

**ENERGY CRISIS AND PRODUCTIVE INEFFICIENCY:
MICRO-EVIDENCE FROM TEXTILE SECTOR OF FAISALABAD**

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ABSTRACT

This study measures productive inefficiency in the textile sector of Faisalabad due to recent energy crisis in Pakistan. Primary data is collected randomly from 124 firms of the industry. Results explain that these firms are facing huge production loss which varies from 23 to 65 percent in 8-hour shift and 21 to 60 percent in 10-hour shift. Spinning and textile firms are facing severe electricity outage while dyeing, chemical and processing firms have huge production losses due to gas shortage. The study further explains that 79 percent of the firms are willing to pay for uninterrupted energy supply and their willingness to pay varies in the range of PAK Rs. 1 to 20 per unit of energy. The findings call for immediate actions of government and policy makers that may help stimulating the production level of the industry.

Key Words: Energy Crisis, Production loss, Order delays, Willingness to Pay

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1. INTRODUCTION

Energy, being an essential component of every production process, plays a pivotal role in the growth process of a country. The production process has undergone a massive transition from labor intensive to energy intensive techniques (Stern and Cleveland, 2004). Now, it is widely recognized that industrialization is an energy-intensive process; hence, uninterrupted supply of energy is necessary to keep the production process in run. In addition, high per-capita energy consumption is considered as an indicator of the level of economic development. This positive correlation between energy consumption and output growth (and development) led many countries, particularly developing ones, to design policies for subsidized energy provision with focus on supply-side in late eighties. At the same time, some European countries (i.e. Germany, Denmark, Belgium, Sweden) formulated energy policy focusing on demand-side (energy conservation), and achieved smaller growth rates in energy consumption without any reduction in economic growth (Pintz, 1986).

After recent episodes of oil price increase (started from 2006-07), tight financial position and huge trade deficits forced many developing countries (Pakistan, in particular) to pull out, at least moderately, from the policy of subsidized energy supply (Alahdad, 2012 and Malik, 2012). The energy demand in Pakistan has also been increasing steadily in every sector of the economy and future energy need of Pakistan is forecasted to be, at least, three times that of today within next two decades.¹ The focus of energy policy in Pakistan has been the demand side as it is believed that energy crisis in Pakistan is a management and not a capacity issue.² Besides, demand-side policies are being adapted to save not only capital but also foreign exchange of the country.

These demand side energy policies e.g. energy conservation, energy-prices mechanism etc. have proved to be a serious constraint in the industrial growth of Pakistan (Siddiqui, 2004; Aqeel and Butt, 2011 and Malik, 2012). Importantly annual production loss due to power shortages is about two percent of gross domestic product (Abbasi, 2011).³ Various studies (i.e., Bose, *et al.*, 2005 and Wijayatunja and Jayalath, 2008) have tried to estimate the output loss due to power outages. In case of Pakistan, a few attempts have been made to quantify the cost of unserved energy (Lahore Chamber of Commerce and Industry, 1986; Pasha, *et al.*, 1989 and Siddiqui *et al.*, 2011). Siddiqui *et al.* (2011) also quantified the industrial production loss due to shift hours whereas the other studies focused on power outages only.

Textile being the largest industrial sector of Pakistan generates the country's highest export earnings of about 58%; providing the bulk of employment (39%) to largely unskilled as well as underutilized workforce, and contributes 8.5% to GDP.⁴ Textile production is comprised of cotton ginning, yarn, fabric, home textiles, towels, hosiery & knitwear, readymade garments and canvas. These components are being produced both in the large and small scale organized sector as well as in unorganized cottage/small and medium units. According to Economic Survey of Pakistan (2012-13), this industry is categorized into ginning, spinning, weaving, fabric and cotton cloth sectors whereas cotton-cloth sector is further subdivided into sizing, down steam, dyeing and textile production.

Textile industry is presently comprised of 521 textile units with installed capacity of 10.0 million spindles and 114000 rotors making Pakistan third largest spinning capacity in Asia with spinning

¹ NTDC Report 2011.

² Framework of Economic Growth 2012, Planning Commission.

³ Reduction in output growth due to energy shortfall is also termed as cost of unserved energy.

⁴ Ministry of Textile Industry Report 2013.

capacity of 5% of the total world and 7.6% of the capacity in Asia.⁵ Despite of this vigorous and export oriented textile industry, dismal performance of textile exports (decreased from 65% of total exports in 2007 to 53% in 2012)⁶ can be mainly attributed to the stifling power shortages. This crisis has left investors fighting for their survival and, in some cases, they are shutting down production units in Pakistan and/or moving abroad (especially in Bangladesh). In other cases, some export-specific production units are, now, unable to meet international orders and have converted into local production units with capturing local market in order to fulfill its average fixed cost. Besides, the power crisis caused prolonged delays in delivery schedule both at intra and inter industry level resulting in less competitiveness of the industry along with tough competition from regional competitors i.e., China, India, Bangladesh etc. These problems in textile industry are structural in nature and cannot be resolved through financial support of the government (Alam, 2011).

Textile production is not only energy but also time consuming process where a conversion of cotton into single type of good e.g. shirt, vest, or socks takes about two months with the involvement of many supporting sub-sectors. It is important to note that every sector of textile industry is not equally energy-intensive and has different level of energy consumption and dependency but delay in accomplishing output orders in any sub-sector involuntarily causes further delays in making the finished product. These delays cause extraordinary production losses (as both domestic and foreign customers turn back) and badly affect capability of the textile industry. Furthermore, energy gap also varies among different sectors of the industry due to disparate scale of production and input mix. Large scale production sectors are using alternative sources of energy like generators; thus, reducing their energy gap and production loss at increased cost of final products. Therefore, high energy intensive industries may not have higher energy gap relative to less energy intensive industries that are unable to purchase costly energy inputs due to capital constraints or bad market conditions (as less orders reduces economies of scale).

These sector-level differences of energy gap and resulting production loss have not been analyzed earlier in case of any industry in Pakistan. A recent study by Siddiqui *et al.* (2011) calculated total industrial output loss by taking into account all major industries including textile and reported that output loss falls in the range of 12 percent to 37 percent due to power outages. This study doesn't take into account the production delays by sub-sectors of textile industry at all. This restrictive assumption of homogeneity of sub-sectors (at least, with regard to energy consumption) may result in a bias towards under-estimation of the impact of energy shortage on production cost for the reason discussed above. Further, the study is based on a survey conducted in the second quarter of 2008 while taking 2007 as the reference year. It cannot, therefore, account for impact of recent developments regarding energy crisis in the textile industry i.e., severity of power outages, capital flight, increased use of alternative energy resources etc. Against this backdrop, the present study would significantly contribute to our understanding about the impact of energy crisis on textile sector.

Based on primary data from various sectors and sub-sectors of textile industry, this study reveals which sub-sectors of textile industry is more energy deficient relative to other ones. This work also attempts to calculate the magnitude of production losses due to different size of lags in accomplishing production orders. Most importantly, it is the first attempt to estimate producers' willingness to pay for uninterrupted energy supply. Therefore, the contribution of this study is twofold in the sense that it not

⁵ Pakistan Textile Journal (various issues).

⁶ Pakistan Economic Survey, 2012-13.

only estimates production loss of textile sector due to unserved energy but also it reports producers' willingness to pay for uninterrupted energy supply at various sub-sectors level.

The remainder of the study is organized as follows. Section 2 details the data, variables and methodology. Section 3 contains a brief discussion on the results while final section concludes the study.

2. DATA, VARIABLES AND METHODOLOGY

This section explains the data source, variables and methodology which is used to analyze the production loss and orders delays due to energy outages in textile sub-sector of Faisalabad, Pakistan. It also presents the energy loss, energy compensation by textile industrialist with the usages of alternative source like stand-by generators and their willingness to pay for uninterrupted energy supply.

The study preliminary utilizes the primary data from the textile industry of district Faisalabad, Pakistan. According to the Faisalabad Chamber of Commerce and Industry (FCCI, 2013-14), there are almost 1090 registered units of different sub-sectors of textile industry. This study covers 124 firms (sub-sectors of textile industry highlighted below) randomly selected according to their percentage in market share as shown in fig 2.1. It takes 2008 as the reference year because at that time energy crisis was in initial stages.

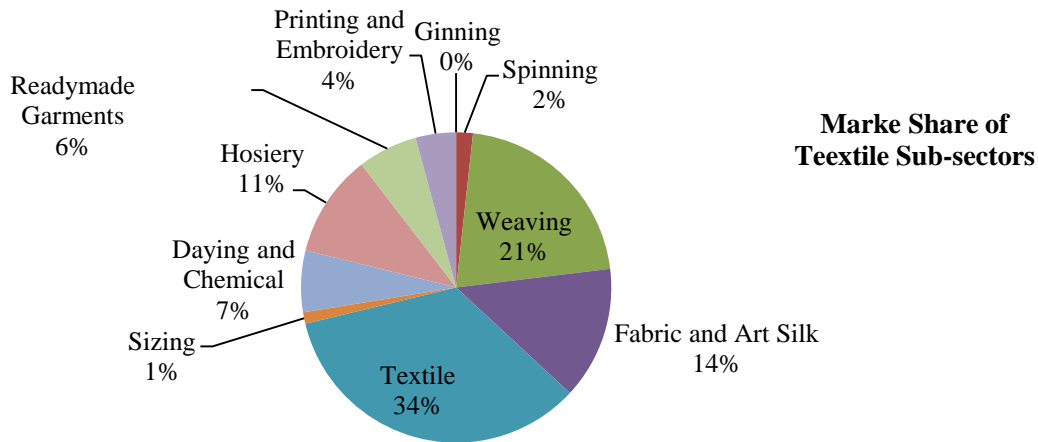


Figure 2.1: Market Share of Different Sectors of Textile Industry in Faisalabad

Source: The Faisalabad Chamber of Commerce & Industry (FCCI, 2013-14)

In Pakistan, energy crisis started in 2007 and became severe in 2008, since that time period, it has badly affected to the production process of major local and export oriented textile sector of Pakistan. In order to identify the production loss and its magnitude, the work of Siddiqui *et al.* (2011) is followed. Firstly,

we compute the production as well as energy loss as whole and sub-sector-wise where the former requires the output per labor hour ($OPLH_z$) and total loss of labor hours ($TLLH_z$) in each sub-sector.

$$PL_i = (OPLH_z)_i \times (TLLH_z)_i \quad (2.1)$$

Where, $i = 1-n$ and total loss of labor hour further requires the average labor hour loss, no of workers and work days while output per labor hour depends on annual output and annual work hour where later one further consists on shift hours, number of workers and annual work days. The most important variables energy loss and compensated energy loss are also computed for the textile sub-sectors of Pakistan. It evaluates the real picture of energy crisis that prevailed in textile sector and have compelled many industrialist to loss the competition from export market in the presence of sever energy crisis, prevailing in the Pakistan. Energy loss per month is derived as:

$$ELMWAS = ERH \times LSH \quad (2.2)$$

Where, $ELMWAS$, ERH AND LSH are energy loss per-month without alternative source, energy required per-hour and load-shedding hour per-day. The magnificence of this study is that it takes both electricity and gas as energy source, provided by Government of Pakistan and measured in their respective units. Energy required per-hour is obtained by dividing the energy unit consumed per-month and working hour per-month.

$$ERH = EUCM / WHM \quad (2.3)$$

Where, $EUCM$ and WHM are energy unit consumed per-month and working hour per-month where the latter is attained by multiplying working hour per-day and total work days. After computing the energy loss per-month, the compensated energy loss is calculated which is the difference between energy loss per-month without the use of alternative-source (derived in eq. 2.2) and energy loss per-month after using the alternative source such as stand-by generators.

$$CELM = ELMWAS - ELMAAS \quad (2.4)$$

Where, $CELM$, $ELMAAS$ are compensated energy loss per-month and energy loss per-month after alternative source. The energy loss per-month in the presence of alternative source makes the eq. (2.2) as:

$$ELMAAS = ERH \times (LSH - UASH) \quad (2.5)$$

Where, $UASH$ is the usages of alternative source per-hour and the computation of ERH requires that change in eq. (2.3) in the light of eq. (2.5). The whole process gives the production loss, energy loss and compensated energy loss for both the whole and sub-sector wise.

