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# DETERMINANTS OF CHOICE OF ENERGY SOURCES FOR COOKING IN INDIA AND THEIR IMPACT ON WOMEN WORKING DECISION

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## ABSTRACT

*This paper discusses the factors that determine the type of energy source to be chosen for cooking and their respective impact on the women decision regarding their employment. Using multinomial logit model on Indian Human Development Survey – I, this paper finds out the determinants of choice of different source of energy for cooking and the marginal effects of household and individual specific variable. Furthermore, linear regression model is used for determining the women working decisions and it has been found that females belonging to households who use LPG for cooking purpose have higher annual working hours than those females whose households do not use LPG for cooking purpose.*

## KEYWORDS

LPG, energy source, firewood, logit model.

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## 1. INTRODUCTION

Today, India is one of the fastest growing economies in the world. But despite of this high GDP growth India is not good in social indicators like education and health as compare to developed countries and even among BRICS countries. There has been increase in women labor force participation rate across globe in 21<sup>st</sup> century. But in India WLFPR has decreased despite of high GDP growth and increased wages and income. This trend is quite puzzling. The first objective of this paper is to find out the factors that determine the type of energy source to be chosen for cooking. This one is related to health. 1.3 million People died every year on average because of indoor pollution from biomass energy (OECD/IEA, 2006). This figure is fact higher than death attributed to malaria estimated at 1.2 million per annum. The following table reveals that majority of the households use traditional methods of cooking i.e. use of firewood and dung cake for cooking. In fact, the percentage of use of these two sources has increased from 2004-05 to 2011-12 (IHDS).

**TABLE 1**

Type of source of energy for Cooking	IHDS-I (2004-05)	IHDS-II (2011-12)
Firewood	47.85	52.37
Dung Cake	28.15	34.41
Kerosene	15.51	10.43
LPG	30.03	39.18
Crop Residue	8.02	17.29

Source: IHDS and IHDS-II data sets

It has two negative effects. First one environmental effect and second one is health effect. Therefore, it will be interesting to see the variables that determine the choice of different energy sources for cooking

There has been increase in women labor force participation rate across globe in 21<sup>st</sup> century. But in India WLFPR has decreased despite of high GDP growth and increased wages and income. Empirically, it is found that various social and economic factors affect WLFPR in India. Some major factors are as follows:

- 1) Increase wage of male in the household. When income of male member in a household increases then it is found that WLFPR decreases. It happens because higher earnings of males encourage women to take care of their children at home.
- 2) Fertility rate or the number of children in a household.
- 3) Educational level of head of household and Women's educational level are other factors that affect WLFPR.

There have been various studies that worked on WLFPR and their determinants in the Indian Context. But there is no study that finds the impact of use of different energy source used in cooking on WLFPR. Therefore, second objective of the present study is to look at the impact of type of energy source for cooking on women working hours so that some policy conclusions can be drawn from the results.

## 2. LITERATURE REVIEW

F. Mwaura et al. "Determinants of household's choice of cooking energy in Uganda" (2014) used a multinomial probit model (MNP) to estimate coefficient of determinants of energy choices. Consumption expenditure welfare, household size, residing in urban or rural areas, achievement of education levels beyond primary level and regional location of a household were the determinants that affect the households' choice of cooking energy.

Fidelis O. Ogwumike et al. "Household Energy Use and Determinants: Evidence from Nigeria" (2014) used 2004 Nigeria Living Standard Survey data to examined household energy use and its determinants in Nigeria. Using multinomial logit models, they found that educational levels of father and mother, per capita expenditure and household size are the determinants for choice of energy use.

Barnes et al.(2010) found that the use of both traditional as well as modern energy sources for cooking improve household consumption and income. They found that the return on modern sources is 20 to 25 times higher than that on traditional sources. They also found that 45% of household were below poverty line while 58% of the household are energy poor. The study concluded that reducing energy poverty helps in reducing income poverty as well.

