

Energy and digital: the energy cost of social change. A qualitative interview study

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*El arabi Bualou*¹, *Farid Zahi*²

¹ESF, Mohamed V University, Morocco

²SRI, Mohamed V university, Morocco

Abstract. In an international context filled with climate and ecological issues, and characterized by an unprecedented geopolitical conjuncture, the issue of energy consumption and dependence has come to the surface in Morocco's growing energy sector. Thanks to the efforts made by the State, access to electricity has developed rapidly in rural areas. In order to contribute to a better use of this energy, this article explores the relationship of rural families to electricity through the use of domestic digital appliances, using a comprehensive biographical interview. Interviews were conducted with families living in three cities in south-eastern Morocco over a three-month period (May, June, and July 2022). Content analysis was applied to analyze the data collected. The results show that the exploitation of electrical energy has contributed to a considerable social change affecting the status of women and children. However, awareness-raising campaigns are needed to stop the irrational wasteful practices. There is an urgent need for a national energy charter guaranteeing the commitment of professionals and private individuals to a national strategy to save energy exploitation at this crucial historical moment.

Index Terms — Digital, energy, repository of practices, society, transition, uses.

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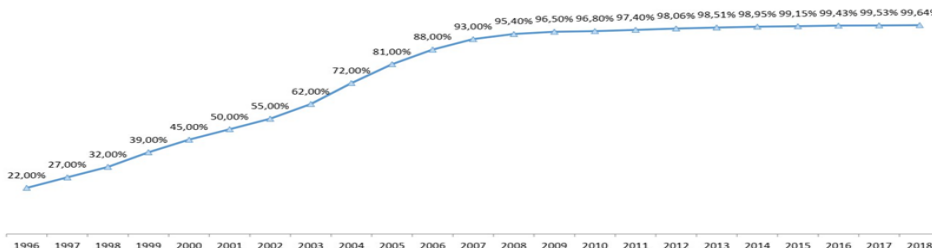
1 Introduction

Given its impact on groups and individuals life, it is clear that digital technology is a major phenomenon of our time. Everyone has their own opinion on the subject, which they express and publish [1].

Numerous studies have pointed to an increase in energy consumption by digital devices, but little has been done on possible initiatives to optimize costs and rationalize consumption [2]. To reduce the energy consumption of digital devices in France, the National Council for Economics, Industry, Energy, and Technology issued a report in which researchers highlighted the energy consumption rates of digital devices, concluding with recommendations to reduce consumption, estimated at 36 TWh of electricity, equivalent to the output of 6 nuclear power plants, down slightly (by around one percent per year) on a like-for-like basis since 2008 [3]. As energy systems have developed and

integrated globally [4], the enthusiasm generated by the digitalization of society has given rise to the idea of green growth, using digital performance to rationalize products and energy flows [5]. The interaction between electrical energy and digital technology within families, with a remarkable increase in consumption, represents a major future challenge for energy savings [6].

In Morocco, rural electrification has reached a remarkable level, thanks to the efforts made by the authorities to achieve 100% coverage. Rural dwellers, fascinated by the offer, have not hesitated to harness energy for their digital well-being.

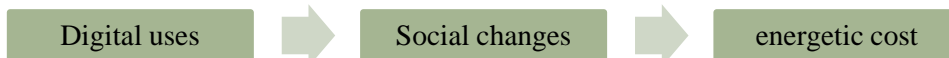


Graphic 1: Evolution of rural electrification rate 1996-2019. (Source: NOE)



Graphic 2: Mobile phone Equipment rate 1996-2019. (Source: NART)

The rapid growth of digital equipment is undoubtedly having an impact on the social sphere. Although many studies have pointed to the importance of the relationship between the digital and families, examining its advantages and disadvantages, few have mentioned the energy costs of digitizing rural daily life. The aim of this article is to provide a comprehensive analysis of the interrelationship between electrical energy, the digitization of rural daily life, and the associated energy cost from the viewpoints of rural families. How does electrical energy affect the social sphere by promoting ownership of digital objects with inherent qualities that drive rural people to act differently? And did these ways of acting have energy costs? In other words, digital technology has become a total social fact, modifying social practices and relationships. Certainly, in the digital age, societies are changing rapidly and ephemerally, so much so that sociologists and anthropologists are unable to grasp the accelerated pace of this change, and can only create concepts to describe the current state of societies: liquid society [7], risk society [8], and accelerated society [9]. So, society and the digital age are destined to cross paths [10].



