

**THE CONSUMPTION OF DOMESTIC GAS IN A TROPICAL SAHELIAN METROPOLIS BETWEEN A SUSTAINABLE DEVELOPMENT STRATEGY AND ADAPTATION OF HOUSEHOLDS TO NEW WAYS OF LIVING: THE CASE OF THE TOWN OF N'DJAMENA IN CHAD.**

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**Abstract :** This study analyses the strategies by the Chadian government to reduce deforestation around the town of N'Djamena as well as over the national territory. Up till date, we observe an increasing growth in the population of the capital of Chad. This growth leads to the abusive and consistent use of fuel wood and charcoal by the households. This situation is detrimental to the environment and to human activities with risks on the real-life of the population. Surveys carried out with the populations and interaction with resource persons as well as direct observations in the field permitted us to bring out the difficult adaptation of populations to the requirements of modernity and to the sometimes inadequate strategies of the Chadian government to limit human pressure on the forest resources of N'Djamena. It becomes very imperative to educate the population and to ameliorate their living conditions so as to control energy consumption and avoid compromising the vegetation cover around Lake Chad and in the Sahel.

**Key words:** Source of energy, government strategy, vegetation cover, environment, sustainable development

## **Résumé**

La présente étude analyse les stratégies de l'Etat Tchadien pour réduire la déforestation aussi bien autour de la ville de N'Djamena que sur le territoire national. A ce jour, on assiste à une croissance démographique de plus en plus accélérée dans la capitale du Tchad. Cette croissance conduit à l'usage abusif et constant du bois de chauffe et du charbon de bois par les ménages. Cette situation est préjudiciable à l'environnement et aux activités humaines avec des risques sur le vécu des populations. Les enquêtes menées auprès des populations et des personnes ressources ainsi que les observations directes sur le terrain ont permis de mettre en évidence la difficile adaptation des populations aux exigences de la modernité et les stratégies parfois

insignifiantes des pouvoirs publics tchadiens pour limiter la pression humaine sur les ressources ligneuses à N'Djamena. Il devient impératif d'éduquer les populations et d'améliorer leurs conditions de vie pour réguler la consommation de l'énergie et éviter de compromettre le couvert végétal autour du lac Tchad et dans le sahel.

Mots clés : sources d'énergie, stratégies de l'Etat, couvert végétal, environnement, développement durable

