



COMSATS PHYSICS TODAY

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NEWS & EVENTS

More about Energy Projects Why we need load shedding?

Project Head: Dr. Syed Javaid Iqbal Head Department of Physics
CIIT Lahore.

I wonder why? Pakistan is one of the most energy blessed country in the world. But still we need load shedding. Presently in the world 46% electricity is produced by coal burning. Pakistan produces only 1% electricity by coal while Pakistan coal energy reserves are more than total energy reserves of Saudi Arabia and Iran combined. China develops one coal based thermal power plant every week.

Hydropower plants are the cheapest source of electricity in Pakistan. It is about one rupee per unit (kWh) but still we produce only 25% of total power by hydropower. First four hydropower projects including Kala-bagh Dam hydropower projects, which are all bigger than Tarbela Dam hydropower projects, are not producing any electricity. If any one of them is completed the load shading will stop completely. If all first four are completed then we will be exporting electricity energy to the neighboring countries and beyond.

In the list provided by the government of Pakistan website www.pakistan.hydropower there are 960 sites which are identified and can be used for producing electricity.

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Forum

S. No	Name of the project	Mega-watt	Present Status	Area
1	Bunji Hydropower Project	7100	Prefeasibility	Northern Areas
2	Basha Dam Hydropower Project	4500	Feasibility	Northern Areas
3	Skardu Hydropower Project	4000	Prefeasibility	Northern Areas
4	Kalabagh Dam Hydropower Project	3600	Under Implementation with Public Sector	Punjab
5	Tarbela Dam Hydropower Project	3478	In Operation	NWFP

If we look into first 20 sites they have total 37691MW capacity which is more than double the total electricity consumption of Pakistan. We have plenty of sun shine which can easily be converted to electricity. China produces 60% for solar panels in the world and they are ready to help Pakistan. We can also develop nuclear power plant. Any of the above sources of energy is more than enough for the total energy need of Pakistan. Still load shedding goes on.

No doubt “all the blessings come from God and all the difficulties come from our deeds”

Basic problem with these mega projects is that government does not have enough funds to start with. Most of the times we are asking international funding agencies to help us to finance these projects and most of the times we fail. Almost 70% of total hydropower resources are located in the northern parts of Pakistan and long expensive transmission lines are needed to supply electricity to the industrial areas which are located either in the middle or to the south of the country. Usually political parties are not interested in the project which will take many years to complete because they believe these long term projects will not benefit them.

Looking into the data provided by the government we have more than 273 sites which can produce between 1 to 10 megawatt electricity. These projects are small and can easily be handled by the local communities where these sites are available. Total output of these sites is 1450 MW which is about three times the total electric power shortfall. If we concentrate on only these small projects then we should not have any load shedding for many years to come. These projects can be completed within a year time only if the political will is there. Of course God will not change fate of our nation unless we try to change it.

One of the major objections with these sites is that most of these falls are low head (water fall height is only few meters) so we can not use turbines which need high pressure water. On the other hand, highly efficient turbines for such situations are also very expensive.

I remember one of my friend ex-professor from MIT (Dr. Amjad Hussian Dalawari) says, “I do not need to fix someone’s Mercedes but I have to fix my Tonga”

In other words, we do not have to buy expensive high efficiency hydropower plants. We can live with low tech water wheel which can also produce electricity. Water wheel based hydropower units can be developed by using the parts which are available in local scrap market of Bilal Gung, Lahore.

There are two main types of water wheels commonly used for generating electricity, first one is undershot and other one is overshot. A simple diagram for this water wheel is shown below.

In undershot water flows from the lower portion of the water wheel as shown in Fig 1. It is 50% to 60% efficient.