The societal change brought about by the digital age has an energy cost. These elements feed off each other. In fact, the daily use of digital devices (smartphones, tablets, printers, washing machines...) can be two-faced and schizophrenic. Despite the fact that electricity automatically brings benefits that have improved the condition of the family's social life, its relationship with the family is marked by unreasonable use. It would therefore seem useful to identify and compare these types of use within Moroccan rural families, and to draw up a list with a view to developing a benchmark of desired practices. So, what is the relationship between rural families and electrical energy?

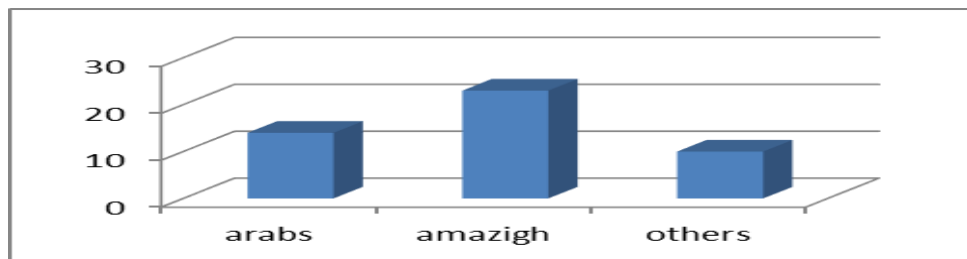
2 Methods

2.1 design

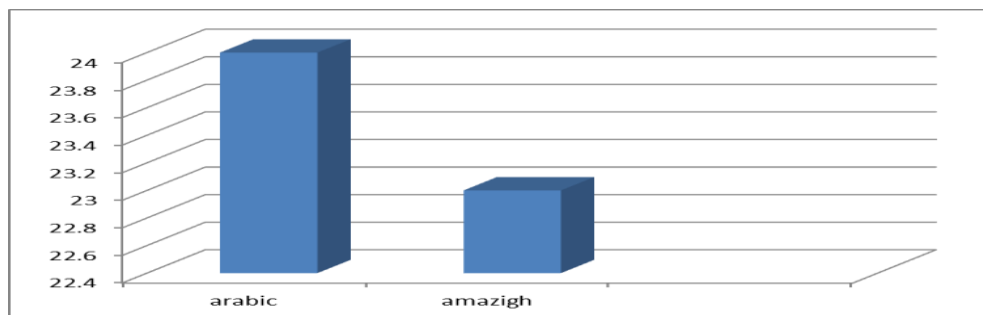
Because there is a lack of accessible data on actual practices, the interview phase of the study was designed to gather information and opinions from families. The interviews were designed to support a content analysis of the gathered data. It was noted more appropriate to use a qualitative approach to obtain the information required, due to the lack of real operational data to support a quantitative approach, and the evolving and complex nature of developments in families' digital practices. The design of the interview questionnaire was semi-structured, with questions aligned to the categories of practices identified by the participants. This approach ensured that key questions were asked consistently of all interviewees, but also supported an investigative approach where different avenues of conversation could be explored. All data from interviewees' responses was captured and categorized to support a content-focused analysis.

2.2 Access to participants

The interview participants were families living in rural areas of south-eastern Morocco with diverse socio-cultural and socio-economic characteristics.