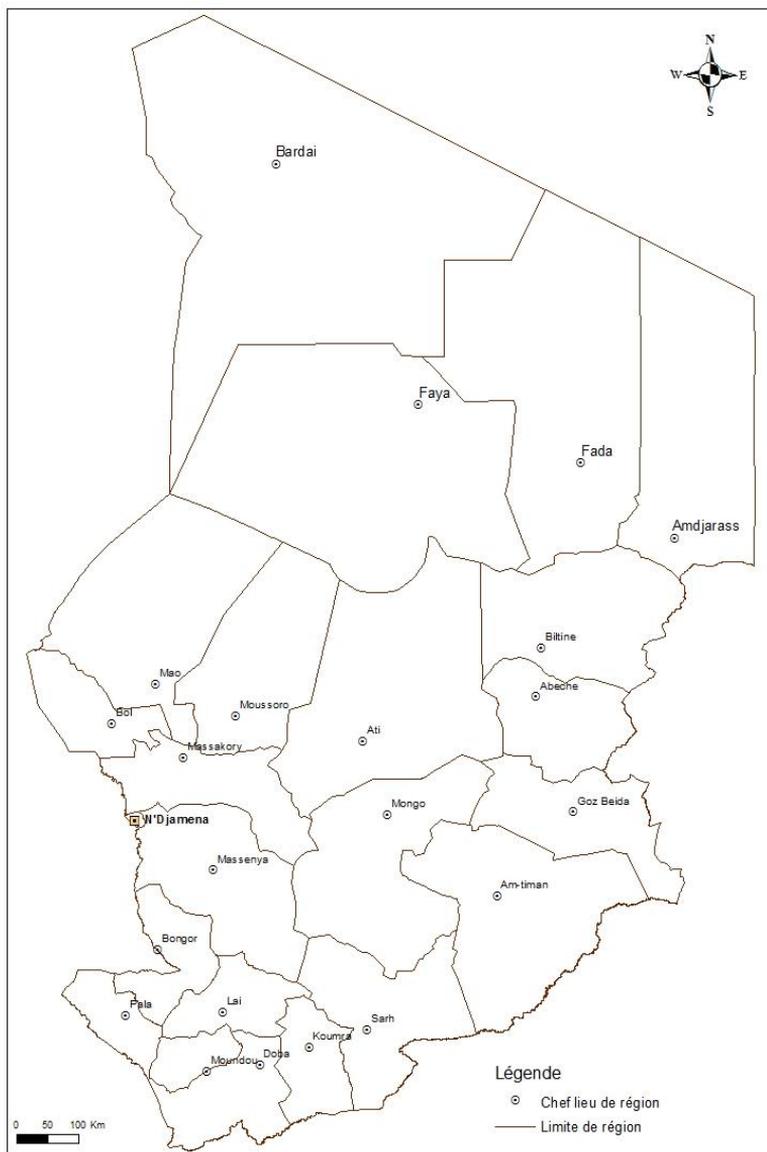
## **A- Introduction and problem**

Chad is a country generally situated in the Sahelian zone. Here, household constantly use charcoal and fuel wood. However, confronted with the approaching desert which has reduced the potential and biodiversity around the Lake Chad, it becomes indispensable to preserve the vegetation cover in this country in order to avoid getting into regrettable situations. In order to do so, the Chadian government has taken measures by introducing the consumption of domestic gas for kitchens and other energy needs. In N'Djamena the political capital of Chad, there is a high demand for butane, more so as this town alone harbours 1/3 of the population of Chad. This provokes an increase in the consumption rate of this product due to eventual difficulties in this sector. However, the state of Chad has approved consistent investments in terms of subvention to reduce the price of domestic gas so as to make it accessible to all levels of the society. Since 2011, the N'Djamena refinery started functioning at full scale and price of gas per bottle has been reduced. This study looks at these political strategies aimed at stimulating sustainable development up stream as well as the adaptation modes of the people of N'Djamena to this situation.

## **B- Methodology**

Situated between latitudes 12°7' and 12°10' North and longitude 14°59' and 15°03' East, N'Djamena (fig. 1), is experiencing an accelerated spatial expansion with an increasingly modern population developing interests for modern sources of energy. This study examines the socio-political, environmental and spatial implications of access to domestic gas in this space. To understand the research questions and to present data collected from the field, the approach used was inclined to systematic methods. It is based on secondary data acquired through documentary research, as well as on primary data resulting from field investigations. Primary data was obtained by way of

survey using questionnaires administered in the randomly selected areas. This questionnaire has been supported by question guides and analyses of field observations. Collected data was treated using the hypothetical-deductive approach.



**Figure 1:**  
*Study area*

Source: P-SIDRAT  
Réalisation: Rathnan A. & Denejembaye A.  
Datum: WGS\_84 UTM 33N

## **C- Results and analyses**

### **1) A poor population and affected by new living style**

Spatially, the town of N'Djamena covers a surface area of 3500 hectares with a population density of 82.57 inhabitants/hectares until 2007. Today it covers about 45500 hectares (MATHUH, 2013). It is bounded to the North by the Kanem region, to the South by the Mayo Kebbi and the Tandjilé regions, to the West by the Republic of Cameroon and the Northern region of Guéra to the East.

