The Institution of Engineers (India)

MUZAFFARPUR LOCAL CENTRE

M.I.T., MUZAFFARPUR-842 003

2022

CONTENTS

53rd ANNUAL GENERAL MEETING

SOUVENIR

WEBINAR

ON

"Alternative Energy- Solar and Solar PV"

16th October 2022

THE INSTITUTION OF ENGINEERS (INDIA)
MUZAFFARPUR LOCAL CENTRE
(FOUNDED 1969)

MUZAFFARPUR INSTITUTE OF TECHNOLOGY
MUZAFFARPUR – 842003 (BIHAR)

Er. Anjani Kumar Srivastava, FIE
Chairman

Prof. Sanjay Kumar Choudhary, AMIE
Honorary Secretary

The Institution of Engineers (India)

Muzaffarpur Local Centre

M.I.T., Muzaffarpur-842003 (BIHAR)

2022

ROLL OF HONOUR

YEAR	CHAIRMAN	HON. SECRETARY	JOINT SEC
1969-70	Er. K.P. Agrawal	Prof. I.C. Nayak	
1970-70	Er. R.P. Agrawal	Er. K.R. Rajagopal	
1971-72	Er. S. Prasad	Er. K.R. Rajagopal	
1972-73	Er. S. Prasad	Er. K.R. Rjagopal	
1973-74	Er. K.R. Rajagopal	Er. R.P. Jayaswal	
1974-75	Er. M.A. Samad	Er. R.P. Jayaswal	
1975-76	Er. M.A. Samad	Er. R.P. Jayaswal	
1976-77	Dr.B.P Sinha	Er. J.S Prasad	Er. J.S. Prasad
1977-78	Dr. B.P.Sinha	Er. K. Prasad	Dr. K. Prasad
1978-79	Er. R.K. Sinha	Dr. K. Prasad	
1979-80	Prof. R.P. Sinha	Er. B.B. Prasad	
1980-81	Prof. R.P. Sinha	Er. B.B. Prasad	
		Er. J.S. Prasad	
1981-82	Prof. R.P.Sinha	Er. I.S. Prasad	
1982-83	Er. G.M. Sahai	Er. I.S. Prasad	
1983-84	Prof. R.K. Garg	Er. B.P. Sahani'Arun'	Er. M. Qutuba
1984-85	Er. Y.P. Sharma	Er. B.P. Sahani'Arun'	
1985-86	Er. Y.P Sharma	Er. B.P. Sahani'Arun'	
1986-87	Dr. U.N. Sharan	Er. B.P. Sahani'Arun'	
1987-88	Dr. U.N. Sharan	Dr. H.P. Sinha	
	Dr. M.K. P. Mishra	Dr. H.P. Sinha	
1988-89	Dr.B.B. Prasad	Prof. S.N.P. Srivastava	
1989-90	Dr. B.B. Prasad	Prof. S.N.P. Srivastava	
1990-91	Prof. B.P. Sahani'Arun'	Prof. S.N.P. Srivastava	Prof. A.K. Nathani
1991-92	prof. B.P. Sahani'Arun'	Dr.H.P. Sinha	
1992-93	Er. S.K.P. Verma	Dr. H.P. Sinha	
1993-94	Er. S.K.P Verma	Dr. R.C Das 'Vikal'	
1994-95	Dr. U.C. Verma	Dr. R.C. Das 'Vikal'	
1995-96	Dr. U.C. Verma	Dr. R.C. Das 'Vikal'	
1996-97	Dr. U.C. Verma	Dr. R.C. Das 'Vikal'	
1997-98	Dr. R.C. Das 'Vikal'	Dr. B.K. Prasad	
1998-99	Dr. R.C. Das 'Vikal'	Dr. B.K. Prasad	
	Er. U. R. Sinha	Dr. B. K. Prasad	
1999-2K	Prof. Bhola Sahu	Dr. B. K. Prasad	
2K-2K1	Prof. Bhola Sahu	Dr. B.K. Prasad	
2K1-2K2	Dr. B.K. Prasad	Dr. Achintya	
2K2-2K3	Dr. B.K. Prasad	Dr. Achintya	
2K3-2K4	Dr. R. Pandey	Prof. Suresh Kumar	
2K4-2K6	Er. V.N. Sahu	Dr. A. K. Rai	
2K6-2K8	Dr. Achintya	Prof. C.B. Rai	
2K8-2K10	Dr. Suresh Kumar	Dr. Sunil Kumar	
2k10-2K12	Dr. A. K. Rai	Er. S.K Tiwary	
2K12-2K14	Prof. C.B.Rai	Er. Jayant Ajat Shatru	
2K14-2K16	Dr. Sunil Kumar	Er. A.P Singh	
2K16-2K18	Er. S.K. Mishra	Dr. Rajeev Ranjan Kumar	
2K18-2K20	Dr. Anjani Kumar Mishra	Er. Narendra Kumar jha	
2K20-2K21	Dr. Anjani Kumar Mishra	Er. Narendra Kumar jha	
2K21-2K23	Er. Anjani Kumar Srivastava	Prof. Sanjay Kumar Choudhary	Er. Lok Ranjan