Graphic 4 Family ethnicity



Graphic 5: Original families' languages

2.3 Execution process

Before starting, we observed the area geography and families lives during 2 visits of 3 days period. We then contacted the families to introduce ourselves and to measure their interest in participating in this research. We explained to them the contents of the letter of consent; it specified the purpose of the research, the conduct of the interviews, and ethical considerations such as the advantages or disadvantages that might come from their participation.

2.4 Collected data

We chose a content-based approach to the data, given the semi-structured nature of the interviews and the qualitative data that was obtained. In addition, qualitative content analysis followed controlled procedures and techniques. The categories used for data analysis corresponded to the categorization of questions in the interviews, which were based on key concepts. The analysis was conducted both within and between categories, in order to identify codes describing topics and themes of implicit meaning from the raw data. Codes were determined as key issues and opinions raised by interviewees that were directly relevant to one of the categories. Once the codes had been identified, further analysis was carried out to identify common themes. The same procedure was followed when identifying themes. Uncommon codes linked to the research question and objectives were the subject of an appraisal process. To achieve this, a combination of inductive and deductive reasoning was applied.

2.4.1 Categories and codes

From the interview questions, and based on the views of the families' practices in relation to their daily lives, four categories and 30 codes were determined (Table 1).

Table 1. Categories and codes used in the interview

Categories	Number of codes	Percentage
Category 1: energy transition and the daily lives of rural families	6 codes	20%
Category 2: everyday use of digital devices	5 codes	16.6%
Category 3: electricity consumption bills	8 codes	26.6%
Category 4: irrational practices	11 codes	36.6%
Total: 4 categories	30 codes	100%

2.4.2 Themes

Following analysis of the codes, six themes (6) were identified:

- 1-Electric power is cleaner than other sources;
- 2-Electricity has helped women to get rid of heavy chores and for children schooling;
- 3-Electricity gave access to digital devices;
- 4-Digital technology has changed family habits;

- 5-Consumer bills wreak havoc on spending;
- 6-Bad consumer practices.

2.5 Data analysis

Categories	Participants' views
1- energy transition	100% of participating families confirmed that electricity has provided effective solutions for them in terms of fuel supply. In addition, electricity is a cleaner source of energy than wood or butane.
2- the use of digital devices	80% of women stressed that digital technology, thanks to electricity, had invaded their daily lives, especially those from middle-income and well-off families: refrigerator, cell phone, washing machine, and television. As a result, they no longer have to perform tedious tasks, and can now schedule other activities. As for the rest of the women, 20% said that easy access to digital technology had enabled them to contact their nearest and dearest, and to take advantage of it in their administrative affairs and their children's schooling.
3- consumption bills	Since the interviews were carried out in 2022, many families received very high consumption bills in that year, prompting the majority of Moroccans to protest. Almost 100% of respondents confirmed that the bills they received had wreaked havoc with their spending and unbalanced their budgets, prompting ONE agents to cut off the power supply because of the families' unpaid bills.
4- irrational practices	40% of families pointed to irrational electricity consumption as the cause of this year's high bills, while 60% confirmed that the bills had no relation to consumption and that the estimation system used by ONE's commercial agencies had caused the disruption. There are families who use electricity only for lighting, but who have received remarkable bills. However, families who use electricity for many of their daily activities have had stable bills.

3 Results

3-1 Electrical energy: characteristics, inputs, and costs

With the fear of unexpected poisoning due to an uncontrolled gas leak, or a fire ravaging property and possessions, electricity is considered as a safe source of domestic energy. Although wood doesn't represent enough danger, it's still a source of smoke, dirt, and bad smells, whereas electric power is clean. These advantages of electricity strongly reflect a modernist orientation that is beginning to break with traditional cultural structures. Families torn between nostalgia for the classic and aspiration for the modern, are trying to undertake a gentle energy transition. In other words, if respondents are to be in phase with the consumption of electrical energy, a sign of modernity, they need to stop using conventional energy sources. Electricity has contributed to social change affecting women's domestic tasks, and has provided evidence that the status of rural women has undergone profound transformation. Thanks to electricity access, women, as the main members of the family, no longer have to perform arduous tasks such as supplying the family with fuel for lighting and cooking. In Moroccan literature, the image of the woman gathering wood in the forest or mountains has become the icon of the rural woman. For anthropologists and sociologists, this is one of the traces of the continuity of pre-industrialized communities, a sign of underdevelopment. However, almost 20% of the women taking part in this study have retained these tasks, even though they have access to electricity. So, there were many facets of change introduced by electricity, but they were also uneven. On the other hand, access to electricity has encouraged the use of digital devices by all family members. These uses, constantly raised by participants, are undoubtedly becoming concerns. A process of transition

