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TO NUDGE OR NOT TO NUDGE HOUSEHOLDS: ENERGY EFFICIENCY CASE iN INDONESIA

[1]*Eka Sudarmaji,[2]Supriadi Thalib

***ABSTRACT**--This paper explores the experiential electricity conservation through "Nudges". "Nudges" are being widely used to encourage energy conservation. We used "nudge" to provide feedback to households on their own and their peers' home electricity usage, the alternative way to make households save energy is by informing them that "comparable others" save more. We explored the idea that households can further improve this nudge by manipulating who the "comparable others" are. We also included two~~three~~ types of 'nudge' conditions: one where no feedback is~~was~~ provided, and one where only statistical feedback is~~was~~ provided (feedback about an average household). Research studies~~y~~ on "Nudges" framings that are~~is~~ not only acceptable on specific manufacturing industry but also universally, given that the number of the industrial sectors was plentiful. There's a huge opportunity to explore 'Nudge' framings especially in 'energy efficiency' in Indonesia, giving so many researchers focus on studying ~~on~~ 'innovation' and 'sustainability business'. The research~~'s~~ model used the 'Non-Equivalent Groups Design' (NEGD) framework for both 'the oberserved group' and 'control group'. The results of this study showed that 'social norm and curtailment (nudge type 1 & 2)' have impacted ~~on~~ the motivation of reduction of electricity consumption in the rural area. The descriptive statistic and MANOVA Analysis were used to analyze the energy efficiency in a rural household in Indonesia.*

***Keyword**--Nudge, Social Norms, Curtailments, Households Energy Efficiency, SLR*

I. INTRODUCTION

An increase in the population surges the number of households, as well as urbanization. According to the data provided by Handbook of Energy & Economic Statistics of Indonesia, the number of population in 2017 stood at 261.891 million with a total number of households as big as 67.173 million, as showed by the graph.1 below.

[1] **Fakultas Ekonomi and Bisnis, University of Pancasila, Jalan Srengseng Sawah, Pasar Minggu Jakarta 12640, Indonesia, esudarmaji@univpancasila.ac.id.*

[2] *Fakultas Ekonomi and Bisnis, University of Pancasila, Jalan Srengseng Sawah, Pasar Minggu Jakarta 12640, Indonesia.*

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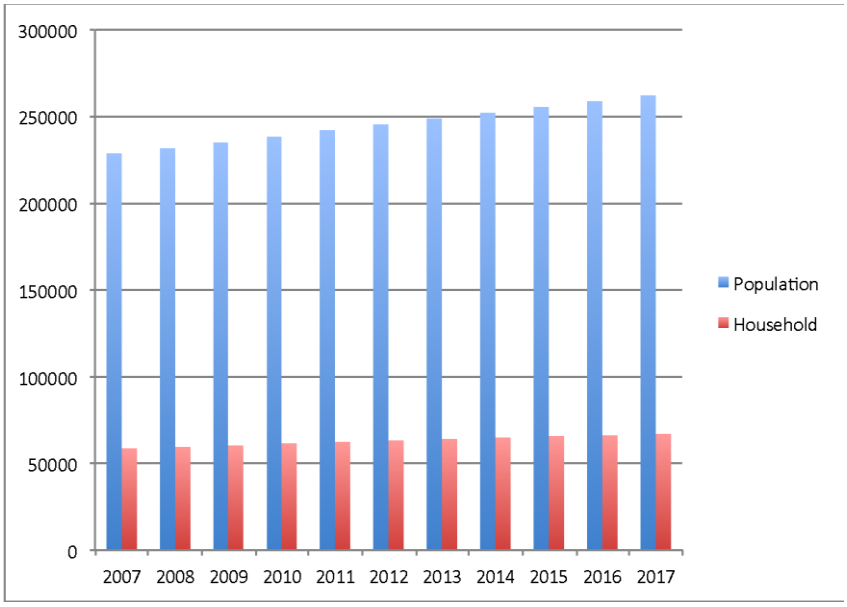

Figure 1: Number of population and households in Indonesia (MEMR, 2018)

Based on the data provided by the World Bank, from the total population in Indonesia, more than 55.33% out of the whole population live in the cities. (graph.2). And Indonesia has become one of the fastest developing countries in the urbanization.

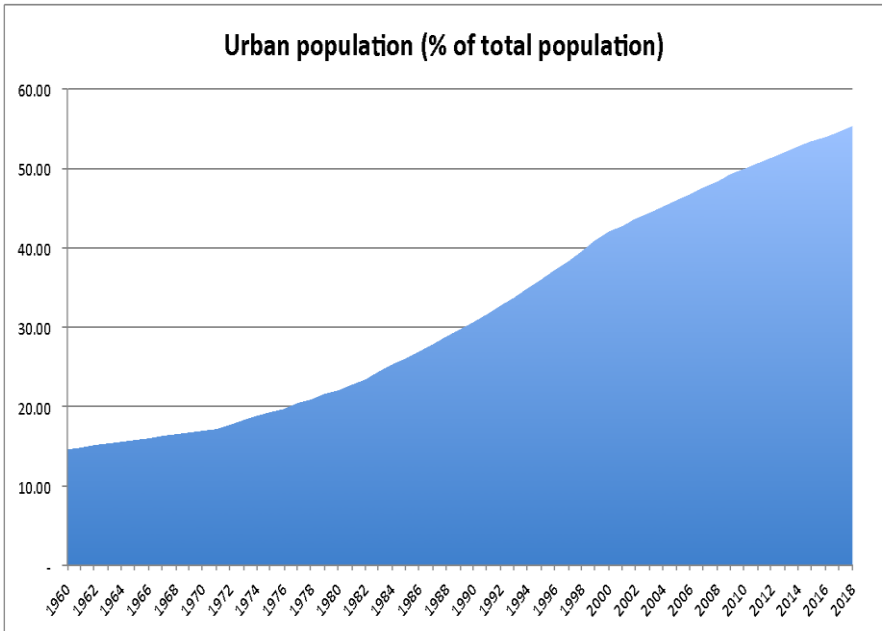

Figure 2: The total population in urban Indonesia (World Bank)