According to the United Nations, the town of N'Djamena is one of the capitals in the world where the cost of living is very high. This is the largest metropolis of Chad in which is found a representation of all the ethnic groups of the country as well as foreigner. Just as other metropolises in Africa, N'Djamena for about 50 years now has been experiencing a very rapid urbanization. Its population increased from 289 000 inhabitants in 1984 to 1.300 000 in 2007. With an annual growth rate of about 7% (Estimation of the BCR, 2007), this population exceeds 1.900 000 inhabitants according to estimates from the United Nations, the World Bank and BEAC. It is a population characterized more than 60% by youths leading a relatively low standard of living. The average per capita revenue is estimated at less than 2 Euros per day (UNDP, 2014). It becomes difficult for these populations to access modern sources energy which are mainly petroleum products such as kerosene and domestic gas. The high concentration of population in N'Djamena (about 1/3 of the Chadian population), mounts a very high pressure on forest resources in the environments close to agglomerations. From available information, firewood and charcoal represent more than 97% of total domestic energy consumption. This amount of wood is high because a quasi-totality of rural households and  $\frac{3}{4}$  of the urban households use exclusively it as a source of energy. This energy is principally used to cook food and for craft. The demand for other energy sources such as kerosene and gas concerns about 1% of the population of N'Djamena.

The coverage of electricity supplied by the service agent is estimated at about 7% only. Consequently, households consume more of charcoal and wood to make up for shortages in the other sources of energy. In the course of the last 20 years, for example, the individual consumption of charcoal in N'Djamena has been multiplied by three, while the consumption of firewood has been divided by five. The number of houses equipped by domestic gas bottles on the contrary is evolving sluggishly. It is estimated today at close to 10 000 (PNG, 2012). Here, most of the households use domestic gas as

exchange energy. Eventually, these households prefer natural energy for cooking food.

In 2001, each inhabitant of N'Djamena consumed an equivalent of 1.8 cubic metres of wood (representing 0.9m<sup>3</sup> or 630 kg). Today these figures are multiplied by 5 and at times by 8. Due to the extent of this human pressure on the vegetation cover which itself is poor, the Chadian government with the assistance of international donors has engaged sensitisation campaigns aimed at compelling households to adopt new behavioural patterns in the consumption of available sources of energy. To this effect, the consumption of energy sources in N'Djamena clearly show that despite the efforts of the state to encourage the use of domestic gas, the actual standard of living and especially the high cost of living in the sahelian towns particularly that of Chad are not in the nature to encourage this situation. Poverty is surrounding them. Eventually, domestic gas continues to be a luxury for those who consume it. Human pressure on vegetation cover around the town of N'Djamena is very evident (table 1)

**Table 1: Sources of energy consumed in Chad in tons in 2012**

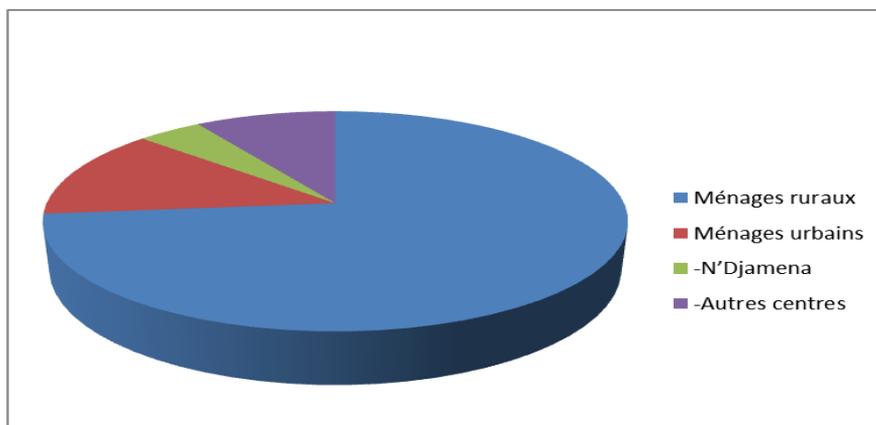
Type of sector	Fire wood	Kerosene	Butane gas	Total
N'Djamena	33.400	550	950	86.700
Urban total	133.600	1.000	1.800	489.900
Rural total	590.600	-	-	990.600
National total	724.200	1.000	1.800	987.500
Percentage	95%	2%	3%	100%

