

# **Power Cuts in Delhi: How Much Does it Cost You?**

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"Pandav Nagar near Mayur Vihar also went without power for about eight hours from Wednesday night. Ashok Vihar, Model Town, parts of Mayur Vihar, Lajpat Nagar and Gulmohar Park also had power cuts... Parts of South Ex-1 shared the same fate on Thursday. There was no power from 2 pm to 9 pm"

Friday, June 4, 2004, *Hindustan Times*, New Delhi

"Areas including Paschim Vihar, Rajouri Garden in West Delhi, Andheria Bagh, Lajpat Nagar, South Extension, Defence Colony in south Delhi and Pandav Nagar, Laxmi Nagar in east Delhi suffered from power cuts on Wednesday"

Wednesday, June 9, 2004, *Times Of India*.

"It was black Friday for Dwarka residents. The area was plunged in darkness for over 17 hours in the searing heat. The lights went off at 3:30 am and showed no signs of being restored even at 9 am."

Saturday, June 19, 2004, *Times Of India*.

"South-Ex resident Rajiv Kumar said the area had no power since 12:15 in the afternoon till 6 pm 'We have been faced with power cuts everyday.....there are 12 hour power cuts daily....'"

Wednesday, June 23, 2004, *Times Of India*.

### **So how many hours of power-cuts do you experience daily?**

Conducting a survey on fifteen households from almost all parts of Delhi and tracking a bunch of newspapers for the peak summer month of June, we found out that on average a Delhiite experiences a one-hour power-cut every day in peak summer months. While the survey conducted by us gave us an average of half an hour of power cut everyday, it was based on certain parts of south Delhi only and did not cover some of the most common areas that figured in the newspapers almost daily, like South Extension, Lajpat Nagar, Defence Colony, CGO complex etc. which had six to ten hours of power cuts very often. Our survey also does not include most of north Delhi, places like Dwarka, Rohini, etc. which has more than eight hours of black out very frequently. So we decided to take a one-hour average black out figure for the whole of Delhi for one whole year. We also took into account the fact that even if certain parts of the city face much longer spans of black outs say eight to ten hours, their generators and inverters probably don't run all the time.

In our paper we have estimated what all these hours of physical anguish transform into when calculated in money terms. In other words how much does an average Delhiite spend due to Delhi's irregular power supply per year?

Power cuts are not only uncomfortable but also extremely disruptive to everyday life. Some businesses and middle class residents seek to keep the disruption to their lives a minimum by using generator sets and inverters and attaching computers to Uninterruptible Power Supplies (UPSs). Since Delhi's two power companies BSES Delhi and North Delhi Power Limited (NDPL) do not provide enough electricity to Delhi's consumers, individual residents and business owners often provide their own private source of electricity through generator sets and inverters. This solution is significantly more costly than electricity produced at a central generating station. This is the added cost we wish to measure along with the cost of Delhi computer users buying UPSs for their desktop computers.

Our paper focuses specifically on the costs incurred by households rather than costs to businesses. There are two reasons for focusing on costs to households rather than businesses. First of all, costs to households are easily quantifiable and in the next section

we will explain exactly how we choose to measure the cost. Second, irregular power supply may be seen by some as the necessary cost of ensuring widespread access to electricity. According to the 2001 Census, 92.9 percent of households in Delhi have access to electricity (Census of India, 2001). As electricity theft and inadequate supply due to low tariffs on electricity are two widely acknowledged reasons for Delhi's frequent power cuts, there may be a trade-off between providing near-universal access to electricity and providing a reliable electricity supply. Our paper will show that Delhi's poor electricity supply not only costs big business (Rs. 20,000 crore for all of India, according to a report issued by MAIT and Emerson Network Power)<sup>1</sup>, but also imposes large costs on the average resident of Delhi as well.

## **Methodology**

The costs we are measuring can be split into two categories. The first is that containing the fixed cost of coping with Delhi power cuts. This fixed cost category contains the cost of buying a new portable generator set or inverter and the cost of buying a UPS for a computer. These are large expenses that will only have to be repeated after several years. Due to the difficulty of collecting some data older than five years ago combined with the problem of adjusting for inflation, we have decided to calculate fixed costs with a rough five-year time horizon, either implicitly or explicitly. The second category contains maintenance and running costs and these represent the cost per hour of operating a generator or inverter. In our paper we begin by looking at the running costs first.

## **Calculations**

### ***Running costs***

#### Generators

The running cost for a generator is the cost of supplying the generator with fuel along with servicing and oil change costs. We use the following formulas to calculate each of these components of the running cost:

Fuel cost = cost of per litre of fuel \* number of litres of fuel used per hour \* number of hours the generator runs per year\* number of generators in Delhi

The average cost of servicing a generator per year is approximately Rs 3,000. Assuming that generators run for an average of 365 hours per year and that there are around 143,000 generators in Delhi<sup>2</sup> we find that the average fuel cost to a Delhiite is Rs 2.15 billion.

The cost of servicing a generator is Rs 3,000 per generator per year (Arvind Electronics 2004). So the total service charge, given that there are 143,000 generators in Delhi, is Rs 429 million.