The growing~~Growing the~~ population also increases household income levels, which concludes that it triggers demand and the utilization~~ing~~ of electronic home appliances in Indonesia drastically. Increasing ~~the~~ demand for electronic appliances or home appliances upsurges energy consumption;~~n.~~ a~~A~~s a result, Indonesia's overall energy consumption growth, with the housing sector being one of the biggest energy consumers in Indonesia. From ~~the~~ Graph 3, the percentage of household energy consumption increased to 15.45% in 2017.

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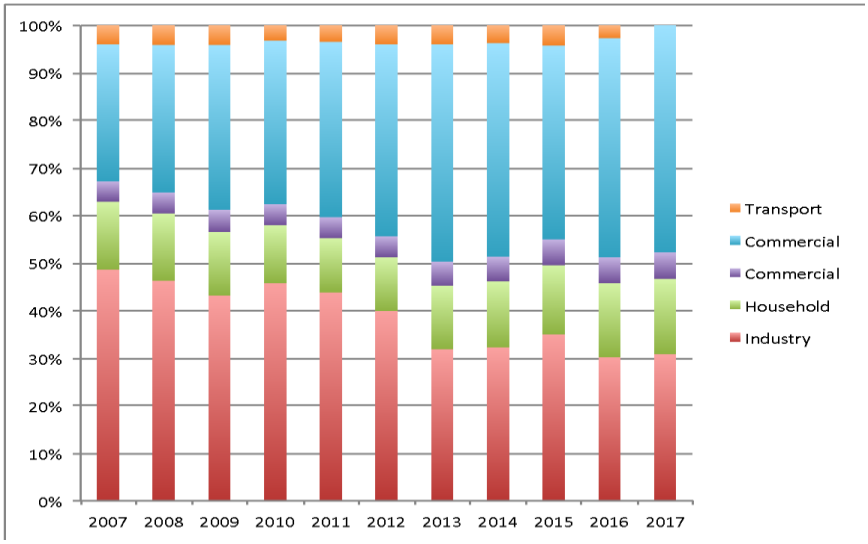

Figure 3: Percentage of energy usage based on sectors. (MEMR)

Given the increasing energy consumption trends among household consumers, Indonesia must improve the energy efficiency of the equipment they~~it~~ uses. Therefore, Indonesia must continue to improve energy efficiency standards and labeling systems for washing machines, refrigerators, air conditioners, and other household appliances. The amount of energy consumption used by consumers in Indonesia can be divided into 4 sources, namely electricity, LPG, Kerosene, and Gas. But on the other hand, increasing electricity consumption in households also increases CO2 emissions. The high source of large fossil fuels, namely oil and coal in power plants are the ones that cause an increase in emissions indirectly. Meanwhile, as prescribed in the National Energy Plan, coal plays an important role in Indonesia's electricity sector due to its reserve, ease to use, and its price. The increase in carbon intensity will increase according to the usage of coal source as a fuel in power plants. During the year 1997-2017, an absolute level of coal consumption increased from 258.19 million ton BOE to 407.50 million tons, although, the percentage of coal consumption as an overall decreased every year from 19.30% in 2007 to 7.40% in 2017, (MEMR 2018)

Reducing the intensity of carbon emissions in electricity has an important role in reducing emissions as a whole. To reduce carbon emissions from the supply side, Indonesia must increase the diversification of its energy mix into the cleaner mix energy-balance, more renewable sources such as geothermal energy. Having a large share of coal-fired power plants is very important for the country to increase its efficiency by adopting the latest technology and increasing coal-fired power plants. However, there are other programs commonly known as electrical energy management programs on the consumer side or Demand Side Management (DSM). ~~The concept of Demand Side Management (DSM) was first conceived by Clark W. Gellings and John H. Chamberli~~Clark W. Gellings and John H. Chamberli first conceived the concept of Demand Side Management (DSM).

Energy efficiency is one of the DSM programs that ~~enables~~enable the reduction of energy consumption while reducing emissions. Many countries control the growth of energy demand through DSM, the right policies made in designing and implementing energy efficiency throughout the economy to keep their energy intensity on track. The ability to limit growth in energy demand utilizes renewable energy and maximizes policies on energy

efficiency can reduce emissions. To cut emissions and achieve the transition to sustainable development, a shared commitment is needed among all stakeholders, including the public and private sectors as well as LSM and other non-profit organizations.

Indonesia's large energy demand is driven by improving activity, mainly due to growth in developing infrastructure. Electricity consumption continues to grow by more than 8.5% per ~~year,~~year; meanwhile, energy investment is still scarce and never meets consumption demand (PT Perusahaan Listrik Negara (Persero), 2017). Beyond the growing energy demand and limited supply, there are large untapped opportunities for energy efficiency in various sectors in Indonesia, one of which is in the household sector

~~Electrical cost in households is mostly dominated by the equipment~~The equipment dominates electrical cost in households. All ~~household's~~households' appliances make households become the third-largest energy user in the United States. According to the data provided by connect4climate, the appliance's equipment that consumes most energy in the home is as follows: 1) Cooling and heating: 47% energy usage, 2) Water heater: 14% energy usage, 3) Washing machines and dryers: 13% energy usage, 4) Lighting: 12% of energy usage, 5) Refrigerators: 4% of energy usage, 6) Electric ovens: 3-4% of energy usage, 7) TV, DVDs, cable boxes: 3% of energy usage, 8) Dishwasher: 2% of energy usage, and 9) Computers: 1% of energy usage.