Farjana Afridi et al. "Declining female labour force participation in rural India: The supply side" (2017) found in their paper that over period of time married women are shifting out of market over time in rural India. They found that women LFPR declined from 55% to 44% from 1987 to 2011. They also found that women LFPR also decline because of their increased enrolment in higher education.

Farjana Afridi et al. "Why Are Fewer Married Women Joining the Work Force in India? A Decomposition Analysis over Two Decades" (2016) used parametric and semi-parametric decomposition techniques and found that changes in individual and household attributes fully account for the fall in women’s labour force participation rate in 1987-1999 and account for half of the decline in this rate in 1999-2009.

**3. DATA AND METHODOLOGY**

**3.1 Data**

Data for our study is taken from IHDS-I (Indian Human Development Survey). IHDS-I was conducted in year 2004-05. It covered 41554 households and 1503 villages with 971 neighbourhood urban villages. Data was taken for variables types of energy sources used for cooking, number of Children and number of Adults in a household, Income of the household, number of total working hours in a year by an individual, highest education by adult male and female in the household.

**3.2 Methodology to find out the determinants of choice of source of energy for cooking in India**

We have used multinomial logit model and logit model to find out the determinants of choice of different source of energy for cooking.

Multinomial Logit Regression

Fuel Type=f(INCOME, No. Of Adults, No. Of Married Females, Highest Education of Adult Female, Highest Education of Adult Male, URBAN

Where, Fuel type=1 if Firewood, 2 if Kerosene, 3 if dung cake, 4 if LPG, 5if crop residue URBAN is a dummy variable and URBAN=1 if Urban household, 0 otherwise.

We incorporated urban dummy in our multinomial logit model because there is huge difference in use of energy sources for cooking in urban and rural areas in India. It can be seen in the following table.

**TABLE 2: PERCENTAGE OF HOUSEHOLDS USING DIFFERENT SOURCE OF ENERGY FOR COOKING**

Type of source of energy for Cooking	IHDS-I	
	Rural	Urban
Firewood	59.89	24.02
Dung	36.53	11.54
Kerosene	15.39	15.76
LPG	18.79	52.29
Crop Residue	11.31	1.50

The advantage of multinomial logit is that it fixes base or benchmark category and it tells us about the change in the ratio of the probability of choosing one outcome category over the probability of choosing the baseline category.

We also used the logit model to find the marginal effects of household and individual specific variable.

**3.3 Methodology to find out the impact of different energy sources for cooking on women working decision**

We use following linear regression models:

1. Total working Hours in a year<sub>i</sub> = β<sub>0</sub> + β<sub>1</sub>\*firewood<sub>i</sub> + β<sub>2</sub>\*INCOME<sub>i</sub> + β<sub>3</sub>\*No. Of Teen<sub>i</sub> + β<sub>4</sub>\*No. Of CHILDREN<sub>i</sub> + β<sub>5</sub>\*Highest Education of Adult Male<sub>i</sub> + β<sub>6</sub>\*Highest Education of Adult Female<sub>i</sub> + μ<sub>i</sub>

2. Total working Hours in a year<sub>i</sub> = β<sub>0</sub> + β<sub>1</sub>\*firewood<sub>i</sub> + β<sub>2</sub>\*INCOME<sub>i</sub> + β<sub>3</sub>\*No. Of Teens<sub>i</sub> + β<sub>4</sub>\*No. Of CHILDREN<sub>i</sub> + β<sub>5</sub>\*Highest Education of Adult Male<sub>i</sub> + β<sub>6</sub>\*Highest Education of Adult Female<sub>i</sub> + μ<sub>i</sub>

Where, i= i<sup>th</sup> female, t= t<sup>th</sup> household

**4. OBJECTIVES OF THE STUDY**

The study of this paper are focusing on following objectives:

1. To examine the factors that determine the choice of different energy sources for cooking in India.
2. To know the effect of using LPG on number of working hours of women in India.

