The George Washington University

IBI - The Institute of Brazilian Business and Management Issues

THE CHANGES IN THE SOCIAL TARIFF OF ELECTRICITY IN BRAZIL

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1. Introduction

Access to electricity is an essential requisite for rising quality of life and social welfare. This is the main argument for favoring social policies when there is insufficient access to this service. In Brazil, the current government program with this purpose is the social tariff for low-income people, which gives discounts on energy prices in accordance with the level of consumption.

This subside exists since 2002 and, in order to improve this program, in January 2010, the Brazilian government passed a law imposing several changes in the social tariff model which will be implemented within a maximum term of 24 months. Basically, the law changed criteria of income, level of consumption and the size of the discounts. These changes will modify significantly the number of families benefited, their consumption and the costs of the program.

Thus, the objective of this study is to analyze how these changes will affect the benefited families and all other energy consumers. First, we want to estimate how many families will be benefited of the new target criteria and how many will no longer receive the benefit.

After that, we will estimate the consumption level of the low income families applying the old and the new table of discounts. This comparison is important to measure the changes in welfare of the consumers. Finally, we will concentrate on the costs of the program before and after the new law.

2. THE LOW INCOME SOCIAL TARIFF FOR ELETRICITY IN BRAZIL FROM 2002 TO 2009 – LAW 10.438/2002

2.1.The 2002-2009 model

The Brazilian current benefit system to the electric energy consumer with low level income is called Low Income Social Tariff and was created in April 2002, by the law 10.438. This law established the requirements of eligibility, the discount table and the source of funds to finance the program.

In according to that legislation, all single-phase[1] consumer units with monthly consumption between zero and 80 kWh (mean of the last twelve months) are automatically considered low income and are able to receive the benefit. No prove of poor condition is required.

The program is based on the idea that electric energy consumption is a proportion of the level of consumer income. If we consider this assumption as a true, the idea of including automatically every household with mean electric energy consumption until 80 kWh per month in the program is quite appropriated.

The units in which consumption level overcomes 80 kWh must follow some rules:

- The consumer unit must have a monthly consumption between 80 and 220 kWh, (mean of the last twelve months).
- Responsible by consumer unit must be enrolled in the Unified Registry to Assistance Programs of the Federal Government (CADUNICO[2]) created by Decree 3.877 of July 24, 2001 and managed by the Ministry of Social Development and Combat Hunger - MDS. Additionally, the mean income per capita of the household members must be less than R$ 120.00 per month.
- A person of the family must go at the concessionaire with the documents mentioned above in order to be enrolled by it, and then, receive the benefit.

Once enrolled, the consumer unit will receive discounts on the electricity tariff according to their consumption level. More discounts are given to less levels of consumption.

Table 1

Table of discounts – Law 14.438/2002

Total consumption Level (kWh)	Discount (%)
0-30	65
31-100	40
100-220	10

An important aspect must be noticed: the discounts aren't in cascade, which means that they aren't cumulative. A family that has a consumption of 200 kWh in a month will receive a discount of 10% in its tariff value.

The law 10.438 also created a national fund, the Energy Development Account - CDE, which has two goals: to stimulate the use of innovative sources of energy and to finance universal access to electricity, what includes the low income tariff program.

Each year, the Ministry of Mines and Energy predict the total costs of the programs financed by the CDE for the next year. This cost will be shared by all consumers of electricity in the country and charged through their electric bills.

The source of the next graph is the 'The hornbook of electricity taxes' by ABRACE[3]. It shows the application of the sources of CDE since 2004. As it is shown, the costs of the social tariff program use almost 50% of all CDE revenues.

Graph 1

Historical Application of CDE
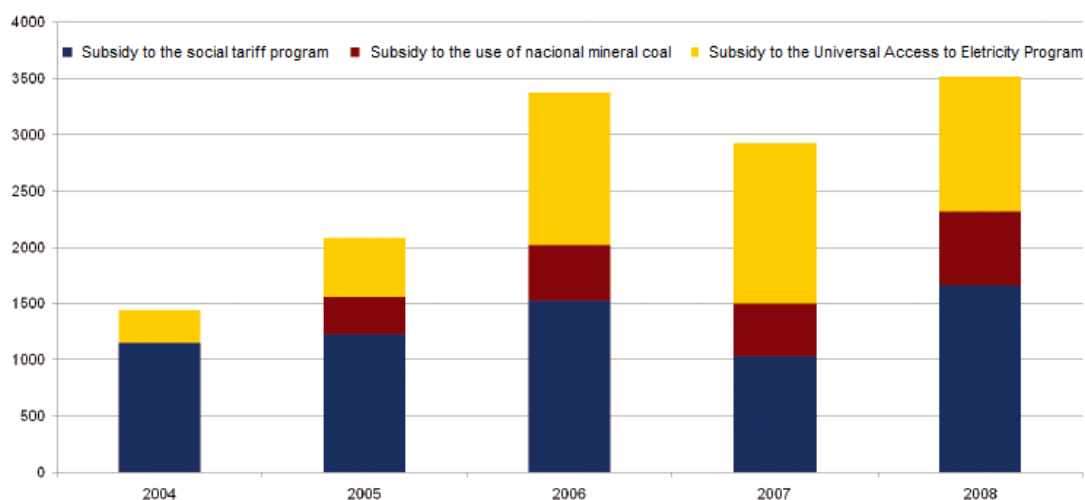
2.2. Current numbers of the program