There are many important factors in understanding households' behavior in reducing energy use, including understanding behavior in adopting energy efficiency technologies in household appliances. Hence this study will investigate the most important factors in motivating technology adoption for these technologies, and/or that prevent technology adoption in households.~~?~~ It is important to explore the behavior of adopting energy-efficient technologies because the adoption or rejection of technology can occur at an individual level, and an individual's involvement is often needed to recognize the full benefits of this technology.

Meanwhile, the "Nudge" theory gives freedom to change the adoption of people's behavior (Thaler & Sunstein, 2003). "Nudge" theory provides incentives to change people's behavior in many dimensions, such as a person's tendency to choose to save money or switch to energy-efficient products. The United Kingdom, the US, and Australia have formed economists working on "nudge units" to test and implement the Nudge initiative (https://www.economist/news/international/1722163, 2017). Some "Nudge units" have positive results, which yield benefits beyond low-cost implementations.

The idea of 'Nudging' underlies thinkers of 'libertarian paternalism' to increase the influence of policy thinking. One of the strategies of the 'libertarian' initiators is that choices can be influenced through 'framing' choices, namely by words or presentation choices, Thaler & Sunsten (2009; p4). In this Home Energy Efficiency (HEE) study, the authors frame the choice "framing" through choices at the most cost-effective, but able to meet the needs of consumers in minimizing their energy costs and regarding the desired targets of energy conservation and reduction of carbon gas emissions.

This study also examines external factors that influence the behavior of energy efficiency adoption in the household sector in Indonesia. Nudge theory is used to make limited choices (framing) to reduce the cost of household energy consumption from limited choices. The goal is clear, which is energy efficiency, energy conservation and reduction of carbon emission. The basic question that must be answered by this research is how likely is it that the Nudge idea can be implemented because, from the available literature, no prior research has been found. Of course, in response to this question, we must understand the potential obstacles that hinder the

implementation of the 'Nudge' initiative itself. Therefore, a mix approach is likely to be used to explore the use of nudge theory in the implementation of the reduction of energy consumption programs in the community.

II. LITERATURE REVIEW

The empirical research on energy efficiency haveresearches on energy efficiency have been categorized into two parts, which is based on internal or endogenous factors (based on characteristics), and research-based on external factors. Characteristic factors consist of 1) economic characteristics, 2) non-economic characteristics, and 3) behavioral and cultural characteristics. While external factors consist of 1) environmental characteristics (environment), 2) policies (policies), 3) energy supply-side factors and 4) energy devices (Dalvi et al (2013).

In the behavior research, at an individual and corporate motivation, most of researchers made the initial hypothesis that motivation was economic or based on economics, which predicts that almost all individuals or companies want to save costs, increase the value of assets, and have high selling-power. But other empirical findings prove that predictions based on economic behavior have many obstacles and were not the only strong predictions, because priorities, practicality, and environmental motivation were also important factors that were widely discussed, and were characteristic for energy efficiency adapters (Priest (2015).

On the other hand, the research based on internal and non-economic factors was often seen in terms of age, gender, education, and information about energy efficiency which was mostly unclear (vague), which results in an information deficit (dalvi et al (2013). Some researchers were also motivated by several factors such as environmental values and perceptions that act as a moral obligation of the community to reduce emissions (in other words) as part of pro-environmental behavior (Chen (2015). Primarily pro-environmental behavior related to energy consumption and was defined as any action that directly or indirectly contributes to conservation and environmental sustainability (Brody et al, 2012).

Research on energy efficiency was taking a lot of different directions among researchers in the world,world; especially the empirical research based on behavioral theories, there was a lot of research on these area. Mostly researchers explored it through various types of social influence (normative and informational), moral norms and influence of information (i.e, trust in friends/relatives and neighbors) and attitudes towards target behavior towards predictors of intentions towards energy efficiency. The theories that underlie and were used usually 'Theory Plan Behavior (TPB)', Ajzen (1991), Lynch et al (2013), Chen et al (2015), Prete et al (2017) and Wang et al (2017)). These researchers found that TPB was a reasonable model to explain the intentions and behavior of energy usage.

Researchers looked into behavioral patterns at the acceptance of energy efficiency technologies was based on Rogers' (1976) theory. In the theory of 'diffusion of innovation', Rogers initially divided adopters into five groups: innovators, early adopters, early majority, final majority, and "slow." In Rogers' theory, innovators can act as leaders of community groups or those who adopt innovations in the future. While individuals who were members of the group may make different decisions to adopt technology and act differently. They might adopt one of these technologies but not the next future technology. Rogers' theory can be said to lack the value or need for technology being the target among adopters, Priest et al (2015).

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Stern and Gardner (1981) distinguished behavior in energy efficiency with non-economic motivations that can be divided into two parts, including 1) curtailment behavior, that was, behavior patterns where individuals reduced activities that endanger the environment and/or choose pro-environment or pro-environmental behavior (turning off lights when leaving the room), and 2) efficiency behavior, that was, reducing environmental impact by adopting more efficient technologies (using energy-efficient equipment).