**5. RESULTS**

**5.1 Multinomial logit regression**

Fuel Type = f(INCOME, No. of Adults, No. of Married Females, Highest Education of Adult Female, Highest Education of Adult Male, URBAN

Where, Fuel type=1 if Firewood, 2 if Kerosene, 3 if dung cake, 4 if LPG, 5 if crop residue We get,

**TABLE 3**

Multinomial logistic regression	Number of obs	=	164971
LR chi2(24)		=	88839.13
	Prob >	chi2	= 0.0000
Log likelihood	=	-197103.48	Pseudo R2 = 0.1839

TABLE 4

fueltype	Coef.	Std. Err.	z	P> z	[95% Conf.	Interval]
1	(base outcome)					
2						
INCOME	4.35e-06	3.26e-07	13.33	0.000	3.71e-06	4.98e-06
NADULTS	.0208687	.0113131	1.84	0.065	-.0013046	.0430421
NMARRIEDF	-.1934065	.0219894	-8.80	0.000	-.2365048	-.1503081
HHED5F	.0285907	.0028	10.21	0.000	.0231029	.0340786
HHED5M	.0165541	.0026292	6.30	0.000	.011401	.0217071
URBAN	1.144921	.0239876	47.73	0.000	1.097906	1.191936
_cons	-1.34618	.0260889	-51.60	0.000	-1.397313	-1.295047
3						
INCOME	2.52e-06	2.53e-07	9.99	0.000	2.03e-06	3.02e-06
NADULTS	-.0968049	.0084069	-11.51	0.000	-.1132823	-.0803276
NMARRIEDF	.4887981	.01539	31.76	0.000	.4586342	.5189619
HHED5F	-.0869222	.0022622	-38.42	0.000	-.0913561	-.0824884
HHED5M	.0264833	.0019105	13.86	0.000	.0227389	.0302278
URBAN	-.094305	.021061	-4.48	0.000	-.1355837	-.0530263
_cons	-.0831463	.0177397	-4.69	0.000	-.1179156	-.0483771
4						
INCOME	.0000132	2.35e-07	56.28	0.000	.0000127	.0000137
NADULTS	-.1938556	.0086607	-22.38	0.000	-.2108303	-.1768809
NMARRIEDF	.0275664	.0165752	1.66	0.096	-.0049205	.0600533
HHED5F	.1289203	.0020975	61.46	0.000	.1248093	.1330313
HHED5M	.120841	.0020677	58.44	0.000	.1167885	.1248936
URBAN	1.593179	.019114	83.35	0.000	1.555716	1.630641
_cons	-1.583027	.0213693	-74.08	0.000	-1.62491	-1.541144
5						
INCOME	7.25e-06	2.67e-07	27.20	0.000	6.73e-06	7.78e-06
NADULTS	-.0433887	.0101297	-4.28	0.000	-.0632426	-.0235348
NMARRIEDF	.3397962	.0185766	18.29	0.000	.3033866	.3762057
HHED5F	-.0410508	.002725	-15.06	0.000	-.0463917	-.0357099
HHED5M	.0293402	.0024023	12.21	0.000	.0246317	.0340486
URBAN	-1.129274	.0351761	-32.10	0.000	-1.198218	-1.060331
_cons	-1.127471	.021775	-51.78	0.000	-1.17015	-1.084793

Firewood is the benchmark category. The likelihood ratio chi-square of 88839.13 with a p-value < 0.0001 tells us that our model as a whole fits significantly. From the above result we can clearly see that if income increases by 1000 rupees then the odds of LPG increases relative to firewood by 0.0132 significantly. This result is obvious as income increase people tend to shift toward efficient source of energy. If number of Adult increases by 1 then the odds of LPG decreases relative to firewood by .193 significantly. The possible explanation for this is that if number of adult increase in a household then there is need of more fuel and this increases the odds of firewood relative to LPG. With the increase in the number of married women in a household increases the odds of LPG relative to firewood by 0.027. The intuition behind this is that with the increase in number of married women in a household there is a possibility of increasing number of kitchen and with the increase in the number of kitchen connections of LPG also increases. Increase in the highest level of education by adult male and female both in a household increase the odds to LPG relative to firewood. This result is quite obvious as level of education increases individual tend to shift towards efficient source of energy. The odds of LPG are higher relative to firewood of those who live in urban areas.

