THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

Strategies Adopted by the Industries in India to Deal with the Power Shortage

Thanseena Bai R.
Assistant Professor, P G Department of Commerce, T K M College of Arts and Science,
(Affiliated to University of Kerala) Kollam, Kerala, India

Abstract:
The purpose of this article is to explore the perceptions of the users of electricity and the various strategies which have been adopted by the industry to deal with the problem of the shortage of the power.
The study explores that the perceptions and the explanations of the power shortage is how somewhat totally different. As people consider that the government fault is the major hand in the shortage of power and their efforts seems to be very less in order to improve the situation, hydropower dependencies, energy policies not proper implemented and high demand requires than supply.
The main objective of this article is to explore the perceptions of the industrial staff towards the power supply interruptions and to describe the various strategies adopted by the industries to deal with this drastic problem.

Keywords: *Power shortage, steel industry, rice industry, brick industry, power generation, equilibrium*

1. Introduction

Power Shortage: In an electric power system power shortage is a condition that occurs when the total real or reactive power in the system of the power plant is not sufficient to supply all consumers with electric power of the required quality.
As a result of the shortage of the real power, the frequency may be lowered often generating the break down condition throughout the power system and we can get rid of this break down condition either by disconnecting some of the consumers or by connecting additional generators.
The first and most important thing is to be aware of the facts and cause of the power failure in order to prevent it before it occurs so that we can protect ourselves as well as our business long lastingly.

1.1. Background

In this section I am using three industries for my analysis i.e. steel mills, rice mills and brick kilns. For these industries production processes and different coping mechanism that can be used to handle the power outages is discussed.

1.2. Industries in India (Steel, Rice& Brick)

In my empirical analysis I specialize in 3 key industries in Republic of India - brick kilns, rice mills and steel mills.

1.3. Steel Milling Industry

In India steel milling is a very important industry. India produced 68.32 million tons of crude steel and was ranked 4th largest steel producer in the world. Steel-making is a fast growing industry. There are various different methods by which steel can be produced. There are three categories of these production methods:

- Basic Oxygen Furnace (BOF)
- Electric Arc Furnace (EAF)
- Electric Induction Furnace (EIF).

EAF and EIF methods and are highly electricity-intensive with electricity consumptions of approximately 600 kilowatt hours/ton and 500 kilowatt hours/ton, respectively and comes under the category minimill production model. These two methods alone account for approximately 60% of steel produced in India. This makes electricity a vital input in Indian steel production. Because of high demand of this industry, unreliability in the supply of electricity can pose serious problems. The difference between EAF and EIF is the intensity of the usage of electricity. Large bursts of electric current in short spurts are needed by an EAF. The average processing time is 45 minutes for a batch of steel using this method? Such intensive use can blow up the grid if the electricity grid is not robust. The EIF method has been used by various industries to avoid this possibility. This method requires less electric current for longer. Two hours approximately is the average processing time under this method. In totality the EAF method produces better quality steel than the EIF method. The decision about which type of production technology to be installed, is a onetime decision and depends on the firm's business. A full description of the steel making process is beyond the scope of this paper. However, details can be found in Ministry of Steel (2011). – 10 – model.

Steel mills tend to address power outages in 2 ways in which. First, they will install generators. While it's not economically possible for many plants to shift production from in public supplied electricity to power generated in-house, corporations tend to use generators to soundly shutoff the plant in response to power outages. Second, the corporations alter their production hours.
Steel mill house owners will get the outage schedule from State Electricity Boards and set up their production schedule around it. as an example, if power outages area unit terribly frequent throughout weekdays, then some steel mills can opt to operate for twenty-four hours per day over the weekend to make up for a few of the lost time. In contrast to rice mills, I don't notice any proof that steel mills will alter the assembly combine to address outages.