"Nudge" Energy Conservation

Meanwhile, empirical research that takes energy conservation by using the concept of architectural choices through the concept of 'Nudge or Nudging' or 'encouragement', is rarely found in empirical research in Indonesia. Nudge is used as an effort to try to change people's behavior, where people are attracted because of the stimulus (incentives). The architect of choice is used to encourage energy conservation, where architects must think about incentives when designing an energy-saving policy system. A sensitive choice architecture will place the right incentives in the right people. Therefore, the idea of "Nudge" is suitable and can be used in implementing this energy efficiency policy in Indonesia.

Framing through the architect of choice is needed because the human automatic system reacts differently to the different information provided; it is crucial to the success of energy efficiency policies. Framing about the causes of loss due to wasteful framing behavior of energy will be more welcomed than framing the benefits of reducing carbon emissions. Framing will work because most people do not like to think and tend to be passive in making decisions. Their reflection system will not work if it needs checking. Framing is a very strong nudge and must be done with care.

Alternative research and policy choices through the 'Nudge' concept were also carried out by the US utility companies through the 'Home Electricity Report' report. The report contains a comparison of household electricity consumption under study compared to all neighbors with houses of the same size and type. It also contains a comparison of household electricity usage in the current month compared to the same period time in the previous year and gives a green star for each month that consumes lower energy costs. The report provides several tips for saving energy, while simultaneously showing the number of costs that can be saved during the year. Each report contains two information: the absolute level of household consumption and how it is compared to 100 neighbors who live in the same size house.

The Role of Social Norms "Social Norms"

In a previous study, it was found that behavior towards the acceptance of energy efficiency products was more dominant than general social norms (H.Y. Ha & Janda, 2012). So that social norms that are generally do not directly affect and are dominant in determining individual behavior to do energy efficiency (Lingyun, Rui, Hualong, & Xiaohua, 2011). Cowan and Daim (2013) suggest harmonizing perceptions about a healthy environment by including social factors in the community, including policies that provide incentives and educational programs made by the government. Government interventions in education programs or campaigns about awareness of the use of energy efficiency in adopting green technology can increase people's efforts to protect the environment and ultimately achieve cost-effectiveness (Malkani, 2012).

The social norm approach to behavior change in the use of energy efficiency products, especially those directly related to the success of a clean and healthy environmental campaign, is largely determined by the existence of government support (Horne & Kennedy, 2017). However, this is contrary to the situation in China, wherein his research Wang, Wang, and Guo (2017) found that government policies did not affect the decision of household owners in China to carry out energy efficiency. The effectiveness of energy costs will also depend on several factors, including energy performance, climate, and most importantly the price of electricity (Banfi, Farsi, Filippini, & Jakob, 2008). The following is the attached below table. 1 Empirical research, which focuses on energy efficiency in household objects.

Table 1: Empirical research on energy efficiency

Authors	Title	Industry	Conclusion
Lingyun, Mi *Rui*, Nie *Hualong*, Li *Xiaohua*, Li (2011)	Empirical Research of Social Norms Affecting Urban Residents Low Carbon Energy Consumption Behavior,	Urban residents	Social norms cannot directly play a role in population energy consumption behavior; it can only have an indirect and positive effect on population behavior through behavioral intentions.
Wang, Zhaohua *Zhang*, Bin *Yin*, Jianhua *Zhang*, Yixiang (2011)	Determinants and Policy Implications for Household electricity-saving Behaviour: Evidence from Beijing, China.	Household	The positive effects of economic benefit, policies and social norms, and past experience because they affect wider electricity-saving behavior and the negative effects of discomfort caused by electricity saving activities.
Ha, Hong-Yeol *Janda*, Swinder (2012)	Predicting Consumer Intentions to Purchase Energy-Efficiency Products.	Energy	Attitudes towards energy-efficient products have a stronger effect on intentions compared to components of subjective norms.
Cowan, Kelly *Daim*, Tugrul (2013)	Adoption of Energy Efficiency Technologies: A Review of Behavioral Theories for the Case of LED Lighting.	LED lighting	Factors that involve social influence include perceptions of environmental friendliness among different user groups, and facilitating conditions include policies, incentives, and educational programs to encourage adoption.

Saleh, Ahmed M. *Haris*, Asmaddy *Ahmad*, Nursilah 2014)	Towards a UTAUT-Based Model for the Intention to use Solar Water Heaters by Libyan Households	Household	To promote the use of SWHS by Libyan households a series of factors have been presented by this paper to form a modified model of the UTAUT model.
Frederiks, Elisha R *Stenner*, Karen *Hobman*, Elizabeth V (2015)	Household energy use: Applying behavioral economics to understand consumer decision-making and behavior.	Household	The value of applying insight from psychology and behavioral economics to inform the design and effective delivery of communication, messages, and consumer-focused behavioral interventions aimed at encouraging household energy conservation.
Xin Liang, Yi Peng, Geoffrey Qiping Shen	A game theory-based analysis of decision making for green retrofit under different occupancy types.	The owners and occupiers of Apartment	This study aims to reveal the underlying logic by analyzing the behavior of building owners and occupants, who are direct decision-makers in initiating green retrofit in the initial intention phase. The results show that owners and occupants are reluctant to retrofit in both scenarios.
Prete, Luigi, Piper *Rizzo*, Cristian *Pino*, Giovani *Capestro*, Mauro 2017)	Determinants of Southern Italian households' intention to adopt energy efficiency measures in residential buildings.	Household	Attitude is a major determinant of household intention to adopt and willingness to pay for EEM. However, subjective norms, perceived behavioral control, and environmental care has their positive effects based on the level of income, education, and age of the household subgroup.
Wang, Zhaohua *Wang*, Xiaomeng *Guo*, Dongxue	Policy implications of the purchasing intentions towards energy-efficient appliances among China's urban	Urban residents	The variable "POLICY" is not significant indicating that the policy environment and media propaganda in China do not have a significant influence on the willingness of Chinese citizens to pay for energy-

