economic factors than for non-LC targets. The latter's demand is determined rather by more contextual and social interaction factors, and notably by the tendency to satisfy what they think to be the expectations of the referent people (injunctive norms).

These results could bring to light a sequential process in demand construction present in the LC-oriented energy access projects. First of all, without social organization of JO production, the people are strongly influenced by what the other villagers think (norms) and by what they can get from those outside the area (assistance bias), making more strategic statements and more discretionary decision-making. These elements override all other factors, such as socioeconomic criteria or the collective benefit expected from Jatropha and JO ("the money remains in the area", "diversification of economic activity", "increased autonomy", and "local solidarity"). Then, in a context where production responds to a spatial and social proximity logic, the decision-making process depends on longer term factors of a more technical and economic nature: household wealth, JO quality, diesel availability, depreciation and increase in engine maintenance expenses. Some studies in the scope of the Theory of Planned Behavior shed light on these findings. In this model, the contribution of each variable explaining intention depends on the behavior studied but also on the population targeted (cf. Ajzen and Fishbein, 2005; White et al., 2009). The LC target's decision seems to be controlled by more reasoned variables, i.e. the attitude towards substitution (results of the action) and the apparent difficulty of the act (impeding factors) whereas that of the non-LC targets by injunctive norms (social conformity)[19]. This type of difference can also be found in consumer typologies (cf. Fischer and Hanley, 2007).

5.2. Recommendations for decision-makers and project sponsors

It is necessary to mention that numerous questions still exist as to the final use of biofuels in developing countries (decentralized electricity, urban transport, exportation) and as to the form of supply chain (Amigun et al., 2011; Ariza-Montobbio and Lele, 2010; Basili and Fontini, 2012; Karekezi, 2002).The evaluation of demand is a step which is often neglected, for it is generally presumed with projects that, in a context where energy is cruelly lacking, once the supply is established the demand will emerge and develop. This analysis shows that

[19] This process conflicts with that shown by Litvine and Wüstenhangen (2011), where being informed stimulates/increases the importance of social norms.)

the classic methods of demand evaluation by simple dimensioning surveys can lead to false evaluations, and thus impair the return on investments and threaten the success of projects. It is necessary to examine the demand determinants and therefore ensure that individual preferences and beliefs are sufficiently formed for populations to be able to express their answers in surveys (Bateman et al. 2002; Lichtenstein and Slovic, 2006; Schwarz, 2006). Moreover, the spatial and social organization of energy supply influences populations' beliefs, and this increases the necessity for qualitative approaches prior to the quantitative questionnaires. The examination of demand must therefore be subjected to careful study concerning the survey method, as well as the statement and strategic biases. Indeed we have observed that a significant number of respondents gave answers depreciating their situation with the aim of obtaining help/or information (assistance bias). Field experiments appears to be very useful in this context, in particular for identifying the factors driving the decision-making and action-taking, as well as the barriers creating a discrepancy between statement, intention and effective substitution (Ajzen et al., 2004).

Given the stimulating effect of LC on substitution demand and the spontaneous craze for this kind of organization, the analysis of supply-demand equilibrium in a rural development context cannot disregard the contribution and limitations of small scale local projects (Karekezi, 2002). The LC is a structuring factor, but our study highlights that it is crucial to ensure other aspects in order to see the emergence and development of an energy supply adapted and conducive to local development. These other aspects include assurance of quality, availability and regularity of JO supply, information on the capacity of engines to use the new fuel, etc. Our survey data also corroborate certain controversies since the people consider that the LC may impair the quality and regular availability of JO. These criteria are central in deciding to use biofuel, as suggested by van de Velde et al. (2009), or Vermeir and Verbeke (2008) in the case of food choices.

Thus, as is already highlighted in northern countries (Devine-Wright, 2007; Maréchal, 2010), the success of bio-energy projects in southern countries does not only depend on their economic interest but also on their integration in the life of local populations (van Els et al., 2012). Our analysis proves that this integration itself depends on the nature of beliefs regarding basic productions, the end-products and the technologies implemented. The evaluation of these beliefs is certainly a key success factor for these new energy solutions.