to other forms of socialization and an unexpected upheaval have begun to eliminate ways of living, acting, and perceiving the world and objects. A frequent comment was that without access to electricity, it will never be possible to use these devices and enjoy their benefits. But there were opinions that pointed to the issue of divergence in the use of these devices, which require a technical process that is not accessible to all. With some concern, women pointed to the technical complexity of devices such as smartphones, computers, and brands of washing machines, which made their use restricted to educated and cultured women. It was strongly argued that digital devices, particularly cell phones and television, had contributed to a radical change in social relations systems and lifestyles. For them, the cell phone became another world, as girls and boys needed only a charged battery and a connection charge card to live out their happiness in their paradises. Drawing a comparison between the past and the present, the family in those days was characterized by a togetherness that united all members around meals and around the fire on cold, frosty nights, telling fables and stories. And today, this way of living together has been reconfigured by the possibility of being free together. As for television, this box of mysteries fascinates members and lures them to spend most nights and days following its programs. A real imbalance has developed since time devoted to entertainment outweighs that devoted to production.

At the time of the interviews (2022), the majority of Moroccan families had received consumption bills with amounts to be paid that exceeded their financial levels. Under pressure from unpaid bills, ONE sales agencies were cutting off electricity and ripping out meters. Families in turn protested, considering these measures illegal and unfair.

The participating families had denounced the measures taken by the agencies, arguing that the problem lay in the fact that the shortage of human resources had led the agencies to adopt the estimation system in a random fashion, and that the bills did not reflect the amount of KW consumed. But there were some divergent opinions. Some families had confirmed that they were receiving bills that recorded a discrepancy between the amount of KW consumed and the amounts to be paid. This issue had triggered much debate throughout Morocco and at high levels. So, although the bill crisis had a negative side, it also had a positive, structuring side. In fact, it prompted consumers to rethink their unreasonable practices such as:

3-2 Referential of positive practices.

Negative consumer practices	Positive consumer practices
Turning on light bulbs during the day.	Making the most of daylight
The habit of putting the computer on standby throughout the day.	Unplugging the computer.
The habit of keeping the TV on all the time.	Unplugging the television.
Keeping the light bulb at the entrance to the house on all night long.	Training a dog for guarding.
The habit of keeping chargers plugged in.	Unplugging the chargers.
Not adjusting the refrigerator according to the season.	Adjusting the refrigerator according to the season.
Using several devices at the same time just for distraction.	Disconnecting additional devices.
Keeping the printer on standby.	Unplugging the printer.
Not using energy-saving bulbs.	Using energy-saving bulbs.
Harnessing electricity to pump water instead of diesel.	Using solar panels.

4 Discussion

4-1 Access to electricity and social change

Before access to electricity, rural people used solid fuels including wood and sometimes cow dung. In addition to its low energy content, biomass not only contributes to the degradation of the ecological environment through its suffocating smoke, but also has repercussions that could harm the physical and mental health of users [12]. In order to obtain supplies, families were obliged to devote a fair amount of time to this activity, which took a large part of the production day and interfered with children's school attendance [13]. However, access to electricity as a clean energy source is beneficial because it doesn't cause respiratory illnesses, and it doesn't involve family members in the supply, which gives the opportunity to schedule other activities. In this context, access to electricity is closely linked to various issues such as the social and solidarity economy, schooling, health, and social and territorial equity. In general, access to electricity helps to improve the livelihoods of local families.

