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Article

Combining Life Cycle Thinking with Social Theory: Case Study of Compact Fluorescent Lamps (CFL) in the Philippines

Marlyne D. Sahakian

The Graduate Institute of International and Development Studies, Rue de Rothschild 20, Geneva, 1207, Switzerland; E-Mail: marlyne.sahakian@graduateinstitute.ch; Tel.: +41-79-393-8733; Fax: +41-22-908-6262.

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Abstract: Resource depletion remains central to human economic activity with resulting negative consequences for the local and global environment. Material and energy consumption patterns are also increasing globally, as developing countries follow the trail blazed by more industrialized countries. Consumers play a role in shifting towards more sustainable forms of consumption. However, consumer-oriented public-policy measures are often restricted to informational campaigns based on moral and price arguments. A multidisciplinary approach to sustainable consumption must go beyond this limited vision of consumers if transitions toward more environmentally friendly consumption patterns are to be made possible. Both a biophysical and social understanding of consumption is necessary. This paper proposes a systemic approach to consumption studies, combining an assessment of consumption patterns with an understanding of the drivers behind them. The concepts will be illustrated using a case study of the government-led promotion of compact fluorescent lamps (CFL) in Metro Manila, the Philippines. Conclusions will include general policy-recommendations.

Keywords: sustainable consumption; compact fluorescent lamps (CFL); life cycle thinking; rebound effect; the Philippines

1. Introduction

The purchase and usage of products and services by consumers are steadily increasing around the world, with developing countries and their growing middle class following in the path of more

industrialized countries. With a rise in affluence, consumers are said to climb a protein and energy ladder to more resource-dependent lifestyles. The question of equity is also worth raising: with limited global resources, including finite fossil fuels, industrialized countries as a whole—as well as pockets of elite groups in less developed countries—are consuming more than their fair share of the natural resource pie. Policy-makers are now calling for a decoupling of economic growth and resource use from environmental degradation, with international efforts underway to address greenhouse gas emissions and biodiversity loss.

The focus of this paper is on understanding consumption, defined here as the purchase and usage of products and services, as being at the nexus of environmental studies and social studies. On the one hand, there is a need to determine existing consumption patterns and priorities for better resource management. This requires a biophysical understanding of consumption that considers the environmental impacts of resource usage over life cycles in a systemic manner and at different scales. On the other hand, it is also critical to grasp the drivers behind those patterns. For this, a social understanding of consumption is necessary, a viewpoint that considers all human and economic activity as embedded in social relations [1].

Current global initiatives to address sustainable consumption and production, such as the UNDP and UN DESA-led Marrakech process, focus more on stakeholder participation than on setting priorities based on scientific research on resource usage patterns and trends. In terms of reaching consumers specifically, policy-makers at the national and local level often apply measures that are limited to the view of consumers as rational decision-makers, sensitive to moral and price arguments. Information campaigns alone do not always lead to so-called rational choices, however, or seemingly rational choices may not lead to the intended outcomes. A multidisciplinary approach to sustainable consumption must go beyond this vision of consumption and consumers, if transitions towards more environmentally friendly consumption patterns are to be made possible.

This paper proposes a systemic approach to consumption studies. The main research question is to determine how life cycle thinking and social theory can be combined to provide insights on how transitions to more sustainable lifestyles could be made possible, from a policy perspective. The focus of this paper is on environmentally significant consumption, one aspect of sustainability. An overview of this conceptual framework will be provided below, and then applied to the case of compact fluorescent lamp (CFL) lighting in Metro Manila. Conclusions will include policy recommendations in this context, as well as a general discussion on the strengths and limits to this approach.

2. Conceptual Framework

Transitions towards more environmentally sustainable lifestyles should involve two approaches: firstly, an assessment of consumption patterns is necessary, drawing on a biophysical and life cycle approach to consumption. Secondly, once priority areas have been established from an environmental perspective, there is a need for a better understanding of what drives these consumption patterns—or the attitude and actions of consumers, which can be apprehended through a social and cultural approach to consumption. The following sections provide an overview of these two complementary approaches.