According to ANEEL[4], in May 2009, about 19 million units are receiving the benefits of the social tariff of electricity. The table bellow summarizes the current numbers of the program:

Table 2

Social tariff beneficiary numbers - Brazilian Regions and Total - 05/2009

Region	Total Residential Consumers (a)		Social Tariff Consumers (b)		b / a	Automatic Benefit - Consumption level under 80 kWh		Enrolled Consumers - Consumption level between 80 kWh and 220 kWh	
	Number	%	Number	%	%	Number	%	Number	%
Brazil	54.051.725	100%	19.311.444	100%	35,73%	14.251.236	100%	5.060.208	100%
North Region	2.873.132	5%	1.220.443	6%	42,48%	911.802	6%	308.641	6%
Northeast Region	13.818.376	26%	8.965.645	46%	64,88%	6.426.316	45%	2.539.329	50%
Southeast Region	25.823.098	48%	6.264.974	32%	24,26%	4.847.775	34%	1.417.199	28%
South Region	7.766.338	14%	1.809.459	9%	23,30%	1.267.066	9%	542.393	11%
Middle West Region	3.770.781	7%	1.050.923	5%	27,87%	798.277	6%	252.646	5%

Source: ANEEL

Around 35.7% of all Brazilian residential units receive the benefit. As we can see, 73.4% of the units that receives the benefit were elected automatically and only 26.2% were previously enrolled units.

Still analyzing ANEEL numbers, the costs of the program in 2008 summed R$1,534,999,076.15. Sharing this number by 19.3 million consumers, the cost will be R$ 79.49 per year, or R$ 6.62 per month in average.

It is important to remember that this cost is paid by all the consumers of electricity by the CDE account.

2.3. The problems of this model

In 2004, the Brazilian Court of Audit – TCU[5] - promoted a research that tried to respond if the legal parameters to include the low income consumers were correct. This research used econometric methods in order to respond if exists a positive correlation among electric energy consumption and income per capita by household. Its final report concluded: "The results found based on a sample with 2000 households shows the

inexistence of correlation statistically significant between income level per capita and household consumption of electric energy." The correlation between these variables is 0.015. Despite of some limitations of the sample used, described in detail in the audit report, is clear that there are other variables that explain better the household consumption of energy, as household dimension (number of rooms, living rooms etc.), than income per capita.

The most important TCU criticize was about the automatic enrolling of the consumer units up to 80 kWh as low income consumers. The graphic present in the TCU report, permits to visualize the correct conditions of the legal parameters to include in the low income program.

Graph 1
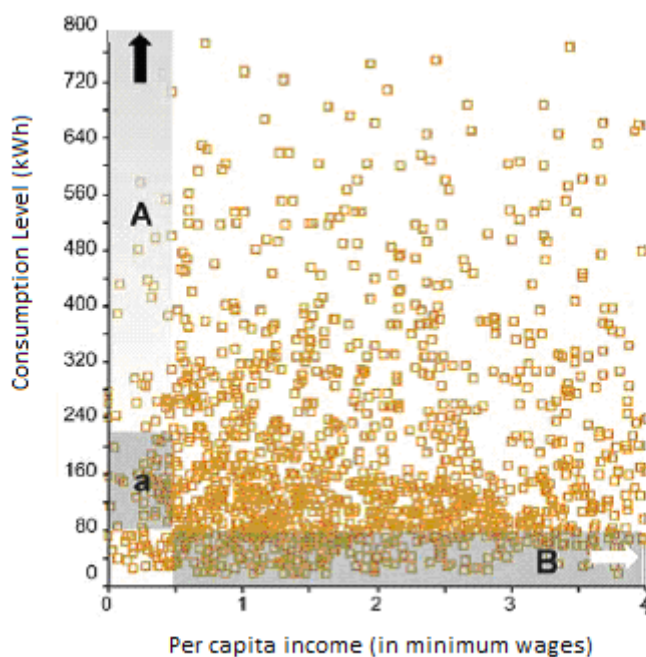
Source: TCU

In the graphic, the vertical area that includes the regions "A" and "a" is that one that the law wishes to select, in other words, households with income per capita less than a half minimum wage. In the other hand, only households located in this area, but bellow of the region "a" get whole discounts in the tariffs. The households located in the region "a" get progressive low discounts and the one of the region "A" don't get discounts.

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The households located in the region B will get benefits, in spite of to have income per capita higher than half minimum wage. The conclusion is that a big number of households with monthly income per capita above ½ minimum wage – the parameter defined by the social tariff law – are receiving the benefit.

Other problem of the program: the inclusion of a national parameter of income per capita. In a country with regional differences like Brazil, it may not be adequate to use a single income parameter to define low income families.

Besides, there are differences in cost of living that changes the relative prices of energy at each region. This could to penalty the poor consumers of regions like South and Southeast, where the cost of living is higher, even though they have a higher income level.