4-2 The energy cost of irrational consumption practices

This register is concerned on the one hand with the estimation of different domestic digital equipment switched on or awake in relation to its unitary and annual consumption, and on the other hand with the practices of the participants already mentioned.

Table 2: Estimated consumption of digital home appliances

Equipments	Power per unit	Average consumption
Smartphone charger	5 - 30 W	2- 11 kWh/yr
Computer charger	65 W	2 -11KWh / yr
Cell phone	10W	2- 5KWh/ yr
Screen (between 24 - 39 inches)	30 W	70 kWh/ yr
Desktop in standby mode	200 - 400 W	18 - 85 kWh/ yr
Laptop in standby mode	50 - 100 W	38 - 58 kWh/ yr
Tablet	30 W	5 kWh/ yr
Refrigerator (according to model)	150-350W	201 - 500 kWh/ yr
Television on standby	3W	22 kWh/ yr
Television (according to model)	80-344 W	121 - 402 kWh/ yr

According to the data in table 2 [11], putting a digital device on standby doesn't mean it is not consuming energy. However, based on the views of the participants, the majority of them are unaware of this truth. Given the importance of this practice, it seems essential to show that this factor contributes to energy wastage and the evolution of residential consumption. Similar practices were raised during the interviews: keeping the charger permanently plugged in, not switching off light bulbs during the day... In this context, the burning bills were only the product of these relationships with energy. Additionally, running more than two devices at the same time put the meter in rapid motion, resulting in uncontrolled consumption.

Concerning the case of the bills received, we had contacted the sales agents for further explanations. They mentioned that the families were unaware that the pricing of electricity consumption follows a slice logic:

- households whose consumption does not exceed 150 kWh, are divided into two categories: the first with a rate of 0.9010 DH per kWh when consumption is less than 100 kWh/h. The second with a rate of 1.0732 DH per kWh when consumption is between 100 and 150 kWh/h.
- households over 150 kWh do not benefit from the low tariffs of the economic bands, and are subject to selective pricing.

Thus, rational household electricity consumption not only helps reduce bills, it also conserves electrical energy.

4-3 Energy-saving measures

In this international context marked by unprecedented international geopolitical conjunctures, energy conservation has become a national affair. Indeed, society is encouraged to set in motion strategies to envisage rules and measures to protect against the waste of electrical energy. In order to respond to this urgent call, this study proposes two mechanisms that appear to be effective in achieving this goal:

- 1-Organizing awareness-raising campaigns in rural areas;
- 2- Drawing up a national energy charter offering guidelines for rationalizing consumption.

As a contribution, we propose the following guidelines for everyday rural life:

- use of systems that can switch off appliances at the same time;
- set energy saving on devices;
- avoid prolonged standby times;
- use energy-saving light bulbs;
- program the TV to switch off automatically;
- the use of solar energy in gardening and irrigation work.

5 Conclusion

The present study was carried out among rural families living in south-eastern Morocco during three months of hard work (May, June, and July 2022). Data collected through comprehensive biographical interviews were analyzed using content analysis procedures and techniques.

The study focused on two questions:

- 1-What is the relationship between families and electricity?
- 2-Do they adopt positive, virtuous behaviors to conserve electrical energy in the house?

It aims to achieve two objectives:

- 1-Rethinking rural people's relationship with digital technology in different ways;
- 2-Identifying bad practices, and then drawing up a set of guidelines for reasonable practices.

Data analysis enabled us to approach the subject of electrical energy consumption in relation to the various uses of digital devices in the residential environment. The results obtained show that the subject of rationalizing electrical energy consumption in rural areas still needs to be addressed through awareness-raising efforts to change household perceptions of energy, and the development of a national energy charter to unite the efforts of professionals and individuals in this direction. In order to contribute to the creation of a global energy consciousness, this article has been produced in several languages.

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