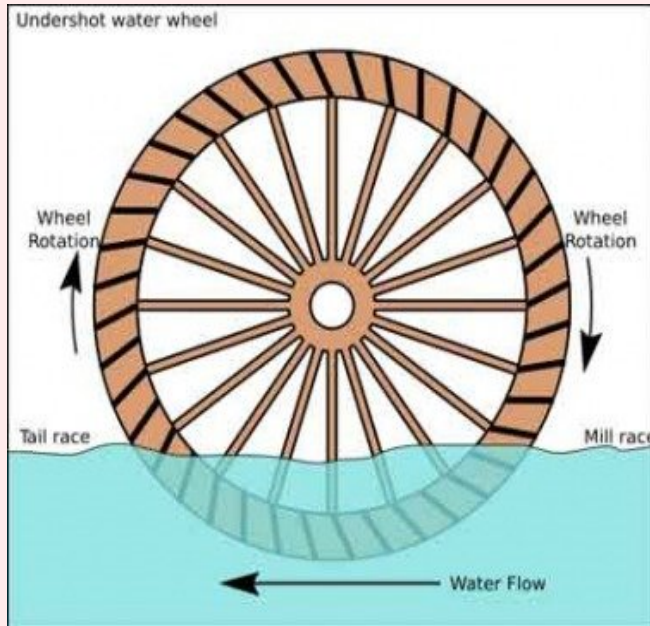


Fig. 1: Undershot water wheel for hydropower

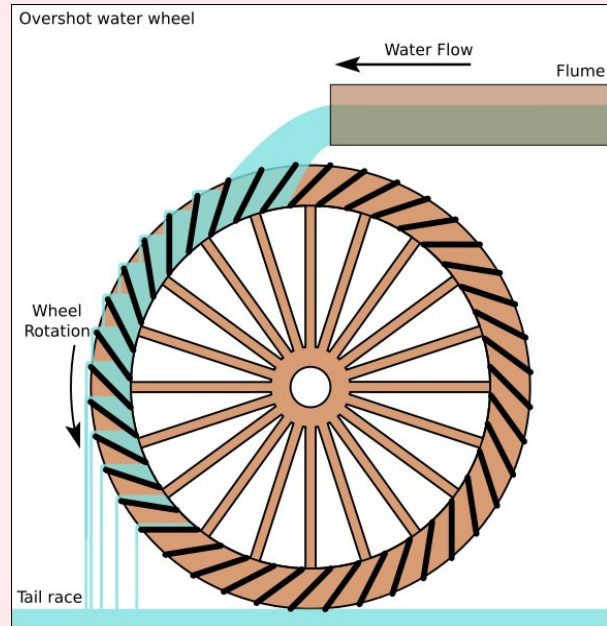


Fig. 2: Overshot water wheel for hydropower

While overshot in which water falls on the upper portion of the wheel as shown in Fig 2. This is also called gravity method. Overshot water wheel based hydropower units are 70% to 80% efficient. In most of the cases we can use one of the above type of water wheel. If we take the average of both means 60% average then still we have $1450 \times 60\% = 870\text{MW}$ which is still about half of the short fall we have now. It will simply reduce the load shedding considerably.

There is piece of advice for the people in the communities and for all those party leaders who has access to water falls, like in the area Patoki, Sahiwal and so on should install low cost hydropower plants to help their communities. In the next election those people will be elected who will ease the life of the common people. This is one of the easiest ways to provide cheap electricity.

All the water falls on the rivers and canal can produce electricity. In small projects like below 10MW you do not have to involve WAPDA. You need not to supply to WAPDA grid.

On the average a village house uses 1 kilowatt while city house uses 10 kilowatt per day. It means if one megawatt is produced it can supply 1000 house in countryside or 100 houses in a city. In the villages there are 10 people per house. So simple calculation is if 5MW generator is installed then it can provide electricity to 5000 houses in countryside and total 50000 people will be benefited. It will also confirm as many winning vote in their area, irrespective of party affiliation.

Using the simple design and low cost system, 25 Lakh rupees are enough for 100kilo watt unit with least modification in the site. Once hydropower unit is up a little maintenances is required. The unit will cover it cost in one to 1.5 years of time. After that rest is profit for the operator.

These units can run independently just like Renala Khrud project. It produces 1.1 MW and system is not connected to WAPDA. They supply electricity in nearby area and also charge them. Prosperity of the community also means prosperity of the community leaders too. Finally, we suggest that every community wherever the opportunities are they must install such hydropower units. We have to make the change. In this regard COMSATS Lahore can help to install such q unit. Our goal is to make life of poor people as easy as possible and we are ready to go great length for achieving this. We are quite sure we will be successful in our mission (InshaAllah). For more information Please contact Prof. Dr. Syed Javaid Iqbal at: syedjav@yahoo.com

WELCOME PARTY FOR NEW FACULTY

A welcome party in honor of Ms. Shaheen Irfan and Ms Fiaza Mustafa was arranged by the Department in the executive club on June 21, 2010. The entire faculty cordially participated in the get together. While the Director Dr. Shaukat Ali Hayat and Advisor Admin. Sheikh Muhammad Hanif, both were also invited on the party. Every one enjoyed a delightful lunch.