Table 3

Monthly income *per capita* - 2008
Households by Regions

	> 1/4 of the Minimum Wage	Between 1/4 and 1/2 Minimum Wage	Between 1/2 and 1 Minimum Wage	Between 1 e 2 Minimum Wage	2 Minimum Wages or more	No income
North Region	10,2%	22,0%	27,2%	23,6%	13,3%	1,5%
Northeast Region	16,6%	24,9%	24,4%	20,6%	10,3%	1,4%
Southeast Region	3,0%	10,3%	21,6%	32,4%	27,2%	1,2%
South Region	2,8%	9,7%	20,6%	35,5%	28,4%	1,0%
Middle West Region	4,0%	13,5%	25,0%	29,6%	24,1%	1,6%

Source: IBGE

Another problem of the actual program is that it does not consider the difference in tariffs among concessionaries. For example, the tariff ratified by ANEEL to CEMAR (distributor of energy of Maranhao, a poor state in Northeast region) is 56.4% more expensive than the tariff verified by the same ANEEL to CEB (distributor of energy of Brasilia, the federal capital). That means that poor people of Maranhao will not receive the benefits in the same manner of the Brasilia people will.

Even though the differences of tariff are plenty justified by ANEEL, if we maintain a single criterion of income to define who poor people are, it appears contradictory that each consumer pays different tariffs in according of the region where it lives.

The next table shows the different tariffs among the Brazilian regions:

Table 4

Concessionaire	Region	Residential Tariff (R$ / MWh)
UHENPAL	S	0,41397
CEMAR	NE	0,41113
EMG	SE	0,40280
AMPLA	SE	0,39397
CELTINS	N	0,38669
COELCE	NE	0,37962
CEMIG-D	SE	0,37652
EFLJC	S	0,37328
ELETROCAR	S	0,36860
ENERSUL	ME	0,36768
RGE	S	0,36642
CEPISA	NE	0,36449
SULGIPE	NE	0,36387
DEMEI	S	0,36339
CEMAT	ME	0,36332
HIDROPAN	S	0,35460
FORCEL	S	0,35073
ELETROACRE	N	0,34952
EEB	ME	0,34309
MUX-Energia	S	0,33608
ELEKTRO	SE	0,33580
IENERGIA	S	0,33570
EPB	NE	0,33561
CPFL-Paulista	SE	0,33220
COOPERALIANÇA	S	0,33154
CELPA	N	0,33059
ESCELSA	SE	0,32897
ENF	SE	0,32833
COELBA	NE	0,32656
CELPE	NE	0,32307
COCEL	S	0,32057
CERON	N	0,31806
EDEVP	SE	0,31473
CEAL	NE	0,31390
LIGHT	SE	0,31143
AmE	N	0,31024
CERR	N	0,30839
CEEE-D	S	0,30410
DMEPC	SE	0,30400
EFLUL	S	0,30380
ESE	NE	0,30199
BANDEIRANTE	SE	0,30146
AES-SUL	S	0,30011
COSERN	N	0,29877
CELESC-DIS	S	0,29772
CPFL- Piratininga	SE	0,29549
ELETROPAULO	SE	0,29349
CFLO	S	0,28972
COPEL-DIS	S	0,28943
CNEE	SE	0,27937
JARI	N	0,27919
CAIUÁ-D	SE	0,26615
Boa Vista	N	0,26356
CEB-DIS	ME	0,26282
CEA	N	0,19729

Source: ANEEL

3.   THE NEW LOW INCOME SOCIAL TARIFF – LAW 12.212/2010

In order to correct some of the problems described in the last chapter, in January 2010, it was approved the Law 12.212/2010 which imposes changes in the current electricity social tariff model. These new rules will be implemented within a maximum term of 24 months from the publication of the law. In this section we will analyze each one of the changes and how they will affect the electricity consumers. Besides, we want to quantify the new costs of the program.

3.1. The extinction of the automatic entitlement

The main novelty is the extinction of the automatic discounts to consumers that spend up to 80 kWh / month. As shown in the previous chapter, the level of electricity consumption does not necessarily reflect the condition of poverty. People who received the benefit in accordance with this criterion will not receive the discounts anymore. From the new law, the sole criterion for granting the benefit is the socio-economic status.

This change will diminish the number of people benefited. It will generate two immediate effects: it will drop the costs of the program and penalty those people that will not receive the benefit anymore. Let's calculate the size of this effects beginning by the amount of money that will be saved.

As saw in the last section, 19.3 millions of households received the benefit in May 2009. 14.3 millions received the benefit automatically and only 5 million were enrolled. Under the new law, households in the first situation will lose the benefit if they do not prove their poor condition. We must admit that some of the people that are automatically entitled actually attend the income criteria of the social tariff rules; they just have to be enrolled by the concessionaries to continue to receive the benefit.

A good proxy of the number of households in this situation can be the difference between the number of people who receive the benefit of the Bolsa Familia Program[6] and the number of people who are benefited by the social tariff program. According to Ministry of Social Development and Combat Hunger – MDS, in 2008 11 million families were enrolled in the Bolsa Familia Program. As saw in the Table 2, 19.3

million people receive the benefit of the social tariff. If we assume that all the households that receive the Bolsa Familia also receive the benefit of Social Tariff we have 8 million families receiving the benefit but not attending the income criteria.