**Source :** *Synthesis report, technical cell*

In the whole, we observe a very high increase in the consumption of firewood in the rural as well as the urban sectors (95%), a very low consumption of kerosene estimated at only 2% and a very low consumption of domestic gas in Chad estimated globally at 3% in the rural and urban areas. This situation, however, hides the alarming disparities. In effect, if realities in the regions of the country are quite alarming to be confirmed by these figures, the town of N'Djamena seems to be at rest. As such, although the consumption of firewood and charcoal is evident, it remains true that it is perpetually on the decrease since the state took over the management of petroleum products in 2006.

The high consumption of energy from forest sources by the population is clearly explained by their low purchasing power. It is more a cultural problem that creates losses in the use of wood and charcoal in Chad in general and in N'Djamena specifically. In effect, the population that comes from rural areas to the political capital bring with them habits and behaviours linked to dependence on ligneous sources of energy. Once in town, it becomes difficult for them to do away with these behaviours. Consequently, they continue going back to ordinary habits at times linked to their level of education and their income.

Only 2% of kerosene and 3% of domestic gas are consumed by these populations. Even if trends are actually on the increase as concerns the town of N'Djamena, it must be said that the state of Chad has difficulties in making service agents to facilitate access to other sources of energy by the population. This equally applies to electricity just as in kerosene and domestic gas. But the situation of domestic gas appears very preoccupying in the sense that its availability to a high proportion of the population will seriously contribute in reducing the human pressure on the vegetation cover.



**Figure 2:** The final household energy consumption in Chad in 2011

**Source :** Comité Directeur de Suivi de la stratégie domestique (2014), Field survey (2014)

We realise that from year to year, the consumption of wood has been multiplied by 10 between 2000 and 2014, which amounts to 7.1kg/person/day in 2014. A comparison of this data with the one from FAO shows that the figures are not exactly intersecting but are found in the same level of increase. A comparison between the forest potentials and consumption rates reveals that forest resources are increasingly degrading and less sufficient to satisfy the needs of the population. From the survey carried out by ESMAP, it is revealed that a majority (71.4%) of the households in N'Djamena like cooking their food using several fuels as shown on table 2. However, close to one of every three households cook with a unique fuel, which is 2/3 made of wood. Wood is the principal fuel for more than 60% of households in N'Djamena. On the contrary, less than one household on two use charcoal as the main fuel. The butane gas remains the privilege of a minority (-3%) limited to the well-off of the population. The consumption of kerosene, which remains in N'Djamena a lighting fuel, as that of electricity is not significant in terms of the number of households.

**Table 2:** *The nature of fuels used for the cooking of food in N'Djamena in 2014*

% total des ménages	Wood	kérosène	Butane gas	Electricity
Unique fuel	18,2	-	21,5	0,3
Main fuel	5,8	0,3	19	-
Replacement fuel	-	5,0	18	-

**Source:** Domestic energy survey ESMAP (2014)

It is clear that the sources of energy used by households in N'Djamena are diversified. But the preponderance and increase in the consumption of domestic gas was perceptible in 2013. based on the household, butane gas is used at the same time as the principal and replacement fuels. This situation varies in relation to the standard of living and the purchasing power of each household. The ESMAP survey judges that when a household uses firewood as the replacement and not principal source of energy, the specific daily consumption of firewood reduces by about 2/3. It was brought down from 0.65kg to 0.21 kg per person. A more restricted survey conducted in 2012 by this same structure indicates that charcoal is today one of the least used sources of energy in N'Djamena after it was forbidden. According to the same source, if in 2000 firewood was the principle if not the unique fuel used by 80%

of households in N'Djamena, in 2015, the use of this fuel has considerably reduced to reach 45% because other sources of energy have occupied an important place within the households of Chad.

The urban growth of the town of N'Djamena influences the consumption of domestic gas in this space. This situation partly accounts for the high demand of this product in this zone. In this light, other forms of energy are outlawed in the town of N'Djamena today. The state controls the consumption of wood and charcoal. This regulation of the consumption of energy influences and brings pressure to bear on domestic gas in the town.