5.2 Logistic regressions

5.2.1 Determinants of use of firewood for cooking

TABLE 5

Logistic regression	Number of obs	=	215722
	LR chi2(7)	=	35852.43
	Prob > chi2	=	0.0000
Log likelihood = -131401.39	Pseudo R2	=	0.1200

TABLE 6

firewood	Coef.	Std. Err.	z	P> z	[95% Conf.	Interval]
INCOME	-2.82e-06	8.80e-08	-32.09	0.000	-3.00e-06	-2.65e-06
NADULTS	.0555396	.0049442	11.23	0.000	.0458492	.0652301
HHED5M	-.036727	.0011751	-31.26	0.000	-.0390301	-.0344239
HHED5F	-.0585164	.0012084	-48.42	0.000	-.0608848	-.0561479
URBAN	-1.203072	.0114357	-105.20	0.000	-1.225485	-1.180658
NMARRIEDF	.143035	.0092543	15.46	0.000	.1248969	.1611732
buffallo_cow	.0036461	.0023373	1.56	0.119	-.0009348	.008227
_cons	.5817858	.0111903	51.99	0.000	.5598533	.6037183

The above logit model result tells us about the direction but it cannot tell about the coefficient. To find out the coefficient we need to find out the marginal effects. Income significantly reduces the probability of using firewood. This result is obvious as with an increase in the income, people tend to shift toward efficient source of energy. Increase in the number of Adults in a household increase the probability of using firewood. The possible explanation for this is that if number of adult increase in a household then there is need of more fuel and as a result use of firewood increases. Increase in the highest level of education by adult male and female both in a household decrease the probability of using firewood for cooking. This is because as education level increases people tend to shift towards cleaner and efficient source of energy. Probability of using firewood is lesser in urban areas as compare to rural areas.

Conditional marginal effects      Number of obs      =      215722  
 Model VCE      :      OIM  
 Expression:      Pr(firewood),      predict()  
 dy/dx w.r.t. : INCOME NADULTS HHED5M HHED5F URBAN NMARRIEDF buffallo\_cow at:  
 INCOME      =      59663.68 (mean)  
 NADULTS      =      3.271623 (mean)  
 HHED5M      =      7.168768 (mean)  
 HHED5F      =      4.720645 (mean)  
 URBAN      =      .3354595 (mean)  
 NMARRIEDF      =      1.454974 (mean)  
 buffallo\_cow      =      -.0196364 (mean)

TABLE 7

	dy/dx	Delta-method Std. Err.	z	P> z	[95% Conf. Interval]
INCOME	-7.02e-07	2.19e-08	-32.12	0.000	-7.45e-07 -6.60e-07
NADULTS	.0138171	.0012299	11.23	0.000	.0114065 .0162277
HHED5M	-.0091369	.0002924	-31.25	0.000	-.0097099 -.0085639
HHED5F	-.0145576	.0003005	-48.45	0.000	-.0151466 -.0139687
URBAN	-.2992986	.0028376	-105.48	0.000	-.3048602 -.293737
NMARRIEDF	.0355841	.0023023	15.46	0.000	.0310716 .0400965
buffallo_cow	.0009071	.0005815	1.56	0.119	-.0002326 .0020467

The above table shows the marginal effects of the variables. Increase in 1 member of adult in a household increase the probability of firewood use for cooking by.014. Increase in the highest level of education by adult male reduces the probability of using firewood by.009. Similarly, Increase in the highest level of education by adult female reduces the probability of using firewood by 0.0145. Leaving in the urban area reduces the likelihood of use of firewood for cooking by.30. Increase in number of married female in a household increases the probability of firewood use for cooking by .035. Number of cows and buffalos has no significant impact on use of firewood collection.