SEMINARS

- Professor D. Bimberg of Technical University Berlin Germany delivered a lecture on Semiconductor Nano-Structures for Photonic systems in future in Islamabad on May 18, 2010, which was accessible via video conference at Seminar Room CIIT Lahore .
- The Department of Physics organized a seminar on Optical Fiber Devices ,by Dr. Saeed Ur Rehman on May 25 2010 at Islamabad Campus ,which was accessible via video Conference at CIIT Lahore .

A visit to Punjab University Lahore

During the month of April the MS-Physics batch-1 and BS-Physics batch 1 & 2 students were granted an opportunity to visit Center of Solid State Physics (CSSP) Punjab University Lahore and Physics department Punjab University Lahore in Supervision of Dr. Ejaz Ahmad Mughal (Assist. Prof. ,Physics) where they visited Material Science labs and conducted few experiments on the subject. This visit was made possible due the inter-departmental collaboration between CIIT and PU.

Marie Curie Quotes

- A scientist in his laboratory is not a mere technician: he is also a child confronting natural phenomena that impress him as though they were fairy tales."
- "Be less curious about people and more curious about ideas."
- "I was taught that the way of progress was neither swift nor easy."
- "All my life through, the new sights of Nature made me rejoice like a child."



FACULTY PROFILE

An Interview with
Dr. Hafiz Muhammad Ashfaq Ahmad
(Assistant Professor of Physics CIIT Lahore)



Name

Dr. Muhammad Ashfaq Ahmad

D.O.B/star

October 10, 1976 Libra

Qualification

I did my matriculation from Govt. MC High School Samanabad Faisalabad, then F.Sc. and B.Sc from Govt. Degree College Samanabad ,Faisalabad. I did my Maters from University of Agriculture Faisalabad in Physics in 2001 and PhD in Physics ,Specialization in Quantum Optics ,Quantum Information processing from Harbin Institute of Technology China(2004-2007).

How were you in your childhood?

My attitude towards others was normal, I loved to play, especially hockey, cricket and Badminton.

Why did you selected Physics for your career?

Actually up to Matric, I was quite interested in Chemistry. But during my F.Sc and B.Sc I got interest in Mathematics and got good marks in it and hence fortunately I got admission in Physics in Masters.

You have recently visited Lancaster University UK, how was the experience?

Nice, I examined that there is a proper system of education as well as administration.

What do you think whether the same system can be adopted here?

I really appreciate their system, we should adopt it here as well and try to bring more betterment in it.

How was the Physics Department over there?

Their Physics Department has defeated Oxford University in research in low temperature physics last year and stood first in UK.

What were some weak points you saw there?

One thing, I did not like, that they issue degree even when the student is failed in certain subjects.

How would you compare UK and Pakistan as far as universities are concerned?

They are much developed than us, they have plenty of funds from the government whereas we are lacking in funding.

If you have been given a chance to change something in COMSATS, what will you change?

I would like to raise the salaries of employees here.

Explain yourself in three words?

Simple, aggressive and patriotic.

Where do you want to see yourself after ten years?

A good and well known Researcher.

Are you satisfied with the administration of Physics Department?

No, I am not.

Your Ideal Personality?

Allama Iqbal and Qaud-i-Azam

Who do you support in Politics?

In my childhood, I supported PPP, in teenage PML and now think I should support Tehreek-e-Insaaf.

You resemble with Imran Khan, have you noticed that?

Yes, many People think that I am a Pathan but this is just a co-incidence.

You cannot forget..

When my father used to beat me In my childhood

You are very close to..

My mother, I use to share everything with her.

Your favorite class that you taught in CIIT?

I taught BTE (ICT scholars) in last semester. I really liked to teach them.

Three qualities that you admire in yourself.

Punctual , try to stay happy and facilitate others.

You fear from?

To become notorious or to lose something.

Your room walls carried..

Posters of Nobel Prize laureates, scientists and Physics researchers.

If you were not a teacher, then you would be...

A hockey player

Are you satisfied with your life?

No, I am not

Your favorite Colleagues?

Dr. Salman Naeem khan and Dr. Rizwan Raza (on study leave).

What do you think when you look into the mirror?

That I am smart enough.

Do you watch movies?

No, I don't even watch TV now a day.

Message for your colleagues.

We should try our level best to go ahead in life and think beyond what is happening.

Message for students?