Dear Corporate Members/Faculty Members/Engineering professionals and students

The 53rd Annual General Body Meeting of The Institution of Engineers (India), Muzaffarpur Local Centre is going to be held on the 16th October 2022. A Webinar will also be organized on the occasion on the topic **“Alternative Energy- Solar and Solar PV"**

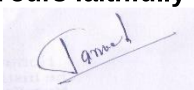
Corporate Members, Faculty Members and all Engineering professionals are invited to participate in The Celebration and also requested to contribute paper for the webinar by 13th October 2022. Your Paper will be printed in the E-Souvenir to be published on the occasion. In order to maintain the schedule, it has been decided that individual paper should not contain more than **1000 (One thousand)** words. The paper to be presented in the Souvenir Should be sent to the Office on e -mail no. **muzaffarpurlc@ieindia.org**

I request you on behalf the Executive Committee kindly to attend the webinar.

<u>Webinar Session</u>

BUSINESS MEETING OF CORPORATE MEMBERS	-	3.00 PM to 3.30 PM
WEBINAR	-	3.30 PM to 4.30 PM

Yours faithfully



Honorary Secretary

<u>AGENDA OF MEETING ON 16.10.2022</u>

1. Welcome Address by the Chairman
2. Presentation of Annual Financial Report for 2021-22
3. Discussion on The Annual Report
4. Webinar session
5. Chairman’s Address
6. Vote of thanks by the Hon. Secretary

WELCOME ADDRESS BY ER. ANJANI KUMAR SRIVASTAVA

THE INSTITUTION OF ENGINEERS (INDIA), MUZAFFARPUR LOCAL CENTRE

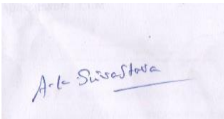
Respected President, Chief Guest, Dignitaries, Corporate Members and Engineers.

It is a matter of great pleasure for me to welcome the chief guest, dignitaries and engineers at the 53rd Annual General Meeting of the Institution of Engineers (India), Muzaffarpur Local Centre.

Muzaffarpur Local Centre of IEI was established in MIT campus in the **year 1969**
Since then, the Centre has been playing a very important role in dissemination of information on engineering, emerging and contemporary technology bringing industry, academia, experts and professionals together on the same platform. This is in pursuit of the **MISSION** of IEI **"to promote the general advancement of engineering, engineering science and technology, and their application".**

IEI, Muzaffarpur Local Centre is committed to the promotion of continual professional development and contributing significantly to the growth of technological knowledge, skill and capacity building of highest order, demonstrated through innovative approach towards the cause of sustainable development.
On this auspicious day webinar on the topic **"Alternative Energy- Solar and Solar PV"** has also been arranged. Such webinar are arranged each year in M.I.T., Muzaffarpur for interaction between fellow engineers. Such discussions provide an opportunity to all participants to exchange idea with each other. We hope such discussions are very useful for individuals as well as the whole society.

I have pleasure to call upon all the honorable members to take active interest in the working of the Centre, suggest improvements and encourage us by enrolling themselves as fresh members. This is also the need of the hour to strengthen the engineering fraternity.
With these words, I again extend big welcome to you all to make programme a success.



CHAIRMAN

THE INSTITUTION OF ENGINEERS (INDIA)
MUZAFFARPUR LOCAL CENTRE
M.I.T., MUZAFFARPUR-842003
Proceeding of 52nd Annual General Meeting

Proceeding of Online 52nd Annual General Meeting of The Institution of Engineers (I) Muzaffarpur Local Centre of, held on 30.10.2021

The Online 52nd Annual General Meeting of The Institution of Engineers (India), Muzaffarpur Local Centre, M.I.T., Muzaffarpur was held on 30.10.2021 in two Session.