Those who don't comply with the criteria will not receive the benefit anymore. Thus, a huge amount of money will be saved and can be used to finance other changes. To calculate this value, we should know how much of the expenses of the program are due to the automatically benefited and how much is due to enrolled households. Unfortunately, ANEEL does not disclose this number so, the best we can do, is calculate proportionally.

Thus, if the total expenses of the program in 2008 were R$1.5 billion, and the number of people that receive the benefit will decrease in 42% because of this change in criteria, we can assume that the total expenses would decrease in the same proportion: 42%. Doing the math, the expenses would fall to R$ 870 million a year or R$ 72.5 million per month.

Another consequence of this change: the households that will be excluded of the program or will pay more for the same amount of electricity or they will consume less. We know that these consumers belong to an upper level of income (more than R$120.00 per capita) even so, their monthly consumption level is very low (less than 80 kWh per month).

In the specific case of these consumers we can assume that they will not change their consumption level (or change it very little) as a consequence of the change in prices. It is because their consumption is not limited by their income level, they simply do not need much energy in their houses (for example, the family can be small). That means that the price elasticity of electricity demand for this specific consumer is very low.

Actually, several studies have demonstrated that in general, the price elasticity of demand for electricity is very low. Andrade and Lobao (1997) [*] estimated the residential

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[*] For methodological details: Andrade, T. & Lobao, W. (1997). "Elasticidade-renda e preco da demanda residencial de energia eletrica no Brasil". Texto para discussao n. 489, IPEA-RJ

demand of electricity in Brazil from 1963 to 1995, annual data. They reached a conclusion that the price elasticity in short term was 0.06.

This means that in short term, if electricity price rise by 40%, which is the case, the consumption of electricity will fall only by 2,4%.

3.2.Inclusion of indigenous and maroon

Another novelty brought by the new law is related to indigenous and maroon people. These are segments of society in situations of extreme vulnerability and historically disadvantaged. Under the new rule, families of those groups, enrolled in the Unified Registry to Assistance Programs of the Federal Government (CADUNICO) will receive an exemption of 100% up to the limit consumption of 50 kWh per month.

In accordance with an estimate made by the Ministry of Social Development and Combat Hunger - MDS, there are about 92.195 families living in maroon communities in 2009. The ministry does not explain if all of these families are enrolled in the CADUNICO, but if we assume that all of them will be able to receive the benefit brought by the law 12.212, we can calculate the total cost of this program as shown at the next table.

Table 5

Estimated cost of the program

Region	Estimative of households by maroon community	Electricity Price (R$/kWh)	Cost of 50 kWh (R$)	Total Cost (R$)
North	5.615	0,3042	15,21	85.394,65
Northeast	66.872	0,2911	14,56	973.483,07
Middle West	4.379	0,2854	14,27	62.495,39
Southeast	9.449	0,3042	15,21	143.708,55
South	5.880	0,2798	13,99	82.249,55
Total	**92.195**	-	-	**1.347.331,21**

Regarding to the benefit to indigenous people, it is not clear if the benefit will be given to any household where a indigenous person live, or if the household must be in a indigenous community. In this study, we will assume that the benefit will be given to

households in rural areas which the person in charge of the family declared himself as indigenous since the data collected from IBGE[7] is published this way.

Another important assumption will be that every one of these households has access to electricity[†].

Table 6

Estimated cost of the program

Region	Indigenous Households (1)	Electricity Price (R\$/kWh)	Cost of 50 kWh (R\$)	Total Cost (R\$)
North	30.709	0,3042	15,21	467.031,95
Northeast	14.839	0,2911	14,56	216.017,40
Middle West	13.585	0,2854	14,27	193.879,86
Southeast	5.469	0,3042	15,21	83.177,27
South	7.866	0,2798	13,99	110.029,75
Total	**72.468**	-	-	**1.070.136,22**

(1) Households located in rural area where the person responsible declared itself indigenous, according to region, Brazil - 2000

3.3. Rise in the income roof and changes in the discount calculus

The Law 12.212 maintained the need of registry in the Unified Registry to Assistance Programs of the Federal Government (CADUNICO) and also the limit consumption of 220 kWh per month.

However, the new law raised the income limit from R\$ 120.00 (or ¼ of the minimum wage in 2010) to half a minimum wage (or R\$ 255.00) in 2010.

Assuming families with more than 4 people, the monthly income of these families will be more than R\$ 1,000. In according to IBGE, 3,528,909 households have a monthly income between R\$ 1,001 and R\$1,200.

[†] This is not a strong assumption since according to the IBGE, 94.8% of the Brazilian households have electricity access.

Table 7

Number of families at each income level

Income level (R$)	Middle West	Northeast	North	Southeast	South	Brazil
Up to R$400	567.950	3.999.064	702.405	1.979.146	700.786	7.949.351
R$400 to R$600	554.958	2.444.761	578.323	2.295.627	873.753	6.747.422
R$601 to R$1000	821.269	2.466.316	766.966	4.305.075	1.821.858	10.181.484
R$1001 to R$1200	247.398	656.923	213.898	1.799.612	611.078	3.528.909
TOTAL	2.191.575	9.567.064	2.261.592	10.379.460	4.007.475	28.407.166

Source: POF-IBGE

If we consider that all this families are already enrolled by the CADUNICO, they all are able to receive the discounts provided by the social tariff program. In order to calculate how much these people will be benefited and how much it will cost, we have to know the electricity consumption of each one of these families. As this is a more elaborated calculation, we will present it in the next section.