Try to choose Physics as a major subject, by studying physics you are studying nature and you will get success in your life.

FACULTY RESEARCH PUBLICATIONS DURING THE SEMESTER SPRING 2010

1. M. Asif "Relationship between normalized thermal energy and conductivity for cylindrical toka-mak geometry", *Natural Science* vol. 2 (2010) 54.
2. M. Asif "Magnetohydrodynamic equations for toroidal plasmas", *Natural Science* vol. 2 (2010) 95.
3. Zhengjun Liu, Shutian Liu and Muhammad Ashfaq Ahmad "Image sharing scheme based on discrete fractional random transform", *Optik* Status: In Press.
4. Kang Dong-Peng, Liao Qing-Hong, Ahamd Muhammad Ashfaq, Wang Yue-Yuan, Liu Shu-Tian Entropy squeezing of an atom in k-photon Jaynes-Cummings model *Chinese Physics B*, (2010), 014206-014213
5. Zhou, Guo Zong Yi, Muhammad Ashfaq Ahmad and Shutian Liu, Excitation of defect modes from the extended PBG structure of the 1D photonic lattices" *Chinese Physics B* (2010) 19(1), 014201-014205.
6. Liao Qing-Hong, Muhammad Ashfaq Ahmad, WANG Yue-Yuan¹, and Liu Shu-Tian; Properties of linear entropy in k-photon Jaynes-Cummings model with the stark shift and Kerr-like medium" *Commun. Theor. Phys.*, (2010), 53, 931-936
7. S. N. Khan, X. Liu, L. Shao, and Y. Wang, "Complementary split ring resonators of large stop bandwidth," *Progress In Electromagnetics Research Letters*, Vol. 14, 127-132, 2010.
8. Z. Shuai, S. N. Khan, S. He, "Reducing Mutual Coupling for an Extremely Closely-Packed Tunable Dual-Element PIFA Array through a Resonant Slot Antenna Formed In-between," *IEEE antenna and Propagation*, accepted (08-Feb-2010).
9. A. Rashid, L. Landstrom and K. Piglmayer "Novel nano and Micro Processing by Photoactivation of Methylene Iodide Precursor" *ECS Transactions*, The Electrochemical Society 25, issue 24, 65-71 (2010), USA
10. Syed Javaid Iqbal, Ali Miratashi, Moin-ud-Din Ghauri, "Using ANFIS System for speed regulation in Linear Inductive Actuators" *Macro Engineering* Vol:1, Issue -04, 22-26 (April-June 2010)

RESEARCH CORNER

MAXWELL EQUATIONS:

THE FOUNDATION OF ELECTROMAGNETIC FIELD THEORY

By Faiza Mustafa & Samia Aslam

The most obvious mechanical phenomenon in electric and magnetic experiments is the mutual action by which electric charges in a certain state set each other in motion while at a sensible distance from each other. This phenomenon depends upon the magnitude and direction of the force acting between the bodies, their relative position and their electric and magnetic conditions according to mathematical laws. This laid the foundation of the modern known Electromagnetic Field Theory and explained the existence of electromagnetic waves.

The existence of an electromagnetic field in nature owes to the similarities which hold between electric and magnetic fields. When a magnetic field is applied to a ferromagnetic material, it applies a force on the atoms of the ferromagnetic material and align them in the direction of the applied magnetic field such that its one end becomes north pole and the other becomes south pole. Analogous to this when an electric field is applied to a dielectric, it polarizes the dielectric which means that the electricity present in each molecule is displaced such that its one side becomes electrically positive while the other is negative[1].

When an electric current is established in a conducting circuit, neighboring part of the field is characterized by magnetic properties and if there are two circuits placed in that field then the effect of their fields is combined. Since every part of the both conductors is in connection with the surrounding field, so any change in electric or magnetic state of one conductor will accordingly effect the state of the other conductor. Alternatively, any increase or decrease of current in one conductor will produce an electric force on the other conductor. This refers to the phenomenon of mutual induction. Similarly when a conductor cuts across any external magnetic field, the increase or decrease in magnetic lines of force produce an electromotive force inside the conductor itself giving rise to self inductance. The phenomenon of inductance initially discovered by Faraday was given mathematical formulation by Maxwell which in modern terminology proposes that the rate of change of magnetic flux density in the surrounding of a conductor (whether current carrying or not) induces an electric field inside it or any neighboring conductor coupled with it.