The overall cost for generators comes to around Rs 2.58 billion (adding up Rs 2.15 billion and Rs 429 million)

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<sup>1</sup> Srikanth, 2002

<sup>2</sup> There are a total of 100,000 Honda portable generator sets in Delhi, according to Honda SIEL's regional sales office in Delhi. If we divide this by Honda's approximate market share, we arrive at 143,000 generators in Delhi.

### Inverters

Now we come to the market for inverters. It is a large market and still very much growing. As can be easily verified from the table of sales given to us by Honda below, inverters have been entering the market full force since 2002. The inverter market in Delhi is dominated by locally assembled models that command approximately 65 percent of the market<sup>3</sup>.

A branded inverter requires a battery change every three years while a locally assembled model requires a battery change every 18 months. A battery costs around Rs 3,000 on average (Action Powertronix 2004). Given that there are around 100,000 inverters in Delhi, the total battery replacement cost is Rs 165 million for Delhi per year.

### Uninterrupted Power Supply (UPS)

The operating costs of a UPS are minimal as UPSs do not use a significant amount of electricity. So this we take as negligible.

### **Total running costs**

Now that we have the separate figures calculated for the generators, inverters and UPSs we arrive at the total operating cost to Delhiites of the unending power cuts by simply adding up the two figures calculated above.

Generator costs + inverter costs = Total running cost  
Rs (2.58 billion +165 million) = Rs 2.75 billion.

Hence Delhi spends around **3 billion rupees** per year simply in running and maintaining its generators and inverters. But this is just one half of the picture. Huge costs are incurred by the citizens in the form of fixed costs. Below we calculate the fixed costs incurred by Delhi residents purchasing generators, inverters and UPSs.

### **Fixed costs**

#### Generators

##### *Honda Portable Generator Set Sales*

<b>Year</b>	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004
<b>Sales</b>	7500	8616	7298	3904	2500

*Source: Sales figures provided by Sales Officer CV Hari at Honda, 2004*

The total number of generators in the last five years in Delhi is taken by adding up the sales figures above which comes to around 30,000 generators. Since the above figures are for Honda portable generator sets, which have a market share of around 70 percent<sup>4</sup>, we conclude that approximately 43,000 generators were sold in Delhi over the past five years. Multiply that by the average price that a Delhiite pays for a generator that is Rs 30,000 and we arrive at the total fixed cost burden of an average Delhiite over five years for generators alone. It is Rs 1.3 billion.

### Inverters

Now we do the same for inverters. The fixed cost of purchasing an inverter is approximately Rs 9,000 for a branded model and 7,000 for a locally assembled model. As there are

<sup>3</sup> Information provided by Siddhartha Upadhyay.

<sup>4</sup> This number was provided by CV Hari of Honda and corroborated by the document "Birla Power Solutions Ltd. listed in the works cited page.

roughly 65,000 locally assembled inverters and 35,000 branded inverters in Delhi, the total amount spent on invertors is Rs 770 million in fixed costs.

### UPS

We estimated the number of UPSs in Delhi using the following formula:

Total UPSs in Delhi = number of households\* percentage with computers

We assume that every PC in Delhi is attached to a UPS to make our calculation simpler. Given that there are 2,316,996 residences in Delhi (Census of India 2001) and the PC penetration is 29 percent the above formula tells us that there are about 672,000 UPSs in the city (PC buying trends 2001). The cost of a UPS ranges from Rs 2,000 to Rs 3,000, so we take an average cost of Rs 2,500 and multiply this by the number of UPSs in Delhi. This gives us a total cost of Rs 1.68 billion.

### **Total fixed costs**

Now in the same way we find the total fixed cost incurred by Delhi by adding up the fixed costs of the three above.

Fixed cost of generators+ fixed cost of inverters +fixed cost of UPSs = total fixed cost

Rs (1.3 billion + 770 million + 1.68 billion) = Rs 3.75 billion

So the city of Delhi spends about **4 billion rupees** in just fixed costs to save itself from all the anguish and discomfort that power cuts entail.

### **Conclusion**

A few observations are in order. What we are looking at is an estimate of the actual figure. For one thing we are completely ignoring the number of people that spend those gruelling hours with the help of a couple of candles and lanterns. We are not taking into account the total cost to the city of the number of candles and lanterns bought and also the oil cost of using lamps and lanterns nor the time spent in looking for them. Also when calculating the fixed cost of generators we only take account of five year sales figures of the generators, while generators may well last for 10 years and even more. Again, this is done for simplicity sake to avoid the problems of data availability, adjusting for inflation, and changing prices through the years. Although the market for generators is much more organized than that of the inverters and a lot more stable, there is a market for local made and assembled generators, no matter how negligible, which we have not taken account of in our paper. On talking to several shopkeepers, generator mechanics and company personnel themselves we arrived at the conclusion that there are not too many households using these generators as Delhiites are supposedly 'quality conscious' people. Nevertheless factories, huge shops and stores are the ones who are likely to use these locally made type or more commonly the diesel generators that are less costly. Additionally, some residential colonies in Delhi also have imported, high-powered generators, and this cost is not accounted for as we are concerned only with portable generator sets likely to be used in residences or small businesses.

If we calculate the harm done to Delhi's economy, we find that residents spend approximately one half of one percent of Delhi's Net Domestic Product just on running generators and inverters. Put another way, if we divide the running costs by the number of residences in Delhi, we find that the average household in Delhi spends Rs. 1,190 per year on running costs.

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