Production order delays are the delays which firms are facing due to the interruption in energy provision. Total number of order delays in particular year and number of order delay day's per-order are used for the analysis.

2.1.Producer's Willingness to Pay for Uninterrupted Energy Supply

On-going energy crisis has reduced the production level and the producers of textile sector are compelled to use alternative energy source such as heavy stand-by generators and self-production of energy. These producers are paying large amount for uninterrupted energy to fulfill their production orders. So, this sub-section relates with the producer willingness to pay for uninterrupted energy supply (alternative energy source).

In order to analyze the producer willingness to pay for alternative energy sources (input), the work(s) of McConnell and Bockstael (2005), modified by Zapta and Carpio (2012) are followed. The theoretical stance of producer willingness to pay requires both consumer and producer side. On consumer and

producer side, utility maximization framework subject to budget constraint and both profit maximization as well as cost minimization framework subject to production constraint are required. After having the indirect utility function, indirect profit function and cost function from the optimization framework, the compensated and equivalent variation need to be mentioned. Non-labor income \bar{h} is assumed to be function of profit that can be obtained from the linkages between the consumer and producer. $\bar{h} = \bar{h}(\pi(p_y, r, q), k)$, and written as:

$$Z \left[\bar{h}(\pi(p_y, r, q), k), L, P_z \right] = Z_0 \quad (2.6)$$

Where, L , P_z and r are non-labor income, prices of goods used by consumer and input prices, respectively. In compensated variation (CV) and equivalent variation (EV) concept, change in the vector of input quantity “ q ” from “ q_0 ” to “ q_1 ” make the amount of money to hold the condition described below:

$$Z \left[\bar{h}(\pi(p_y, r, q_0), k), L, P_z \right] = Z \left[\bar{h}(\pi(p_y, r, q_1), k) - CV, L, P_z \right] \quad (2.7)$$

$$Z \left[\bar{h}(\pi(p_y, r, q_0), k) + EV, L, P_z \right] = Z \left[\bar{h}(\pi(p_y, r, q_1), k), L, P_z \right] \quad (2.8)$$

Equation (2.7) and (2.8) represent the economic values that producer is willing to pay for better input quantity level. It is obvious that positive CV and EV measure leads to the better welfare and negative CV and EV generates the welfare loss. CV and EV can also be explained by the producer willingness to pay (WTP) function d , defined as:

$$d = \bar{h}(\pi(p_y, r, q_1), k) - \bar{h}(\pi(p_y, r, q_0), k) \quad (2.9)$$

CV and EV functions are described above which depend on the initial and final levels of non-labor income (McConnell, 1990). The best availability of any input quantity/level, “ q_1 ” may increase the profit as $d > 0$. In addition, it also represents the maximum amount of profit that producer is willing to accept (forgo) to give up (obtain) the benefits of new input quantity level, “ q_1 ”.

It has been assumed that non-labor income is a linear function of firm profit and other factors defined by “ k ”. It can also be assumed that change in input quantity “ q ”, from “ q_0 ” to “ q_1 ” is also the linear function of the difference in profits, written as:

$$d = \pi(p_y, r, q_1) - \pi(p_y, r, q_0) \quad (2.10)$$

The above equation yields that the maximum amount of money a producer is willing to pay for the improvements of input quantity level which may reduce the difference between ex-post (after new input) and ex-ante (before new input) firm’s profit levels.

In our analysis, the old input level is described by the current energy provision to all industrial sectors of Pakistan. Water and Power Development Authority (WAPDA) and Sui Northern Gas Pipeline Limited (SNGPL) have been the supplier of electricity and gas provision to all textile industries of Faisalabad, respectively. The ongoing energy crisis has badly affected to their production level and they have to rely on alternative energy source such as heavy standby generators, working on oil, solar

energy plants and other such expensive opportunities to run their industries. So, “ q_0 ” is energy provision in form of electricity and gas and “ q_1 ” are alternative expensive energy sources.

It is also apparent that alternative energy sources are more expensive as compared to traditional energy sources. That is why, industrialist pay higher amount for that and reduces their profit as well (if price remains same). So, “ r ” is energy price that is categorized in two components “ r_0 ” and “ r_1 ”, where former is the price of traditional energy provision and latter one considers the price of alternative energy sources.

The analysis requires the specific form of production function for both cost minimization and profit maximization. From that forms, we can drive all the equations written above and extend the analysis for comparative statics of WTP variation function. It is also helpful for the sign and implication of input price effect, output price effect and input quality effect. The expected sign are as:

$$\frac{\partial d}{\partial r_0} < 0, \quad \frac{\partial d}{\partial r_1} < 0 \quad (2.11)$$

For better input quantity level or alternative energy source, the willingness to pay for producer would be higher and the variation function for own and cross price⁷ is negative.

3. RESULTS AND DISCUSSION

This section presents the results and discussion of production order delays, production and energy loss of textile sub-sectors in different forms. In addition, it shows both theoretically and graphically the willingness to pay response across the sub-sectors.

3.1. Production Analysis

This sub-section explains the production and labor hour loss due to load-shedding, production orders, production order delays and production order delay day’s per-order for each sub-sector. The total production and potential production per-day are also calculated for both 8 and 10-hour shift, which are reported in table 3.1 and 3.2, respectively.

The maximum gap of potential and total output is apparent for textile, dying, chemical & processing and embroidery firms. These sub-sectors are badly affected by the prevailing energy crisis, producing from the lowest of their potential output and have highest output loss, respectively. The production loss is worst in electricity as compared to gas dependant industries. Textile and dying, chemical & processing firms are facing the major production loss from both electricity and gas shortage. Spinning and weaving & sizing have no production loss from gas shortage but latter depends more on electricity as compared to former one. The production loss is highest in electricity oriented industries but less bad in gas oriented industries. Overall, textile, dying and hosiery & readymade garments firms are more energy dependant as compared to others and facing severe production crises in their industries.

The current situation has also adverse impacts on labor market, have created huge unemployment, and most of the workers are fighting for their survival. The biggest labor hour loss appeared in textile, hosier & readymade garments and dying industries, where major class of workers has lost their maximum working hour. The situation is less severe in those industries which have 10-hour shift. In

⁷ Depend on substitutions and complements input alternatives. Here, only complement is more relevant.

Table 3.1: Production Analysis 8-Hour Shift (In Thousands units per-day)

| Variables | | Dyeing & Chemical | Embroidery | Fabric | Spinning | Hosiery & Garments | Textile | Weaving & Sizing |
|------------|-------------|-------------------|------------|--------|----------|--------------------|---------|------------------|
| Production | Total | 6.15 | 1.63 | 2.99 | 0.01 | 1.60 | 19.12 | 2.61 |
| | Potential | 28.81 | 5.93 | 6.07 | 0.02 | 4.43 | 62.44 | 3.80 |
| Labor hour | Electricity | 0.24 | 0.06 | 0.11 | 0.12 | 0.93 | 0.99 | 0.06 |
| | Loss | Gas | 0.15 | 0.03 | 0.01 | 0.06 | 0.56 | 0.58 |
| Production | Electricity | 13.89 | 2.74 | 2.81 | 0.01 | 2.33 | 28.58 | 1.19 |
| | Loss | Gas | 8.77 | 1.57 | 0.26 | 0.00 | 0.49 | 14.73 |

Table 3.2: Production Analysis 10-Hour Shift (In Thousands units per-day)

| Variables | | Dyeing & Chemical | Embroidery | Fabric | Spinning | Hosiery & Garments | Textile | Weaving & Sizing |
|------------|-------------|-------------------|------------|--------|----------|--------------------|---------|------------------|
| Production | Total | 6.15 | 1.63 | 2.99 | 0.01 | 1.60 | 19.12 | 2.61 |
| | Potential | 24.28 | 5.07 | 5.45 | 0.02 | 3.86 | 53.90 | 3.56 |
| Labor hour | Electricity | 0.24 | 0.06 | 0.11 | 0.12 | 0.93 | 0.99 | 0.06 |
| | Loss | Gas | 0.15 | 0.03 | 0.01 | 0.06 | 0.56 | 0.58 |
| Production | Electricity | 11.11 | 2.19 | 2.25 | 0.01 | 1.87 | 22.95 | 0.96 |
| | Loss | Gas | 7.02 | 1.25 | 0.21 | 0.00 | 0.39 | 11.83 |

this shifting hour, the potential output, total output and production loss with both electricity and gas for each sub-sectors are less than 8-hour shift industries.

The total production loss for both 8 and 10-hour shift in textile industry is shown in fig. 3.1. It varies in the range of 23 to 65 percent for 8 hour shift while 21 to 60 percent for 10-hour shift. This production loss is above than 25.6 percent obtained by Lahore Chamber of Commerce and Industry (LCCI) for Punjab during 1984-85 crises and 12 to 37 percent by Siddiqui *et al.* (2011) study which use 2007 as reference period and conduct the survey in 2008 when the energy crisis was in initial stages. The 65 percent production loss of textile industrial sector clearly identify that up to 10-hour electricity load shedding and 4 days a week gas load shedding has thrown textile sector into trouble which appeared as severe loss in output, loss in competitiveness in international market and capital outflow of major textile industries to neighbor countries.

Fig. 3.2 shows the production loss (on-average) of textile sub-sectors under both 8 and 10-hour shift. The highest loss is appeared in hosiery & readymade garments firms under both shift hours. It faced almost 49 percent on average in 8-hour shift while weaving & sizing firms faced the lowest production loss which is 32.5 percent. In addition, the 10-hour shift hour also give the maximum production loss of hosiery & garments industry (45 percent) and minimum in weaving & sizing industry (28 percent). However, textile and dyeing industries are facing production loss above 40 percent. All firms relating to different sub-sectors are facing the production loss above or equal 28% and none of them face above 49

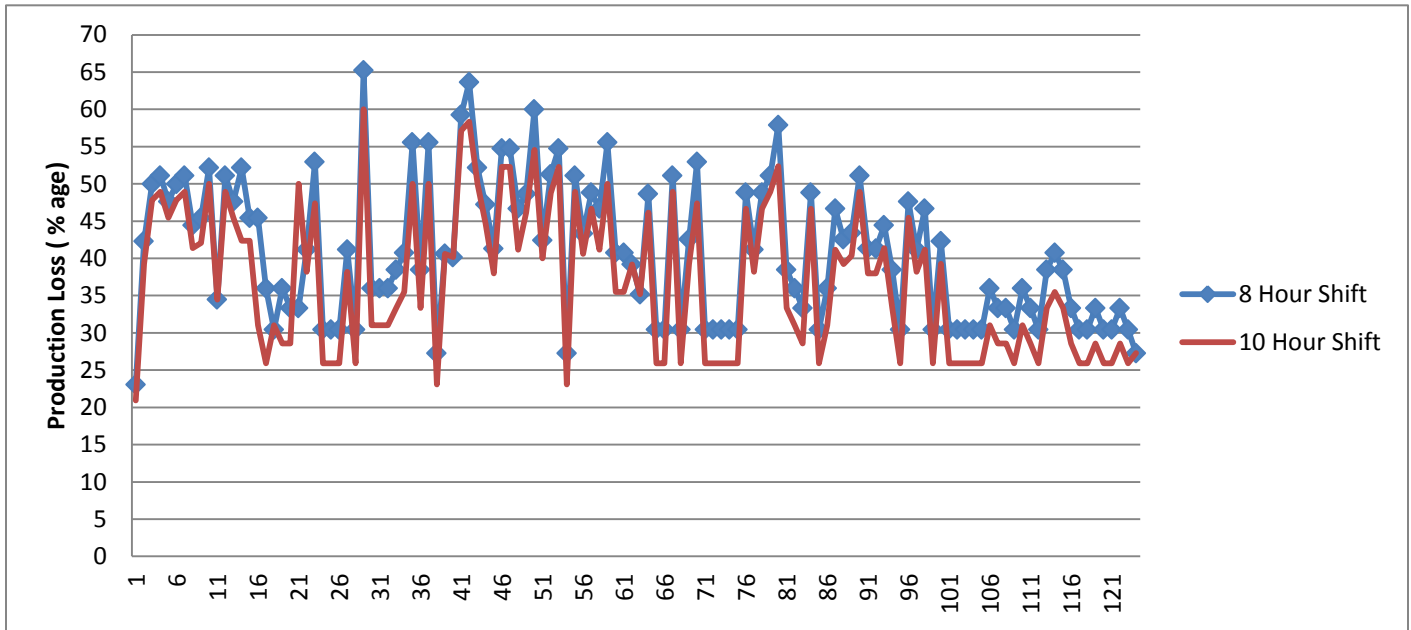


Fig. 3.1: Production loss of Textile sector

percent of total production loss. Dying, chemical & processing, fabric and textile firms are facing the production loss above embroidery, spinning and weaving & sizing firms.