Maxwell suggested that if there is an experimental evidence that a changing magnetic field can give rise to an electric field then converse should also be possible. This was explained by the idea of displacement current given by Maxwell which also modified the famous Ampere's law according to which, the magnetic field enclosed in a closed loop around a current carrying conductor is μ_0 times the current enclosed by the loop, where μ_0 is defined as the permeability of free space for magnetic field [2]. In order to understand the idea of displacement current again consider the polarization of an insulator (dielectric) due to an applied electric force.

The electric force produces general displacement of the charges inside the dielectric which does not constitute electric current but if connected to an external circuit, it can initiate current in positive or negative direction. This happens within the plates of a capacitor. When the capacitor is charging or discharging, a rate of change of electric field takes place across its plates which establishes an electric current in the external circuit and consequently magnetic field is produced. This confirms the validity of Maxwell's suggestion that varying electric field produces magnetic field and also removes the discrepancy in Ampere's law which previously only addressed the situation pertaining to constant electric fields [1]. The Maxwell's laborious calculations given in his famous paper [1] were summarized to four fundamental equations of electromagnetism as follows

1. Gauss law of electrostatics – explains the electric fields and their generating electric charges
2. Gauss law for magnetism—explains that there are no magnetic monopoles in nature and magnetic fields always exist with both North and South poles together.
3. Faraday law of electromagnetic Induction- explains that a time varying magnetic field can give rise to an electric field.
4. Ampere's law with Maxwell correction- explains that a time varying electric field gives rise to a magnetic field [2].

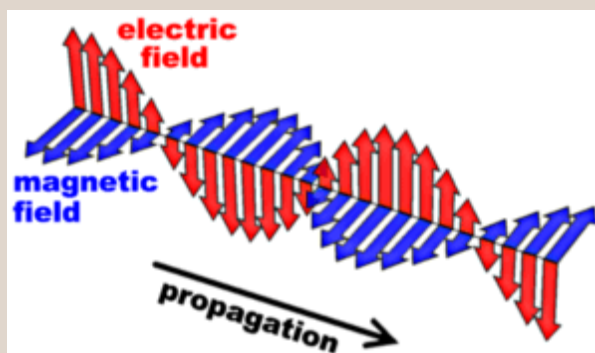


Fig: Propagation of electromagnetic waves

On the ground of these four laws, Maxwell predicted the existence of electric and magnetic fields oscillating at right angles to each other and how they can propagate in a dense medium. The mechanism of energy transport through a medium involves the absorption and re-emission of the wave energy by the atoms of the material. When an electromagnetic wave impinges upon the atoms of a material, the energy of that wave is absorbed. The absorption of energy causes the electrons within the atoms to undergo vibrations. After a short period of vibrational motion, the vibrating electrons create a new electromagnetic wave with the same frequency as the first electromagnetic wave. While these vibrations occur for only a very short time, they delay the motion of the wave through the medium. Once the energy of the electromagnetic wave is reemitted by an atom, it travels through a small region of space between atoms. Once it reaches the next atom, the electromagnetic wave is absorbed, transformed into electron vibrations and then reemitted as an electromagnetic wave. While the electromagnetic wave will travel at a speed of c (3×10^8 m/s) through the vacuum of interatomic space, the absorption and reemission process causes the net speed of the electromagnetic wave to be less than c [3].

Maxwell derived the waveform of the electric and magnetic fields and predicted that the velocity of the electromagnetic waves coincide with the numerical value of the velocity of light. Therefore he concluded that light is also an electromagnetic wave.

The influence of Maxwell equations is evident from the sparkling discoveries and inventions in the field of telecommunication and shaping today's life that is incomplete without wireless communication devices.

References:

1. *A Dynamical Theory of the Electromagnetic Field*. By J. Clerk Maxwell, F.R.S December 8, 1864
2. Physics "*Halliday, Resnick, Krane*", vol, 2, 4th edition.
3. <http://www.physicsclassroom.com/class/waves/u10l1c.cfm>

Physics behind the nature



Glass is not a solid. It is actually a liquid but so viscous that its flow cannot be seen. Very old windows become thicker from the bottom because with the passage of time the glass has flowed downwards.

JOIN COMSATS PHYSICS FORUM

Objectives of the Forum

- Arrangement of Seminars / workshops
- Arrangement of educational trips
- Organization of Co-Curricular activities e.g. Quiz competition, Research and general paper reading contest etc

FREE MEMBERSHIP OPEN FOR ALL

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