1.4. Rice Mill Industry

Rice edge is that the biggest grain process trade in Republic of India in terms of output. In 2006, Republic of India made ninety-three.35 million metrics a lot of processed rice as compared to solely sixty-nine.35 million metrics a lot of wheat. Between 2003 and 2005, polished rice was the one biggest agricultural export item. Export of rice alone accounted for 16 PF of the full worth of exports.
It is a seasonal trade that operates post-harvest. The first input within the rice edge process is paddy (unprocessed rice) and also the production method is basically uniform. In rice edge, paddy undergoes 3 basic processes: de-husking, polishing, and grading. In the de-husking and sprucing processes paddy is rubbed between 2 surfaces to get rid of the outer skin. In grading, broken rice is separated from the most batches. The ultimate product is these statistics are from WWW.indiastat.com. They were discharged by the Ministry of Agriculture; Government of India ready-to-cook rice. All 3 processes concerned in rice edge are extremely electricity-intensive. Rice mills tend to address power outages in 2 ways in which. First, they'll install generators that generate electricity victimization diesel throughout power outages. Second, they'll accelerate the production method and turn out a lot of output throughout the time that electricity is obtainable.
In specific, de-husking and sprucing machines will be run at many completely different speeds, so rice mills will accelerate the de-husking and sprucing method. However, this accelerated production comes at the value of the next fraction of broken rice grains that can't be included within the final rice output. Since paddy is pricey, rice millers choose to operate the two machines at an occasional speed for an extended period of your time. This minimizes the breakage of paddy. However, if ironed for time, the mills will method rice the maximum amount as 3 times quicker by running the machinery at the best speed. I incorporate this in my model by permitting the mills to decide on freely between 2 completely different production technologies: edge at an occasional and high speed. Shifts between the low and high speeds will be created costless by simply pressing a button.

1.5. Brick Kilns Industry

Brick creating could be a leading non-electricity-intensive business in Bharat. It's principally a seasonal business that operates within the time of year and its primary material inputs square measure clay and sand. Clay is mixed with water and created into bricks. The bricks square measure then discharged until they dry and harden. Once cooled, the bricks square measure prepared available. Brick-making uses coal or wood as the energy input in its production method. However, brick kilns do use some electricity for two purposes: 1st, for pumping water (which is then held on in ponds or barrels) and second for illumination of housing of migrant staff. Since water could be a storable sensible, power outages don't have an effect on the assembly of bricks (unless an influence outage lasts for many days).
Since bricks square measure out and away the foremost unremarkably used artefact in Bharat, brick-making is sensitive to economic process. Therefore, it's a perfect business for capturing the impact of economic growth on firm decisions.

2. Model

I use my model to come up with comparative static predictions regarding the input decisions, output, and profits of rice and steel mills because the frequency of power outages will increase. My model generates totally different comparative static predictions for the 2 industries as a result of they use totally different adaptation mechanisms to deal with power outages. Since brick kilns don't use electricity within the production method, power outages won't influence their behaviour.

2.1. Set Up

I assume that corporation's area unit risk neutral agents and model their drawback as that of static profit maximization. I assume that there's uncertainty regarding the provision of publically supplied electricity corporations believe there'll be an influence outage with chance $\theta \in [0, 1]$, and this chance is treated as given by the corporations. Each rice and steel mills turn out output (y) by mistreatment capital (k), material (m), and electricity (e) within the production method.15 if a firm is electricity-constrained, then the most amount of electricity that it will use is e (θ). As θ will increase the firm becomes additional unnatural in its electricity usage ($de(\theta)\, d\theta < 0$). The entire inputs area unit complementary ($\partial 2f \partial xi \partial xj >$ zero for i 6= j ∈). In my model, economic growth will have an effect on the input and output selections of corporations by influencing the costs. Further, I assume that the primitives of the model square measure specified the firm perpetually finds it profitable to operate.
Mills have 2 ways in which of addressing power outages. Each rice and steel mills will select to insure against power outages by investment in self-generation capability. There's a hard and fast cost (φ) of putting in a generator (g). The worth of self-generated electricity is higher than that of electricity consumed from the general public network additionally, rice mills will also adapt by costless shift to a technology that uses electricity additional with efficiency. As discussed, potency of the electricity is accrued by in operation the machinery at a way quicker speed. This suggests that the potency of capital conjointly will increase. However, this different technology is way less economical in material usage (paddy wastage increases). While each rice and steel mills will use

technology one (y1 = f (m, e, k)), rice mills will also switch to technology a pair of (y2 = f(aLm, aHe, aHk) wherever aH > one and aL < 1). Based on production information gained throughout field visits to rice mills, I assume that compared to technology one, technology a pair of uses electricity and capital additional with efficiency (∂y1∂x >∂y2∂x for x ∈). However, this comes at the expense of exploitation materials less with efficiency (∂y1∂m <∂y1∂m).