5.3. Conclusion

Current energy and climatic crises lead to rethink the location and energy production methods for the North as for the South. These same crises also lead to relocate the agricultural economy and to give priority to the consumption of local produce. Bio-energies are at the crossroads of these two dynamics prompted by concerns to limit transport, find an alternative to fossil fuels and gain in energy autonomy. But it increasingly appears and our analysis proves it, that this relocation also responds to demands for directs links between producers and consumers. This corresponds to the restoration or maintenance of social ties but also to a concern for territorial development and support for local systems of production and processing. The bio-energies are at the heart of territorial, social, food, identity and economic stakes; and this position questions the support mechanisms of local authorities towards development and notably the place given to territorial communities. Quite paradoxically, thought is for the moment rather absent from decision-makers' preoccupations, notably in Burkina Faso. Whereas the moment is opportune since the country has just been given a Strategy for national and regional development and a new law on agricultural and property Reform and it has recently begun experimenting local productive systems around competitiveness poles.

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References

Abrahamse W., Steg L., 2009. How do socio-demographic and psychological factors relate to households' direct and indirect energy use and savings? Journal of Economic Psychology (30), 711-720

Achtnicht M, 2011. Do environmental benefits matter? Evidence from a choice experiment among house owners in Germany. Ecological Economics 70(11), 2191-2200

Ajzen I., 1991. The Theory of Planned Behaviour. Organizational Behavior and Human Decision Process 50, 179-211

Ajzen I., 2002. Constructing a Theory of Planned Behavior questionnaire: Conceptual and methodological considerations. Working paper University of Massachusetts <*www-unix.oit.umass.edu/~aizen*>

Ajzen I., Fishbein M., 2005. The influence of attitudes on behaviour. In Albarracín D., Johnson B., Zanna M. (Eds.), The handbook of attitudes (pp. 173-221), Mahwah, NJ

Ajzen I, Brown T., Carvajal F., 2004. Explaining the discrepancy between intentions and actions: the case of hypothetical bias in contingent valuation. Personality and Social Psychological Bulletin 30 (9), 1108-1121

Ajzen I., Sexton J., 1999. Depth of processing, belief congruence, and attitude-behavior correspondence, in Chaiken S., Trope Y. (eds.), Dual-process theories in social psychology, Guilford Press, 117-138.

Alberini A., Cooper J., 2000. Applications of the Contingent Valuation Method in developing countries – A survey. Fao Economic And Social Development Paper 146, Rome. 63 p

Amigun B., Kaviti Musango J., Stafford W., 2011. Biofuels and sustainability in Africa, Renewable and Sustainable Energy Reviews 15, 1360-1372

Ariza-Montobbio P., Lele S., 2010. Jatropha plantations for biodiesel in Tamil Nadu, India: Viability, livelihood trade-offs, and latent conflict. Ecological Economics 70, 189-195

Arnold M., Köhlin G., 2006. Woodfuel, Livelihoods, and Policy Interventions: Changing Perspectives. World Development 34 (3), 596-611.

Banfi S., Farsi M., Filippini M., Jakob M., 2008. Willingness to pay for energy-saving measures in residential buildings. Ecological Economics 30, 503-516

Baker E., Al-Gahtni S., Hubona G., 2007. The effects of gender and age on new technology implementation in a developing country – Testing the Theory of Planned Behavior (TPB). Information Technology and People 20(4), 352-375

Barnes DF, Krutilla K., W. Hyde, 2004. The urban household energy transition energy, poverty, and the environment in the developing world. WB, 114p. (http://siteresources.worldbank.org/INTGENENERGY/Resources/UrbanEnergyTransitionV51.pdf)

Basili M., Fontini F., 2012. Biofuel from Jatropha curcas: Environmental sustainability and option value. Ecological Economics 78, 1-8

Bateman I.J., Carson R.T., et al., 2002. Economic Valuation With Stated Preference Techniques: A Manual. Edward Elgar, Chelten-ham/Northampton.