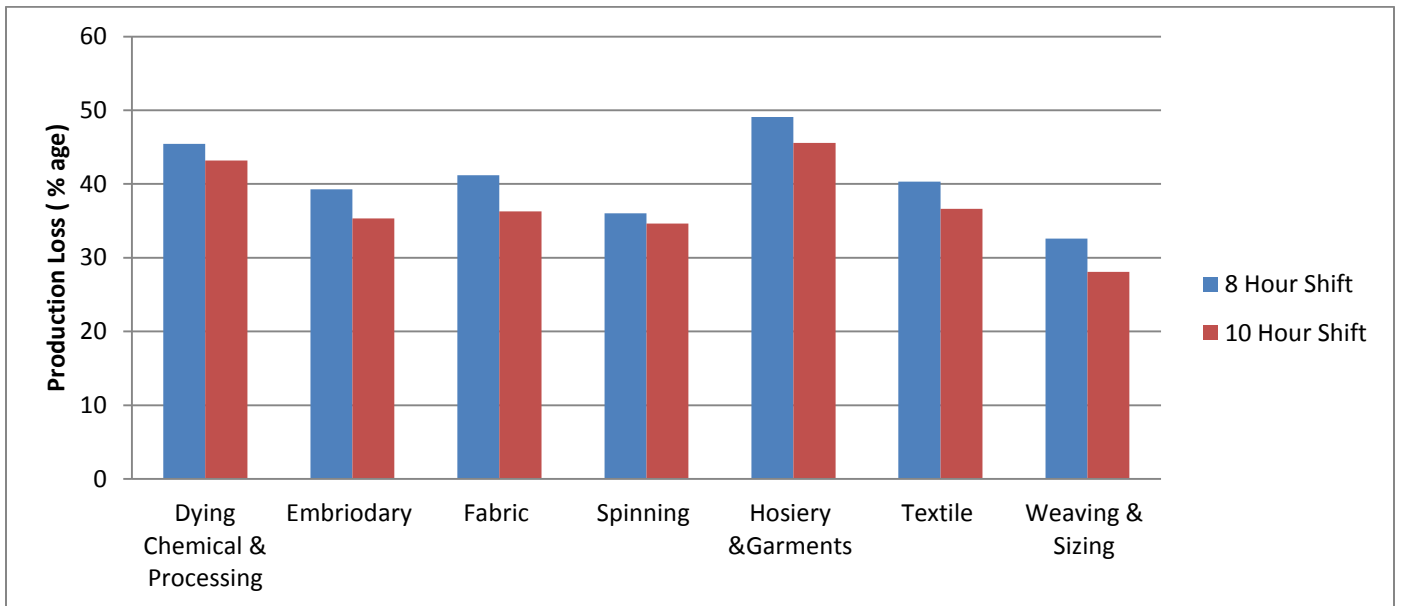


Fig. 3.2: Production loss of Textile Sub-sectors

3.1.1. Production Orders and Delays

Production orders, their delays and production order delays days per-order for textile sub-sectors of Faisalabad, Pakistan are discussed in Table 3.3. We take 2008 as reference period when the energy crisis was in initial stages and compare it with year 2013 when energy crisis has become severe and badly affected to the textile sector of Pakistan. Further, in this analysis, both the local and export orders and their delays are analyzed individually which clearly highlight the picture of textile sector in better way.

In 2008, textile firms have the highest both local and export order as percentage of the total orders per-year while spinning sector has the least local orders in 2008 which is just 4.3 percent of total orders obtained by the whole textile sector. The order of attaining the local orders was same in 2013 for all sub-sectors but weaving & sizing sector has lost its orders in local market due to the on-going energy crisis in textile industry of Faisalabad, Pakistan. The interesting picture is that textile sector has strengthened and its orders have increased more percentage in 2013 as compared to 2008 when the energy crisis was in initial stages. Export orders of textile sector was highest in 2008 leading to hosiery & garments, fabric, spinning and dyeing, chemical & processing firms. In 2013, international orders of all sectors have decreased as compared to reference period; except fabric which gained in orders from 6.8 to 17 percent. It is obvious that textile and hosiery & garments sectors have been unable to fulfill the international requirements and faced reduction in their export demands as compared to 2008. Further, embroidery and weaving & sizing firms have no export orders in both duration 2008 and 2013. The emerging results show that energy crisis has reduced the production orders in both international and national market which result in loss of production.

Weaving & sizing firms have the highest which is 47.8 percent of total order delays in 2008, leading to dyeing & chemical, textile, embroidery, fabric and spinning sectors, respectively. In 2013, textile created major loss of order delays order delays dyeing and chemical had no export production order delays which is 43 percent of total order delays. Embroidery did not become worse but all other sectors have more local order delays in 2013 as compared to 2008. Embroidery, spinning and weaving & sizing firms have no production order delays problem in international market during both years. Dyeing, chemical & processing firms have no export order delay problem in 2008 but in 2013 they are facing the order delays problem as 3.6 percent of total orders. The worst situation is apparent in hosiery & garments sector which have faced the highest order delays problem in international market. In this table, local and export order delays days per-order is documented which clearly identify the picture of order delay phenomenon. It has been an important variable in industrial sectors not only from demand-side perspective but also from industrial owner's concentration. If anyone textile industry is going worse in days to fulfill any order requirement, it will get less to less orders in future either in local or export market but more severe in latter one. In local market, the worst situation belongs to hosiery & garments sector which faced the highest increase in their percentage as compared to 2008 period. In spite of that, all industries faced more order delay days per-order in 2013 as compared to reference period. In addition, textile firms have become less competitiveness in international market due to having more delays days' per-order in 2013 as compared to 2008. Dyeing, chemical & processing firms have also entered in the same phenomena.

Table 3.3: Production Orders and their Delays (In Percentage of Total Concerned orders per-year)

| Orders | Dying & Chemical | Embroidery | Fabric | Spinning | Hosiery & Garments | Textile | Weaving & Sizing |
|--|-----------------------------|-------------------|---------------|-----------------|-------------------------------|----------------|-----------------------------|
| Local Orders 2008 | 18.6 | 7.8 | 5.0 | 4.3 | 14.7 | 34.5 | 15.2 |
| Local Orders 2013 | 16.5 | 7.1 | 3.5 | 3.1 | 13.3 | 39.2 | 0.2 |
| Export Orders 2008 | 3.2 | 0.0 | 6.8 | 6.4 | 23.2 | 60.3 | 0.0 |
| Export Orders 2013 | 1.9 | 0.0 | 17.3 | 3.7 | 32.6 | 44.5 | 0.0 |
| Local Order delays 2008 | 31.8 | 27.3 | 23.3 | 22.8 | 16.3 | 31.7 | 47.8 |
| Local Order delays 2013 | 42.1 | 27.3 | 34.8 | 26.5 | 30.1 | 53.8 | 50.7 |
| Export Order delays 2008 | 0.0 | 0.0 | 6.4 | 0.0 | 11.1 | 8.2 | 0.0 |
| Export Orders delays 2013 | 3.6 | 0.0 | 9.5 | 0.0 | 12.8 | 10.3 | 0.0 |
| Local Order delay days per-order 2008 | 7.1 | 10.3 | 6.2 | 3.3 | 2.9 | 11.1 | 13.4 |
| Local Order delay days per-order 2013 | 13.3 | 6.6 | 7.5 | 5.7 | 6.8 | 15.3 | 15.3 |
| Export order delay days per-days 2008 | 0.0 | 0.0 | 14.5 | 0.0 | 2.3 | 1.5 | 0.0 |
| Export order delay days per-order 2013 | 2.3 | 0.0 | 8.0 | 0.0 | 3.7 | 2.5 | 0.0 |

The whole framework presented in table 3.3 is also presented graphically in fig. 3.3 to 3.8. In both years, 2008 in 2013, textile firms got the highest local orders, leading to the dying, chemical & processing, hosiery & garments and weaving & sizing sectors as shown in fig 3.9. Each of the sub-sector faced severe loss of local orders in 2013 as compared to 2008 except textile firms, where they have higher local orders. The worse picture of weaving & sizing sector is prominent whose orders have declined as compared to reference year and faced almost 13 to 14 percent reduction in their local orders while embroidery firms are less affected by the energy crisis. Textile firms have the highest export orders in both time periods while the export orders of fabric and hosiery & readymade garments have increased as compared to the 2008 and the highest percentage increase in export orders goes to fabric firms. But embroidery and weaving & sizing sectors have no export orders in both eras as shown in fig. 3.4. On average, in local market, textile sectors have strengthened with respect to their orders but in international market, fabric and hosiery & readymade garments sector have strengthened. In addition, weaving & sizing firms have lost their strength in obtaining local orders but spinning sector is going to disappear in international market.