Rice mills perpetually use technology a pair of if besides being additional electricity-efficient it's conjointly less costly to use. If this can be true, then the model can generate identical comparative static predictions for each rice and steel mills. In what follows I explore the sole attention-grabbing case of my model (this case is additionally the one delineated by rice mill homeowners throughout field interviews): rice mills have the choice to change to AN electricity-efficient nonetheless expensive technology. I assumethat the cost of manufacturing output is higher below technology a pair of than technology1 (dC1(y)dy<dC2(y)dy) with or while not generator possession. The information shows that on the average, rice mills' expenditure on paddy is twenty-four times that of electricity. Therefore, it's extremely possible that the accrued wastage of fabric inputs below technology a pair of create it the additional expensive technological selection for rice mills.

Further, I assume that companies apprehend the worth of θ and costs. Supported this, both rice and steel mills create the choice regarding whether or not or to not install a generator, how much capital to possess, and the way abundant materials and energy to use. Rice mills additionally decide between technology one and a couple of.

2.2. Equilibrium

In this section I characterize the behaviour of rice and steel mills because the frequency of power outages will increase.

2.3. With Generator

Conditional on generator possession, the matter featured by rice and steel mills is identical. Both of them use technology one: steel mills will solely use technology 1 and rice mills opt for technology one as a result of it's less expensive. If a firm owns a generator, then it's not unnatural in its electricity usage. However, the value of electricity (pe = θpHe + (1 − θ)pLe) will increase aspower outages become additional frequent. The comparative statics for input use are given by:

de∗Gdθ = (pHe − pLe) fkkfmm– fmkfmk| f |< 0

dm∗Gdθ = (pHe − pLe) fmkfek– fekfmm| f |< 0

dk∗Gdθ = (pHe − pLe) fekfkm– fmkfkk| f |< 0

| f | is that the determinant of the third principle minor of the boot matrix of the production perform. By concavity of the assembly perform, | f | < zero. Further, concavity of the assembly performs and complementary nature between all the inputs imply that de∗G dθ < 0, dm∗G dθ < 0, and dk∗ Gdθ < 0. As power outages become additional frequent, generator owning firms use less of all the inputs. As a result, they turn out less output and are less profitable.

2.3.1. Rice Mills

As power outages increase, the firm switches from mistreatment technology one to technology 2. If the firm is free in its electricity usage, then it prefers mistreatment technology one (π1∗> π2∗) as a result of the price of production is higher for technology two. On the opposite hand, if the firm's electricity constraint binds terribly powerfully, then the firm prefers to use technology two. If the electricity usage of a firm is very affected, then by change to the additional electricity-efficient technology (technology 2) it will manufacture additional output with the same quantity of electricity. If the rise in output is enough to catch up on the upper marginal cost of production beneath technology two, then the firm prefers mistreatment technology two. Starting from no power outages (θ = 0), as power outages increase the firm's decisions change within the following manner:

- As long as θ < θ1, the firm can select technology one and isn't electricity-constrained.

An increase in outages has no result on its decisions as a result of the firm is at liberty in electricity usage.

- For θ1 < θ < θt, as outages increase, the firm continues to use technology one. The use of all 3 inputs, output, and profits falls (these predictions and therefore the reasoning behind them square measure clone of the predictions and reasoning for non-generator owning steel mills).
- As outages increase on the far side θ = θt, the firm switches from technology one to two.

Profit remains unchanged:

Since the firm switches between the 2 technologies at the purpose of indifference, its profit remains unchanged.

Output increases:

The firm switches to a lot of pricey technology however its profit remains unchanged. Therefore, it should be that the firm's output will increase to make up for the upper price of victimization technology two.

Material usage increases:

Since, the firm is shift to a lot of electricity efficient technology, complementary nature between electricity and material implies that material usage can increase.