Bernard T., 2010. Impact Analysis of Rural Electrification Projects in Sub-Saharan Africa. The World Bank Research Observer 26(2), 1-19

van den Bergh J., 2008. Environmental regulation of households: An empirical review of economic and psychological factors. Ecological Economics 66(4), 559-574

Brittaine R., Lutaladio N., 2010. Jatropha: a smallholder bioenergy crop: the potential for pro-poor development. Vol. 8. Integrated Crop Management. Rome: Food and Agriculture Organization of the United Nations. 96p

Cameron A.T, Huppert D.D, 1989. OLS versus ML estimation of non-market resource values with payment card interval data. Journal of Environmental Economics and Management 17(3), 230-246

Carson R., Groves T., 2007. Incentive and informational properties of preference questions. Environmental and Resources Economics 37, 181-210

Cotula L., Dyer N., Vermeulen S., 2008. Fuelling exclusion? The biofuels boom and poor people's access to land. Rome: FAO and IIED, 82 p.

Dabat M.-H., Hanff E., Blin J., 2012. Are Biofuels a Factor of Sustainable Development in a Food Insecurity Context in Africa? Case Study of Burkina Faso. Global Sustainable Development and Renewable Energy Systems, Phillip Olla editor, Madonna University, USA, Publisher IGI Global, 354p, 152-171

DellaVigna S., 2009. Psychology and Economics: Evidence from the Field. Journal of Economic Literature 47(2), 315-72

Devine-Wright, P., 2007. Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review. Manchester: School of Environment and Development, University of Manchester (www. sed. manchester. ac. uk/research/beyond_nimbyism)

Djerma G.C., Dabat M.-H., 2012. Biofuels in West Africa: From institutional vacuum to multi-actors partnership in the strategies formulation and policies implementation, 20th European Biomass Conference and Exhibition, Setting the course for a biased economy, Milan, Italy, 18-22 June, 13p

Eagly A. H., Chaiken S., 1993. The psychology of attitudes. Harcourt Brace Jovanovich College Publishers.

van Els R.H., de Souza Vianna J.N., Brasil A.C.P., 2012. The Brazilian experience of rural electrification in the Amazon with decentralized generation - The need to change the paradigm from electrification to development. Renewable and Sustainable Energy Reviews 16(3), 1450–1461

FAO, 2009. Small Scale Bioenergy Initiatives - Brief description and preliminary lessons on livelihood impacts from case studies in Asia, Latin America and Africa (www.impattoambientale.it/documenti/Rapporto%20FAO%202009.pdf)

Farrow K., Teisl M., Noblet C., McCoy S., Rubin J., 2011. Does Money Grow on Trees? People's Willingness to Pay for Cellulosic Wood Ethanol. [http://cdn.intechweb.org/pdfs/17886.pdf]

Fazio R., Powell M., Williams C., 1989. The role of attitude accessibility in the attitude-to-behavior process. Journal of Consumer research 16(3), 280-288

Fazio R., 1995. Attitudes as object-evaluation associations: determinants, consequences, and correlates of attitude accessibility, in Petty R., Krosnick J. (Eds.), Attitude strength: antecedents and consequences, Lawrence Erlbaum Associates, NJ

Fischer A., Hanley N., 2007. Analysing decision behaviour in stated preference surveys: A consumer psychological approach. Ecological Economics 61(2-3), 303-314

Fore S. R., William L., Porter P., Jordan N., 2011. Economics of small-scale on-farm use of canola and soybean for biodiesel and straight vegetable oil biofuels. Biomass and Bioenergy 35(1), 193-202.

Geels F.W., 2004. From Sectoral System of Innovations to Socio-Technical Systems Insights About Dynamics and Change from Sociology and Institutional Theory. Research Policy 33, 897-920.

Godin G., Bah AT, Sow A., Minani I., Morin D., Alary M., 2008. Correlates of Condom Use among Sex Workers and Their Boyfriends in Three West African Countries. AIDS Behavior 12, 441-451

Green D., Jacowitz K., Kahneman D., McFadden D, 1998. Referendum contingent valuation, anchoring, and willingness to pay for public goods. Resource and Energy Economics 20, 85-116

Groves R. M., Fowler Jr F. J., Couper M. P., Lepkowski J. M., Singer E., Tourangeau R., 2009. Survey methodology. Second Edition, Hoboken, NJ: Wiley Publication

Gupta G., Köhlin G., 2006. Preferences for domestic fuel: Analysis with socio-economic factors and rankings in Kolkata, India. Ecological Economics 57 (1), 107-121

Haab T., McConnell K., 2002. Valuing environmental and natural resources - the econometrics of non market-valuation. Edward Elgar, UK. 326 p.