In the First session Business meeting of the corporate members was held with the welcome address by the Chairman Dr. Anjani Kumar Mishra, Principal, Govt. Polytechnic, and Gopalganj. Thereafter Er. Narendra Kumar Jha, Honorary Secretary of the Local Centre read the proceeding of the 51st Annual General Meeting and also presented the 52nd Annual General Report based on the activities and facilities that was all through available during the period. He also presented the Income and Expenditure with Balance Sheet for the Financial year 2020-21 duly Audited by the Charted Accountants followed by the Auditors Reports before the house, which was passed by the house after brief discussion.

Then the matter of appointment of Auditors for the financial year 2021-22 was also discussed in the house with fixation their remuneration.

The house authorized the Executive Committee of the Local Centre to appoint Auditors and fix their remuneration in their next meeting.

Then Dr. Anjani Kumar Mishra and Er. Narendra Kumar jha, after completion of their full term announced and introduced the new executive committee for session 2021-23

Thereafter webinar session began on the topic **"Role of industrial Revolution for Engineers"** with the welcome address by the Chairman Dr. Anjani Kumar Mishra. Er.Shyam Kumar Mishra, FIE, of the Local Centre was elected president unanimously for the session. Dr. Amit Kumar, H.O.D. Mechanical Engg. Depts. N.I.T. Patna was the Chief Guest. The session was started with the lecture of chief guest on the topic in which he told that role of engineer is presently redefined by the rapid and very much disruptive emergence of fourth industrial revolution. No other revolution has made such a great impact as the industrial revolution has ever made. He further said that it is important for students to get involved in activities to develop and sharpen their soft skills. Engineers should think outside the box and develop solutions to solve real time development problems.

Er. Anjani Kumar Srivastava, Er. Nilmani Srivastva, Er. Krishna Kanhai, Er. Prabhat Ranajan Bhardwaj, Er. Rahul Kumar alongwith many members were present in the programme.

The Programme was anchored by Er. Lok Ranjan and ended with vots of thanks by Er. Narendra Kumar Jha, Honorary Secretary, of the Local Centre.

Honorary Secretary

THE INSTITUTION OF ENGINEERS (INDIA)
MUZAFFARPUR LOCAL CENTRE
M.I.T., MUZAFFARPUR-842003
THE 53rd ANNUAL REPORT

I feel pleasure to present the 53rd Annual report of the Muzaffarpur Local Centre of the Institution of Engineers (India) before the distinguished corporate members on the 16th October 2022.

A new office was allotted to Muzaffarpur local Centre in the M.I.T premises which was inaugurated by Principal, M.I.T on 5th February 2022.

Muzaffarpur local Centre in association with M.I.T Muzaffarpur participated in the Technical activity programme ROBOTIC model competition (DANGAL) on 25-26th May 2022. It was very much appreciated by IEI, HQ and they included it in report of Technical Activities of the Centers for first Qtr. of 2022-23. This is a major milestone achieved by the Centre in pursuit of the Mission of IEI to promote the general advancement of Engineering, Engineering Science and Technology and their application.

In order to popularize the functioning of this local Centre many programs have organized on different topic such as "**Storing Energy for Sustainable Future"** 14th December 2021, **Republic Day** 26th January 2022, "**Groundwater: Making the invisible visible"** 22nd March 2022, **"Digital technologies for older persons and healthy ageing"** 17th May 2022, World Environment Day **"Only One Earth"** 5th June 2022, **Independence Day** on 15th August 2022, **Role of engineers in disaster resilient state"** for Royal Charter Day held on 9th September 2022, **"Smart Engineering for a Better World"** 15th September 2022. A number of eminent engineers and distinguished faculty members of M.I.T., Muzaffarpur were present. Students took active part in webinar held during these occasions.

Committee Meeting

During the period 27.11.2021 to this date Ten online/offline committee meeting were held on 27.11.2021,19.12.2021,23.01.2022,27.02.2022,27.03.2022,24.04.2022,19.05.2022,19.06.2022, 24.08.2022,27.09.2022

Financial status

The duly audited statement of accounts for the period from April 2021 to March 2022 is appended with the report for the kind perusal of the members

Library facility

The local Centre library is frequently utilized by ST/T members attached to this local Centre. There is good collection of textbooks and reference books. Returnable sum of Rs.50/- is realized from each members interested in using library facilities. The books are issued for a period of 15 days. The corporate members are also entitled to avail the library facility without any Security deposit.