5.2.2 Determinants of use of LPG for cooking

Logistic regression

Number of obs      =      215722  
 LR chi2(7)      =      59908.88  
 Prob > chi2      =      0.0000  
 Log likelihood      =      -101887.94  
 Pseudo R2      =      0.2272

TABLE 8

lpg	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
INCOME	4.59e-06	9.41e-08	48.82	0.000	4.41e-06 4.78e-06
NADULTS	-.0661461	.0055589	-11.90	0.000	-.0770414 -.0552509
HHED5M	.0913566	.0014195	64.36	0.000	.0885744 .0941387
HHED5F	.1110085	.0013219	83.98	0.000	.1084176 .1135993
URBAN	.9574549	.0123873	77.29	0.000	.9331763 .9817335
NMARRIEDF	-.0703017	.010772	-6.53	0.000	-.0914145 -.0491889
buffallo_cow	-.0404674	.0030173	-13.41	0.000	-.0463813 -.0345536
_cons	-2.534011	.0150343	-168.55	0.000	-2.563477 -2.504544

Income significantly increases the probability of using LPG. This result is obvious as with an increase in the income, people tend to shift toward efficient source of energy. Increase in the number of Adults in a household decreases the probability of using LPG. The possible explanation for this is that if number of adult increase in a household then there is need of more fuel and as a result use of firewood increases. Increase in the highest level of education by adult male and female both in a household increase the probability of using LPG for cooking. This is because as education level increases people tend to shift towards cleaner and efficient source of energy. Probability of using LPG in urban areas is higher than rural areas. Increase in the number of married females in a household decreases the probability of using LPG. Increase in the number of cows and buffalos reduce the probability of LPG as people use dung cake.

Conditional marginal effects

Number of obs      =      215722  
 Model VCE: OIM  
 Expression : Pr(lpg), predict()  
 dy/dx w.r.t. : INCOME NADULTS HHED5M HHED5F URBAN NMARRIEDF buffallo\_cow at:  
 INCOME      =      59663.68 (mean)  
 NADULTS      =      3.271623 (mean)  
 HHED5M      =      7.168768 (mean)  
 HHED5F      =      4.720645 (mean)  
 URBAN      =      .3354595 (mean)  
 NMARRIEDF      =      1.454974 (mean)  
 buffallo\_cow      =      -.0196364 (mean)

TABLE 9

	dy/dx	Delta-method Std. Err.	z	P> z	[95% Conf. Interval]
INCOME	8.70e-07	1.81e-08	47.94	0.000	8.34e-07 9.06e-07
NADULTS	-.0125313	.0010537	-11.89	0.000	-.0145964 -.0104661
HHED5M	.0173073	.0002642	65.51	0.000	.0167895 .0178251
HHED5F	.0210303	.0002506	83.91	0.000	.0205391 .0215216
URBAN	.1813879	.0023347	77.69	0.000	.1768119 .1859638
NMARRIEDF	-.0133185	.0020408	-6.53	0.000	-.0173185 -.0093186
buffallo_cow	-.0076665	.000572	-13.40	0.000	-.0087876 -.0065453

Increase in the number of Adults in a household significantly decreases the probability of using LPG by 0.012. Increase in the highest level of education by adult male and female both in a household increase the probability of using LPG for cooking by.017 and.021 respectively. Probability of using LPG in urban areas is higher

than rural areas by .18. Increase in the number of married females in a household decreases the probability of using LPG by 0.013. Increase in the number of cows and buffalos reduce the probability of LPG by 0.077.

**5.3.1 Impact of firewood for cooking on total working hours of females**

Total working Hours in a year<sub>t</sub> = β<sub>0</sub> + β<sub>1</sub>\*firewood<sub>t</sub> + β<sub>2</sub>\*INCOME<sub>t</sub> + β<sub>3</sub>\*No. of Teen<sub>t</sub> + β<sub>4</sub>\*No. of CHILDREN<sub>t</sub> + β<sub>5</sub>\*Highest Education of Adult Male<sub>t</sub> + β<sub>6</sub>\*Highest Education of Adult Female<sub>t</sub> + μ<sub>t</sub>. reg WS8ANNUAL firewood NCHILDREN NTEENS INCOME HHED5F HHED5M if RO3==2 & RO5>22