The law also changed the way the discounts are calculated. The table of discounts remains the same, but now, the discounts are cumulative.

Table 8

Table of discounts – Law 12.212/2010

Total consumption Level (kWh)	Discount (%)
0-30	65
31-100	40
100-220	10

This means that a family that has a consumption of 200 kWh in a month will receive a discount of 65% in 30 kWh, 40% in the next 70 kWh and than 10% off in the last 100 kWh.

In order to calculate how much the changes in the discount calculus will modify the consumption and how much it will cost we have to know the consumption level before and after the new rules.

These two modifications in the law will provide a big change in the consumption levels and expenses. In order to calculate the consequent changes in consumption and costs, we will have to take some assumptions which will be explained in the next section.

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4. CALCULUS OF THE CHANGES IN INCOME CRITERIA AND THE DISCOUNT LEVELS

4.1. Assumptions

Brazil is a huge country with considerable social and economic differences among its regions. This characteristic can have an effect on electricity consumption, so we decided to make simulations for each one of the regions: North, Northeast, Middle West, Southeast and South.

First step will be measure the low income families' consumption of electricity applying three different tariffs: the regular tariff (i.e. the tariff that all regular consumers pay), the social tariff under the rule of the previous law and the social tariff under the rule of the new law. The difference in the consumption will show how much the households will be benefited.

Differently than we did in section 3.1, here, we are making simulations for low income consumers, thus we can imagine that their consumption can be strongly affected by changes in prices. That means that the price elasticity of electricity demand for this specific consumer must be higher than we saw in section 3. Unfortunately, we do not have the elasticities for each one of the income levels, so, as an alternative, we will adopt in this study as a proxy of the consumers of electricity utility function, the Cobb-Douglas utility function. Other utility functions could be used but we decided to use the Cobb-Douglas because of its mathematical tractability and also for its empirical relevance.

The Cobb-Douglas preferences have the property that the fraction of income that a consumer spends on a good is always fixed. It is a strong hypothesis, but we will still use the Cobb-Douglas function because:

1. We do not have an estimate of electricity demand function, or price elasticity of demand, by class of income.
2. The data collected in the Familiar Budget Research, elaborated by IBGE do not provide enough information to estimate a demand function. Hence the necessity to assume a demand function, in this case, the utility function Cobb-Douglas.

Thus, the utility function of an individual i will be:

$$U_i = f(X_E, X_O) = X_E^c \cdot X_O^d \qquad \text{(Equation 1.0)}$$

Where:

X_E = Amount of electricity consumption

X_O = Amount of others goods consumption

Raising the value to the power $1 / (c + d)$ we get:

$$U_i = f(X_E, X_O) = X_E^{c/c+d} \cdot X_O^{d/c+d} \qquad \text{(Equation 1.1)}$$

If we define $\alpha = c / c + d$:

$$U_i = X_E^{\alpha} \cdot X_O^{1-\alpha} \qquad \text{(Equation 1.2)}$$

Where:

α = Share of spending on Electricity.

$1 - \alpha$ = Share of spending on other goods.

If the budget constraint is $m = p_E \, X_E + p_O \, X_O$, so the optimal choices of the individual will be:

$$X_E = \alpha \cdot \frac{m}{p_E} \qquad \text{(Equation 1.3)}$$

$$X_O = (1 - \alpha) \cdot \frac{m}{p_O} \qquad \text{(Equation 1.4)}$$

Where:

m = household income

p_E = electricity price

p_O = other goods price.

We will use equation 1.3 to make consumption simulations for different energy prices as presented before.

Then, with these results we can estimate the costs that the adoption of the new rules brought by the new social tariff law.

4.2.Data

The data referring to forecasting of monthly familiar expenditures with electric energy consumption belong to the Familiar Budget Research, elaborated by IBGE to the year of 2002. The next table resumes the information collected.

Table 9

Electricity Expenses by Monthly Income Level

Income level (R$)	Brazil	North	Northeast	Middle-West	Southeast	South
Up to R$400	13,71	12,94	7,90	19,65	20,94	22,43
R$400 to R$600	19,85	17,62	11,94	25,90	24,29	27,98
R$601 to R$1000	28,79	23,57	16,83	31,00	33,67	34,64
R$1001 to R$1200	35,81	30,68	20,98	39,99	39,63	40,63

Source: IBGE

With an income level of R$1,200.00 the family would not be able to receive the benefit of social tariff under the previous law which imposed a limit of R$ 120 per capita (unless the family has 10 people or more). But under the rules of the new law, the per capita limit will be ½ minimum wage, or R$ 255, thus, a family with five people or more, will be enable to benefit from social tariff.