The relative prices of wood and charcoal tend to orient consumers towards charcoal on account of its comparative advantage (Kitchen comfort, cleanliness, etc). It describes the impact of poverty on the consumption of firewood highly solicited by the poor families. It brings out the actors of the charcoal sector as well as the lucrative side of this activity. However, it demonstrates the harmful environmental character of this activity. To them, the constant exploitation of firewood and charcoal in particular destroys living milieu of the people. It becomes very important to protect the vegetation cover in order to ensure the effects of sustainable development.

## **2) Sustainable development initiated from the top**

The situation of N'Djamena and the diversity of the modes of live within the urban society in Chad favours the consumption of mixed sources of energy in this locality. Henceforth, we differently resort to domestic gas, firewood and kerosene stoves. This diversity depends at the same time on the standard of living and the daily happenings within the households. In several records, the consumption of domestic gas in N'Djamena appears to be a social stratification criterion. It is for this reason that certain households having this source reserve its use for occasional situations: necessary economising. To this effect, the role of the state becomes determinant in the regulation and the control of quality and quantity of the production of domestic gas upstream and downstream.

In 2006, a government measure strictly prohibited the use of firewood as well as that of charcoal all over the national territory. Mixed control comates were created in all the 23 regions of the country in order to guarantee the effectiveness of this measure. Up till today, the use of domestic gas has been made obligatory in household by the state of Chad be it in the urban or the rural areas of the country. This governmental measure is made possible by subvention awarded to this product. This is a means to fight against desertification, which is threatening the Sahel countries in general and Chad in particular. We thus talk of the stimulus to sustainable development from the top. This situation articulates around diverse incentives of the government to

protect the environment as well as setting up strategies to promote sustainable development at the local scale.

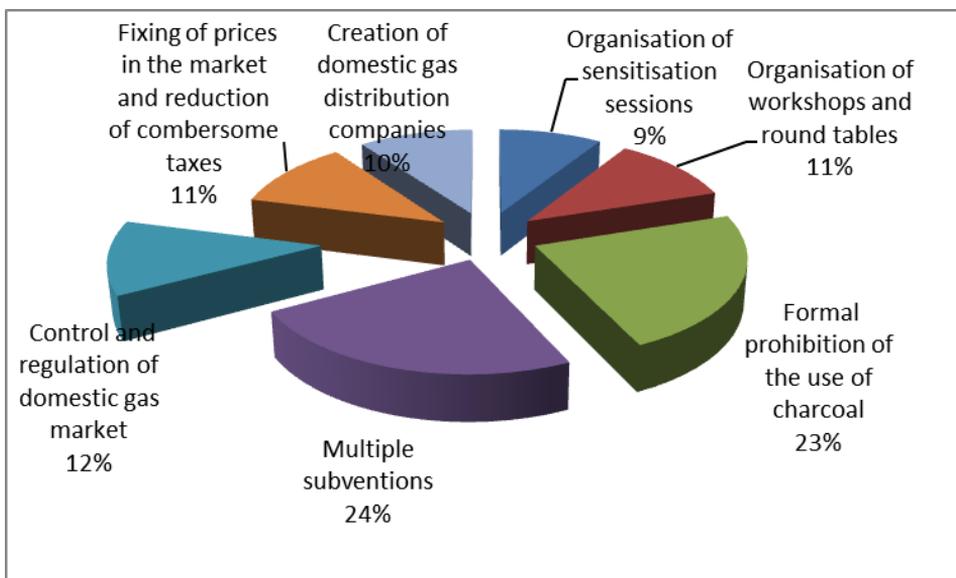
### **3) A strategy to conserve the vegetal cover and promote sustainable development**