2.1. A Biophysical and Life Cycle Approach to Consumption

In its biophysical definition, consumption involves human material and energetic provisioning from resources that draw and depend on ecosystem services. While production processes also consume resources, for the purpose of this article the term 'consumption' refers to domestic or household consumption. In ecological economics, economic activity is placed squarely within the environmental system and, therefore, all human activity is subordinate to thermodynamic natural laws and takes place within the limits of the Biosphere, in the sense given to the word by Russian scientist Vladimir Ivanovich Vernadsky (1863–1945)—an open system on which all life depends [2-6]. Unlike what is often asserted by neo-classical economists, resource depletion and pollution cannot be externalized, distinguishing ecological economics from environmental economics. The former does consider biophysical realities and environmental limits.

A close relative of ecological economics, industrial ecology, addresses "anthropogenic complex and coupled systems" [7]. Consumption is significant from an environmental perspective when patterns of resource consumption (the rate and scale of material and energy flows) lean towards exhausting non-renewable resources, or the use of renewable resources beyond their regenerative capacity, and pollution which overwhelms the absorptive capacity of both local and global ecosystem services [8]. Methods used in industrial ecology, such as life cycle analysis, evaluate the resources and energy used in products and services throughout their trajectory, from the extraction of primary resources to final disposal, and envisions ways of slimming down the industrial metabolism [9]. In environmental Life Cycle Analysis (LCA), assessing the impact of a product or service is based on the evaluation of a functional unit, or the quantified performance of a product system based on product utility (1,000 wash cycles, for example, an aspect we will return to later). Economy-wide methods such as Material and Energy Flow Analysis and Environmentally-Extended Input-Output methods are also employed to gauge the physical scale of the economic activities of societies.

These approaches represent a shift away from environmental perspectives of the 1960s and 1970s that focused more on the end of the pipe. In the United States, for example, early environmental regulations were ratified following public and media concern for overflowing landfills, chemical spills and other visible environmental problems. Today, more and more emphasis is being placed on understanding the complete life cycle of products and services, with attention shifting from production processes to consumption patterns and trends.

The following definition of environmentally significant consumption from a biophysical perspective offers a helpful summary:

> Consumption consists of human and human-induced transformations of materials and energy. Consumption is environmentally important to the extent that it makes materials or energy less available for future use, moves a biophysical system toward a different state or, through its effects on those systems, threatens human health, welfare, or other things people value. ([10]: p. 20).

Princen went a step further in defining consumption as a "using-up" of resources, with over-consumption including ethical questions such as unequal access to resources ([11]: p. 348). Furthermore, consumption is not a static activity and must take into consideration rates of throughput,

growth, scale and patterns of resource use ([12]: p. 3). Thus far, this definition of consumption comprises all economic activity, from the extraction of natural resources to production, distribution and storage, public and private usage, and disposal, but can also include forms of consumption outside of the realm of economic activity (e.g., gathering mushrooms in the forest) and even as a non-activity, including the non-usage of products and services.

While industrial ecology was born in the context of industrialized countries (see [13] for the first use of the term and [14] for its history), researchers have more recently considered socio-economic factors and the specific context of developing countries in relation to resource use [15-18] and energy usage specifically [19,20]. Efforts are underway to measure the social impact of products and services throughout their life cycle (see [21] for an overview of guidelines towards Social LCA), to not only reduce resource use and emissions, but also improve the socio-economic performance of products. Shifting the focus away from products to consumers, it is less evident to understand how consumers—seen as individuals, household units, social groups or citizens—might be compelled to change their actions and attitudes. In the editorial section of two special issues on sustainable consumption in the *Journal of Industrial Ecology*, Hertwich underlined a need for more research focused on understanding the consumer and consumption patterns, particularly in developing countries [22], and Tukker, Cohen, Hubacek and Mont argued for the need to bridge a gap between an understanding of consumers and the policy measures needed for sustainable lifestyles [23]. The following section outlines how a social and cultural approach to consumption can help better understand consumers, leading to policy recommendations later in this paper.