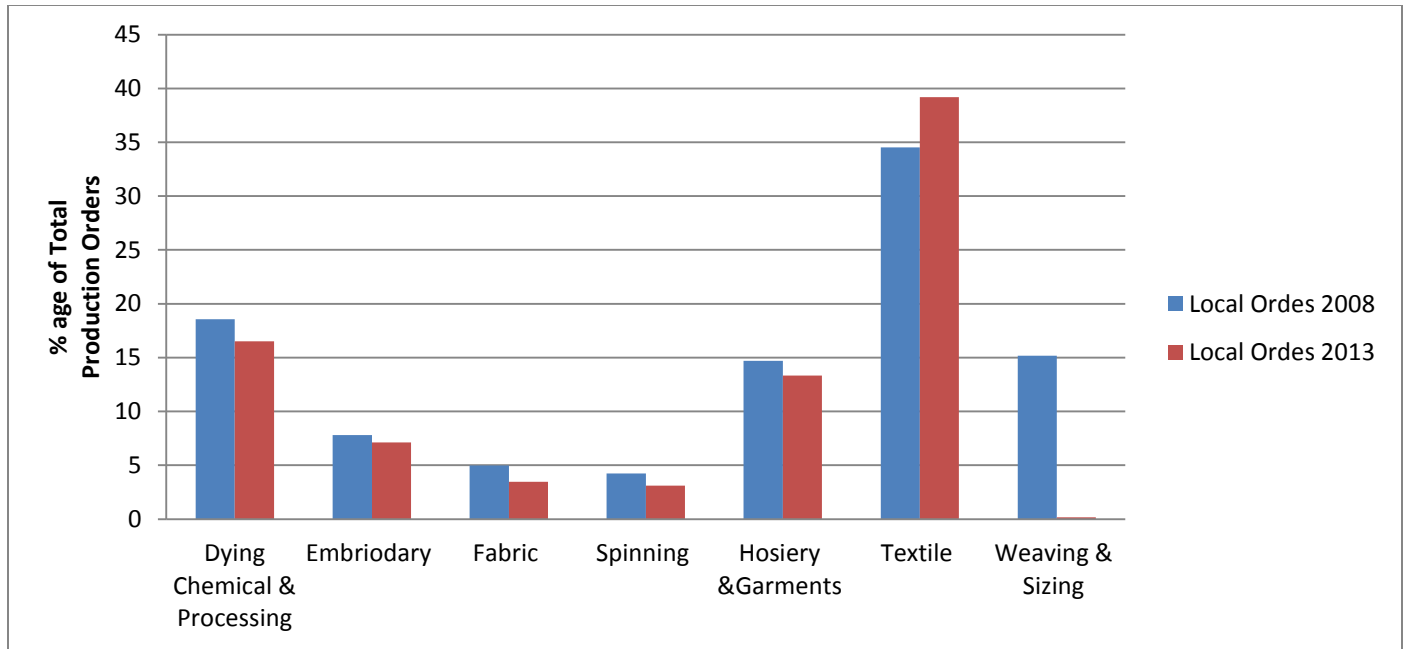


Fig. 3.3: Local Production Orders of Textile Sub-sectors

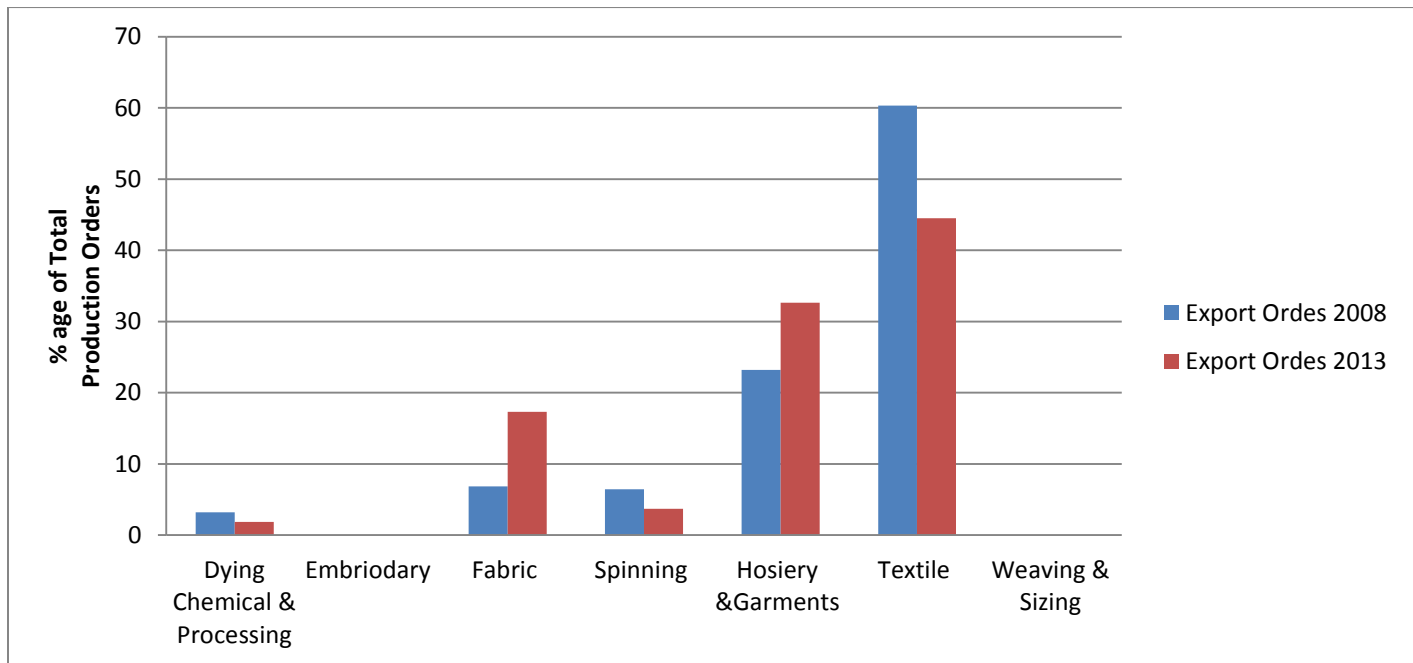


Fig. 3.4: Export Production Orders of Textile Sub-sectors

Fig. 3.5 presents the production orders delays problem in local market by textile sub-sectors. In 2008, weaving & sizing had the highest production order delays which is 48 percent of total production order delays, more than dying, chemical & processing, textile, embroidery, fabric and spinning which have 31.8, 31.7, 27.3, 23.3 and 22.8 percent share, respectively. In 2013, all of the sectors faced huge

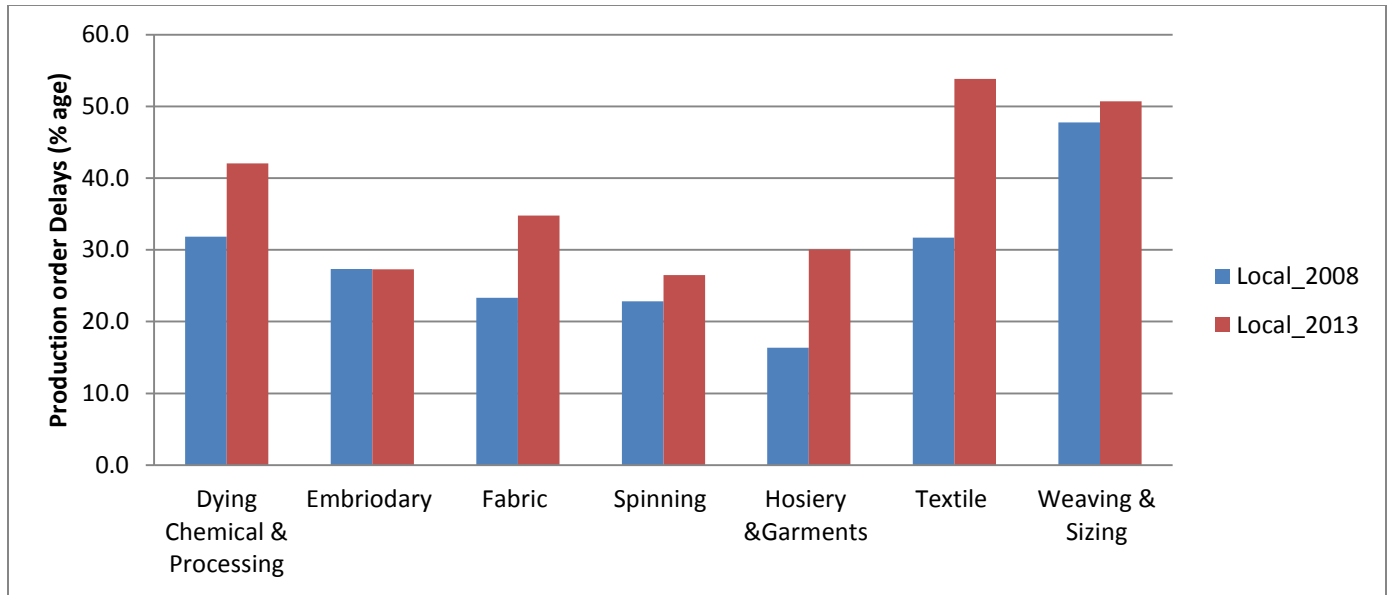


Fig. 3.5: Local Production Order Delays of Textile Sub-sectors

increase in their production order delays except embroidery which has the same behavior as in 2008. The on-going energy crisis has badly affected to the production of textile sector of Pakistan. Textile firms are unable to meet the local requirements and have affected badly but spinning sector is less effected as compared to other sub-sectors which may be due to have its less commitments with the local markets in producing the desire commodities. Dying, chemical & processing firms have the more delays in 2013 as compared to 2008 while embroidery, spinning and weaving & sizing have no export order delays problem. Fabric is facing the highest increase in export order delays in 2013 as compare to other sectors, leading to hosier & readymade garments and textile firms. Dying, chemical & processing is also losing in international market.

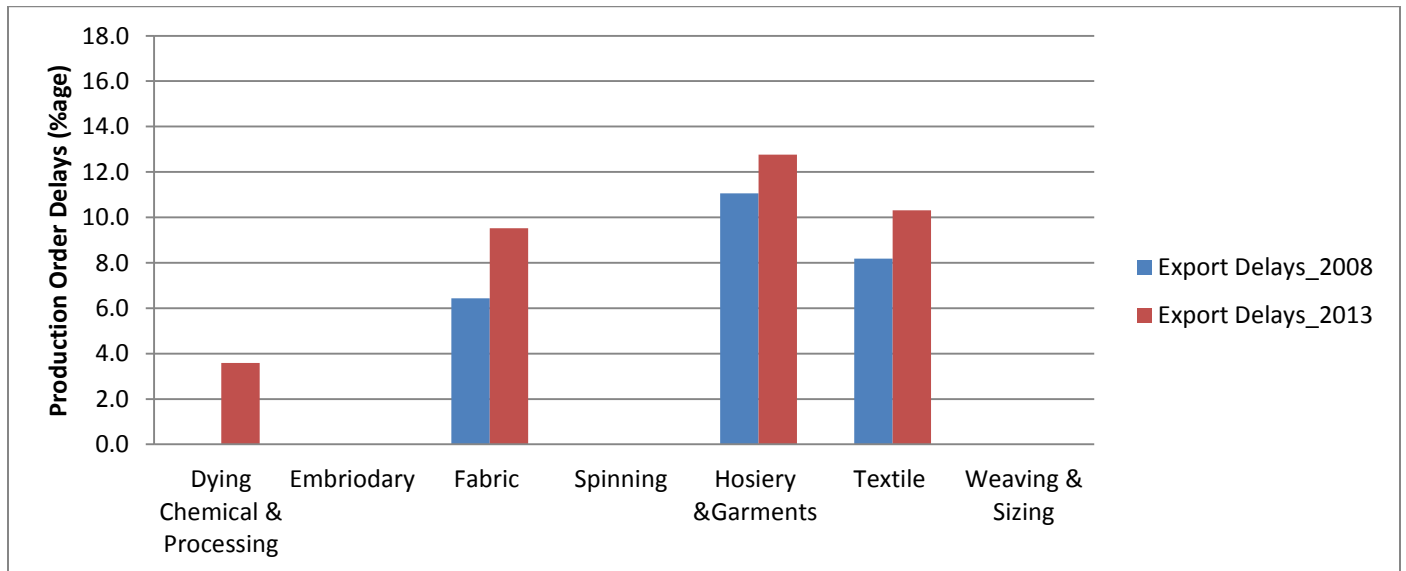


Fig. 3.6: Export Production Order Delays of Textile Sub-sectors

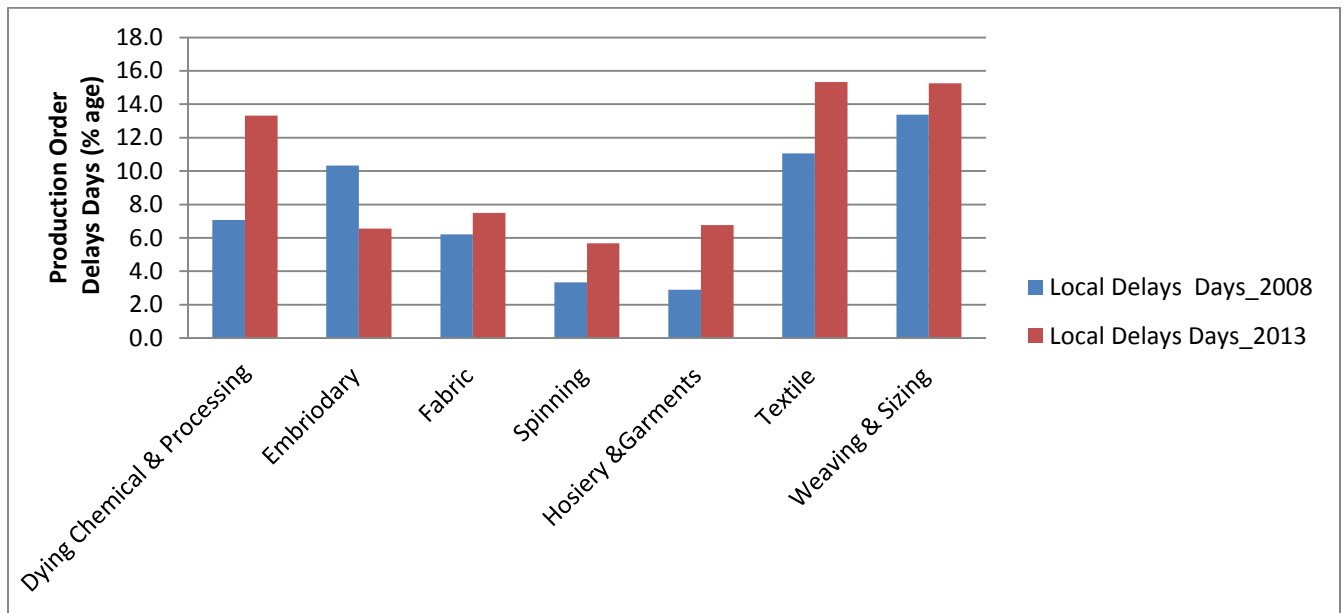


Fig. 3.7: Local Production Order Delays Days of Textile Sub-sectors

In spite of production order delays problem of both local and export orders, production order delay days per-order is another important factor which not only contribute to increase the loss in production but also causing to lose the Pakistan textile export sector in international market. In 2008, fig. 3.7, the highest local order delay days per-order was faced by the weaving & sizing sector that were 13.4% of

