Energy Saving Through Green Infrastructure in textile sector

Engr. Aftab Khan Masood , Engr. Shazia Shabbir , Engr. Hammad Altaf , Engr. Usman Hafeez , Associate Engr. Wasi Ullah and Associate Engr. Faisal Shabbir

Abstract— Pakistan is facing a serious energy crisis affecting all economic sectors. Energy Audits were conducted in Textile sector to identify energy saving potential areas. It was observed that, due to lack of local R&D on the Green infrastructure concept and awareness regarding relation between Energy Efficiency and Green Infrastructure, the sector has followed the old & inefficient infrastructure without considering energy efficiency aspect of the building. Which has resulted in high energy input, low productivity and low product quality. By introducing Green infrastructure concept we can utilize recyclable / useful waste energy and the natural energy. It will lead to optimize the energy consumption, reduce GHG emissions and help in cleaning the environment.

Index Terms— Green Building, Energy Consumption, Energy Efficiency, Building Layout, Spinning textile sector.

1 Introduction

PAKISTAN's textile industry is the largest export oriented sub sector adding up to huge share of the economy. [1, 2]. Industrial energy consumption in Pakistan is given below:

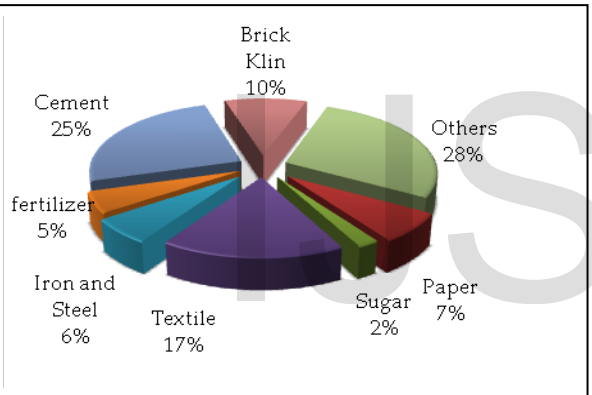

Fig. 1. Idustrial Energy Consumption, Textile sector being second largest energy consumer is selected for further research

Textile industry has been chosen for further research.

Average electricity consumption per day in a Textile Spinning sector is as under:

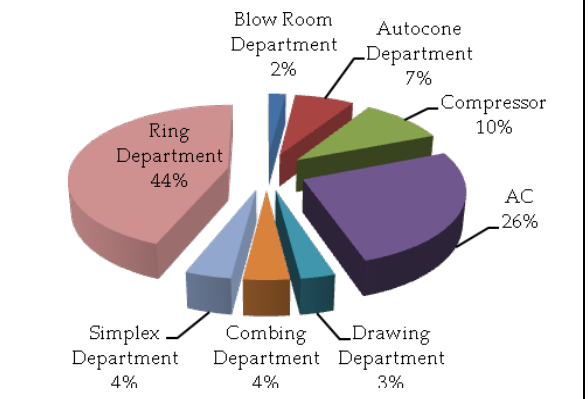

Fig. 2. Energy Consumption of spinning sector

It is in strong competition in the international market and energy is one of the major important cost factors in this industry to be addressed. There are significant barriers existed in industrial sector to adopt best available technologies in Pakistan. These include:

1. Lack of technical capacity;
2. A focus on upfront investment cost instead of full lifecycle cost;
3. Fearing from the adoption of early stage technologies;
4. Restricted access to financial support to cover the extra costs of technologies; and
5. The inefficient, polluting technologies with long lifetimes.

This finding suggests that relatively low priority is given to Energy efficiency in Pakistan, and it is suggested to invest in green building idea where it can reduce operating costs and can have a notable impact on building occupants.

This paper discusses the long term potential for green infrastructure in the Industrial Textile Spinning sector of Pakistan. It is part of the Green Productivity Centre (GPC), National Productivity Organization (NPO) contribution to the research work in the field.