(2017)	residents: Do subsidies work.		efficient equipment.
Marius Claudy & Aidan O'Driscoll (2008)	Beyond Economics: a Behavioural Approach to Energy Efficiency in Domestic Buildings.	Residential House	An effective policy design that aims to encourage the use of sustainable energy systems requires a better understanding of the behavioral factors that influence household decisions to invest in SES. The determinants of SES adoption and the interdependence between personal and contextual factors tend to vary in different countries and even regions.
Ferdinando Fornara, Piermario Pattitoni, Marina Mura, Elisabetta Strazzera (2016)	Predicting intention to improve household energy efficiency: The role of value-belief-norm theory, normative and informational influence, and specific attitude.	Home Owner	VBN theoretical framework models, normative and informational social influences, and attitudes towards target behavior, in explaining behavioral intentions of efficiency as the adoption of renewable energy devices at the household level.
David Lynch and Peter Martin (2013)	How Energy Efficiency Programs influence Energy use: an application of the Theory of Planned Behaviour	Household	This model explains the moderate level of variance in participants' intentions to reduce energy use (24%), but only the amount of variance is relatively small in the consumption of actual electricity usage (4%). It is proposed that the low prediction of changes in electricity usage may be due to perceived behavioral control being a poor proxy for actual control for energy consumption.

Susanna Hornig Priest, Ted Greenhalgh, Helen R. Neill & Gabriel Reuben Young (2015)	Rethinking Diffusion Theory in an Applied Context: the Role of Environmental Values in Adoption of Home Energy Conservation.	Household	Motivation shared widely in the sample (in this case, almost everyone wants to save money and increase the value and selling power of their home) is not necessarily the best motivation to predict the actual intention to act in adopting home energy innovation (in this case, prioritization - practicality and environmental motivation) —that is, what characterizes the best early adopters. For research purposes, an integrated approach that combines diffusion theory with other conceptual and theoretical approaches might work well.
Santosh D Dalvi, Ashok V Bhonsale, Ravindra M Datar (2014)	Acute Assessment of Dynamics, Barriers and Resolutions Governing Household Energy Efficiency: Global Review.	Household	The literature identifies various determinants for predicting household electricity use behavior, but there is a need to highlight only a few local, continental, national behaviors. The authors also recommend designing an FBEBS (feedback based electricity billing system) that helps to save energy in more efficient ways. We propose a strategic command and control support system for household energy management, which includes energy efficiency to happen by itself.

This research emphasizes on two types of 'Nudge' ideas, which are energy cost information through a whiteboard provided as information that records all energy costs incurred by households and the use of general social norms through comparative information comparing the level of absolute consumption of houses stairs and how they are compared to neighbors who live in the same neighborhood with the same size house. Second type of 'nudge' fall into the category of curtailment behavior, as pro-environmental or pro-environmental behavior patterns. For the category of efficiency behavior or the third part of the idea of 'nudge', the research does not discuss especially how the pattern of behavior through replacing saving equipment, especially conventional lighting into energy-saving lamps.

III. METHODOLOGY & METHOD

This study will explore that providing real-time information through information displays on energy consumption will reduce the average household electricity consumption. This study supports the hypothesis that the reduction in energy use is mainly driven by the learning effect. The writer divides into two groups of households, i.e. observe households (self-selected), and control households (randomly selected). Both observed and controlled households must have an active electricity account for at least one year, with an area of between 200 and 50 square meters. The selected target respondents only use electrical energy sources not to produce or conduct business activities, bearing in mind that many household units conduct their MSME businesses starting from within their homes. So that selected respondents who use electrical energy as input in generating comfort (eg temperature in the room) and family recreation activities.

Total household electricity consumption depends on 1) house attributes, such as size; 2) equipment attributes; and 3) intensity of the use of equipment for recreational and household activities. These choices, in turn, depend on climate, price, and personal attributes, including brands. It can be said that this study uses an experimental method with Non-Equivalent Groups Design ("NEGD"), which is the form of research most often used in social research (Sudarmaji & Mira, 2019, Enkel, Bell, & Hogenkamp, 2011; Shadish, Cook, & Campbell, 2002; Trochim, 2002). NEGD appears when program participants are treated differently. The main strategy of this research is to provide additional information to observe or intervention the household group, which is used as an 'observed' variable to other 'controlled' groups. Some additional information on limitation and efficiency behavior taught in the Observe group can be described as follows: 1) Turn off the lights when occupants leave the room, 2) replace old light bulbs at home with energy-efficient consumption, 3) Washing clothes during pick-off hours and only done when there are enough, 4) Replace high-consumption electrical appliances (eg dishwashers, irons) with more energy-efficient models, 5) Turn off the computer and monitor when not in use.