Today, the equipping of 20% of households with butane gas stoves led to the economization of 150 000 bags, being 7.5% of charcoal consumption in N'Djamena between 2007 and 2014. This implies a sustained economic growth, a favourable evolution in the standard of living of urban households and a high increase in annual amount of financing for the gas Fund, which is more than the 1.65 billion FCFA agreed on in 2007 for the subvention of 6 kg of bottle and diverse equipment. The use of butane gas is made obligatory by the state of Chad in the households of the country. Through these measures, the state tries to preserve the living milieu of these populations this is done through the protection of biodiversity generally and fight against deforestation. The repeated cutting of trees in a sahelian milieu such as Chad finally risks compromising the equilibrium of the ecosystem and reinforcing global warming in this space. The matter here is to conserve the relatively declining vegetal resources in these zones. Since the publication of the Brundtland report in 1987, states of the world are under the influence of sustainable development. These reports consider that sustainable development responds to the expectations of present generations to satisfy their needs without compromising the capacity of future generations to satisfy theirs. This is an assumption of long term viable development that is based on respect of the environment, social equity and economic profitability. Today, most sub-Saharan African states are in search of their emergence. This vision projects the emergence of Chad in 2025, Gabon in 20250 and Cameroon in 2035, just to name these few.

.With the exigencies of major development projects in this part of Central Africa, Chad is facing difficulties to reconcile the development of spaces and territories while taking the environment into consideration. Nevertheless, the geographic situation of N'Djamena in open Sahel exposes its households to natural dependence vis-à-vis firewood made up mainly of acacia and charcoal for cooking of food. This situation in the long term contributes in the reduction of vegetation cover leading to the degradation of the environment with consequences such as climate change. However, with high the cost of living in N'Djamena, the largely poor population still faces difficulties to meet up with the susceptible efforts deployed by the state to instigate sustainable development upstream through mass sensitization of the need to consume domestic gas instead of wood in all its forms. Concretely, sustainable

development brings to light the necessity to maintain or ameliorate the quality of the natural environment by ensuring the durability of resources, in order to ensure self sufficiency of communities from one generation to the other.

According to several specialists, development involves a systemic and coherent policy of the state aimed at promoting economic and social progress of a people. This subject matter can in no instance be dissociated from the impacts produced by the intervention of the Chadian government in the domestic gas sector. The state of Chad has initiated different strategies to promote sustainable development in N’Djamena (figure 2).



**Figure 3 :** Different strategies initiated by the state

**Source :** Field survey (November 2014)

Chad is one of the most exposed African countries to the desert, therefore to the heat and climate change with its numerous consequences. Conscious of this situation, the state has set up several strategies in terms of strategies to make the population better adapted to their environment. Among these measure, the following can be enumerated: organization of sensitization sessions (9%), holding of workshops and round table discussions (11%), formal prohibition of the use of charcoal (23%), multiple subventions (24%), the control and regulation of domestic gas market (12%), the creation of domestic gas distribution companies (11%) as well as the fixing of market prices and reduction of cumbersome taxes.

In detail, these strategies of the state evolve in function of their importance in the decision making platform and acceptance by the population. In effect, the subvention of petroleum products by the state of Chad appears to be the most envisaged and the most utilized. As such the government makes available to the production and distribution companies significant means evaluated in terms of investments to permit them to in turn subsequently reduce the cost of domestic gas. These subventions have become an obligation for the state to reduce the consumption of other forms of energy whose consequences on the ozone layer need not to be demonstrated again. This concerns firewood and charcoal. This also reduces the stress on the population especially women who at times compelled to trek several kilometres to acquires firewood or charcoal. As such, each year, the Chadian government introduces an important portion of its revenue into the subvention of petroleum products. This is also a means for Chad to fight against the high cost of living while ensuring social peace.