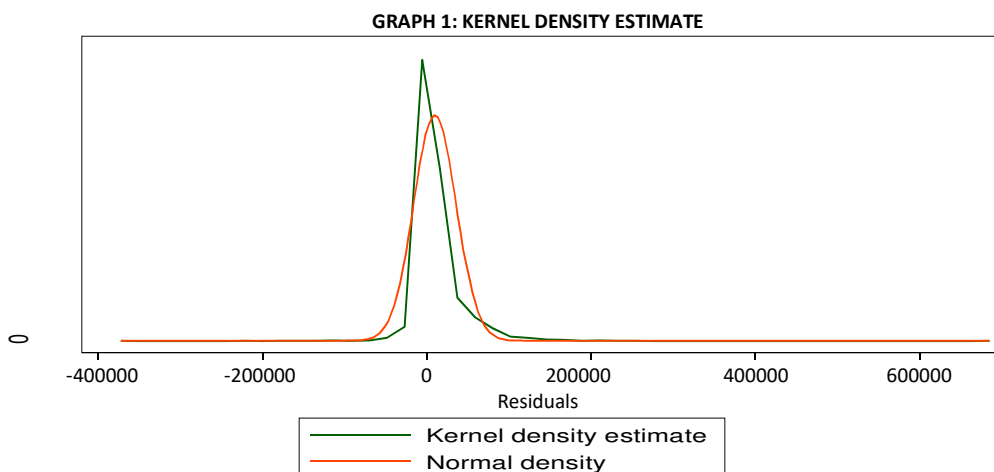
TABLE 10

Source	SS	df	MS	
Model	4.5984e+12	6	7.6640e+11	Number of obs = 11060
Residual	2.8278e+12	11053	255837045	F( 6, 11053) = 2995.67
Total	7.4262e+12	11059	671506888	Prob > F = 0.0000
				R-squared = 0.6192
				Adj R-squared = 0.6190
				Root MSE = 15995

TABLE 11

WS8ANNUAL	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
firewood	-2469.04	318.6922	-7.75	0.000	-3093.733 -1844.346
NCHILDREN	-1229.515	96.87754	-12.69	0.000	-1419.412 -1039.618
NTEENS	-1301.514	163.5421	-7.96	0.000	-1622.085 -980.9421
INCOME	.2548607	.0028248	90.22	0.000	.2493235 .2603979
HHED5F	1123.846	42.61488	26.37	0.000	1040.314 1207.379
HHED5M	-262.289	37.0662	-7.08	0.000	-334.9454 -189.6327
_cons	4189.909	361.356	11.59	0.000	3481.586 4898.231

To find out the determinant of annual working hours for female, we regress the above model and found the result above. Before interpreting the coefficient, we checked for the normality of error term and found that error term is normally distributed. Following is the graph for the normality of error term.



kernel = epanechnikov, bandwidth = 1.1e+03

After checking normality of error term, we checked for multicollinearity and heteroscedasticity. We found no multicollinearity among explanatory variables. But we found that there is problem of heteroscedasticity. It can be seen below the result of test for heteroscedasticity.

.estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity Ho: Constant variance

Variables: fitted values of WS8ANNUAL

chi2(1) = 51996.48

Prob > chi2 = 0.0000

We used weighted least square model to take care for heteroscedasticity. We have found the following results.

TABLE 12

Variance-weighted least-squares regression	Number of obs	= 1577
Goodness-of-fit chi2(728) = 65140.08	Model chi2(6)	= 38365.50
Prob > chi2 = 0.0000	Prob > chi2	= 0.0000

TABLE 13

WS8ANNUAL	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
firewood	-1547.009	12.8651	-120.25	0.000	-1572.224 -1521.794
INCOME	.0519129	.0004663	111.34	0.000	.0509991 .0528268
HHED5M	-23.57471	1.464981	-16.09	0.000	-26.44602 -20.7034
HHED5F	-106.3632	1.945895	-54.66	0.000	-110.177 -102.5493
NCHILDREN	-234.6288	4.267288	-54.98	0.000	-242.9926 -226.2651
NTEEN	-591.5767	12.17926	-48.57	0.000	-615.4476 -567.7058
_cons	3760.278	17.05956	220.42	0.000	3726.842 3793.714