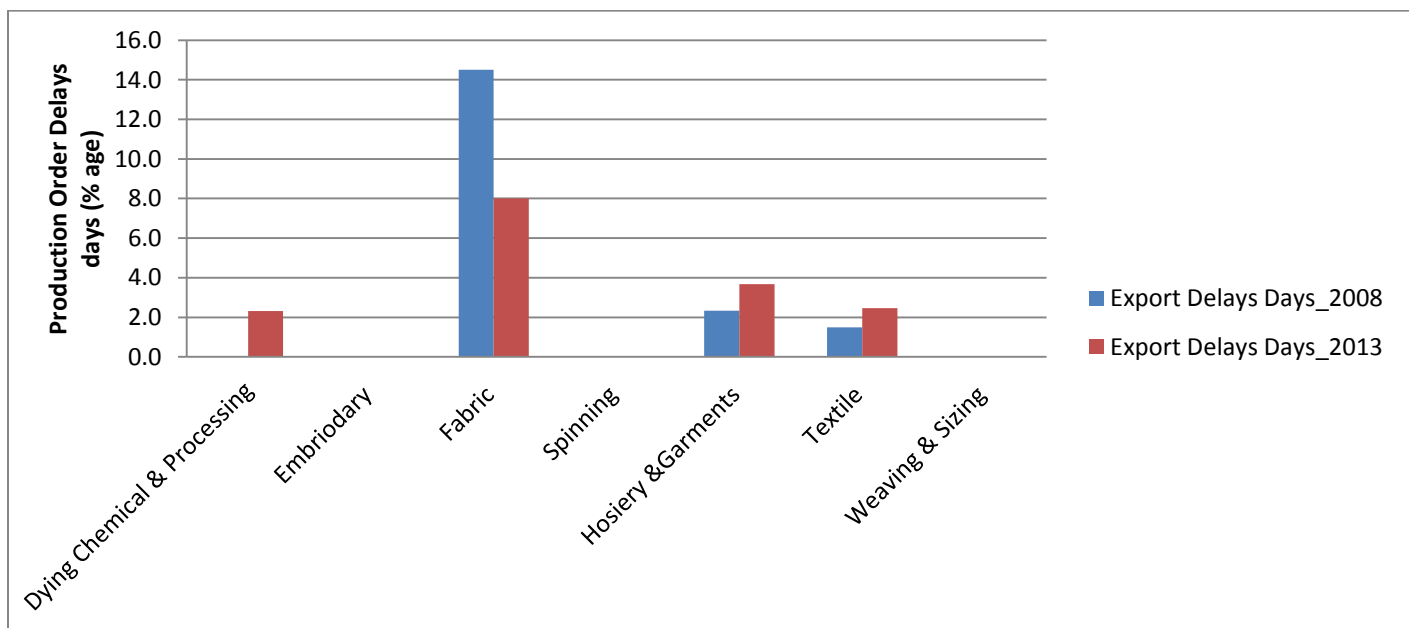


Fig. 3.8: Export Production Order Delays Days of Textile Sub-sectors

total production order delays days per-order but the least delay days per-order was faced by the hosiery & readymade garments firms which were only 2.9 percent. In 2013, dying, chemical & processing sectors are facing the huge production order delay days per-order that is almost more than double of reference. Weaving & sizing, textile and hosiery & readymade garments are also seen with the higher percentage loss in order delay days per-order as compared to 2008 while fabric firms are seen in better position. Fig. 3.8 explains the behavior of international production order delay day's per-order. It is obvious that these orders are high in quantity as compared to the local orders and their delay day's per-order may results in less orders in coming period from international importers. The condition of dying, chemical & processing sector is weak which appears as higher loss of export order delay days per-order which was zero percent in 2008 but now they have more than 2.3 percent. It has decreased for fabric firms from 14.5 to 8 percent, while textile and hosiery & readymade garments sector have faced the percentage increase in their loss. Embroidery and weaving & sizing contribute nothing in export market.

3.2. Energy Analysis

This sub-section defines the estimates of energy (both electricity and gas) used in textile industry of Faisalabad, Pakistan. Table 3.1 presents energy estimates i.e. schedule and unscheduled load shedding hour, required energy and its loss and consumed energy of both electricity and gas, separately.

Table 3.1: Energy Estimates (In Thousands units per day)

| Variables | | Dying & Chemical | Embroidery | Fabric | Spinning | Hosiery & Garments | Textile | Weaving & Sizing |
|-------------------------------|-------------------|------------------|------------|--------|----------|--------------------|---------|------------------|
| Sched. Load Shedding (hour) | Electricity | 8 | 8 | 8 | 8 | 8 | 7 | 7 |
| | Gas* (on-average) | 14 | 6.5 | 1 | 10 | 7.5 | 6.5 | 0 |
| Unsched. Load Shedding (hour) | Electricity | 0.5 | 1.25 | 1.5 | 2 | 1.5 | 1.0 | 1.25 |
| | Gas* | 0 | 0 | 0 | 0 | 0.04 | 0 | 0 |
| Energy Consumed | Electricity | 2.88 | 0.96 | 3.77 | 18.35 | 3.34 | 14.29 | 4.49 |
| | Gas | 21.25 | 7.31 | 0.56 | 3.13 | 11.41 | 88.63 | 1.81 |
| Energy Loss | Electricity | 0.07 | 0.02 | 0.12 | 0.34 | 0.09 | 0.27 | 0.06 |
| | Gas | 0.67 | 0.22 | 0.01 | 0.06 | 0.43 | 2.92 | 0.00 |
| Energy Required | Electricity | 2.95 | 0.97 | 3.88 | 18.69 | 3.43 | 14.55 | 4.55 |
| | Gas | 21.92 | 7.53 | 0.58 | 3.19 | 11.83 | 91.55 | 1.81 |

Note: load-shedding is in per-hour and per-day. *Textile industry is facing four days a week gas load-shedding but in order to compare the analysis with electricity and for reader convenience, we derive and report it in per-day load-shedding hour.

The table explains that dying, embroidery, fabric, spinning and hosiery and garments are facing on-average 8-hour load shedding period per-day and these sub-sectors are also facing almost half-hour to two-hour unscheduled load-shedding period per-day in electricity. While, textile and weaving & sizing firms are facing on-average 7-hour schedule load-shedding period and more than one hour unscheduled load-shedding period per-day. Textile, Dying and hosiery & garments are facing severe schedule gas load-shedding period but fortunately they are free from unscheduled gas load-shedding. Electricity consumption is highest in spinning and textile firms that are 18.35 and 14.29 thousand unit per-day while gas consumption is highest textile and dying & chemical industries which are 88.63 and 21.25

thousands unit per-day while embroidery firms have the lowest electricity consuming per-day and fabric industry has the lowest gas consumption per-day. Spinning, Textile and Fabric sectors are facing severe electricity loss while gas loss has taken its severe form in textile, dying and hosiery & readymade garments industries. Four days a week outage of gas has badly affected to the production of these industries. Spinning and textile sectors are demanding the highest electricity while the requirement for

a. Shifting Hour Criteria (Energy Loss)

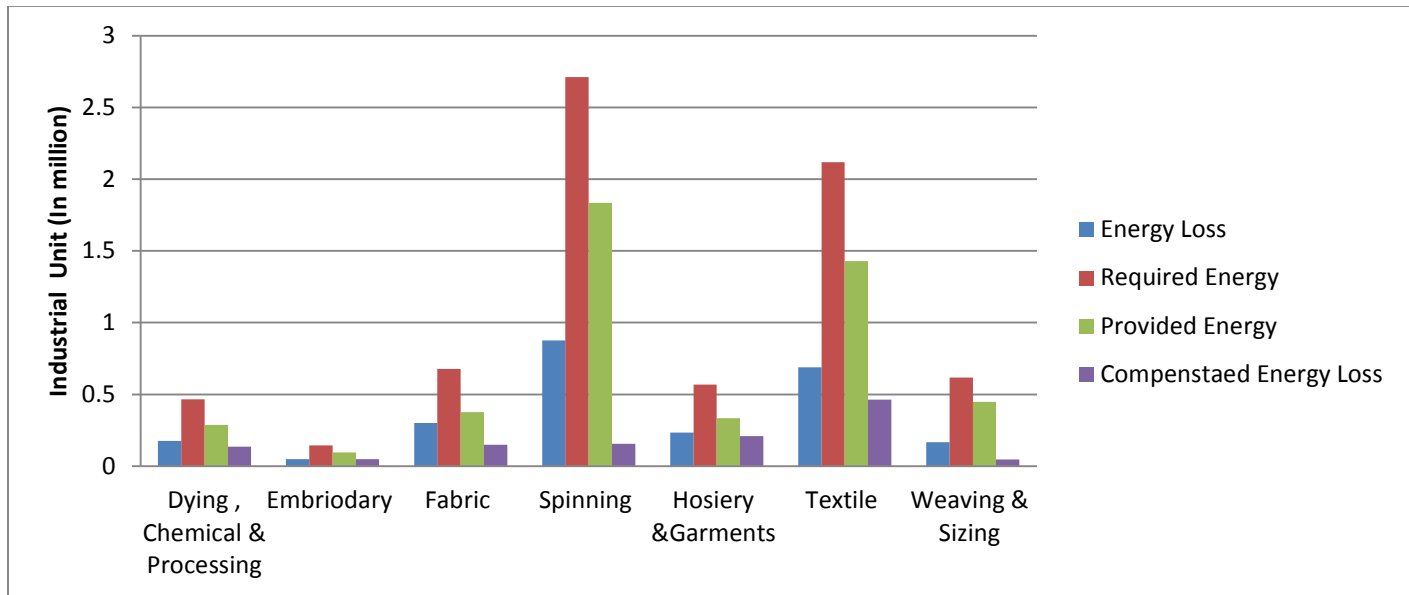


Fig. 3.9: Electricity Loss of Textile Sub-sectors (per-month)