Hanff E., Dabat M-H., Blin J., 2011. Are biofuels an efficient technology for generating sustainable development in oil-dependent African nations? A macroeconomic assessment of the opportunities and impacts in Burkina Faso. Renewable and Sustainable Energy Reviews 15, 2199-2209

Heltberg, R., 2005. Factors determining household fuel choice in Guatemala. Environment and Development Economics 10(3), 337-361

Irwin J., Slovic P., Lichtenstein S., McClelland G., 1993. Preference reversals and the measurement of environmental values. Journal of Risk and Uncertainty 6, 5-18

Jacobsson S., Johnson A., 2000. The diffusion of renewable energy technology: an analytical framework and key issues for research. Energy Policy 28, 625-640.

Kahneman D., Tversky A. (Eds.), 2000. Choices, values, and frames, Cambridge University Press, 840 p

Karekezi S., 2002. Renewables en Africa – meeting the energy needs of the poor. Energy Policy 30, 1059-1069

Kotchen M., Reiling S., 2000. Environmental attitudes, motivations, and contingent valuation of nonuse values: a case study involving endangered species. Ecological Economics 32, 93–107

Kotchen M., Moore M., 2007. Private provision of environmental public goods: household participation in green-electricity programs. Journal of Environmental Economics and Management 53(1), 1-16

Leach, G., 1992. The energy transition. Energy Policy 20(2), 116-123

Leitmann J., 1989. How to collect data on household energy consumption. WP (WPS 108 - PPR Industry and Energy Department, WB)

Lichtenstein S, Slovic P. 2006. The Construction of Preference. London: Cambridge Univ. Press

Litvine D., 2010 . La participation volontaire des citoyens sur le marché européen des permis d'émission de CO2 : Une évaluation contingente élargie à la Psychologie environnementale, Repec (credwp 10.07.87)

Litvine D., Wüstenhagen R., 2011. Helping light green consumers walk the talk: Results of a behavioural intervention survey in the Swiss electricity market. Ecological Economics 70, 462-474

Maréchal K., 2010. Not irrational but habitual : The importance of "behavioural lock-in" in energy consumption. Ecological Economics 69(5), 1104-1114

Masera O.R., Saatkamp B.D., Kammen D.M., 2000. From Linear Fuel Switching to Multiple Cooking Strategies: A Critique and Alternative to the Energy Ladder Model. World Development 28(12), 2083-2103

Massard N., Torre A., Crevoisier O., 2004. Proximité géographique et innovation, in Economie de proximités, Pecqueur B., Zimmermann J.-B., Lavoisier, Paris, 264p

Milder J.C., McNeely J.A., Shames S.A., Scherr S.J., 2008. Biofuels and ecoagriculture: Can bioenergy production enhance landscape-scale ecosystem conservation and rural livelihoods? International Journal of Agricultural Sustainability 6(2), 105-121

Miller JM, Peterson D., 2004. Theoretical and Empirical Implications of Attitude Strength. The Journal of Politics 66(3), 847-867

Misra R.D., Murthy M.S., 2010. Straight vegetable oils usage in a compression ignition engine - A review. Renewable and Sustainable Energy Reviews 14, 3005-3013

Mondal P., Basu M., Balasubramanian N., 2008. Direct use of vegetable oil and animal fat as alternative fuel in internal combustion engine. Biofuels, Bioproducts, Biorefining 2, 155-174

Mulligan K., Grant J.T., Mockabee S.T., Monson J.Q., 2003. Response latency methodology for survey research: measurement and modeling strategies. Political Analysis 11, 289-301

Murphy JT, 2001. Making the energy transition in rural east Africa: Is leapfrogging an alternative? Technological Forecasting and Social Change 68(2), 173-193

Niez A., 2010. Comparative study on rural electrification policies in emerging economies-Keys to successful policies. OECD/IEA information paper (www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2213)

Ouedraogo I.M., 2010. Electricity consumption and economic growth in Burkina Faso: A cointegration analysis. Energy Economics 32, 524-531

Pohl C., 2010. Jatropha: money doesn't grow on trees, ten reasons why jatropha is neither a profitable nor sustainable investment. Friends of Earth International 120. Amsterdam, 18p.