<u>**Membership**</u>

The strength of membership of the local Centre is as follows:-

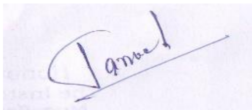
	2020-2021	**2021-2022**	**Growth**
FIE	90	91	1
MIE	282	290	8
AMIE	1427	1563	136

We are trying to increase student's activities in the Institution by arranging more debates, educational discussions, establishment of students chapter is also on cards. We solicit the cooperation of Honorable Principal, M.I.T., Muzaffarpur and faculty members of M.I.T., Muzaffarpur in our programme.

The local Centre committee expresses sincere gratitude to all members of M.I.T., family in general and Principal M.I.T in particular for extending all possible facilities to the local Centre. It is very much hoped that the local Centre committee would continue to enjoy enhanced cooperation from all concerned.

With these words, I again extend big welcome to you all to make programme a success.

Thanks.



Honorary Secretary
Prof. Sanjay Kumar Choudhary

Singh & Thakur
Chartered Accountants

AUDITOR'S REPORT

We have examined the attached Balance Sheet of **THE INSTITUTION OF ENGINEERS (INDIA), Muzaffarpur Local Centre** from 01/04/2021 to 31/03/2022 & the related Income & Expenditure Account on the said date.

These financial statements are the responsibility of the **THE INSTITUTION OF ENGINEERS (INDIA), Muzaffarpur Local Centre** management. Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with generally accepted auditing standards in India. These standards require that we plan and perform the audit to obtain reasonable assurance whether the financial statements are prepared, in all material respects, in accordance with an identified financial reporting framework and are free of material misstatements. An audit includes, examining the evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statements. We believe that our audit provides a reasonable basis for our opinion.
On the basis of the information and explanation given to us, we are of the opinion that:

(a) Balance Sheet gives a true and fair view of the state of affairs of **THE INSTITUTION OF ENGINEERS (INDIA), Muzaffarpur Local Centre**, as at **01/04/2021 to 31/03/2022** and

(b) Income & Expenditure Account gives a true and fair view of the results of operation of **THE INSTITUTION OF ENGINEERS (INDIA), Muzaffarpur Local Centre** for the year ended on the date stated above.

For **SINGH & THAKUR**
Chartered Accountants

(CHANDAN THAKUR)
Proprietor
M. No. 523869

Place: Muzaffarpur
Date: 30.06.2022

UDIN:- 22523869AMDSCY7166

H.O. : Speaker Road | Nayatola | Muzaffarpur (Bihar) - 842001
B.O. : Hotel Umang| Kiran Chowk| Sitamarhi (Bihar) - 843301
Ph. : 0621-2057777, 2245003, 8409429999, 9199429999
E-mail : SINGHANDTHAKUR@GMAIL.COM

THE INSTITUTION OF ENGINEERS (INDIA)

Muzaffarpur Local Centre

Balance Sheet as at 31st March 2022

ANNEXURE-1 (Page1 of 7)

31st March 2021 Rs.	LIABILITIES	Schedules	31st March 2022 Rs.	31st March 2021 Rs.	ASSETS	Schedules	31st March 2022 Rs.
	Reserve & Surplus	7	-	1,80,212.36	Fixed Assets	1	1,80,212.36
					Investments : Long Term		
46,21,277	Capital Reserve	8	46,42,106.75	25,00,000	Fixed Deposits with Banks	2	25,00,000.00
					Current Assets		
					Stock	3	-
	Earmarked Funds	9	-		Sundry Receivables	4	
				19,51,364.89	Cash & Bank Balances and short term Fixed Deposits with Banks	5	19,72,194.39
10,300.00	Current Liabilities & Provisions	10	10,300.00	-	Other Advances	7	-
-					Interest Outstanding and accrued on Investments	8	-
46,31,577.25	TOTAL		46,52,406.75	46,31,577.25	TOTAL		46,52,406.75

Notes to Accounts 11

This is the Balance Sheet referred to in our report of even date.
For SINGH & THAKUR
CHARTERED ACCOUNTANTS
Firm Registration No. 024623N