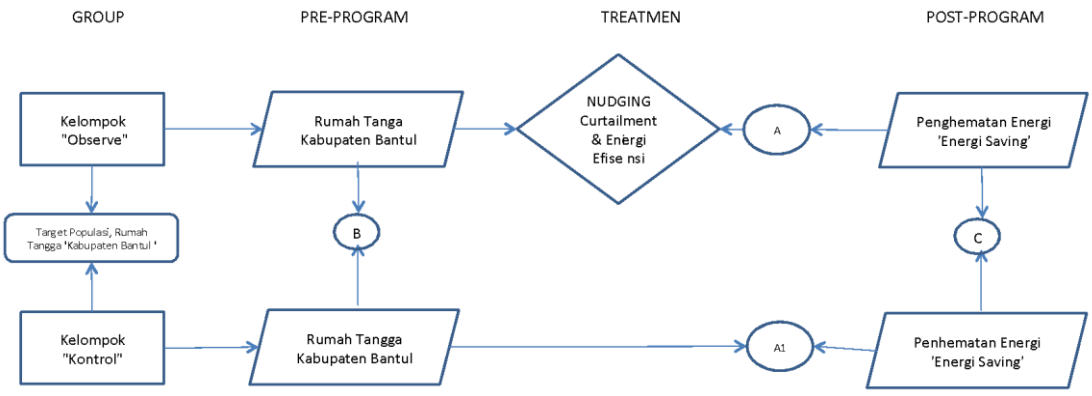

Figure 4: Research Framework

This study also explores the decision whether these households can adopt energy-saving equipment technology and consumption saving programs designed by the author based on the idea of 'Nudge', which screens the choices available in reducing electricity consumption. Besides, this study also discusses the potential

of micro-scale retrofitting efforts that might be conceived as part of innovation in improving the welfare of small households. The idea of increasing prosperity and micro-business is the existence and success of the small bank business Grameen Bank initiated by Muhammad Yunus. Therefore, this research is expected to provide answers and clear insights about how household consumers spend energy costs and their knowledge about energy conservation. With this background, two main hypotheses are being tested. Observe household groups will read reports and respond as if they want to reduce their bills and then reduce their consumption. While the control group will continue to consume exactly as they have done so far.

This research was arranged through several steps to get a comparison of the different training results: 1) Focus Group Discussion (FGD) is performed before the experiment take a place, 2) the initial questionnaire using questionnaire filling and then transferring it into Google Form was given at the beginning of all groups including the observe group and control group variables, 3) some information and additional training on limitation and efficiency behaviors that are taught in the Observe group, 4) the final questionnaire is distributed to see the effect or the actual effect after the consumers know the benefits of carrying out energy conservation activities. Questionnaires are distributed via Google Form and distributed to observe class variables.

The pilot experiment took place in an area in Bantul Regency with 31 households with two experiments using two types of ‘Nudge’. The experiments took place between April to August 2019. There are two types of 'Nudge' ideas used in experiments: (i) providing information about the consequences of curtailments, and (ii) providing information about social norms. Field experiments compare the relative effects of two different types of 'nudge' ideas on household electrical energy consumption behavior. Interventions use encouragement that does not change economic incentives or prohibits all kinds of behavior. Using this specially created field trial, the authors hope to find that every intervention has a positive effect. Also, a literature review and Focus Group Discussion (FGD) activities that the writer will hold to find out the choices (default) that already exist in each household. It's important to show whether the 'default option' has a strong effect on energy consumption behavior in the household. Analysis of findings from the literature review, Focus Group Discussion (FGD) activities and the results of pilot trials are expected to play an important role in energy conservation policies in the household sector, for example regarding energy use, and resource effectiveness.

IV. RESULT

Based on the multivariate test analysis, it can be stated that there is a very significant difference between the observed group and the control group. By using Multivariate Analysis of Variance ("MANOVA"), we can see the difference between the variables 'social norms (nudge type 1)', 'curtailment (nudge type 2)' and 'social norm and curtailment (nudge types 1 & 2)'. From the test results stated well according to Pillai's trace, Wilks' Lambda, Hotelling's trace, and Roy's Largest Root are that all indicators have very significant differences between the two groups. In the Wilks' Lambda test results, the result is 0.202, at F (3.58) with a value of 76.49, with a P-value = 0.000 which is stated to be smaller than <5% while Partial n2 is worth 0.798.

Table 2: Descriptive Statistics

Group		Mean	Std. Deviation	N
Social Norms (Nudge type 1)	Observed	26.68	2.166	31
	Controlled	31.55	1.895	31
	Total	29.11	3.178	62
Curtailment (Nudge type 2)	Observed	26.68	2.166	31
	Controlled	29.84	2.162	31
	Total	28.26	2.673	62
Social Norms & Curtailment (Nudge type 1 & 2)	Observed	26.68	2.166	31
	Controlled	32.19	1.600	31
	Total	29.44	3.361	62

Using statistical analysis, there are significant differences in the variable 'social norms (nudge type 1)', 'curtailment (nudge type 2)' and 'social norm and curtailment (nudge type 1 & 2)' between the group observe and the control group. To analyze the effect or influence of the architect's choice through nudge on electricity (energy) costs in both groups, the MANOVA analysis is also used where the NEGD model is tested to predict the results of the nudge type 1 and type 2 architecture choices in urban environments. Indicators of the mean and standard deviation of variables 'social norms (nudge type 1)', 'curtailment (nudge type 2)' and 'social norm and curtailment (nudge types 1 & 2)' which affect the motivation of reduction of electricity consumption shows a very significant result between the two groups. Table 2 above shows the differences in the mean and standard deviation indicators between the two groups.

From table 3, the results of ANOVA testing conducted at level 0.025 (two-tailed) of all 'social norms (nudge type 1)', 'curtailment (nudge type 2)' and 'social norm and curtailment (nudge types 1 & 2)' can be seen in Table 3 below. From the results of ANOVA testing conducted at the level of 0.025 (two-tailed) on 'social norms (nudge type 1)', it has a value of F-value (3.38) = 88.81, p-value = 0.000 and partial ETA square n2 or r-square = 0.597 and r-adjusted square = 0.590. It can be concluded that many 'urban' households will read the report and respond by reducing their consumption (Kotchen and Moore 2008; Costa and Kahn 2010). Through information, they spend more time monitoring their electricity bills and are actively involved in reducing their electricity costs voluntarily (eg turning off unnecessary lights. The results of this study are in line with the results of Michele Graffeo's research, Ilana Ritov, Nicolao Bonini and Constantinos Hadjichristidis (2015); Richard G. Newell and Juha Siikamäki (2013) who point out that the choice of architecture (nudging) has a significant impact on reducing the cost of electricity or generating energy saving within the group (experimental group).

