

Energy efficient technologies to Combat Climate Change

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Abstract

This paper aims to study and look into various innovative technologies and high performing appliances that have a significant effect on domestic electricity consumption. To achieve this aim, a comprehensive literature review of national and international research looking into these factors was undertaken. The review establishes various potential factors affecting domestic electricity consumption. This includes various innovative technologies and appliances having a significant positive effect on electricity use. This paper helps to understand those factors that certainly affect electricity consumption. Understanding the effects of those factors can help in implementing new technologies, use of better performing appliances to predict the future of electricity consumption in the domestic sector, thus helping combat climate change.

Key Words: Innovative Technologies, Climate Change, Domestic Electricity consumption.

1. Introduction:

World has seen rapid growth in Energy demand since 1970, mainly manifested by fossil fuels. Almost 40% of the energy is consumed by Residential sector. Standard of living and rapid population growth attribute to high energy consumption levels. This has resulted to study factors affecting energy consumption in domestic sector.

Electricity use in domestic buildings is a result of occupants need for energy services, like light, comfort, etc. but the energy consumed depends on different socio-economic, dwelling and appliance related factors.

This Paper presents reviews of the existing research which look into various factors that affect domestic electricity consumption. The aim is to reinvestigate the results of the previous studies and to establish whether specific factors have significant or non-significant effect.

This Paper addresses the effects of the factor at individual household level, including Socio-economic factors, which refer to the characteristics of the occupants residing in a home (e.g. number of occupants, presence of children, annual household income); dwelling factors, which describe dwelling condition (e.g. dwelling type, number of bedrooms, heating or cooling system type); and appliance factors, power demand and use of electrical appliances in home.

This Paper seeks to investigate household energy consumption level across Northern and Western locale in India. Non-household level factors, such as policy

preference and regulatory factors are outside the scope of this review.

There are numerous papers examining different factors affecting electricity consumption, to the author's knowledge, a comprehensive analysis of ownership of assets does not currently exist. It is hoped that this review will fill this gap, and prove that it affects electricity consumption and will provide evidence for it being consistently stated as significant or non significant effect on electricity usage.

The paper is further divided into four sections. The first section discusses the study related to different factors affecting domestic electricity consumption. In the second section, sample and data validation are discussed. Third section presents analysis and results obtained using stata on household asset ownership data. Last section ends with conclusion.

1.1. Indian and European Studies

In this section, we will review the methods and main findings from different relevant research papers pertaining to the topic.

World Bank (2008) studied the impact of appliances on household electricity consumption for fiscal 2031 – 32. The study aimed to understand which factors influenced the level of household electricity consumption, like Climate, GDP growth, Per Capita Expenditure, Urban and Rural Population, Household Size, Appliances.

Jones et al. (2014) studied factors impacting the level of domestic electricity consumption. The study assessed the influence of number of factors like, socio-economic, dwelling and appliance related factors having significant or non-significant effects on domestic electricity consumption.

Haas et al. (1998) used cross-sectional analysis on a sample of 500 households in Austria between 1960 and 1995. Monthly electricity bills were regressed against electricity price, socio-economic, and dwelling parameters to assess the impacts of these parameters on use age of electricity by different appliances.

Bakirtas et al. (2018) studied causal relationship between energy consumption, urbanization and economic growth using causality test for the period of 1971 to 2014 in New Emerging Market Countries (Colombia, India, Indonesia, Kenya, Malaysia and Mexico. The test resulted into a causal relation between energy consumption and urbanization to economic growth, from economic growth and urbanization to energy consumption and from energy consumption and economic growth to urbanization.

1.2. Data Description

TERI, Delhi compared household electricity consumption in both Northern & Western regions on the basis of survey data, national statistics and consumption data provided by census of India. The database available for all household in both the Northern and Western region for the year 2011 were used in the analysis. The data available captured household related information like demographic attributes of the household, income, assets owned, housing condition.

Stratified random sampling was done to capture and compare heterogeneity in the use age of electricity according to different household condition and ownership of assets. To ensure a geologically even distribution of the sample, records in the stata were arranged state insightful into northern and western locale. The first example included 102 areas of four states viz. Jammu Kashmir, Rajasthan, Maharashtra, Gujarat. Every one of them are having distinctive atmosphere zones as pursues Cold, Hot and Dry, Warm and Humid, Composite. Stata was used to do regression test for the relation between main and independent variables and to prove that assets affect the level of electricity consumption.

Household Electricity consumption data for Northern and Western region in India.

Variable	Mean	Std. Deviation	Type of Variable
Electricity	78.90	15.088	Ordinal

Table 1

The average consumption of electricity use age in Northern & Western region of India is tabulated in Table 1. It shows the average amount of electricity consumed by appliances in both the regions.