2 Related Work

Energy Crisis is appearing to be blockage to the country's economy. The shortage of energy resources and increase in demand is badly affecting all economic sectors in general and industrial sector in particular. [3]. Due to the emmissions of carbon dioxide in the atmosphere, climate has already been changed and a lot of the change is expected over the next 30-40 years. Sustainable low-carbon industries are performing well during the recession and are ripe for investment and growth. Human being is totally reliant on healthy environment, therefore in order to endup the poverty for long term there is need to shift the economies to green. [4]

Building construction, operation, and demolition have a variety of environmental impacts, including air pollution emissions, greenhouse gas emissions associated with climate change, solid waste generation, water pollution, natural re-

source depletion, and habitat disturbance. [5]

The creative use of the green infrastructure is one of the most promising opportunities for adaptation and these needs to be recognized in the planning process at all scales. [6]. Green buildings are healthy, energy-efficient buildings that increase natural light and improve air flow for occupants. Green, living roofs and many other features may be added to integrate the building directly into the environment. [7]

United States Environmental Protection Agency (EPA, 2014) states: "Green building uses the environmental friendly and energy / resource efficient processes and structures all through a building's life-cycle including design & maitenance, construction & operation and deconstruction & reformation". [8]

Luke Wreford says that the shift to green economies will not only save the energy but also re-shape the labour market significantly. A review conducted by International Labour Organisation (ILO) covering 8 countries, has suggested that greening the economies proposes the latent for 15-60 million additional jobs overall, taking into account both losses and gains. [4]

The industrial sectors of many emerging economies are developing rapidly. It is important that they do so in a sustainable way. They need to be encouraged to leapfrog to climate friendly technologies if they are to avoid locking themselves into long-lasting, inefficient and polluting technologies for decades to come. [9]

These crisis appears as a barrier in the long-term future, unless proper implementation is assumed on priority basis. Thus, in order to cope with the present energy crises, low energy buildings can be a best solution.

3 METHODOLOGY

3.1 Energy Audits

Energy Audits (data collection, data analysis, gap analysis, suggestion/solution identification) of textile industries were conducted to review the existing energy consumption practices, identify the key potential energy efficiency & conservation areas and provide detailed recommendations.

3.1 Energy Auditing Instruments

NPO has used following energy-auditing instruments during the audits as and when required:

- ✓ Power Quality Analyzer
- ✓ Power Logger
- ✓ Lux Meter
- ✓ Flue Gas Analyzer
- ✓ Thermal Imager
- ✓ Infra Red Gun
- ✓ Digital vane Probe Anemometer
- ✓ Digital Hygrometer
- ✓ Tachometer
- ✓ Ultrasonic Flow Meter for Liquids
- ✓ Belt Tension Meter
- ✓ pH/Conductivity Meter with TDS
- ✓ Pitot Tube
- ✓ Fluke 922/Kit , Fluke 922 Airflow Meter

4 DATA ANALYSIS & OBSERVATIONS

The follow up energy audit in the industrial units leads us to know that suggested energy savings and best practices are not being implemented to achieve the targets. This motivated us to search for the reasons of this poor response and conversion of identified saving potentials to real savings.

All related aspects of the matter were analysed, which leaded us to find that factory building layout is one of the most significant barriers amongst different bottlenecks, due to which the mill management is not able to implement even the no-cost and low-cost measures.

On further micro study, three main area which are affected by building characteristics were identified for improvement i.e. Compressed air system, Humidification and lighting. It was noted that the hot air of compressor can be utilized for yarn conditioning in winter season. But in most of the Industrial units it cannot be used as the temperature could not be maintained due to high skin losses of ducting system between compressor room and yarn conditioning room. To meet the need of the process electric heater is mostly used, means extra energy used.

Another area identified was Humidification Plant. The layout of the system, size of trenches and location of the spray chamber is of key importance with respect to Sun path.

It was noted that heat gain and heat loss and direction of the sun path is not being considered in selection of location of the washing chamber. The layout of the trenches is not laid for multi-purposes, it is mostly not positioned to remove dry heat produced by the machine and motors, which could be released easily in case of good trenches layout and it directly dissipates to production hall, it increases its load on humidification plants and consumes more energy.

The size and surface of the ducts and trenches were also not supporting the fan capacity and restricts the airflow, results in less output per input and hence leads to energy losses. The size, location of the trenches and washing chamber may be planned and design as per calculated needs.

The third area was Lighting system. It was noted that there is no combination of natural, a free and green/clean energy and artificial lighting. Almost all the mills are fully dependent i.e. almost 100% on artificial lighting and the required LUX level was not being achieved due its location, housekeeping and height, in other words energy is being wasted.