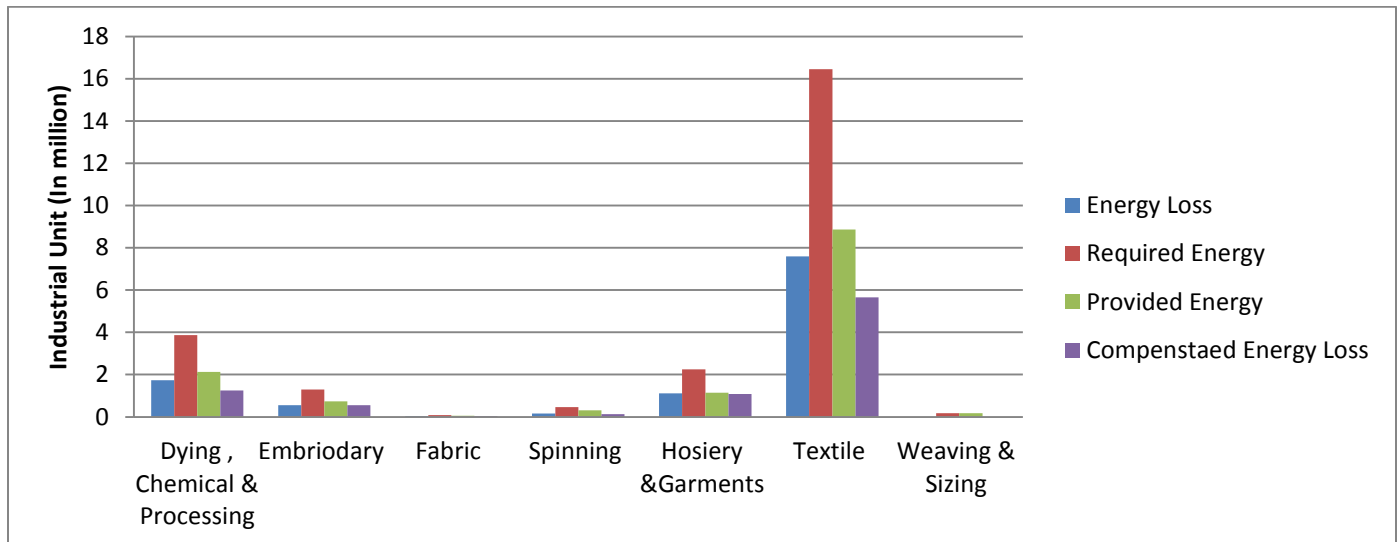


Fig. 3.10: Gas Loss of Textile Sub-sectors (per-month)

gas is highest of textile and dyeing sectors. The highest electricity requirements go to spinning firms which have 18.69 thousand unit per-days, leading to textile, weaving & sizing, fabric and hosiery & readymade garments. While textile firms are requiring the 91.55 thousand unit gas unit's per-day, the highest demand in Textile industry and fabric has the minimum gas requirement. In result, the textile industry is more energy consumed sector in Pakistan and there is need to provide more electricity and gas to more energy deficient sub-sectors on immediate basis.

Energy loss is calculated via different three methodologies by considering the 10-hour shift. In first one, the shifting hour of the concerned industry is followed while in the second methodology, weight is assigned according to their shifting hour period and third one considers the concept of load-shedding during peak hour time. During the survey, we found that most of the firms particularly, dealing with the electricity usages claims that they are facing severe load-shedding during their peak time of production process that is usually during diurnal in these industries.

The required energy (electricity or gas) by each firms, energy provided by government, energy loss and compensated energy loss are shown graphically for each sub-sector. The graph 3.9 shows that spinning firms are requiring higher electricity leading to textile, fabric, hosiery & readymade garments and weaving & sizing sectors. In spite of providing them highest energy, they are facing the sever energy loss and are least compensating to their energy loss. Hosiery & readymade garments and dyeing, chemical & processing have the highest compensation for their energy loss. The gas requirement is highest for textile firms which are requiring above than 16 million industrial units. Fabric, spinning, weaving & sizing and embroidery firms have less demand for gas as well as its total loss and compensated loss. Dyeing, chemical & processing sector has almost 4 million gas requirements with 1.7 million unit losses while hosiery & readymade garments firms are maximum compensating to their gas loss as required by the total loss.

b. Weight according to Shift hour (Energy Loss)

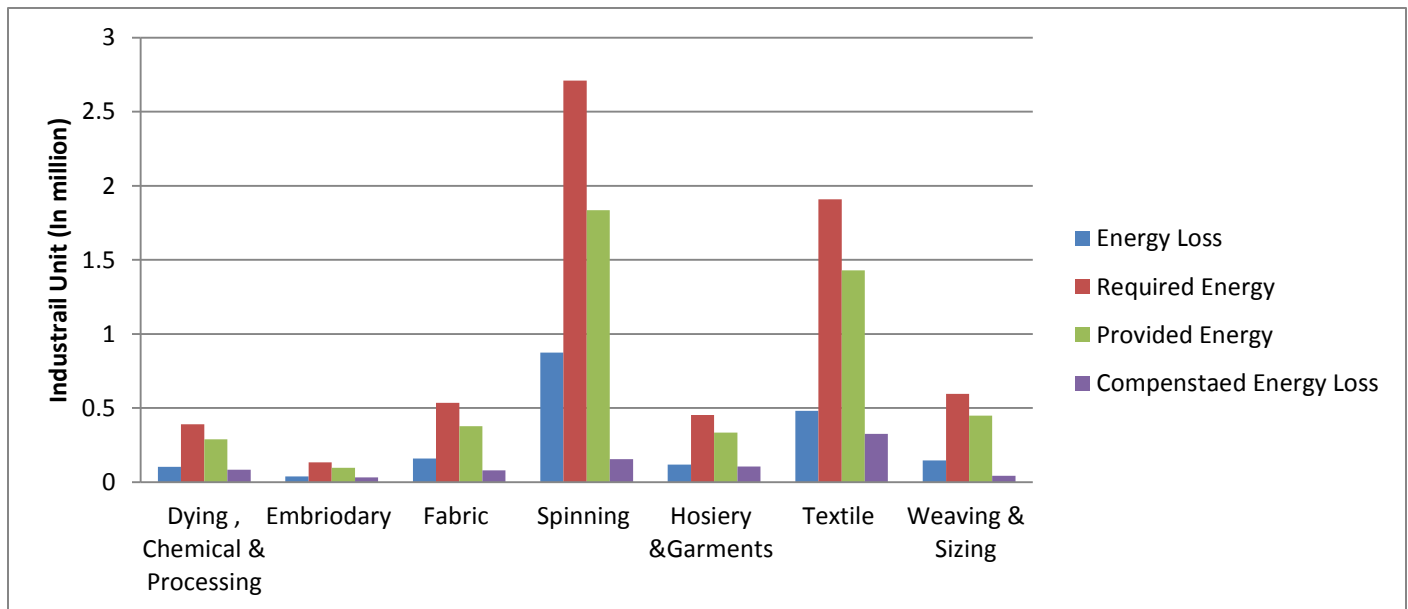


Fig. 3.11: Electricity Loss of Textile Sub-sectors

The fig 3.11 and 3.12 covers the same phenomena by using the weights according to their shift hour. The firms which are working 24-hour are getting more weights as compared to the firms which work for 10-hour or above than it. Both energy and gas loss are underestimated according to this methodology as compared to last one. The energy loss for each sub-sector (firm) is reduced with some amount. Again, it is evident that spinning firms have highest requirements of energy and facing its deficiency but the textile firms are observed to have more shortage of gas leading to the dying, chemical & processing and hosiery & readymade garments firms. Gas shortage problem is not present in severe form at weaving & sizing, fabric and spinning sectors.

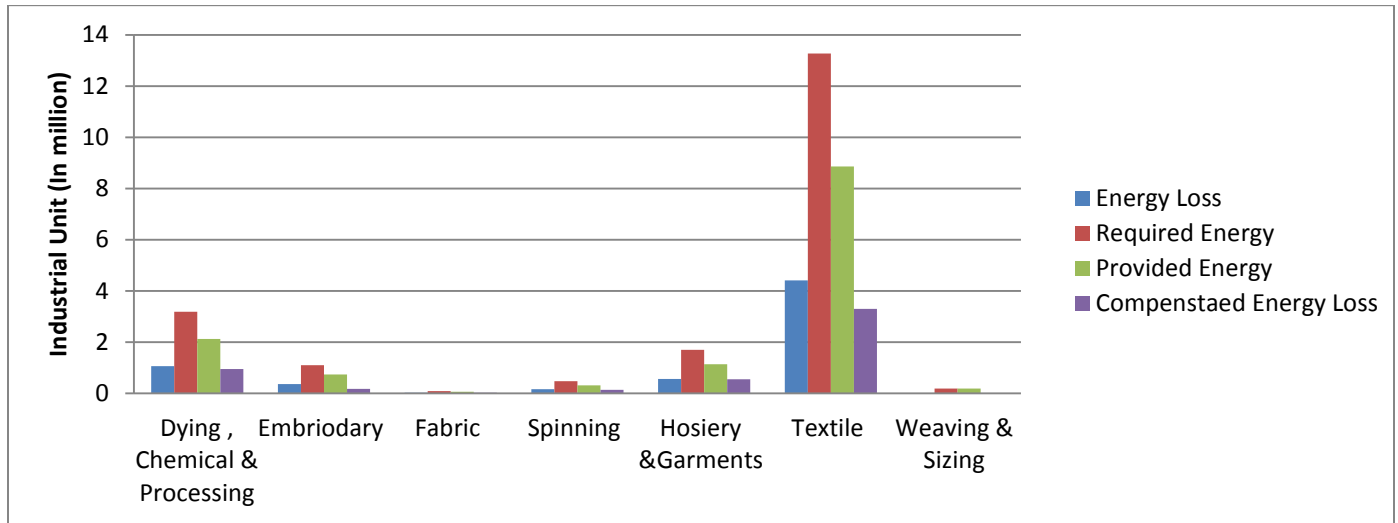


Fig. 3.12: Gas Loss of Textile Sub-sectors

c. Peak Time Load-shedding Hour (Energy Loss)