2.2. A Social and Cultural Approach to Consumption

Sociologists and anthropologists have a long history of theorizing consumption, as seen by an explosion of books in the 1980s [24-27]. Economic anthropology offers a specific view of consumption that "asks why people want things, not just how they set about to satisfy those wants" ([28]: p. 37). This article builds on economic anthropologist Richard Wilk's framework, which proposes three perspectives—including social, cultural and individual choice forms of consumption—that are each relevant to understanding consumption but also limited in, and of, themselves. Wilk therefore argues for a "multigenic" approach that combines all three perspectives, which is elaborated below and combined with new elements from marketing approaches.

Social forms of consumption "reveal the ways that consumption serves to maintain and challenge the boundaries of social groups, including nations, classes, genders and ethnic groups" ([29]: p. 7). The concepts of status, lifestyles and standards of living are tied to this perspective. The first social theorist of consumption was undoubtedly Thornstein Veblen [30], who coined the term "conspicuous consumption" to define forms of lavish spending on products and services for the display of wealth and for communicating a social position. Following Veblen's line of thinking but using extensive ethnographic materials from France, Pierre Bourdieu [31] took consumption a step further, seeing it as a means for class distinction and therefore political control. He argued that taste judgments are tied to class positions and interest calculations, thus limiting the range of options available to consumers who are neither free agents nor entirely structured by society. As Shove and Warde [32] have argued, forms

of inconspicuous consumption—such as bathing or commuting—can be particularly relevant to questions of environmental degradation, and should therefore not be dismissed.

In marketing, advertising campaigns often tap into this social approach to understanding consumption, conveying group characteristics through products that incite consumers to aspirational lifestyles. A shift began to take place in marketing strategies of the 1990s, influenced in part by anthropologists and sociologists joining marketing departments. Up until then, consumption was seen as being driven from the top-down by affluent consumers who are then emulated by lower classes, to follow Veblen's line of thinking [30]. Consumption was also considered as being controlled by production industries and their marketing agencies, following the arguments of Adorno and Horkheimer [33], who saw media and production systems as manipulating the masses into passivity. Malcolm Gladwell in "The Coolhunt" [34], however, noted that fashion trends were also being set and established as 'cool' in the streets before being picked up by 'coolhunters' who used them to inform marketing and production strategies.

Gladwell explains a process by which trends can be diffused to different types of consumers, using the following marketing terminology borrowed from sociologist Everett M. Rogers' work, *Diffusion of Innovations* (1962) [35]: the 'innovator' is the person who finds a pair of old All Star Converse's in a flea market (the canvas and rubber shoe first produced in 1917 for basketball players); the 'early adopters' are the immediate followers of the trend that will try to hunt down their own pair; the 'early majority' are the millions who buy into the trend "jumping in because the really cool people have already blazed the trail" ([34]: p. 78); with the 'late majority' joining the bandwagon last (assuming products are affordable to the masses). For products that embody cool and for Gladwell, the process could not have happened the other way round: a marketing campaign designed by Converse and directed at consumer masses would not have convinced the 'innovator', who in turn would not have influenced the 'early adopter', and so forth. The conclusion drawn from this analysis by Gladwell is that the cool aspect of products is constantly changing, but "Cool people, on the other hand, are constant" (p. 82). As Rogers summarized: "Diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system" ([35]: pp. 5–6). This is consistent with social marketing efforts that seek to engage people through social networks (neighborhood groups, word of mouth, *etc.*), which can be more effective and credible than mass marketing (advertisements, promotions, *etc.*). See [36] for details on how community-based social marketing can foster sustainable lifestyles.

Regardless of whether consumption trends are driven from the top-down or bottom-up, or whether they are conspicuous or not, social forms of consumption place a focus on people and their interactions in society. The focus of cultural forms of consumption is less on people, and more on the goods and products themselves. This second perspective, proposed by Wilk, sees consumption as a form of symbolic behavior with goods coded for communication that express meaning and identity, beyond their practical uses or functional purpose. From the UK, in the same period as Bourdieu, anthropologist Mary Douglas and economist Baron Isherwood [37] saw goods as functioning in a "live information system"—carrying meaning that is not fixed, but rather constantly in transit and in relation to other goods [25]. In France, Jean Baudrillard also offered a symbolic approach to understanding objects [38] as well as a critique of consumerism [39]. This perspective also appears in certain marketing tactics: a car, for example, is often advertised in relation to a graduation diploma and symbolizes a period of life

that represents a sense of achievement and freedom (in certain societies). A nuance to the cultural theory of consumption, however, is also needed. For example, a street child in Manila, seen wearing a t-shirt with a black swastika, has neither the choice nor notion of what he is wearing, and people around him may also not understand the political connotations of the logo. Therefore, not all forms of consumption may be intended to communicate meaning, and not all consumers may be equipped to de-code meaning.