(CHANDAN THAKUR)
PROPRIETOR
Membership No. 523869

Date : 30/06/2022

Place: Muzaffarpur

SINGH & THAKUR CHARTERED ACCOUNTANTS FRN: 024623N

07/07/22

Honorary Secretary
The Institution of Engrs (I)
Muzaffarpur Local Centre
M.I.T. Muzaffarpur

07/07/2022

Chairman
THE INSTITUTION OF ENGRS. (INDIA)
MUZAFFARPUR LOCAL CENTRE

THE INSTITUTION OF ENGINEERS (INDIA)
Income and Expenditure Account for the year ended 31st March 2022
Muzaffarpur Local Centre

ANNEXURE-1 (Page 2 of 7)

2020 - 2021		INCOME	RATIO		2021 - 2022		TOTAL
Research & Development	Education		R& D	EDU	Research & Development	Education	
Rs.	Rs.				Rs.	Rs.	Rs.
		Grant received from Head Quarter:					
3,60,821.00	90,205.00	For Manpower Grant	80	20	91,029	22,757	1,13,786
		For Sr/Jr Most Salaries					
		For Leave encashment					
		For Bonus/ Exgratia					
		For Staff Welfare Expenses					
		For Technical activities					
		For Seminars and Symposia					
		For National convention					
		For International Conference					
		For Council Meeting Grant					
		For Engineering Congress Grant					
0		For Election Grant					
		For Technical publications					
		For Jubilee celebration					
		For opening New centre					
		For Best Centre award					
		For procurement of hardware for election					
		For Examinations Expenses					
		For Convocation Grant					
		For Technician/students chapter					
2,09,635	52,409	For Annual Recurring Grant	80	20	1,57,798	39,449.40	1,97,247
		For Special Repairs Grant					
		For Land and Building Grant					
		For Non conventional energy Grant					
4,800	1,200	For Incentives	80	20	4,800	1,200.00	6,000
		For Special Grant					
		For reimbursement of TA/DA					
		For Miscellaneous Grant					
5,75,256	1,43,814	**Sub-Total (A)**			2,53,626	63,406.60	3,17,033
		Income Generated by Centre:					
		Receipts for National Convention of Division					
		Receipts from Seminars and Symposia					
		Receipts for Technical Activities					
		Sponsorship fees					
		Donations & Development Charge					
		Receipts for Continuing education					
		Receipts for Technicians' Chapter					
		Refresher Course Lecture					
		Advertisement					

07/07/2022
Chairman
THE INSTITUTION OF ENGRS. (INDIA)
MUZAFFARPUR LOCAL CENTRE

SINGH & THAKUR CHARTERED ACCOUNTANTS FRN: 02462

07/07/22
Honorary Secretary
The Institution of Engrs.(I)
Muzaffarpur Local Centre
M.I.T. Muzaffarpur

THE INSTITUTION OF ENGINEERS (INDIA)

Income and Expenditure Account for the year ended 31st March 2022

Muzaffarpur Local Centre

ANNEXURE-1 (Page 3 of 7)

2020 - 2021		EXPENDITURE	RATIO		2021 - 2022		TOTAL
Research & Development	Education		R& D	EDU	Research & Development	Education	
Rs.	Rs.		24%	76%	Rs.	Rs.	Rs.
		Salaries and Allowances, etc. to Permanent staff					
39,422	1,39,767	Salaries and Allowances, etc. to Temporary staff	24	76	39,681	1,25,655	1,65,336
		Staff welfare expenses					
		Direct Expenses for conducting Examination					
		Technical Publication					
-	-	Expenses for National Convention of Division					
-	-	Expenses for Seminars and Symposia	100		-	-	-
-		Exp. Technical Activities (Engineers Day)	100		6,700		6,700
		Refresher Course Lecture					
		Expenses for Technicians' Chapter Activities					
		Expenses for Continuing education					
		Prize Awarded					
		Convocation Expenses					
		Expenses for Lectures					
59,724		Annual General Meeting Expenses	100		35,472	-	35,472
-	-	General Meeting Expenses	100		31,010	-	31,010
		Indian Engineering Congress Expenses					
		Council Meeting Expenses					
-		Committee Meeting Expenses			-		-
2,607	652	Data Procesing Exp. (Computer Exp.)	80	20	12,720	3,180	15,900
504	126	Printing and Stationery			-	-	-
1,907	477	Postage expenses	80	20	1,411	353	1,764
-	-	Office Eqiptment (Printer & R.O)			-	-	-
		Electricity Charges					
		Advertisement Expenses					
		Election Expenses	100		8,750		8,750
-	-	Bank Charges	80	20	71	18	89
		Charges General					
951	238	Internet Expenses			-	-	-
		Office Expenses	80	20	42,404	10,601	53,005
		Rent, Rates and Taxes					
		Refreshment Expenses					
5,192	1,298	Statutory Audit Fees	80	20	5,192	1,298	6,490
		Other Auditors' Fees					
		Internal Audit Fees					
7,633	1,908	Misc. Expenses	80	20	26,198	6,549	32,747
-	-	Repairs and Maintenance on Buildings					
		Repairs and Maintenance on Others					
		Books and Periodicals					
		Travelling and Conveyance					
		TA/DA to Committee Members					
		Bad Debts written off					
		Fixed assets written off					
1,17,940	1,44,466	**Sub-Total (C)**			2,09,609	1,47,654	3,57,263
-	-	**Excess of Income/exp. over Exp./income [Surplus/(Deficit)] [(A+B) - C = D]**					
		: GRAND TOTAL (C + D) :					