Apart from regular subventions constantly on the increase each budgetary year, formal prohibition of the use of charcoal appears to be the second most applied strategy by the Chadian state to promote sustainable development. In effect, since 2007, the government has been trying to prohibit the cutting of firewood around N'Djamena to cook food. It is as such that within this town, households are gradually getting used to the use of modern sources of energy. Even if there are still situations of the consumption of firewood and charcoal in this town, it should be noted that the origin of these materials is not directly from the town of N'Djamena and its environs. These are populations of the rural areas who continuing bringing them for commercial purposes. Each day they come to N'Djamena to sell off charcoal and firewood and make some money. In this context, police controls are common and at times often repressive at retailing points. Notwithstanding some complicity, we however observe a reduction in the activity in the town of N'Djamena today.

The organisation of sensitisation sessions (9%), the holding of workshops and round tables (11%), the control and regularisation of domestic gas market (12%), the creation of gas distribution and production companies (11%), as well as the fixing of prices at the market and reducing cumbersome taxes (10%) are generally found in the same pot of governmental strategies. Here, the state provides means to promote partnership with the civil society as well as production and distribution companies of domestic gas. These partners make it possible that all types of abuses are avoided and especially to make the populations face their responsibilities. Even so, the question is less that of adopting a market economy in a sector where the state still remains the main determiner, than that of finding specific legitimate regulatory modalities

between economic agents. It is the state and its different mechanisms that make it possible to reconcile the predationist, redistributionist and stock-holder logic to that of supplying petroleum products.

The role of partners in the production, distribution and consumption chain is certain and henceforth important. To succeed making available the necessary quantity of domestic gas for the needs of the urban and peripheral populations depends in most cases on the technical and organizational prowess of the state and its partners. Despite the unfortunate attempts to take over the supply of the towns of Chad with different goods especially petroleum products, the state has moved from the stage of competition with the private sector to that of partnership. The creation of local companies and their involvement in the gas sector in Chad aligns with this will by the Chadian government and has and it remains today in the trade of petroleum products. The requirements of sustainable development and of equitable urban governance for the interest of the community have questioned the correctness in the theory of total and complete retreat by the state. Analyses of the modalities to regulate the supply system of domestic gas in the town of N'Djamena generally has permitted an understanding of the study of the functioning of the distribution network and the state appreciated here based on the expectations of urban and rural actors who are the consumers. As such, in a context characterized by unemployment, the state insists that the activity of domestic gas should be organized in its entirety. This organization brings out the contribution of this sector in the fight against poverty and unemployment in N'Djamena.

#### **D- Discussion**

Despite strategies brought forth by the Chadian government to reduce the consumption of ligneous energy sources by limiting the degradation of the vegetation cover, access to modern sources of energy still remain preoccupying in Chad. In effect, populations living under difficult socioeconomic condition face enormous difficulties to abide to governmental measures. This is shown on the spot by the low level of education and especially by increasingly visible poverty within the Chadian society. On to this is added unemployment that affects young Chadians. In the past, young educated or trained Chadians in universities of the sub region and of the world on needed to submit a file to the administration to be recruited state agents based on the nature of training received. Today, this situation has significantly changed. This age group of the population now has to wait for an eventual competitive examination in vain. Even when this competitive examination is possible, the results are selective. As

such, the cost of living and the risks mentioned above do not still allow poor households to regularly access modern source of energy.

## **Conclusion**

Despite the geographic situation of Chad and its proximity to the Sahara desert, the more or less educated population is not yet conscious of the phenomenon of desertification that is becoming irreversible nowadays. The restrictions of a new mode of life imposed on the population by the state and the diverse strategies to encourage the consumption of modern sources of energy remains up till date insignificant. These assumptions are doomed to failure with the exigencies of the contemporary society and of the population pressure that is increasingly on the rise. This will compromise the efforts of the government in the future between several expectations within a short or long period of time. Therefore, at the moment when Chad is actually getting afoot towards its emergence, it is urgent to transform the consumption of the modern source energy in reality within the Chadian society. This will be through the consideration of social needs and the economic contingency that allows for a better distribution of wealth and an undeniable social peace. It is at this cost that the consumption of domestic gas will become a means of reducing deforestation and conservation of the environment in N'Djamena in particular and in all Chadian territory in general.

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