Capital:

The prediction regarding capital holdings is ambiguous. Once the firm switches to technology two, capital additionally becomes a lot of productive. The firm's capital holdings decrease if the firm is experiences decreasing returns to capital once it switches between the 2 technologies. In my model this is often similar to the marginal product of capital being extremely elastic with relevance capital. Otherwise, capital holdings can increase. 17And moving from right to left on the coordinate axis in

• For θ

$t < \theta < \theta 2$, the firm can select technology two. Conditional on its technology choice, the firm isn't electricity-constrained. a rise in outages has no result on choices.

- For $\theta > \theta 2$, the firm continues to use technology two. As power outages increase, the use of all 3 inputs, output, and profits falls (these predictions and therefore the reasoning behind them square measure clone of the predictions and reasoning for non-generator owning steel mills).

2.4. Generator Ownership

Supported the 2 sets of demand functions, the result of power outages on generator installation depends on the intensity of power outages and therefore the price of installation. If there aren't any power outages ($\theta = 0$), then it's ne'er optimal for the firm to take a position in self-generation capability. Similarly, if there's no publically available electricity ($\theta = 1$), then the firm can forever install a generator. Therefore, $\exists b\theta$ such that $\forall\theta > b\theta$ firm can install a generator. Because the price of generator installation (φ) will increase the threshold ($b\theta$) higher than that the firm installs a generator can increase.

3. Knowledge Sources and Specifications

3.1. Plant Data

The plant-level knowledge that i take advantage of comes from India's Annual Survey of Industries. The ASI is associate annual survey of roughly thirty, 000 registered factories in Republic of India. The sampling frame consists of all corporations that either use a minimum of ten employees whereas victimization electricity or at least twenty employees while not victimization electricity. i take advantage of the 5-digit NIC code to spot rice mills and brick-making corporations and therefore the 4-digit NIC code to spot steel-making corporations. For my analysis, i take advantage of ASI for the years 1999 - 2000, 2001 - 2002, 2004 - 2005, and 2009 - 2010. In every wave, corporations report the number of electricity purchased, average worth paid per kilowatt-hour, and total purchase worth in rupees. Corporations additionally report the number of electricity generated by the firm itself for consumption. This info is employed to construct a dummy for whether or not the firm owns a generator or not. Corporations additionally report the number, price, and total purchase worth of fabric inputs and outputs. For the worth of capital, i take advantage of the value of plant and machinery at the beginning of the reference amount.

3.2. Construction of the Live of Breakdown

To construct the live of breakdown i take advantage of satellite knowledge from the u. s. Air Force Defencearbiter Program (DMSP-OLS Night Time Lights International Composites). This knowledge is collected by the U.S.A. Air Force Weather Agency. Under this program, the satellite has been orbiting the planet fourteen times daily since the 1970's. The digital archive is out there for all years between 1992 and 2010.18 Nightlights emanating from each location on Earth are discovered by the satellite between 8:30 p.m. and 10:00 p.m. local time.

The National geology knowledge Centre (NGDC) processes and aggregates these raw data to form the typical visible lights (AVL) composition year variation in candlepower at a degree and use this variation as a live of power outages at that time. The data clean-up method adopted leads to composites that principally capture manmade light. the photographs therefore created attach a specific worth of sunshine intensity to each thirty arc second output picture element (approximately zero.86 sq. kilometres at the equator). The AVL composite contains the typical of the visible band digital variety values with no any filtering. The intensity of every picture element ranges from 0-63. I construct the live of power outages at the district-level.

This live doesn't directly capture variations in growth of the native economy because the observed lighting in associate economically a lot of developed location goes to be proportionately higher in each the composites. However, as mentioned antecedent, it'd be the case that areas that are a lot of developed have a better incidence of power outages because of higher demand. These considerations are addressed within the empirical strategy.

3.3. Specification

The concern is that the 3 industries might face completely different business environments among a section. for instance, a section government might care a lot of concerning electricity intensive industries than electricity non-intensive industries. If this can be true then the government can facilitate electricity-intensive industries by providing a lot of reliable electricity supply in the district and by giving them flexible loans, tax rebates, and special concessions.