The price of electricity for each Brazilian region was collected at ANEEL website. With this information and applying the discounts provided by the social tariff Law 11.438, we reached the following rates:

Table 10

Mean Electricity Rates by Brazilian Region

Region	Regular Tariff	Social Tariff - Law 11.438		
		Up to 30 kWh	30 to 100 kWh	Above 100 kWh
Middle West	0,2854	0,0999	0,1713	0,2569
Northeast	0,2911	0,1019	0,1747	0,2620
North	0,3042	0,1065	0,1825	0,2737
Southeast	0,3042	0,1065	0,1825	0,2738
South	0,2798	0,0979	0,1679	0,2518

Source: ANEEL

4.3. Consumption Simulations

Middle West Region

First, we calculated the consumption of electricity applying the regular tariff, applying the social tariff under the rules of the previous law and applying the social tariff under the rules of the new law. We will use the data presented in the last section. Bellow are the forecast did to Middle West region:

Table 11

Middle West - Variation in eletricity consumption

Income level (R$)	Regular Tariff (kWh)	Social Tariff 2002-2009 (kWh)	Social Tariff 2010 (kWh)	Variation	Variation
	a	b	c	(b/a)	(c/b)
Up to R$400	68,84	100,00	118,16	45%	18%
R$400 to R$600	90,74	100,82	142,49	11%	41%
R$601 to R$1000	108,61	120,67	162,34	11%	35%
R$1001 to R$1200 (1)	140,10	140,10	197,34	0%	41%

(1) The previous social tariff law did not provide benefits to households with this level of income.

The results show that the changes in the income roof and the way discounts are calculated increased the consumption of electricity of the low income families between 18% and 41% in relation with the previous rules. In total, the electricity consumption of these income levels in Middle West region increased 34.4% under the new rules of social tariff.

The costs of the program can be calculated simply calculating the difference between how much the benefited consumer would pay applying the regular tariff, and how much they actually pay applying the social tariff.

Table 12

Value of subsidy given to each customer under the new rules

Income level (R$)	Cost of energy - Regular Tariff (R$)	Social Tariff 2010 (R$)	Value of the subsidy (R$)
	a	b	(a-b)
Up to R$400	33,73	19,65	14,08
R$400 to R$600	40,67	25,90	14,77
R$601 to R$1000	46,34	31,00	15,34
R$1001 to R$1200	56,33	39,99	16,34

The total cost can be found multiplying these numbers by the number of households benefited in each income level. Assuming that all the families in these income levels will receive the benefit, the total cost o this program for Middle West region will be as follow:

Table 13

Total cost for Middle West region

Income level (R$)	Number of families per income level	Total cost of the program (R$)
Total	2.191.575	32.829.582
Up to R$400	567.950	7.994.659
R$400 to R$600	554.958	8.197.167
R$601 to R$1000	821.269	12.596.176
R$1001 to R$1200	247.398	4.041.579

Northeast Region

The same calculi were done for the Northeast region and the results are showed bellow:

Table 14

Northeast - Variation in eletricity consumption

Income level (R$)	Regular Tariff (kWh)	Social Tariff 2002-2009 (kWh)	Social Tariff 2010 (kWh)	Variation	Variation
	a	b	c	(b/a)	(c/b)
Up to R$400	27,13	45,22	71,82	67%	59%
R$400 to R$600	41,01	68,35	87,23	67%	28%
R$601 to R$1000	57,81	96,34	105,90	67%	10%
R$1001 to R$1200 (1)	72,06	72,06	121,73	0%	69%

(1) The previous social tariff law did not provide benefits to households with this level of income.

The results show that the changes in the income roof and the way discounts are calculated increased the consumption of electricity of the low income families between 10% and 59% in relation with the previous rules. In total, the electricity consumption of these income levels in Northeast region increased 24.8% under the new rules of social tariff.

The tables bellow show the costs of the program for the Northeast region.

Table 15

Value of subsidy given to each customer under the new rules

Income level (R$)	Cost of energy - Regular Tariff (R$)	Social Tariff 2010 (R$)	Value of the subsidy (R$)
	a	b	(a-b)
Up to R$400	20,91	7,90	13,01
R$400 to R$600	25,40	11,94	13,46
R$601 to R$1000	30,83	16,83	14,00
R$1001 to R$1200	35,44	20,98	14,46

Table 16

Total cost for Northeast region

Income level (R$)	Number of families	Total cost of the program (R$)
Total	9.567.064	128.956.765
Up to R$400	3.999.064	52.023.632
R$400 to R$600	2.444.761	32.901.205
R$601 to R$1000	2.466.316	34.531.320
R$1001 to R$1200	656.923	9.500.608

North Region

The same calculi were done for the North region and the results are showed bellow:

Table 17

North - Variation in eletricity consumption

Income level (R$)	Regular Tariff (kWh)	Social Tariff 2002-2009 (kWh)	Social Tariff 2010 (kWh)	Variation	Variation
	a	b	c	(b/a)	(c/b)
Up to R$400	42,54	70,90	88,94	67%	25%
R$400 to R$600	57,93	96,55	106,03	67%	10%
R$601 to R$1000	77,49	100,00	127,77	29%	28%
R$1001 to R$1200 (1)	100,87	100,87	153,74	0%	52%

(1) The previous social tariff law did not provide benefits to households with this level of income.

The results show that the changes in the income roof and the way discounts are calculated increased the consumption of electricity of the low income families between 10% and 52% in relation with the previous rules. In total, the electricity consumption of these income levels in North region increased 29.4% under the new rules of social tariff.

The tables bellow show the costs of the program for the North region.