Raadal H.L., Dotzauer E., Hanssen O.J., Kildal H.P., 2012. The interaction between Electricity Disclosure and Tradable Green Certificates. Energy Policy 42, 419–428.

Schwarz N., 2006. Attitude construction: evaluation in context, in Grawronski (ed.), What is attitude ?, (*sitemaker.umich.edu/norbert.schwarz/files/07_sc_schwarz_attitude_construction.pdf*)

Sidibé S.S., Blin J., Vaitilingom G., Azoumah Y., 2010. Use of crude filtered vegetable oil as a fuel in diesel engines state of the art: Literature review. Renewable and Sustainable Energy Reviews 14, p. 2748-2759

Shove E., Walker G., 2010. Governing transitions in the sustainability of everyday life. Research Policy 39(4), 471–476.

Solomon B.D, Johnson N.H, 2009. Valuing climate protection through willingness to pay for biomass ethanol. Ecological Economics 68, 2137-2144

Stern P.C, 2011. Contributions of Psychology to limiting climate change. American Psychology 66(4), 303-314

Sundkvist A., Jansson A., Larsson P., 2001. Strengths and limitations of localizing food production as a sustainably-building strategy. An analysis of bread production on the island of Gotland, Sweden. Ecological Economics 37(2), 217-227

Tatsidjodoung P., Dabat M.-H., Blin J., 2012. Insights into biofuel development in Burkina Faso: Potential and strategies for sustainable energy policies. Renewable and Sustainable Energy Reviews 16, 5319-5330

Tomomatsu Y., Swallow B., 2007. Jatropha curcas biodiesel production in Africa: economics and potential value chain development for smallholder farmers. WP 54. Nairobi. World Agroforestry Centre. 33p.

Torre A., Gilly JP., 1999. On the analytical dimension of Proximity Dynamics. Regional Studies 34 (2), 169‑180.

Townsend A., 2000. Energy access, energy demand, and the information deficit. In Energy Services for the World's Poor. Energy and Development Report (2000:8‑24). Washington, DC: ESMAP, The World Bank.

United Nations Millenium Project (UNMP - Sachs J.D.), 2005. Investing in Development: A practical plan to achieve the millenium development goals, London, Earthscan, 329 p

United Nations Department of Economic and Social Affairs (UNDPESA), 2007. Small-Scale Production and Use of Liquid Biofuels in Sub-Saharan Africa: Perspectives for Sustainable Development. Energy and Transport Branch. Division for Sustainable Development. United Nations Department of Economic and Social Affairs. New York. 51p

Upham P., Shackley S., Waterman H., 2007. Public and stakeholder perceptions of 2030 bioenergy scenarios for the Yorkshire and Humber region. Energy Policy 35(9), 4403-4412.

van de Velde L., Verbeke W., Popp M., Buysse J., van Huylenbroeck G., 2009. Perceived importance of fuel characteristics and its match with consumer beliefs about biofuels in Belgium. Energy Policy 37(8), 3183-3193

Verbeke, Wim. 2007. Consumer Attitudes Toward Genetic Modification and Sustainability: Implications for the Future of Biorenewables. Biofuels, Bioproducts and Biorefining 1(3), 215–225.

Vermeir I., Verbeke W., 2008. Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. Ecological Economics 64(3), 542-553

Wahl N., Jamnadass R., Baur H., Munster C., Iiyama M., 2009. Economic viability of Jatropha curcas L. plantations in Northern Tanzania. World Agroforestry Centre ICRAF, 71p

White K.M., Smith J.R., Terry.D.J., Greenslade J.H., McKimmie B.M., 2009. Social influence in the theory of planned behaviour: The role of descriptive, injunctive, and in-group norms, British Journal of Social Psychology 48, 135-158

Wicker P., Becken S., 2013. Conscientious vs. ambivalent consumers: Do concerns about energy availability and climate change influence consumer behaviour? Ecological Economics 88, 41–48.