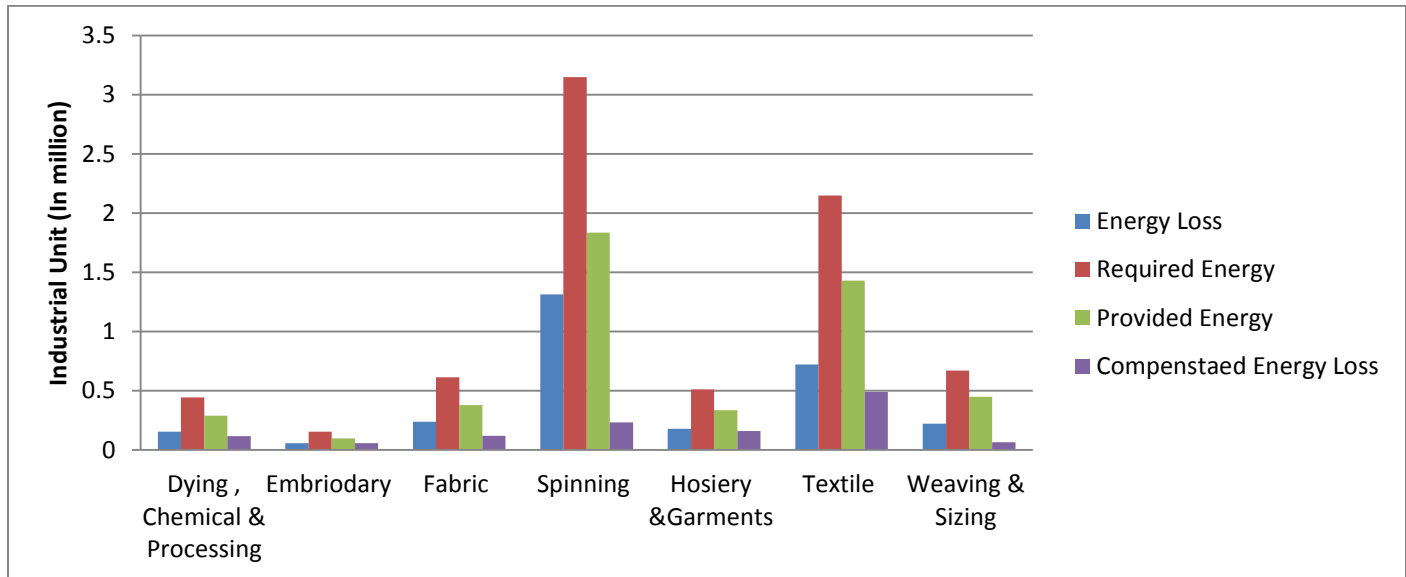


Fig. 3.13: Electricity Loss of Textile Sub-sectors

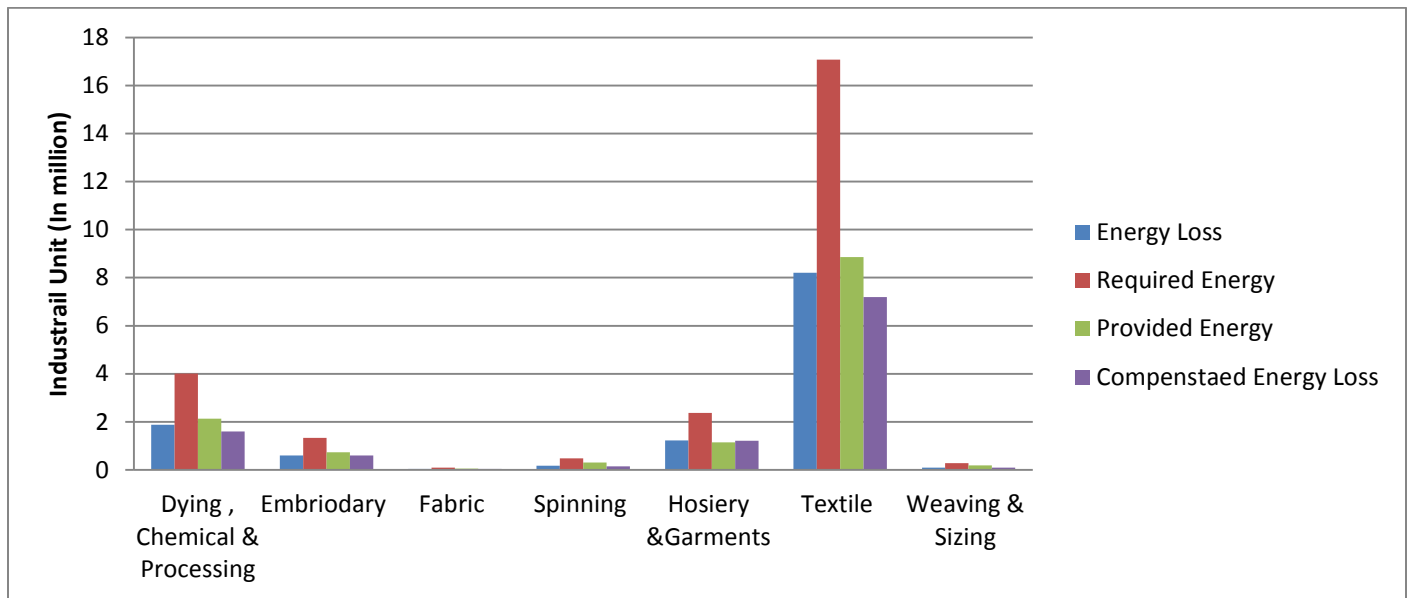


Fig. 3.14: Gas Loss of Textile Sub-sectors

In third and last stage, we utilize the concept of peak time load-shedding. Most of the firms confirm that they face severe shortage of electricity during their peak time of business and production activity. Each value of concerned group of firms has more electricity requirements as compared to shift-hour criteria and weight according to shift-hour criteria defined above. Electricity requirement for spinning sector is almost 3.2 million unit per-month while government is providing only 1.8 million units. In this way, this sector is facing electricity shortage of 1.4 million units per-month and compensating 0.25 million units to its energy loss through standby generators and other alternative sources, left over with huge energy deficiency. The weaving & sizing firms are least compensating their energy loss same as they have in both of the criterions defined above. Fig. 3.14 depicts the picture of gas using firms that have higher gas values as compared to shift-hour and weight according to shift-hour criteria. Fabric, spinning and weaving & sizing are free from the issue of gas shortage. They have less demand as well they compensate according to their requirements. But textile, dying, chemical & processing and hosiery & readymade garments are facing the severe shortage of gas in spite of the utilization of alternative source in order to fulfill their requirements.

In peak hour load shedding environment, we found that firms are facing the severe loss of energy and producing the less output. Overall, spinning sector is facing the high deficiency of electricity while textile and dying, chemical & processing are facing the huge deficiency of gas and their alternative source are not seen more energy producer which can fulfill their requirements. The immediate solution is that government of Pakistan should overview its policy for energy provision to other industrial sectors, particularly the provision of Compressed Natural Gas (CNG) in Pakistan.

3.3. Willingness to Pay (WTP) for Uninterrupted Energy Supply

The shortage of energy in textile sub-sectors has compelled them to show their willingness to pay for uninterrupted energy supply on one unit of both gas and electricity. The table 3.5 presents the estimates of WTP for uninterrupted energy supply.

Table 3.5: Willingness To Pay (WTP) in Pak. Rs. for uninterrupted Energy supply on one unit

| Willingness to Pay (WTP) | Dying | Embroidery | Fabric | Spinning | Hosiery & Garments | Textile | Weaving & Sizing | Total |
|---------------------------------|--------------|-------------------|---------------|-----------------|-------------------------------|----------------|-----------------------------|--------------|
| Total Firms | 13 | 9 | 15 | 3 | 21 | 39 | 24 | 124 |
| WTP (Firms) | 9 | 7 | 11 | 2 | 12 | 24 | 14 | 79 |
| WTP (% of Total Firms) | 69 | 78 | 73 | 67 | 57 | 62 | 58 | 64 |
| WTP (% of Sample Size) | 11 | 9 | 14 | 3 | 15 | 30 | 18 | 100 |
| Maximum Pak. Rs. | 20 | 10 | 9 | 8 | 20 | 13 | 11 | — |
| Minimum Pak. Rs. | 4 | 4 | 5 | 3 | 6 | 2 | 4 | — |
| Average Pak. Rs. | 9 | 7 | 7 | 6 | 11 | 6 | 7 | — |

Out of 124 sample of industrial firms, only 79 (64% of total) are willing to pay for uninterrupted energy supply. The firms involved in embroidery are seen more concerned for uninterrupted energy supply and involved in hosiery & readymade garments are less concerned to uninterrupted energy supply either having less belief on governmental policy or their less interest due to the recently faced shock of high price of electricity.⁸ During our survey, we use the contingent valuation survey technique and put the maximum value 20 Pakistan Rupee and got the response of different textile firms according to that. The maximum willingness to pay was 20 Rs. by dying, chemical & processing and hosiery & readymade garments sectors. It means that these firms are willing to welcome the high price of gas and electricity units in spite of facing and offering huge costs. In addition, they are willing to face the increasing cost of energy, in spite of caring the huge cost of their products in local and international markets. The minimum willingness to pay is 2 Rs. by the textile firms of textile sectors. The firms working under fabric sector has minimum range of willingness to pay which is 9 Rs. to 5 Rs. and dying, chemical & processing firms have maximum range varies in 20 Rs. to 4 Rs. On average, hosiery & readymade garments firms has maximum willingness to pay that is 11 and minimum willingness to pay belongs to textile and spinning sectors that is 6 Rs. for uninterrupted energy.

The fig. 3.15 explains the picture of willingness to pay as percentage of total firms. It is apparent that firms involved in embroidery industry (with the maximum 78%) have the highest share in willingness to pay, leading to Fabric, dying, chemical & processing, spinning, textile, weaving & sizing and hosiery

⁸ We conducted our survey in the end of September and October at that time; the entire industrialist faced almost 50% increase in their energy units. This huge increment also discourages to their willingness to pay for uninterrupted energy supply.

& readymade garments which have 73%, 69%, 67%, 62%, 58% and 57% share, respectively of their sample size. It has been derived already that hosiery & readymade garments have the maximum production loss and their concerned firms are less involved in willingness to pay for uninterrupted energy supply which may be due to the recently faced increased price of electricity and gas.

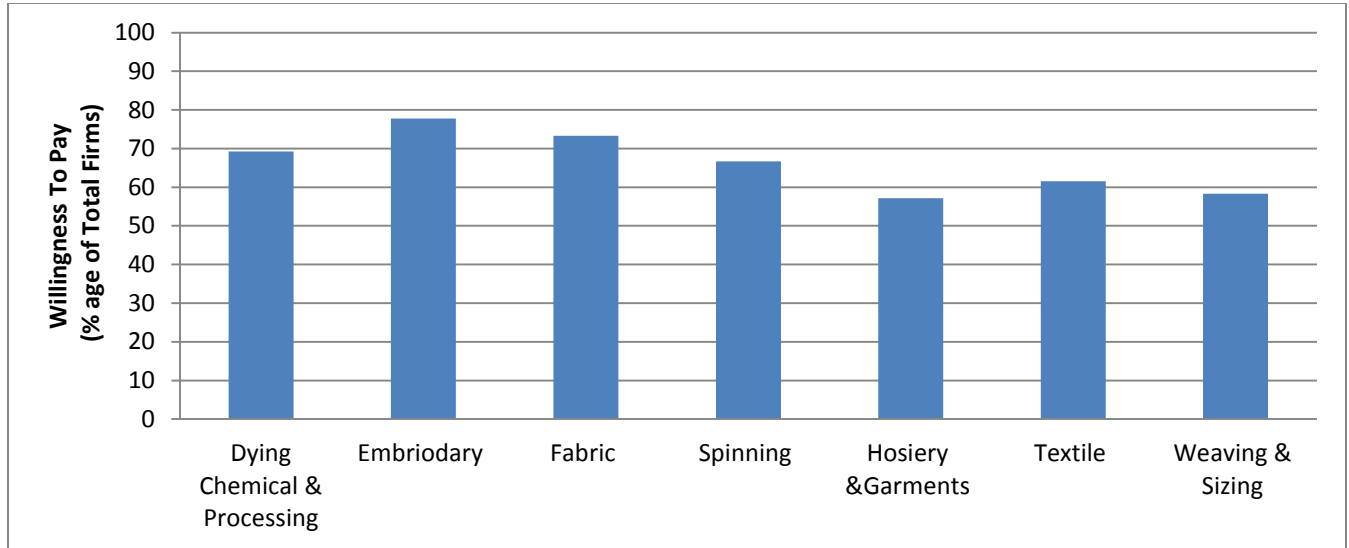


Fig. 3.15: Share willingness to pay for Interrupted Energy by each sub-sector

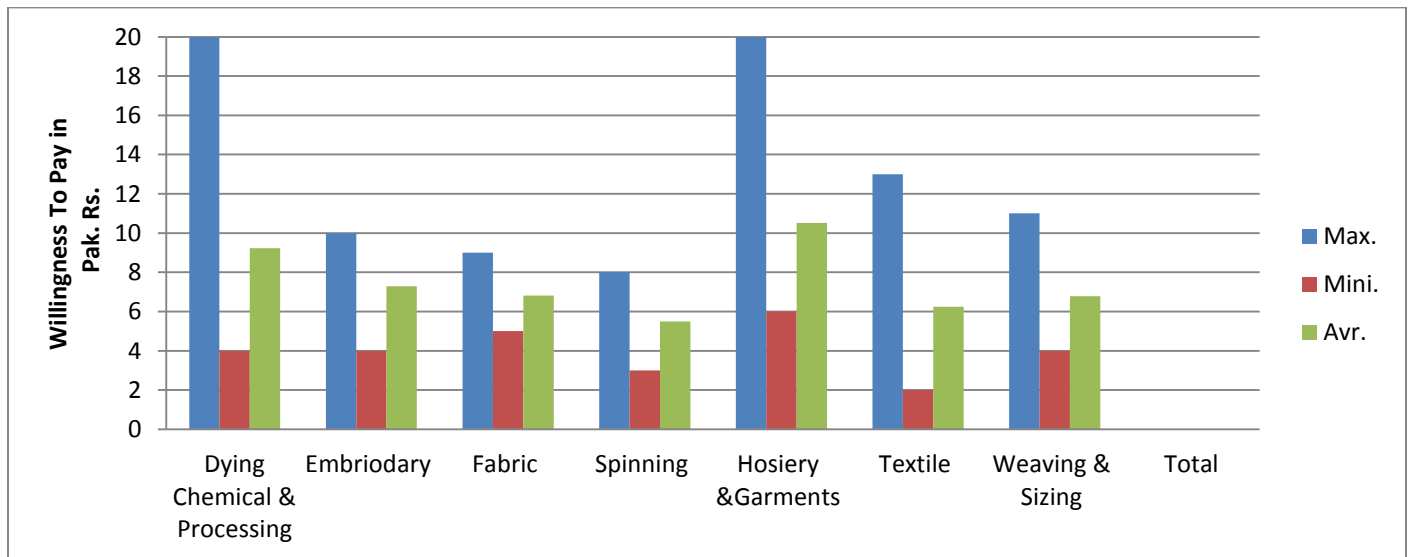


Fig. 3.16: Share of Willingness to Pay for Interrupted Energy by each sub-sector

After defining the percentage share of each sub-sector for WTP, the fig. 3.16 is shown which explains the maximum, minimum and average values of WTP for each sub-sector. Firms involved in dying, chemical & processing and hosiery & readymade garments are willing to pay maximum 20 Pak. Rs. for uninterrupted energy supply while the WTP for embroidery, fabric, spinning are not higher than 10 Pak. Rs. The maximum WTP for textile and weaving & sizing firms varies in the range of 11 to 13 Pak. Rs. The minimum-highest WTP is apparent of firms working in hosiery &