From the results of ANOVA testing conducted at the level of 0.025 (two-tailed) for 'curtailment (nudge type 2)', it has a F-value (3.38) = 33.81, p-value = 0.000 and partial ETA square n2 or r-square = 0.355 and r-adjusted square = 0.345. This study supports the hypothesis that reducing energy use, especially during ‘peak time’, can reduce electricity costs. The curtailment saving effect (nudge type 2) ’is driven by the learning effect. The results of this study are in line with the results of research by Michele Graffeo et ... al (2015); Hakimul Batih and

Chumnong Sorapipatana (2016); Nihan Karali, Michael A. McNeil, Virginie Letschert and Stephane de la Rue du Can (2015) and Y. Tanoto, M. Santoso, E. Hosea (2013). The concept of curtailment is indirectly in line with the concept of Demand Side Management (DSM) expressed by Clark W. Gellings and John H. Chamberlin (1987). Turn off the lights when you come out of the room.

The concept of the 'curtailment (nudge type 2)' that was carried out included, is the use of washing machines when off-peak, turning off lights, or electrical equipment when not in use and washing clothes when the clothes are dirty together and the capacity of the laundry is full. Meanwhile Anova test results carried out at the level of 0.025 (two-tailed) on 'social norm and curtailment (nudge types 1 & 2)', have a F-value (3.38) = 130.04, p-value = 0.000 and partial ETA square n2 or r-square = 0.684 and r-adjusted square = 0.679.

Table 3: Variance Analysis (ANOVA) for each variable

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Social Norms (Nudge type 1)	367,758[a]	1	367.758	88.81	.00	.597
	Curtailment (Nudge type 2)	154,903[b]	1	154.903	33.08	.00	.355
	Social Norms & Curtailment (Nudge type 1 & 2)	471,629[c]	1	471.629	130.04	.00	.684
Intercept	Social Norms (Nudge type 1)	52548.790	1	52548.79	12690.31	.00	.995
	Curtailment (Nudge type 2)	49508.129	1	49508.13	10572.34	.00	.994
	Social Norms & Curtailment (Nudge type 1 & 2)	53719.758	1	53719.76	14811.56	.00	.996
Group	Social Norms (Nudge type 1)	367.758	1	367.76	88.81	.00	.597
	Curtailment (Nudge type 2)	154.903	1	154.90	33.08	.00	.355
	Social Norms & Curtailment (Nudge type 1 & 2)	471.629	1	471.63	130.04	.00	.684

a. R Squared = ,597 (Adjusted R Squared = ,590)

b. R Squared = ,355 (Adjusted R Squared = ,345)

c. R Squared = ,684 (Adjusted R Squared = ,679)

From the individual results of the ANOVA analysis, where all the values can be stated that the group observed or the people who were given a boost through the choice of architecture (nudging) can be said to have the desire to reduce the electricity costs of the control group that was not given a boost, see table 3 and table 4.

Table 4: Analysis of the mean and variance within the group

Dependent Variable		Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Social Norms (Nudge type 1)	Observed	26.677	.365	25.946	27.408
	Controlled	31.548	.365	30.817	32.279
Curtailment (Nudge type 2)	Observed	26.677	.389	25.900	27.455
	Controlled	29.839	.389	29.061	30.616
Social Norms & Curtailment (Nudge type 1 & 2)	Observed	26.677	.342	25.993	27.362
	Controlled	32.194	.342	31.509	32.878

V. CONCLUSION

The empirical research explored the treatment effects of the 'home energy reporting - HER' report and also examines how their effects vary based on standard characteristics such as home attributes and socioeconomic characteristics of their owners. A distinguishing feature of this study is the emphasis on the urban household environment as an important determinant of how urban society responds to new information. This research emphasizes the concept of 'Nudge' through the use of architectural options for energy efficiency. This concept is widely used by many countries. Our initial hypothesis is that urban society as energy consumers tend to agree with public opinion and hear what they have to say. A group of people in a rural environment may have the same similarity so that the government or authority can draw the same conclusion. Likewise, the behavior of receiving energy efficiency products and energy conservation, public opinion or social norms with general behavior will certainly be more dominant. The 'Nudge' that pushes for energy conservation or energy efficiency is new and is becoming a trend and is widely practiced by many governments. In energy efficiency projects, the relevant Ministries can work together with district governments to display energy savings in more prominent media and make them more visually attractive to the public. The idea of 'Nudge' can be used to frame incentives for the wider community. The 'Nudge' idea to reduce energy consumption could result in many energy-saving projects and reduce carbon emissions in the future (Krstic & Krstic, 2015).