Wiser R., 2007. Using contingent valuation to explore willingness to pay for renewable energy: A comparison of collective and voluntary payment vehicles. Ecological Economics 62, 419-432

Table 1 – Classification of factors according to their impact on the intention to substitute (self-evaluation)

		More important factor
Conducive factors (à priori)	JO quality is reliable	24.4%
	JO organized in a Local supply chain (LC)	**19.2%**
	JO price more stable than gas-oil price	7.1%
	Local demonstration of JO use	10.3%
	A local project uses JO	0.6%
Restraining factors (à priori)	JO is not always available	15.4%
	JO from local crops is sold outside the district (non-LC)	**11.5%**
	Technical engine risk	3.8%
	JO is not known by other villagers	1.9%
	Total (N)	100% (156)

Table 2 – Comparison of the level of potential demand between "LC respondents" and "non-LC respondents"

	Type of measure	LC respondents M (σ - n)	Non-LC respondents M (σ - n)	Mean difference ΔM (σ) [a]
Intention to substitute gas-oil with JO (IS)	Scale 1-4	3.69 *(0.67 - 94)*	3.25 *(0.79 - 60)*	0.44** *(0.12)*
Intention to adapt one's engine (IA)	Scale 1-4	3.33 *(0.87 - 98)*	2.95 *(1.00 - 58)*	0.38** *(0.15)*
Willingness to pay (WTP)	CFA Francs	531 *(82 - 96)*	505 *(103 - 59)*	26* *(15.7)*

[a] ANOVA, after variance homogeneity test (Levene), and confirmed with a non-parametric test (Welch) *p<0.1 **p<0.05

Table 3 – Impact of LC on demand determinants and their accessibility to memory (only significant differences)

		LC respondents (A)		Non-LC respondents (B)		Statistics tests (σ)[a]	
	Measure	N	% / Mean (σ)	N	%/ Mean (σ)		
Have already heard about Jatropha	0/1	97	97% -	50	80% -	13.3(1) ***	
Various points of contact with Jatropha (more than 3 points=median)	0/1	49	51% -	21	33% -	5.2(1)**	
Jatropha is used to produce fuel that can replace gas-oil	0/1	91	95% -	36	60% -	29.5(1) ***	
Knowledge of a JO production project	0/1	63	68% -	28	48% -	5.6(1) **	
If JO project known, it is local (village or district)	0/1	33	52% -	5	18% -	9.5(1)***	
No JO available for use	0/1	88	92% -	40	66% -	17.2(1)***	
Other local people grow Jatropha (*descriptive norms*)	0/1	84	88% -	33	68% -	8.4(1)**	
N° of negative salient behavioral beliefs (spontaneous)	0/6	80	2.10 *(0.66)*	61	0.96 *(0.73)*	1.14*	*(0.42)*
N° of positive salient behavioral beliefs (spontaneous)	0/6	78	1.90 *(0.96)*	56	0.74 *(0.65)*	1.16*	*(0.39)*
Average score for negative behavioral beliefs	-2/+2	100	0.91 *(0.71)*	64	0.01 *(0.79)*	0.90**	*(0.21)*
Attitude towards JO substitution	-2/+2	99	0.39 *(0.49)*	64	0.65 *(0.58)*	-0.26**	*(0.08)*
Injunctive norms (I think the important others would like me to use JO)	1/4	96	3.40 *(0.48)*	57	3.22 *(0.46)*	0.18**	*(0.08)*
Descriptive norms (other villagers use JO)	1/4	80	0.13 *(0.43)*	42	0.02 *(0.15)*	0.11*[NE]	*(0.05)*
Descriptive norms (weak version - other villagers talk about JO)	1/4	97	1.52 *(0.74)*	61	1.07 *(0.79)*	0.45**	*(0.12)*
Perceived difficulty of substitution	1/4	95	2.79 *(0.99)*	63	2.43 *(0.94)*	0.36**	*(0.16)*
External control (barriers to substitution)	1/4	94	3.05 *(0.92)*	56	2.73 *(0.92)*	0.32**	*(0.15)*
Response time to "negative behavioral beliefs"	seconds	91	10.5 *(8.9)*	56	13.9 *(10.1)*	-3.4*	*(1.79)*
Response time to "what do other people say about Jatropha?"	seconds	91	5.8 *(4.7)*	59	6.9 *(4.3)*	-1.1*	*(0.76)*
Response time to the "intention to substitute"	seconds	92	3.0 *(3.2)*	63	5.1 *(4.0)*	-2.1**	*(0.57)*

