

**Class 8 Geography Project**

**Power potential in Pakistan**

**The Material**

**Power potential in Pakistan**

Pakistan does not have large proven reserves of fossil fuels but is fortunate enough to have been endowed with considerable hydroelectric potential. Unfortunately Pakistan's energy market investment in hydel power generation has shown no significant improvement. At present, Pakistan is generating power from a number of sources which are as follows:

- Hydel
- Thermal
- Nuclear
- Solar
- Wind
- Bio Fuels

**Hydel**

Pakistan is a water rich country. The hydel resources are mainly in the north; the resources in the south being scarce. The hydel potential of Pakistan can be divided into six sectorial regions namely:

- KPK
- Punjab
- Azad Jammu & Kashmir
- Gilgit-Baltistan
- Sindh
- Baluchistan

Pakistan is endowed with a hydel potential of approximately 41722 MW, most of which lies in the province of Khyber Pakhtunkhwa, Northern Areas, Azad Jammu and Kashmir and

Punjab. However, an abundant hydel potential (about 27,000MWh) is still untapped which needs to be harnessed.

Pakistan's hydel power generation capacities have deteriorated as a result of lower water levels in rivers. Hydel electricity is a considerably cheaper source when compared to thermal sources. WAPDA controls the country's major hydroelectric plants; with the largest being the Tarbela plant at 3,046 MWh installed capacity. Additional hydroelectric plants in operation include Mangla 1,000MWh, Warsak 240MWh. Hydro-electric power represents about a third of Pakistan's power source. However, periodic droughts affect the availability of hydroelectric production. Due to this WAPDA and other power generation companies have to rely more on thermal power generators to cater the power demand of the country and are facing difficulties in coping with the high prices of oil on the international market.

Following are the large existing hydel power stations of Pakistan according to their installed capacity:

Name of Project	Installed Capacity
Tarbela	3478
Ghazi Brotha	1450
Mangla	1000
Warsak	240
Chashma	184
Jagran 1	30.4
Rasool	22
Dargai	20
Malakand	19.6
Shadiwal	13.5
Chichoki Malian	13.2

There are other smaller projects also generating electricity in small amounts.

### Thermal

To combat the recent power crisis in Pakistan due to the underutilisation of the power potential, it is necessary to look for other ways of generating electricity. There are a number of reasons for which it is beneficial to establish thermal power plants.

- Transmission costs of thermal power are much less compared to hydel power because thermal power stations are close to the distribution centres.

- Thermal power production is more demand driven and can accommodate daily, seasonal and annual fluctuations and peaking requirements.
- Thermal power stations can be designed and constructed in relatively less time and therefore are planned for short/medium needs.
- Mostly thermal power stations do not cause displacement problems.
- Initial capital cost of thermal projects is relatively less compared to hydel projects

WAPDA (Water and Power Development Authority) operates the majority of thermal power plants in Pakistan, with over 5000MW of installed capacity in its control. The Guddu plant is the largest plant operated by WAPDA with a capacity of 1,650 MW. In recent years, growth in thermal power generation has come primarily from new IPPs (Independent Power Producers), some of which have been funded by the foreign investors. The two largest IPPs in Pakistan are Kot Addu (1,600 MW) and Hub Power (1,292 MW), both of which provide power to WAPDA.

### **Nuclear Power Generation**

Pakistan has three nuclear power plants; Chashma 1 or Chasnupp with a capacity of 330MWe and Kanupp with a capacity of 125MWe. Chasnupp 2 with a capacity of 325 MWe was connected to the national grid on 14<sup>th</sup> March, 2011. The Pakistan Atomic Energy Commission (PAEC) operates these power plants. Kanupp was Pakistan's first nuclear power reactor and was set up in 1971 whereas Chasnupp 1 became operational in 2000. Government of Pakistan is having negotiations with China National Nuclear Corporation to set up two more plants in Karachi (Kanupp II and III).

### **Solar Energy**

Pakistan is lucky to have longer sunshine hours coupled with high insolation levels and is ideally located to benefit from solar energy for power generation. Pakistan is currently building solar power plants in Kashmir, Punjab, Sind and Baluchistan. The program is currently under development by the International Renewable Energy Agency, China and Pakistani private sector energy companies.

Pakistan has stepped ahead by inaugurating the first ever solar power on-grid power plant in Islamabad. This has been set up with the assistance of Japan under Cool Earth Partnership Program. This project includes the installation of a Solar System each at two offices in Islamabad.