Finally, Wilk does not exclude the individual choice forms of consumption that draw from social psychology and behavioral economics and consider the mechanisms by which individuals satisfy so-called needs. In this approach, "needs are produced internal psychological and cognitive processes, leading to choices within a marketplace of possibilities" [29]. One main assumption in public policy is that individuals make consumption choices based on a "price and information" formula, or that individuals have a need for the right price and are swayed by having access to the best information. This strategy was used to "catch a consumer" in post-1950s US and UK marketing techniques (Russel W. Belk in [40]; Frank Mort in [41]). Promotional activities today continue to attract consumers with discounts and sales, and environmental information campaigns prove the prevalence and pervasiveness of this perspective in policy-making. Several authors have argued that information and prices alone do not lead to behavior changes among consumers [42], which can be translated at the policy level into eco-labeling and eco-tax schemes that are often too simplistic [43]. An approach that focuses solely on communicating cost savings or energy efficiency messages to individual consumers tends to ignore the collective aspect of consumption [44], but can be part of a more comprehensive strategy.

As we will see later in this paper, the value of such an approach depends on the social and cultural weight of specific products and services. In the purchase of a car, the cultural and social aspect may play more of a role in influencing consumption decisions than in the purchase of a light bulb. Buying a convertible car most likely costs more and does not relate to the functional aspect of mobility, for example, as social and cultural factors may be more at play. Price does play a role, as does information, but not in the same way for all products and services.

3. Applying the Concepts: The Example of Household Lighting in Metro Manila

In this section, a case study on the public sector promotion of compact fluorescent lamps (CFLs) in Metro Manila, the Philippines, will be used to illustrate how a conceptual framework that combines a life cycle and social approach to consumption can be used to better understand consumption patterns and drivers.

This case study is based on several months of fieldwork in the Philippines between 2005 and 2008, and is part of a larger study that considered other forms of direct energy consumption, including private transport and cooling. The research on which this paper is based involved 30 semi-structured interviews with consumers from different socio-economic groups, age, educational level and gender. Interviews were conducted in homes, while observations took place in both private and public spaces. The interview sample was gathered from three neighborhoods of different socio-economic standing: a former squatter community in Tondo; middle-income houses and apartments in Malate; and the gated communities of the affluent in Makati. Questions ranged from attitudes towards lighting, cooling and transport, to energy, electricity and environmental issues in general. Interviews were transcribed and

fieldnotes were gathered in order to facilitate interpretation, or to uncover the purpose and meaning behind words and actions CFL marketing and distribution tactics were also observed.

Incandescent light bulbs are among the household electrical appliances that have transitioned from novelty to normality over the last one hundred years (see Elizabeth Shove's work [45] for insights into how everyday practices are constructed as normal and ordinary over time). Turning on a switch to instantly illuminate a space is something that is done by millions of people all over the world on a daily basis, without a second thought. Lighting is less significant that cooling in terms of the rate of energy consumption, but presents an interesting case study because of the high frequency of usage: over 95% of households nationwide use some form of lighting. There is nothing conspicuous about this form of consumption, and yet it is environmentally significant as it draws on a coal-dependent electricity grid and replaces more traditional forms of fuel that are now seen as less convenient (for example, jetropha was traditionally burnt for lighting in Manila).

The technology of the incandescent bulb has changed very little since its original conception. Today, new forms of lighting technology are available on the market, including light-emitting-diode (LEDs) lamps, and the CFL bulb. The CFL bulb, which is more commonly used at the household level than the LED, gives off light by passing electricity through mercury vapor, which in turn produces an ultraviolet light that is absorbed by a phosphor coating inside the lamp, causing it to glow. The presence of mercury in CFLs means that special considerations need to be in place for recuperating and managing the waste stream of old bulbs. These bulbs have a longer life span than incandescent bulbs (lasting eight- to nine-times longer) and are more energy efficient (using a quarter of the electrical power needed for an incandescent bulb, e.g., an 18–20 watt CFL is equivalent to a 75 watt incandescent bulb). There is a drawback: CFL bulbs are more expensive to purchase (typically five- to six-times the cost). The cost-saving for the household is in their electricity bills and while the initial cost of the CFL bulb is higher than the traditional bulb, it is less expensive over the course of its life cycle as it does not have to be replaced as often as the incandescent bulb.