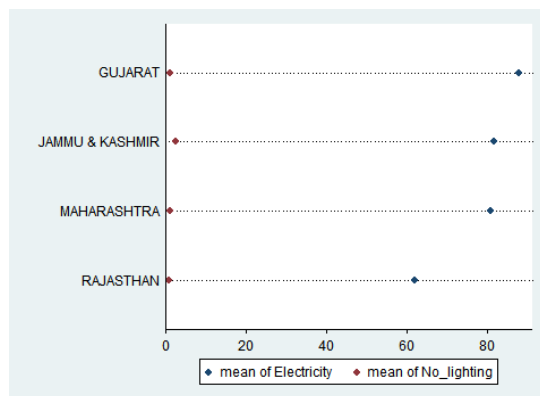


Figure 1: stata

Point chart of mean and median representing access to electricity and no access to electricity

- The above chart shows that most of the households have access to electricity.

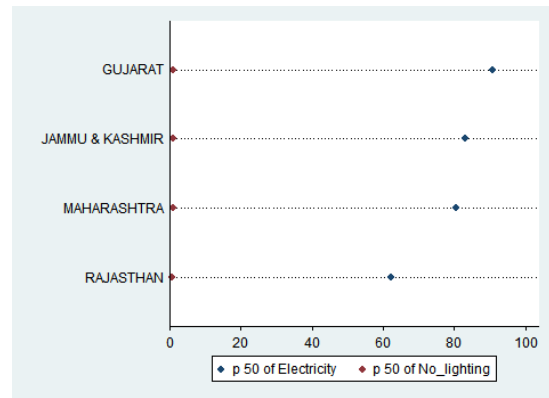


Figure 2: stata

Point chart of mean and median representing access to electricity and no access to electricity

- The above chart shows that most of the households have access to electricity.

1.2.1. Regression test:

In first case electricity is the independent variable and television as the dependent variable, so to test the dependency regression test was applied to the two selected variable to find out the codependency between them.

Regression Table 1

```

. regress television Electricity
-----+-----
Source      |      SS       |   df       |   MS       |
-----+-----+-----
Model      | 11411.622     |     1     | 11411.622  |
Residual   | 6260.47109    |    50     | 125.209422 |
Total      | 17672.0931    |    51     | 346.511629 |
-----+-----+-----
television |      coef.    |  std. Err. |      t      |  P>|t|     | [95% Conf. Interval]
-----+-----+-----+-----+-----
Electricity|  1.081781     |  .1133141  |     9.55    |  0.000     |  .8541827   1.309379
_cons     | -40.34949    |  9.072645  |    -4.45    |  0.000     | -58.57243  -22.12654
    
```

Figure 3: stata

Table 2: Multiple Linear Regression

	Electricity
Television	1.08
Observations	52
R ²	0.64

Regression analysis for 1 independent variable and two dependent variable :

Interpretation: F value >4 at F(1,50) so it is rejected.

R² is 0.64 i.e. 64% variance is explained by the model. As P value < 0.05, this shows how owning assets affects use of electricity.

In this case electricity was chosen as the independent variable and household condition and household with internet connections were chosen as the dependent variable .

Regression Table 2

```
. regress Electricity computerwith_Internet household_Good
```

Source	SS	df	MS			
Model	5149.80659	2	2574.90329	Number of obs =	52	
Residual	4601.63399	49	93.9108978	F(2, 49) =	27.42	
Total	9751.44058	51	191.204717	Prob > F =	0.0000	
				R-squared =	0.5281	
				Adj R-squared =	0.5088	
				Root MSE =	9.6908	

Electricity	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
c-h_Internet	.8790896	.5252789	1.67	0.101	-.1764978 1.934677
household-od	-.7263272	.1335191	5.44	0.000	-.4580105 .9946439
_cons	36.06018	7.113197	5.07	0.000	21.76568 50.35469

Figure 4: stata

Table 3 : Multiple Linear Regression

	Electricity
Household Condition	0.72
House with Internet	0.87
Observations	52
R ²	0.52

Regression analysis for 1 independent variable and two dependent variable :

Interpretation: F value >4 at F(2,49) so it is rejected.
R² is 0.52 i.e. 52% variance is explained by the model
As P value < 0.05, this shows how owning assets affects use of electricity.

2. Conclusions

Aim of this study is to understand if owning appliances and assets affects the level of electricity consumption at domestic level and do energy efficient appliances help in improving it. To achieve this, a comprehensive literature review of National and International research which looked into these factors was done.

This study shows that there are many factors affecting domestic electricity use. This includes various socio-economic factors, dwelling factors and appliances factors. For some of them out of all three factors, the number of papers indicating positive effect is much higher than the papers indicating negative effect. The review identifies some factors out of which each factor has been studied less frequently than others, this has been particularly observed for the appliance related factors, where there has been very less study over its ownership and its subsequent effects.

This paper makes us better understand of those factors that certainly affect electricity consumption. Future research should look into understanding effects of those socio-economic factors, dwelling factors and appliances factors which are under studied.

Thus the study establishes that ownership of assets affect the level of electricity consumption at domestic level and if energy efficient appliances and technologies are used that will help in saving energy and thus help in combating climate change.

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