The outcome variables are electricity bought from the general public grid, total electricity usage, price of capital (k), material (m), output (y), and a dummy for generator possession (g). I conjointly consider whether or not companies reply to power outages. I assess whether or not change at the in depth or intensive margin of operation; that's, a dummy for whether or not the firm operates or not (short-run shutdown), and therefore the length of operation.

4. Results

I initial gift proof that my live model of power outages could be a sensible predictor of electricity shortage then gift results for the result of power outages on decisions of corporations. When presenting my results, I indicate the expected share amendment within the outcome variable when power outages increase by 100%. At the mean, a tenth increase within the equipment failure measure corresponds to power outages increasing by one hour every day. I specialize in the results of my specifications.

4.1. Electricity Usage & Profits

Increased power outages lead to rice and steel mills intense less publically provided electricity. In specification one (district-year fixed-effects), a tenth increase within the mean level of power outages ends up in steel mills and rice mills victimisation nine.95% and 4.85% less electricity, respectively. The negative impact of power outages on electricity usage persists after I look at the overall electricity usage27 of the corporations. Similarly, in the specification a pair of (district-industry fixed-effects) a rise within the frequency. The phrasing of the question is: "How regular is your power provided when sunset?" Total electricity is that the add of electricity bought from the general public grid and electricity that's self-generated of power outages reduces the electricity consumption of steel and rice mills however the coefficients estimated for rice mills aren't important. Since fifty-three of brick kilns don't use electricity, brick kilns don't dead management for the impact of economic process on electricity usage. Therefore, the impact of power outages on rice and steel mills is biased towards zero in specification a pair of. This explains why the results for electricity usage of rice mills aren't important. It also explains why the edge of the ninety fifth confidence interval for constant calculable for steel mills is nearer to zero in specification a pair of compared to specification one. I realize that albeit power outages negatively have an effect on the electricity usage each rice and steel mills, their impact on the profits of the 2 industries is totally different. In specification a rise in power outages considerably lowers the profits of steel mills however not rice mills. As an example, in specification one, a tenth increase in power outages lowers the profits of steel mills by 8.5%. This means that rice mills are higher able to address electricity shortage than steel mills.

5. Conclusion

In this article, I even have examined the impact of power outages on the alternatives created by Indian companies. I even have allowed companies to use business specific adaptation mechanisms and traced the results of power outages on firm size, output, and profits for rice and steel mills in India. I even have additionally analyzed whether or not companies will comply with power outages by fixing their production strategy and length of operation.

In my empirical strategy, I even have known the impact of power outages on electricity intensive industries relative to their impact on electricity non-intensive industries. I even have found evidence that even among electricity-intensive industries there are important variations in the adaptation capability to power outages. I even have found that short changes in power outages don't induce corporations to put in generators. First, rice mills regulate by change to a production technology that enables them to method a lot of material inputs within the given quantity of time (they operate the plant at a far quicker speed). I notice that the fabric usage and output of rice mills goes up considerably as power outages become a lot of frequent. Second, they make up for a 3rd of the loss in productive time by in operation for a lot of days. Since rice mills have a lot of adaptation mechanisms offered to them, a rise in power outages negatively affects the profit of steel mills however not that of rice mills.

6. References

i. Abeberese A. B. (2013) Electricity Cost and Firm Performance: Evidence from India, Available at SSRN: http://ssrn.com/abstract=2273729.
ii. Alby P., J-J Dethier, and S. Straub (2013):"Firms Operating under Electricity Constraints in Developing Countries", The World Bank Economic Review, 27(1), 109-132.
iii. Fisher-Vanden K., E. T. Mansur, and Q. Wang (2012):"Costly Blackouts? Measuring Productivity and Environmental Effects of Electricity Shortages", National Bureau of Economic Research, Working Paper No. 17741.
iv. Rud J. P., (2012):"Electricity provision and industrial development: Evidence from India", Journal of Development Economics, 97, 352-367.
v. Calderon C., E. Moral-Benito, and L. Serven (2011): "Is Infrastructure Capital Productive? A Dynamic Heterogeneous Approach", Policy Research Working Paper, 5682.
vi. Chauduri S., M. Ravallion (2006):"Partially Awakened Giants: Uneven Growth in China and India", World Bank Publications.