Because of the greater energy efficiency in CFL usage, governments around the world have passed measures to phase out incandescent light bulbs, either voluntarily or through legislation. In the Philippines, the campaign to transition away from incandescent light bulbs is known as SWITCH to CFL and was launched jointly by the government of the Philippines and the Asian Development Bank (ADB). How could a life cycle and social understanding of consumption help guide the way to more environmentally sustainable forms of lighting consumption in the case of Manila? The following section applies the concepts to this case study, and is followed by policy implications in the context of the Philippines.

3.1. The Switch to CFL in Manila: A Life Cycle Perspective

CFL bulb usage is promoted as being energy efficient, yet the production and transport of CFL bulbs, as well as their final disposal, must also be considered in a LCA. From the perspective of ecological economics, the resource depletion and pollution related to CFL bulbs cannot be externalized. CFL bulbs require more material inputs during production processes, and do not contribute to a slimming-down of the industrial metabolism. CFLs are currently not produced in the Philippines—thus incurring energy inputs necessary for their transport into the country. No LCA on the switch to

CFLs was conducted in the context of the Philippines prior to this initiative. Opportunities for slimming-down the metabolism of CFLs upstream—during the manufacturing and transportation phase—might have been identified.

However, transport and manufacturing energy requirements were found to be minimal as compared to the energy savings during the usage phase in a study of CFLs in the context of Australia [46]. In the same study, the potential environmental impact of mercury waste from CFLs was also found to be insignificant. CFL bulbs carry approximately four milligrams of mercury per bulb, but because coal-powered electricity plants also release mercury, the benefit of reducing coal-powered electricity consumption outweighs the problem of mercury waste. However, mercury waste remains a health risk when improperly managed.

In the Philippines, as in many developing countries, open dumpsites have been most commonly used in the last few decades, often operated without a license, and are part of the daily lives of thousands of people who live by the landfills and derive their livelihood from collecting recyclables. Non-recycled waste in Manila ends up in semi-controlled landfills (such as the Payatas landfill), illegal open landfills (such as Pier 18), and the natural environment, including waterways (such as the Pasig river and the Manila bay). Household waste segregation has been part of environmental advocacy campaigns for many years. With the passage of the Ecological Solid Waste Management Act in 2001 (RA 9003, [47]), responsibility for household waste segregation was driven down to the *barangay* level, or the smallest governmental unit in the Philippines. The overall objective of RA 9003 is to decrease the total volume of waste that reaches landfills and this has been achieved to a great extent because of the economic value of recyclables, as well as Metro Manila's access to the sea and the nearby Chinese market. According to a 2004 study by the Asian Development Bank, Metro Manila produces approximately 6,700 tonnes of garbage per day of which only 720 tonnes is retrieved for recycling and composting [48]. CFL bulbs that are not segregated out of the waste stream can therefore pose a toxic hazard when left in the natural environment or in open dumpsites—particularly because poorer populations continue to live in close contact with this waste (based on my observations and interviews at the Smokey Mountain landfill in Tondo, which has been out of use since the 1990s, the surrounding community grows vegetables directly on the waste).

In the press coverage around the launch of the Switch to CFL campaign—which received much media attention as the first initiative of its kind in Asia—the question of recycling was raised: the Department of Energy (DOE) in the Philippines is said to buy back used CFLs and recycle their toxic mercury content. There are thousands of people involved in recycling in Manila, from scavengers more politely called individual waste workers, to cooperatives and micro-enterprises, to larger-volume operations and exporters. It would require a massive effort to engage all those involved in waste collection and segregation to sell the CFL bulbs back to the DOE. The management of the CFL waste stream and recuperating mercury before final disposal seems less clear in this context where so many players are involved.