5 RECOMMENDATIONS

During the designing of building and process layout of spinning unit of Textile Sector the concept of Green Building should be consideredwhich may support the re-use of waste energy. The location of equipments / departments should be in layout where the energy may be recycled and the heat dissipation and the energy use for heat elimination from the production hall should be minimized. Similarly, the building layout should support maximum utilization of natural lights. For example, useful waste energy recycling like hot air of compressor may be utilized for yarn conditioning heat from the electric motors may be removed through exhaust system / fan of humidification plant. Similarly, the location of washing

chamber should be positioned with respect to sunrise and sunset to minimize summer heat gain.

6 Results

After applying recommendations we can have significant energy savings.

1. If we use compressor hot air for yarn conditioning, we can save:

TABLE 1
Energy saving through compressor hot air

Sr.No	Unit	Saving
1	kWh/Years	180000
2	PKR/Years	1,440,000/-

KWh = Kilo Watt Hour, PKR = Pakistani Rupee

2. By managing lighting system:

TABLE 2
ENERGY SAVING BY MANAGING LIGHTING SYSTEM

Reducing # of tube lights by	After Saving (kWh)	Before Saving (kWh)	Potential for Savings %
30%	40	50	20

KWh = Kilo Watt Hou

7 Conclusion

The above discussion conclude that only Energy Efficiency technology and process management will not lead us to save the identified savings, but building layout and construction is also of core importance, and facilitate in achieving the energy savings. The better layout will lead us to reuse the energy being wasted in yarn conditioning room avoid extra energy input in humidification system to remove dry heat produced by motors and encourage natural energy like lighting. The concept is not common in Industrial sector of Pakistan.

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Biography

Aftab Khan was born in South Waziristan Pakistan, in 1981. He has a B.Sc. in textile engineering from National Textile University Faisalabad. Pakistan, and MS in Project Management from COMSATS Institute of Information Technology CIIT, Islamabad, Pakistan, 2015.

Currently he is working as Team Leader of GPC department of National Productivity Organization (NPO) in Pakistan. He has 9 years of professional experience in Energy Efficiency, and has, over the past 8 years, focused his work to the field of Energy Efficiency & Energy conservation area. He has done more than 120 energy audits and made significant contributions.

Mr. Khan is member of the Pakistan Engineering Council.

Shazia Shabbir was born in Sindh Pakistan, in 1987. She has a B.E. in electrical engineering from University of Engineering & Technology UET, Taxila, Pakistan, 2010 and M.Sc. in engineering management from University of Engineering & Technology UET, Taxila, Pakistan, 2012.

Currently she is working as Management Associate in GPC department of National Productivity Organization (NPO) in Pakistan. She has 4 years of professional experience in Energy Efficiency, and has worked as a team member in energy auditing projects.

Mrs. Iftikhar is member of the Pakistan Engineering Council.

Hammad Altaf was born in Abbottabad Pakistan, in 1987. He has a B.E. in Electrical Engineering from COMSATS Institute of Information Technology CIIT, Abbottabad, Pakistan, 2010.

Currently he is working as Management Associate in GPC department of National Productivity Organization (NPO) in Pakistan. He has 5 years of professional experience in Energy Efficiency, and has conducted more than 60 Energy Audits of different industrial sectors of Pakistan.

Mr. Altaf is member of the Pakistan Engineering Council.

Usman Hafeez was born in Islamabad Pakistan, in 1987. He has a B.E. in Federal Urdu University of Arts Sciences and Technology PIMSAT, Lahore, Pakistan, 2009.

Currently he is working as Management Associate in GPC department of National Productivity Organization (NPO) in Pakistan. He has 5 years of professional experience in Energy Efficiency, and has conducted more than 60 Energy Audits of different industrial sectors of Pakistan.

Mr. Altaf is member of the Pakistan Engineering Council.

Wasi Ullah was born in Charsadda Pakistan, in 1989. He has a B.Tech. in Electrical Engineering from Preston University, Lahore, Pakistan.

Currently he is working as Management Trainee in GPC department of National Productivity Organization (NPO) in Pakistan. He has 4 years of professional experience in Energy Efficiency, and has conducted more than 50 Energy Audits of different industrial sectors of Pakistan.

Faisal Shabbir was born in Islamabad Pakistan, in 1989. He has a Diploma in Electrical Engineering from Rawalpindi Swedish Institute of Technology, Rawalpindi, Pakistan.

Currently he is working as Management Trainee in GPC department of National Productivity Organization (NPO) in Pakistan. He has 3 years of professional experience in Energy Efficiency, and has conducted more than 25 Energy Audits of different industrial sectors of Pakistan.