Table 18

Value of subsidy given to each customer under the new rules

Income level (R$)	Cost of energy - Regular Tariff (R$)	Social Tariff 2010 (R$)	Value of the subsidy (R$)
	a	b	(a-b)
Up to R$400	20,91	7,90	13,01
R$400 to R$600	25,40	11,94	13,46
R$601 to R$1000	30,83	16,83	14,00
R$1001 to R$1200	35,44	20,98	14,46

Table 19

Total cost for North region

Income level (R$)	Number of families	Total cost of the program (R$)
Total	2.261.592	33.542.374
Up to R$400	702.405	9.911.896
R$400 to R$600	578.323	8.461.657
R$601 to R$1000	766.966	11.728.812
R$1001 to R$1200	213.898	3.440.010

Southeast Region

The same calculi were done for the Southeast region and the results are showed bellow:

Table 20

Southeast - Variation in eletricity consumption

Income level (R$)	Regular Tariff (kWh)	Social Tariff 2002-2009 (kWh)	Social Tariff 2010 (kWh)	Variation	Variation
	a	b	c	(b/a)	(c/b)
Up to R$400	68,84	100,00	118,16	45%	18%
R$400 to R$600	79,85	100,00	130,39	25%	30%
R$601 to R$1000	110,69	122,99	164,66	11%	34%
R$1001 to R$1200 (1)	130,29	130,29	186,43	0%	43%

(1) The previous social tariff law did not provide benefits to households with this level of income.

21

The results show that the changes in the income roof and the way discounts are calculated increased the consumption of electricity of the low income families between 18% and 43% in relation with the previous rules. In total, the electricity consumption of these income levels in Southeast region increased 32.3% under the new rules of social tariff.

The tables bellow show the costs of the program for the Southeast region.

Table 21

Value of subsidy given to each customer under the new rules

Income level (R$)	Cost of energy - Regular Tariff (R$)	Social Tariff 2010 (R$)	Value of the subsidy (R$)
	a	b	(a-b)
Up to R$400	35,94	20,94	15,00
R$400 to R$600	39,66	24,29	15,37
R$601 to R$1000	50,09	33,67	16,42
R$1001 to R$1200	56,71	39,63	17,08

Table 22

Total cost for Southeast region

Income level (R$)	Number of families	Total cost of the program (R$)
Total	10.379.460	166.380.332
Up to R$400	1.979.146	29.688.613
R$400 to R$600	2.295.627	35.290.539
R$601 to R$1000	4.305.075	70.668.510
R$1001 to R$1200	1.799.612	30.732.668

South Region

The same calculi were done for the South region and the results are showed next:

Table 23

South - Variation in eletricity consumption

Income level (R$)	Regular Tariff (kWh)	Social Tariff 2002-2009 (kWh)	Social Tariff 2010 (kWh)	Variation	Variation
	a	b	c	(b/a)	(c/b)
Up to R$400	80,18	100,00	130,75	25%	31%
R$400 to R$600	100,01	111,13	152,79	11%	37%
R$601 to R$1000	123,82	137,58	179,24	11%	30%
R$1001 to R$1200 (1)	145,23	145,23	203,03	0%	40%

(1) The previous social tariff law did not provide benefits to households with this level of income.

The results show that the changes in the income roof and the way discounts are calculated increased the consumption of electricity of the low income families between 30% and 40% in relation with the previous rules. In total, the electricity consumption of these income levels in South region increased 34.8% under the new rules of social tariff.

The tables bellow show the costs of the program for the South region.

Table 24

Value of subsidy given to each customer under the new rules

Income level (R$)	Cost of energy - Regular Tariff (R$)	Social Tariff 2010 (R$)	Value of the subsidy (R$)
	a	b	(a-b)
Up to R$400	36,58	22,43	14,15
R$400 to R$600	42,75	27,98	14,77
R$601 to R$1000	50,15	34,64	15,51
R$1001 to R$1200	56,80	40,63	16,17

Table 25

Total cost for South region

Income level (R$)	Number of families	Total cost of the program (R$)
Total	4.007.475	60.947.584
Up to R$400	700.786	9.915.354
R$400 to R$600	873.753	12.901.462
R$601 to R$1000	1.821.858	28.248.948
R$1001 to R$1200	611.078	9.881.820

4.4.Final Results – Brazil

The next table resumes the results reached for Brazil.

Table 26

Electricity consumption in Brazil

Region	Regular Tariff (kWh)	Social Tariff 2002-2009 (kWh)	Social Tariff 2010 (kWh)	Variation	Variation
	a	b	c	(b/a)	(c/b)
Middle West	408,29	461,60	620,33	13,1%	34,4%
Northeast	198,01	281,98	386,68	42,4%	37,1%
North	278,83	368,32	476,48	32,1%	29,4%
Southeast	389,67	453,28	599,64	16,3%	32,3%
South	449,24	493,94	665,82	9,9%	34,8%
Brazil	**1724,05**	**2059,10**	**2748,94**	**19,4%**	**33,5%**

The rise in the income level combined by the rise in the discounts brought by new law will provide an increase of 33.5% in the consumption of the families benefited by the social tariff. In the case of the northeast region, which is the poorest region in Brazil, the rise in consumption reaches 37.1%. The cost estimative of this change is showed next.