In terms of energy efficiency, an evaluation of the eco-efficiency and environmental impact of CFL bulbs must take into consideration the regional electricity mix and related energy sources involved in CFL usage. As the Republic of the Philippines is made up of islands, energy sources and electricity mix should be calculated by region or greater island area. At a regional level and for Luzon—the northernmost group of islands in the Philippines and home to Metro Manila—residential sector

demand represented the highest share of total energy demand in 2007. Household energy consumption in Metro Manila draws from the Luzon energy grid, more dependent on coal-powered energy and natural gas than other parts of the country. In 2007, coal-fired plants in Luzon accounted for 27% of the total national mix, and for 2006, coal-powered energy represented 14,417,796 MWh of the national total demand of 16,837,096, or 85.6% of national demand. Carbon emissions for a region also need to be placed in relation to energy sources: for Metro Manila, recent reports developed under the Kyoto Protocol's Clean Development Mechanism for waste-to-energy projects in Manila refer to an emission factor of 0.557 kg CO_2e/ kWh for the Manila grid [49], slightly higher than the Filipino average of 0.523 kg CO_2/ kWh, which can be explained by a higher reliance on coal in Manila's electricity mix.

From a life cycle perspective and drawing from industrial ecology, CFL bulbs in their usage phase are more efficient that the traditional incandescent bulb. However, because electricity use in general is highly dependent on coal-powered electricity in Metro Manila, the goal must be to reduce overall electricity consumption. This can be achieved through technical innovations and more eco-efficiency per unit of production, but only if electricity consumption overall doesn't increase. CFL bulbs also pose a problem in terms of final disposal. Finally, because electricity in Manila is dependent on coal-powered energy, it would be significant to determine how lighting consumption patterns change with the introduction of a new technology from a biophysical perspective, and whether this leads to lower electricity usage overall. This is a question we will return to later in this paper.

3.2. The Social and Cultural Meaning of Lighting, and the Role of Influencers

As we saw earlier, a social understanding of consumption means recognizing the role of people and their interactions in society as one driving force for consumption patterns and trends. While CFLs have been researched in terms of technical efficiency, little empirical research exists on relating the uptake of this new technology to socio-economic factors [50]. In this section, we will focus specifically on how social interactions can affect change.

In an interview, an elderly couple explained how their daughter was responsible for their switch to CFL in their home. The daughter had studied environmental issues, had heard about the new bulbs and uses them in her own home, and therefore took the initiative to make the change at her parents' home. To use Gladwell's terminology, as the 'early adopter', she then influenced the 'early majority'.

This type of influencing can also happen on a mass scale, through the use of the media: in the Philippines, celebrities—including models, actors, TV show personalities or members of the wealthier families—are often invited to promote a given message, service or product. Celebrities campaign for everything from family planning to environmental issues in the Philippines, but the influence of celebrities is also global in scope—as images and ideas are communicated through the Internet, as well as TV and radio programs. When I asked one woman (in the 45–54 years age bracket) if she had made the switch to CFLs in her home, she stated:

> *I did! See, because I watch Oprah. And she said change all your lights so I did. I changed most of them. I heard it this year in one of the shows. She had someone talking about that, and they said that it really saves energy (…) Oprah convinces me of everything (laughter).*

For many, a light bulb has very little symbolic value. It is what is known in marketing as a low involvement product: most people in industrialized countries spend less time thinking about what type of light bulb to purchase than they would for the purchase of a new car, as we have already noted. The consumption of products with less of a symbolic and cultural value can more easily influenced by the individual-approach to consumption: for example, among the lower income groups interviewed, the higher initial cost of CFLs was seen as prohibitive and represents a barrier to change. Cost is not the only issue, however. Those who had purchased cheaper versions of this form of lighting expressed disappointment over product longevity (the Chinese brands were perceived to not last very long), leading to mistrust over the product features (a similar conclusion was drawn for the Indian market, see [51]). On store shelves, Chinese brands are offered at a lower cost than brands such as Philips and GE. A cost incentive could act as a driver for CFL consumption, but this strategy alone will not address the question of brand credibility and consumer trust.