Firewood collection or use in a household reduces 1547 annual hours of a female (Those females whose age is greater than 22). Increase in the annual income of the household by rupees 1000 lead to increase 52 hours in a year. Highest education of adult male and female reduces annual working hours of female in that household. The explanation for this is that if the same female has highest education then she will have high wage rate and income effect dominates substitution effect in that case. If male member has highest income, then there is strong chance of getting good job and he can earn enough so that female of his household reduces the working hours. Increase in the number of children and teen reduces the total number of working hours annually for a female.

**5.3.2 Impact of LPG and firewood as source of energy for cooking on total working hours of females**

Total working Hours in a year<sub>i</sub> = β<sub>0</sub> + β<sub>1</sub>\*LPG<sub>i</sub> + β<sub>2</sub>\*firewood + β<sub>3</sub>\*INCOME<sub>i</sub> + β<sub>4</sub>\*No. of Teen<sub>i</sub> + β<sub>5</sub>\*No. of CHILDREN<sub>i</sub> + β<sub>6</sub>\*Highest Education of Adult Male<sub>i</sub> + β<sub>7</sub>\*Highest Education of Adult Female<sub>i</sub> + μ<sub>i</sub>

. v\wls WS8ANNUAL lpg firewood INCOME NCHILDREN NTEEN HHED5M HHED5F if RO3==2 & RO5>22

**TABLE 14**

Variance-weighted least-squares regression	Number of obs	= 1540
Goodness-of-fit chi2(712) = 62880.21	Model chi2(7)	= 38847.20
Prob > chi2 = 0.0000	Prob > chi2	= 0.0000

**TABLE 15**

WS8ANNUAL	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
lpg	2137.659	67.07786	31.87	0.000	2006.189 2269.129
firewood	-1532.387	12.88577	-118.92	0.000	-1557.642 -1507.131
INCOME	.0506391	.0004671	108.41	0.000	.0497236 .0515546
NCHILDREN	-237.4587	4.272092	-55.58	0.000	-245.8318 -229.0855
NTEEN	-575.9226	12.20956	-47.17	0.000	-599.8529 -551.9923
HHED5M	-20.80988	1.468312	-14.17	0.000	-23.68772 -17.93204
HHED5F	-112.3693	1.957346	-57.41	0.000	-116.2056 -108.533
_cons	3759.864	17.09295	219.97	0.000	3726.363 3793.366

After correcting for heteroscedasticity, we found that females belonging to households who use LPG for cooking purpose have higher annual working hours than those females whose households do not use LPG for cooking purpose. Females belonging to households who use firewood for cooking purpose have lower annual working hours than those females whose households do not use firewood for cooking purpose. With the increase in Income of household, working hours annually also increases for female. Increase in the number of children and teen reduces the total number of working hours annually for a female. Highest education of adult male and female reduces annual working hours of female.

**6. CONCLUSION**

Till 2011, the main source of energy for cooking in India was primarily traditional especially in rural India. Pradhanmantri Ujjwala Yojna has been started since 2016 to provide subsidized LPG. The impact of Ujjwala yojna is yet to see. We found that use of LPG increases with the increase in income of the household, increases with the educational level of households and decreases with the total number of livestock. Use of LPG should be encouraged because it has dual positive effects i.e. reduces indoor pollution and saves time by not collecting firewood. We also found that with the increase in the use of LPG, working time hours in a year also increases for female who are more than 22 years.

**7. POLICY IMPLICATIONS**

In last 10-15 years' women LFPR has been reduced. This is because of many factors like increased rural wage for males, increased enrolment of girls in higher education. India brought time use survey in 1999-2000 for only one time. There should be survey of time use in India so that we can take a closer look at the change in the daily activities among women due to change in the energy sources for consumption.

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