[a] We run a χ^2 test for the % differences and an Anova for the mean differences (A-B) [NE]: Welch's non-parametric test (non-equality of variances) Bilateral p-value: *p<0.1 **p<0.05 ***p<0.01

Table 4 – Explanatory models for the potential demand variables by comparing LC and non-LC respondents

	Model 1 Intention to substitute		Model 2 Intention to adapt engines		Model 3 Willingness to pay for JO	
	LC respondents	**Non-LC respondents**	**LC respondents**	**Non-LC respondents**	**LC respondents**	**Non-LC respondents**
	β^a *(t)*	β^a *(t)*	β^a *(t)*	β^a *(t)*	B^b *(s.e)*	B^b *(s.e)*
Constant	-	-	-	-	528.6*** *(22.6)*	556.1** *(214.1)*
Socio-economic group	0.28*** *(3.0)*	-	-	-	52.60*** *(16.3)*	-
Intention to seek information about JO	0.20*** *(2.6)*	-	0.30*** *(3.8)*	-	-	-
Do you consider price as an indicator of fuel quality?	0.19*** *(2.6)*	-	-	-	-	46.85*** *(8.1)*
Unavailability is the main disadvantage of gas-oil	-	0.25** *(2.6)*	-	-	-	-
Increased change of major spare parts	-	-	0.22*** *(2.9)*	-	45.07** *(19.5)*	-
High gas-oil consumption (average per year)	-	-	0.21*** *(2.7)*	-	-33.78*** *(11.5)*	-
Positive beliefs about "*collective economic well-being*" (axis 1)	0.18** *(2.4)*	-	-	-	-	-
Positive beliefs about "*technical benefits of JO*" (axis 2)	-	-	-	0.36*** *(3.7)*	-	-
Negative beliefs about "*impact on community*" (axis 3)	-0.26*** *(-3.1)*	-	0.41*** *(5.2)*	-	-	-
Negative beliefs about " *change risk and aversion*" (axis 4)	-	-	-	-	-34.41*** *(9.9)*	-
Overall attitude towards JO substitution	0.28*** *(3.9)*	-	-0.13** *(-2.1)*	-	-	-
Perceived ease of substitution	0.20*** *(2.7)*	-	-	-	-	-
Behavior influenced by what other villagers do (*descriptive norms*)	0.26*** *(3.4)*	-	-	-	-	-
JO quality is assured & participation in demo (axis A)	0.45*** *(6.1)*	-	-	-	60.65*** *(20.1)*	-
PC organization & local project using JO (axis B)	-	0.36*** *(3.9)*	-	0.29*** *(2.8)*	-	59.80*** *(14.9)*
Behavior influenced by what other villagers think (*injunctive norms*)	-	0.23*** *(2.8)*	-	0.19** *(2.1)*	-	268.8*** *(71.4)*
Many negative opinions circulate about Jatropha	-	0.36*** *(4.2)*	-			
Many local people grow Jatropha	-	-		-	-	-56.8*** *(16.2)*
Interviewer : Jacques	-	-0.31*** *(-3.3)*	-	0.25** *(2.3)*	-	-
Respondent insists to see and try JO first (assistance bias)	-	-0.17** *(-2.1)*	-	-0.27*** *(-2.9)*	-	-88.80** *(41.6)*
Number of obs (n)	99	63	99	63	82	63
Fisher's stat (dl)	F(10;89)= 12.4***	F(7;56)=13.6***	F(5;94) = 15.1***	F(7;56) = 12.8***	F(7;75) = 5.35***	F(7;56)=10.96***
Stand. estimation error.	0.44	0.49	0.55	0.62	71.05	68.59
Adjusted R^2	0.54	0.59	0.55	0.57	0.27	0.52

[a] Standardized coef β (student t value) [b] Coef. B (s.e: standard error) *p<0.1 **p<0.05 ***p<0.01

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