### **Wind Power**

The Government of Pakistan has developed Alternative Energy Development Board (AEDB) which looks after the development of wind power farms for the generation of wind power.

Wind farms have not been developed on a larger scale though Pakistan has the potential to produce up to 346 gigawatts of electricity through wind energy alone. This can be achieved if the Government of Pakistan utilises the potential and encourages more companies to build wind energy projects in the country.

Pakistan's first 50MW wind energy project at Jhimpir in Thatta District started its trial production in June 2012. This wind farm has been set up with the technical assistance of a Turkish company. Other local and foreign companies have shown keenness to invest in this sector as well.



Wind turbines in Jhimpir, Thatta District (Sind)

### **Bio fuels**

The Government of Pakistan is focusing on promoting bio technology. Since more than 60% of exports come from the agricultural sector, bio-technology is of utmost importance. The energy crisis is badly affecting agricultural activities and the Pakistani Government needs to put a lot of stress on developing the bio fuel sector. The Government has handed over bio gas plants to many villages especially in Punjab to overcome the electricity problem.

Most villages are away from main transmission lines or the population is not large enough to make the provision of electricity feasible. Under such conditions alternative energy methods need to be developed, bio fuels being one of them.

### **Reasons for low productivity and transmission and line losses**

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For years, the matter of balancing Pakistan's supply against the demand for electricity has remained a largely unresolved matter. Pakistan faces a significant challenge in revamping its network responsible for the supply of electricity. One major issue is the disparity between returns from foreign and domestic investors.

Contrary to Pakistani Government claims, Pakistan suffers from a massive electricity shortage. Electricity generation in Pakistan has shrunk by up to 50% in recent years due to an over-reliance on fossil fuels. Pakistan was hit by its worst power crisis in 2007 when production fell by 6000 Megawatts and massive blackouts followed suit. Load shedding and power blackouts have drastically hampered the economy and public life. The main reasons for Pakistan's poor power generation are given below:

- Political instability
- Under exploitation of indigenous resources
- Poor governance and lack of integrated planning
- Existing power plants not working to full capacity
- Low efficiency of thermal power plants
- Power line losses

The reasons for power or transmission line losses are:

- use of old transmission lines which do not have the required diameter conductor
- old transformers instead of low loss transformers which are more energy efficient
- use of solid conductors instead of twisted conductors
- lack of use of high temperatures super conductors
- lack of monitoring of transmission equipment
- low maintenance level

There is a dire need for the Government to make an integrated plan and encourage the electric supply companies to minimise line losses to combat the current situation.

#### **The Project:**

## Power Potential in Pakistan: Finding Ways to Combat the Power Crisis

### Introduction:

The current state of energy generation and its use in Pakistan has brought the pace of production wheel to a seriously low level. There are many reasons for this state of affairs.

You have recently been given the responsibility to head a task force which is going to look into the 'Power Potential in Pakistan' and observe the problems at hand while suggesting ways to overcome the problems.

### The Process:

Divide the class into four groups. Give them the reading material. They will assign the roles in their respective groups after going through the reading material and task at hand. The group leader will be the 'Head of Task Force' and the rest will be the advisors.

### The Task:

All the groups will be working on the same task. The findings will have to be presented through power point presentation/OHTs/Flip charts. The students have to present the answers to the following questions:

- Power generating sources in Pakistan (use maps)
- Provincial sources of power generation (use maps)
- Power generating companies (use a table or chart)
- Sector wise consumption of energy (use graphs)
- How electricity gets to you (use description, diagram, maps)
- Gap in supply and demand (facts and figures)
- Reasons for low productivity, transmission and line losses (facts and figures – use graphs or tables)
- How can energy needs be balanced with community needs (use description)

### Success Criteria:

- The duration of power point presentation or OHT will not be more than 10 minutes.
- The presentation will include slides beginning with the details of members of group to references in this order
  - ✓ Main topic
  - ✓ Group details
  - ✓ Introduction (problem at hand)
  - ✓ Answers (suggesting ways to overcome the problem)

- ✓ Materials used
- ✓ Conclusion
- ✓ References (for materials used)
- Every group member has to present a part in front of the audience
- Slides should be relevant to the topic
- Slides should not be overwhelmingly colourful or contain too much information

**Suggestions:**

- Information can be gathered from multiple sources
- Students can use different sources which may include facts and figures, maps, tables, charts, diagrams
- Library period can be integrated with this project.