During this fieldwork, many interviewees admitted to not remembering any commercials for light bulbs and only buying new bulbs on an annual basis. However, another couple told me that they had first seen CFLs at a friend's house, who had proudly explained their energy saving qualities, showing that these new bulbs could also serve as objects for display, communicating the environmental concern of their owners. Lighting has the potential to become a cultural form of consumption for some, with the CFL a carrier of symbolic meaning.

3.3. Lighting, Rational Choice and the Rebound Effect

Before mass-produced incandescent bulbs, people read, studied or worked by candlelight. Today, our standard of what constitutes appropriate reading light has changed. In an interview, one man (in the 45–54 years age bracket) explained his transition to energy efficient light bulbs in his home:

> *But I just told my wife, I need two not one. I said, "Don't use one use two". Because in one room* di ba parang ganyan *instead of using, she put one for here and one there, one there. But when I work, it's a little dark, I had to put on a two. Anyway it's economical so I said just open both all the time anyway. Anyway it's consuming very little. But it's bad for the eyes to be using only one CFL, there has to be two at a time for a room like this.*

A young couple (24–34 years old) also explained how they use light for safety reasons:

> *Sometimes we leave on the lights because it shows people that we're home, it's a safety thing. In the kitchen. When we leave or when we're asleep. But it's an energy saving light bulb.*

To use LCA terminology, the functional utility of the light bulb is not solely for lighting, but also for safety, which poses the question of how to measure this functionality, and how to find less energy-intensive alternatives that address this particular "cultural energy service" [52].

What is most telling in the quotes above is that people seem to have understood the message of energy and economical savings with the new CFL bulbs, but their actions lead to the overall consumption of more energy (which might only become apparent later, on the monthly electricity bill). This presents a significant issue in terms of energy reduction: perceptions of energy- and

economic-savings per light bulb or per production unit can lead to the practice of adding light bulbs to the household or the increased usage of a bulb by extending the time it is turned on. This is what is known as the rebound effect or what Edgar Hertwich also called the ripple effect [53]: an increase in overall consumption despite energy efficiency technological improvements.

In the examples above, there are two driving forces behind the expressed need for additional lighting when switching to more energy-efficient bulbs: the first is that the new bulbs do not give off the same luminosity as the traditional bulbs, and therefore more bulbs are needed. A new design or moving up to a higher wattage could improve this aspect, but a more dangerous reasoning is in the second driver: that if households can save energy and electricity costs by switching to more energy efficient bulbs, then adding new sources of lighting is possible. This is a seemingly rational decision that goes against the purpose of energy-efficient technology. In both examples, lighting also serves other functions that cannot necessarily be addressed by technology alone, but rather a change in external factors (such as safety) and in perceptions (what is considered "normal" light intensity).

4. Policy Implications

Based on life cycle thinking and from a biophysical perspective, switching household consumption to CFLs would represent an improvement on natural resource usage and pollution compared to incandescent bulbs so long as the following criteria are met: the CFL bulb longevity is up to standard, the dumping of mercury in landfills is avoided, and overall lighting usage doesn't increase over time per household, leading to what has been described earlier as the rebound effect. For the first criteria, some respondents approached through fieldwork expressed feelings of mistrust towards product longevity, which translates to a loss of credibility for certain brands. From a policy perspective, the Philippines must raise their standards in terms of the types of CFL bulbs that can be imported and made available on their markets. In terms of addressing the issue of recycling, the DOE should communicate a clear buy-back strategy for used CFL bulbs, which is currently not the case. Recycling is not free in terms resource usage, and should be seen as a last resort—reducing overall energy consumption should be the main goal. There is also another issue, that of government mistrust: in all interviews, research participants spoke of high levels of corruption in the public sector and general mistrust of politicians. Partnering with the private sector or other institutions would be beneficial in order to lend credibility to any efforts to promote CFL waste segregation and recycling. In both these examples, insights drawn from fieldwork have led to identification of barriers and opportunities that can inform policy-making.

In terms of communicating the energy-efficiency of CFL bulbs, it is not only the medium that presents a problem given general mistrust of the public sector, but also the message: consumers should be given the full picture through an introduction to life cycle thinking when it comes to their household electricity consumption, or a deeper understanding of material and energy used throughout a product's life cycle. Educational campaigns—through school systems, neighborhood associations, celebrity endorsement or other credible sources—must focus not only on the cost-saving aspect of energy-efficient light bulbs, but on the coal-dependent and polluting aspect of Manila's electricity mix. An informational campaign based on advertising alone may not be able to achieve this. None of the

respondents interviewed could provide an accurate description of the energy sources for their electricity, with the exception of two respondents working on energy issues.