Table 27

Total cost of the changes in income criteria and discount calculus

Region	Total Cost (R$)
Middle West	32.829.581,56
Northeast	128.956.765,50
North	33.542.374,28
Southeast	166.380.331,64
South	60.947.583,90
Brazil	**422.656.636,87**

The total cost of the changes in income criteria and in the discount level can reach R$ 422.66 million in a month. The regions that stand out are the Southeast and the Northeast regions. It happens because in these regions are the majority of the beneficiaries in absolute terms.

5. FINAL CONSOLIDATION

The next table presents the final balance of the changes in the social tariff program:

Table 28

Net result of the changes in social tariff law

Change in the law	Δ Consumption of the affected families (%)	Cost of the change per month (R$)	Number of affected families
Extinction of the automatic entitlement	-0,24%	-72.500.000	-8.000.000
Inclusion of indigenous and maroon	NC	2.417.467	164.663
Net effect of A e B	33,5%	422.656.637	3.528.909
A - Rise in the income roof	46,5%	57.596.685	3.528.909
B - Changes in the discount calculus	28,3%	365.059.952	NA
(=) Final Balance	33,3%	352.574.104	-4.306.428

NC: Not Calculated

NA: Not Affected

The changes in the social tariff rules brought by the Law 12.212 will cause an increase in electricity consumption. Using the methodology applied in this study, this raise will be approximately 33.3%. Even though this number can be overestimated, the fact is that the net effect of the changes will elevate the total welfare, either through an increase of electricity consumption or through an increase in income (through falling the energy prices).

In the other hand, the number of people who can be benefited will decrease. The extinction of the automatic entitlement will exclude 8 million families of the program and the rise in the income roof will allow 3.5 million families meet the criteria and have access to the social tariffs. Summing the indigenous and maroons, the net effect will be less 4.3 million families being benefited.

In spite of the decrease in the number of people benefited, the costs of the program will increase. The release of funds promoted by the extinction of the automatic entitlement is not big enough to cover the extra costs provided by the other changes in our analysis. The total cost of the program will increase from R$1,534,999,076 to R$4,230,889,252. That means a huge increase of almost 276%.

In this case, the changes would bring another effect: the rise in the price of electricity for all consumers because the costs of the program are shared by every consumer through his electricity bill.

6. CONCLUSIONS

The intention of this paper was to provide a notion of how the electricity consumers will be affected by the changes in the law of the low income electricity tariff. This study has an objective to illustrate and support analysis. Then it was not established any empirical model to test the results presented.

The new law presents several advances in relation to the previous one, mainly in terms of target and raising the income ceiling. The extinction of the automatic entitlement promotes greater equity and we understand that the increase in the income ceiling was designed in order to cover a greater number of poor people, however, this change can greatly increase program costs by penalizing other energy consumers who pay the bill of the program. In this sense, it is an idea for future studies to estimate how the increased in the value of CDE impacts the welfare of other consumers.

Other two features of the program also can be a problem in terms of target: the ceiling of monthly consumption in 220 kWh can exclude multifamily household units, so common among low-income populations or even families with numerous members.

The other one is the necessity of registering at the Unified Registry to Assistance Programs of the Federal Government (CADUNICO) in order to guarantee the benefit. Although this requirement seems to be more equitable, it may in practice exclude many consumers that do not have access to information or legal documentation.

The new law did not present many improvements with respect to the social regional differences presented in the section 2.3. The solution for this problem could be give higher discounts to the areas where the tariffs are higher or impose a unified social tariff for poor people, but this action deserves further studies in terms of benefit-cost analysis.

At last, is important to mention that although it is a recurring practice, there are discussions about the effectiveness of using public prices as a social policy tool. First, it is very difficult to focus on target audience, in this case, the poor people. Second, to charge prices that are not efficient may cause misallocation of resources and wastage. And lastly, the price differentiation by levels of income can lead to discrimination prices that may benefit the company more than society.

GLOSSARY

[1] Single Phase: It is the standard electric connection for homes with installed load up to 12,000 W. Households with higher load tend to have higher income levels.

[2] CADUNICO – Cadastro Único: in English 'Unified Registry to Assistance Programs of the Federal Government'. It is an instrument to collect data and information in order to identify all low-income families in the Brazil.

[3] ABRACEE – Associação Brasileira de Grandes Consumidores Industriais de Energia e de Consumidores Livres: In english 'Brazilian Association of Industrial Consumers of Energy'.

[4] ANEEL: Brazilian Electricity Regulatory Agency

[5] TCU - Tribunal de Contas da União: in English 'Brazilian Court of Audit'. It audits the accounts of administrators and other persons responsible for federal public funds, assets, and other valuables, as well as the accounts of any person who may cause loss, misapplication, or other irregularities that may cause losses to the public treasury.

[6] BOLSA FAMILIA PROGRAM: is a social assistance program based on direct cash transfers to families in poverty (with incomes per person of R$70 to R$140) and extreme poverty (with incomes per person of up to R$70. For more details visit: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/LACEXT/BRAZILEX TN/0,,contentMDK:21447054~pagePK:141137~piPK:141127~theSitePK:322341,00.ht ml

[7] IBGE – Instituto Brasileiro de Geografia e Estatística: in English 'Brazilian Institute of Geography and Statistics'. It is the main provider of data and information of Brazil.

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