REFERENCES

1. Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.
2. Banfi, S., Farsi, M., Filippini, M., & Jakob, M. (2008). Willingness to pay for energy-saving measures in residential buildings. *Energy Economics*, *30*, 503–516.
3. Batih, H., & Sorapipatana, C. (2016). Characteristics of Urban Households ' Electrical Energy Consumption in Indonesia and Its Saving Potentials. *Renewable and Sustainable Energy Reviews*, *57*, 1160–1173.
4. Brody, S. D., Zahran, S., Vedlitz, A., & Grover, H. (2008). Examining the Relationship Between Physical Vulnerability and Public Perceptions of Global Climate Change in The United States. *Environment and Behavior*, *40*(1), 72–95.
5. Chen, M. F. (2015). Extending the Theory of Planned Behavior Model to Explain People's Energy Savings and Carbon Reduction Behavioral Intentions to Mitigate Climate Change in Taiwan-Moral Obligation Matters. *Journal of Cleaner Production*, *112*, 1746–1753.
6. Cowan, K., & Daim, T. (2013). Adoption of Energy Efficiency Technologies: A Review of Behavioral Theories for the Case of LED Lighting. *Green Energy and Technology*, *60*, 229–248.
7. Dalvi, S. D., Bhonsale, A. V, & Datar, R. M. (2014). Acute Assessment of Dynamics, Barriers and Resolutions Governing Household Energy Efficiency: Global Review. *Journal of Automation and Control Engineering*, *2*(2), 129–133.
8. Enkel, E., Bell, J., & Hogenkamp, H. (2011). Open Innovation Maturity Framework. *International Journal of Innovation Management VO - 15*, (6), 1161.
9. Gellings, C. W. (1985). The Concept of Demand-Side Management for Electric Utilities. In *The IEEE* (pp. 1468–1470).
10. Graffeo, M., Ritov, I., Bonini, N., & Hadjichristidis, C. (2015). To Make People Save Energy Tell Them What Others Do But Also Who They Are : A Preliminary Study. *Frontiers in Psychology*, *6*(August), 1–9.
11. Ha, H.-Y., & Janda, S. (2012). Predicting Consumer Intentions to Purchase Energy-Efficient Products. *The Journal of Consumer Marketing*, *29*(7), 461–469.
12. Horne, C., & Kennedy, E. H. (2017). The Power of Social Norms for Reducing and Shifting Electricity Use. *Energy Policy*, *107*(March), 43–52.
13. http://www.economist/news/international/1722163. (2017). Policymakers around the world are embracing behavioural science.
14. Karali, N., McNeil, M. A., Letschert, V., & de la Rue du Chan, S. (2015). *Potential Impact of Lighting and Appliance Efficiency Standards on Peak Demand : The Case of Indonesia*.
15. Lingyun, M., Rui, N., Hualong, L., & Xiaohua, L. (2011). Empirical Research of Social Norms Affecting Urban Residents Low Carbon Energy Consumption Behavior. *Energy Procedia*, *5*, 229–234.
16. Lynch, D., & Martin, P. (2013). How Energy Efficiency Programs Influence Energy Use : an application of the Theory of Planned Behaviour. *Proceedings of ECEEE 2013 Summer Study on Energy Efficiency*, (December 2015), 2037–2048.
17. Malkani, A. P. (2012). Building Green: The Adoption Peocess of LEED and Energy Star-Rated Office Buildings.
18. Ministry of Energy and Mineral Resources Republic of Indonesia. (2018). *Handbook of Energy & Economic*

Statistics of Indonesia. Jakarta.

19. Newell, R. G., & Siikamaki, J. (2013). Nudging Energy Efficiency Behavior: The Role of Information Labels. *Resources For The Future*.
20. Prete, M. I., Piper, L., Rizzo, C., Pino, G., Capestro, M., Mileti, A., … Guido, G. (2017). Determinants of Southern Italian Households' Intention to Adopt Energy Efficiency Measures in Residential Buildings. *Journal of Cleaner Production*, *153*(13), 83–91.
21. Priest, S. H., Greenhalgh, T., Neill, H. R., & Young, G. R. (2015). Rethinking Diffusion Theory in an Applied Context: Role of Environmental Values in Adoption of Home Energy Conservation. *Applied Environmental Education and Communication*, *14*(4), 213–222.
22. PT Perusahaan Listrik Negara (Persero). (2017). Keputusan Menteri ESDM No. 1415 K/20/MEM/2017 Tentang Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) PLN 2017-2026.
23. Rogers, E. M. (1995). *Diffusion of Innovation*.
24. Saleh, A. M., Haris, A., & Ahmad, N. (2014). Towards a UTAUT-Based Model for the Intention to use Solar Water Heaters by Libyan Households. *International Journal of Energy Economics and Policy*, *4*(1), 26–31.
25. Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). Experimental And Quasi-Experimental Designs For Generalized Causal Inference. Belmont, CA: Wadsworth, Cengage Learning.
26. Stern, P. C. (2011). Contributions of Psychology to Limiting Climate Change. *American Psychologist*, *66*(4), 303–314. https://doi.org/10.1037/a0023235
27. Tanoto, Y., Santoso, M., & Hosea, E. (2013). Demand Side Management of Household ' s Lighting Considering Energy Use and Customer Preference : a Preliminary Study. *International Journal of Engineering and Technology (IJET)*, *5*(3), 3134–3141.
28. Thaler, R. H., & Sunstein, C. R. (2003). Behavioral Economics, Public Policy, And Peternalism. In *AEA Papers and Proceedings* (pp. 175–179).
29. Thaler, R. H., & Sunstein, C. R. (2008). *Nudge - Improving Decisions About Health, Wealth, and Happiness*. Michigan, United States of America.
30. Trochim, W. M. (2002). What is the Research Methods Knowledge Base?
31. Wang, Z., Wang, X., & Guo, D. (2017). Policy Implications of The Purchasing Intentions Towards Energy-Efficient Appliances Among China's Urban Residents: Do Subsidies Work? *Energy Policy*, *102*(December 2016), 430–439.
32. Wang, Z., Zhang, B., Yin, J., & Zhang, Y. (2011). Determinants and Policy Implications for Household Electricity-Saving Behaviour: Evidence from Beijing, China. *Energy Policy*, *39*(6), 3550–3557.