readymade garments manufactures (which have 6 Pak. Rs.). Textiles firms have minimum-lowest WTP which is 2 Pak. Rs. The highest-average WTP is prominent in hosiery & readymade garments industries but spinning firms are WTP the lowest-average value which is 6 Pak. Rs.

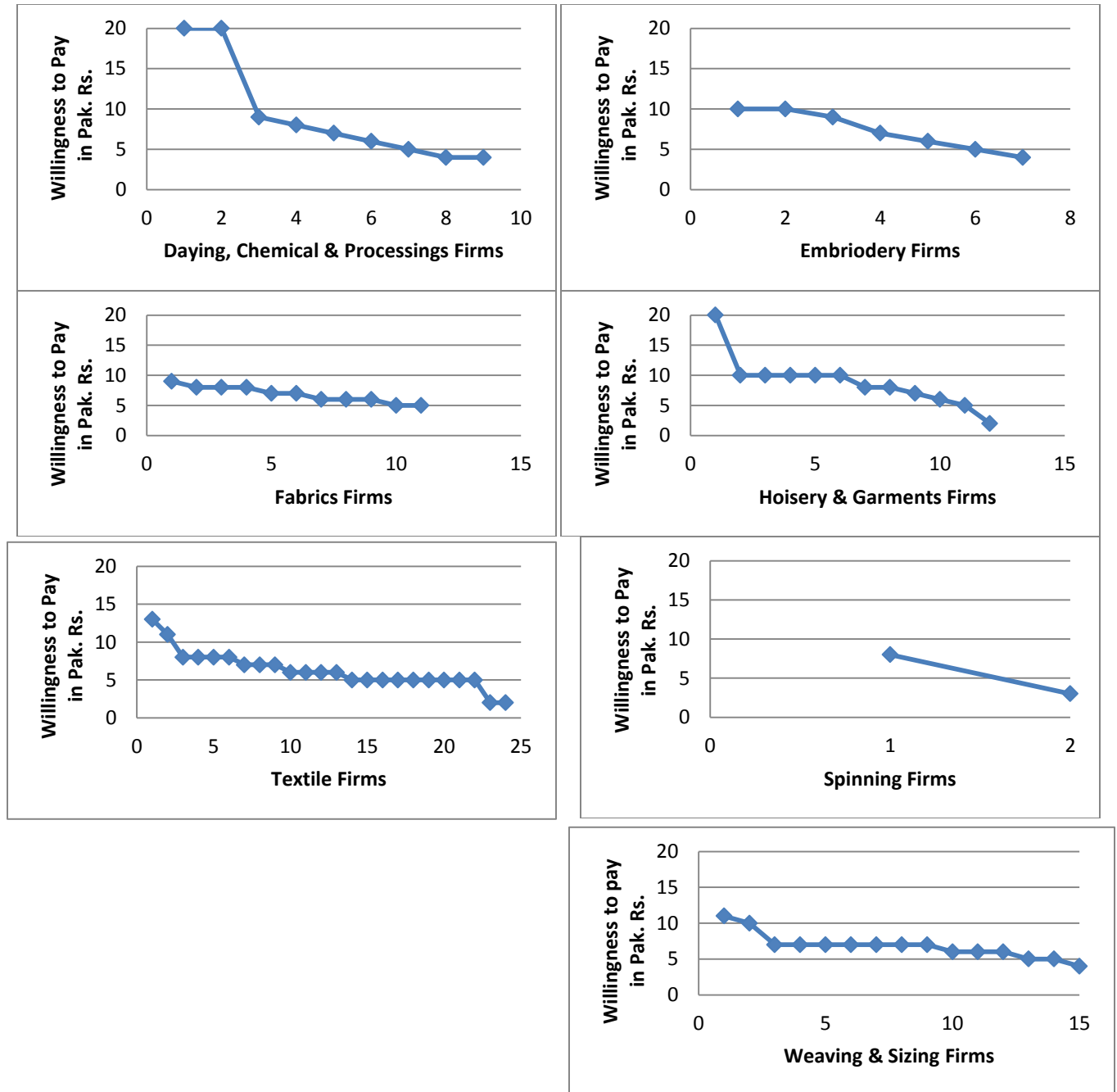


Fig. 3.17: Willingness to pay for uninterrupted Energy by Textile Sub-sectors (Firms-wise)

In chart 3.17, seven figures are drawn for each sub-sector of textile industry which draws the curve of willingness to pay (Pak. Rs.). All of the curves have negative relation with the number of firms under each sector, clearly defining the shape like demand curve. We further extend the analysis and show the behavior of all firms in just one graph. It is shown in fig. 3.18 which has the negative slope for 79 firms, willing to pay for uninterrupted energy supply.

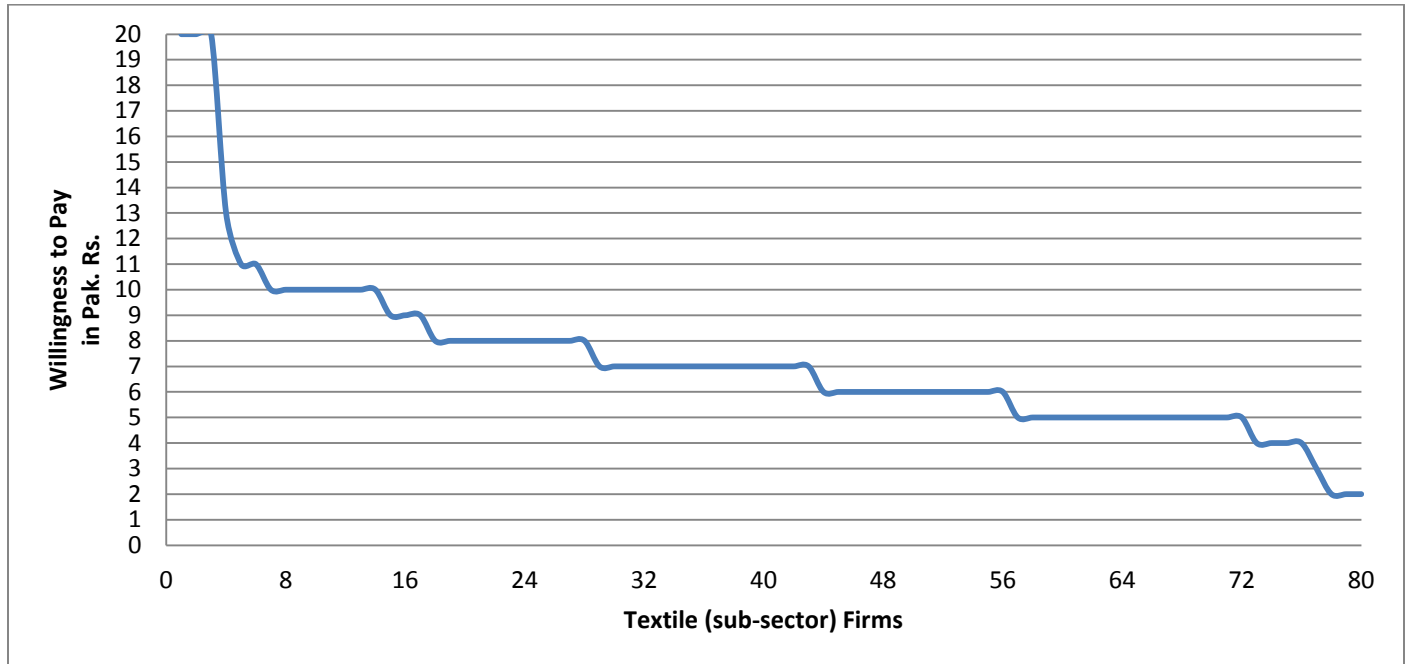


Fig. 3.18: Willingness to pay for uninterrupted Energy by Textile Sub-sectors (All Firms)

4. CONCLUSION

Since 2007, major export oriented textile sector has been unable to meet the demand of both national and international orders due to heavy planned and unplanned energy outages in Pakistan. This outage has appeared in number of findings; intense production loss, big industrial units have been converted into smaller one, most of the industries have shut-down and large number of capital flight (industries), particular in competing neighbor countries, heavy loss of competitiveness in international market and loss of confidence by big international exporters.

This study covers 124 firms of textile sector having huge dependency on electricity and gas. The survey results reveal that textile sector is facing 23 to 65 percent production loss for 8-hour shift and 21 to 60 percent for 10-hour shift due to interruption in energy supply. Hosiery & readymade garments sub-sector is sharing highest in total production loss while weaving & sizing firms have minimum share in production loss. Textile firms have the highest labor hour loss per-day in both shift-hours, leading to hosiery & readymade garments and dyeing, chemical & processing industries. The energy outage has not only adverse impact on production but also create major delays in

production orders. The highest percentage increase in local order delays (as compared to its reference period, 2008) are seen in textile firms, leading to hosiery & readymade garments and dying, chemical & processing industries. In international market, the percentage increase in order delays problem are observed for fabric firms, higher than textile and hosiery & readymade garments. Furthermore, dying, chemical & processing firms have highest order delays problem in both local and international market. It is evident that delays in production orders clearly indicate for fewer orders in near future. Most of the firms in textile sector have lost their both local and international orders. Weaving & sizing firms have severe reduction in their local orders while textile firms have strengthened as compared to reference period, 2008. The entire textile sector except firms involved in hosiery, readymade garments and fabrics production have lost their export orders.

The findings reveal that spinning firms are more electricity consuming and electricity deficient in Pakistan while textile firms are facing big loss in its production due to the gas outage. The entire firms in textile industry have taken the stand-by generator as alternative source in order to kill the heavy schedule & unscheduled load-shedding and to reduce the major output loss. They are trying to compensate (maximum) their energy loss according to their requirements but still they are facing the huge energy as well as production loss. This heavy energy loss has compelled them to express their willingness to pay for uninterrupted energy supply. From the sample, only 64 percent of the firms are willing to pay for uninterrupted energy supply. On average, the whole sub-sectors are willingness to pay more than or equal to 5 rupees per-energy unit. The embroidery firms have highest willingness to pay while hosiery & readymade garments have least willingness to pay. These findings are helpful for the policy makers to make the best energy policy in favor of textile industrial sector that may reduce the production loss and generate the huge employment in this sector.

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