As noted by Elizabeth Shove, it is ultimately the systems of provision that shape what people do: institutional change the Philippines means changing the "contexts of action" [54] by adding more renewable energy to the electricity mix, for example, or addressing the question of safety. From a life cycle perspective, the problem of household electricity consumption in Metro Manila must start upstream and cannot be addressed through technical solutions alone. CFL bulbs may reduce household electricity consumption, but electricity consumption will increase overall in Manila as households continue to rise in affluence. Public policy must focus on energy sources for a capital region that continues to grow, in terms of population and infrastructure development.

Meters at the household level that record electricity usage for specific household appliances would be effective in helping consumers understand the energy consumption of their lighting needs. These efforts could help reduce the rebound effect and have already been identified as a viable solution for other cities in Asia [55]. In 2009, "smart meters" were deployed to residential homes in Manila, but are cost prohibitive for a large part of the population. In low-income housing developments, electricity meters for apartment units would be a good start. Including environmental objectives in smart meter technology is not merely a question of technology, however, and would need to involve "a powerful shift in the regulatory and institutional frameworks within which utilities and manufacturers are configuring the functionalities of smart meters" [56].

A lack of interest in light bulbs as a low-involvement product, coupled with a higher purchase price of CFLs, represent a barrier to entry for the CFL market, particularly for poorer populations. But this lack of cultural meaning can also be seen as an opportunity: if people have no preference for the type of light bulb they use, it could be easier to promote the new bulbs. Where products and services have low social and cultural value, approaches that focus on price and information could be more effective if combined with a broader social understanding of consumption that yields some of the insights discussed above. Efforts to give away free CFL bulbs seem particularly relevant: by testing a new type of lighting device, you may be more apt to purchase that bulb in the future, as long as the product delivers on its promise (e.g., bulb longevity). The SWITCH campaign has succeeded in giving out free CFLs in poorer neighborhoods, thanks to support from the Asian Development Bank. Influencers could also continue to be engaged in campaigns that would give a cultural meaning to CFL bulbs, promoting them as objects of display. But to avoid the rebound effect, additional measures must be taken, such as household energy meters and education on life cycle thinking, as mentioned above.

5. Conclusions

This article has brought together Wilk's multigenic approach to understanding consumption as a combination of social, cultural and individual choice approaches, with a biophysical understanding of consumption. It represents a small bridge between social and environmental studies, but one that merits to be expanded upon. Patterns of consumption can be better assessed and prioritized in order of environmental significance, but the drivers of those patterns should also be revealed. For the former, quantitative research is both useful and necessary. For the latter, fieldwork based on observations and

interviews with consumers can yield valuable insights into how people relate to various products and services.

The campaign to switch to energy-saving CFL bulbs in the Philippines provides a case study example for understanding how life cycle thinking and social theory can shed light on opportunities for more environmentally-friendly consumption. The functional utility of a product such as the light bulb, for example, can only be uncovered by understanding what secondary lighting functions are important to consumers, such as perceived household safety and reading comfort. Fieldwork can therefore provide useful insights for the design of LCA, while also uncovering the barriers and opportunities for change. This means finding ways to build bridges between disciplines to form multidisciplinary teams, which is not always easy given the different backgrounds and approaches of researchers. Such an effort may be deemed cost- and time-prohibitive, particularly in the context of developing countries, but even a simplified approach—as was the case in this CFL example—can reveal key insights to move policy recommendations in the right direction.

Ultimately, life cycle thinking and social theory have in common a systemic approach that attempts to see the full picture when it comes to understanding consumption patterns and drivers. This approach would certainly be helpful in tackling the question of private transportation and travel, for example, two energy-intensive consumption areas that are also tied up in cultural and social meaning. Combining macro-level data with micro-living insights is not without complexity, but such a multi-disciplinary approach is necessary for understanding how transitions to more sustainable lifestyles could be made possible.

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