This is the Income and Expenditure Account referred to in our report of even date.

For SINGH & THAKUR
CHARTERED ACCOUNTANTS
Firm Registration No. 024623N

(CA CHANDAN THAKUR)
Proprietor
Membership No. 523869
Date : 30/06/2022
Place: Muzaffarpur

SINGH & THAKUR CHARTERED ACCOUNTANTS CA FRN: 02462

07/07/22

Name and Signature
Honorary Secretary
Honorary Secretary
The Institution of Engrs.(I)
Muzaffarpur Local Centre
M.I.T. Muzaffarpur

07/07/2022

Name and Signature
Chairman
Chairman
THE INSTITUTION OF ENGRS. (INDIA)
MUZAFFARPUR LOCAL CENTRE

Alternative Energy-Solar and Solar PV

Dr. Anjani Kumar Mishra, FIE
Principal,
Govt. Polytechnic Vaishali, Bihar

Er. Akash Kumar,
Lecturer (Civil Engineering),
Govt. Polytechnic Vaishali, Bihar

Abstract

Alternative energy is energy that does not come from fossil fuels, and thus produces little to no greenhouse gases like carbon dioxide (CO2). This means that energy produced from alternative sources does not contribute to the greenhouse effect that causes climate change. These energy sources are referred to as "alternative" because they represent the alternative to coal, oil, and natural gas, which have been the most common sources of energy since the Industrial Revolution. These fossil fuels emit high levels of CO2 when burned to produce energy and electricity. Alternative energy, however, should not be confused with renewable energy, although many renewable energy sources can also be considered alternative. Solar power, for example, is both renewable and alternative because it will always be abundant and it emits no greenhouse gases. Nuclear power, however, is alternative but not renewable, since it uses uranium, a finite resource. Alternative energy here includes hydroelectric energy, solar energy, geothermal energy, wind energy, nuclear energy, and biomass energy. Solar energy is radiant light and heat from the Sun that is harnessed using a range of technologies such as solar power to generate electricity, solar thermal energy (including solar water heating), and solar architecture. It is an essential source of renewable energy, and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power, and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

Keywords: Alternative Energy, Renewable Energy, Solar Energy, Photovoltaic.

Main Thrust

Solar energy is a powerful source of energy that can be used to heat, cool, and light homes and businesses. More energy from the sun falls on the earth in one hour than is used by everyone in the world in one year. A variety of technologies convert sunlight to usable energy for buildings. The most commonly used solar technologies for homes and businesses are solar photovoltaic for electricity, passive solar design for space heating and cooling, and solar water heating. Businesses and industry use solar technologies to diversify their energy sources, improve efficiency, and save money. Energy developers and utilities use solar photovoltaic and concentrating solar power technologies to produce electricity on a massive scale to power cities and small towns. Solar cells, also called photovoltaic cells, convert sunlight directly into electricity. Photovoltaic (often shortened as PV) gets its name from the process of converting light (photons) to electricity (voltage), which is called the *photovoltaic effect*. This phenomenon was first exploited in 1954 by scientists at Bell Laboratories who created a working solar cell made from silicon that generated an electric current when exposed to sunlight. Solar cells were soon being used to power space satellites and smaller items such as calculators and watches. Today, electricity from solar cells has become cost competitive in many regions and photovoltaic systems are being deployed at large scales to help power the electric grid. Variety of Solar cells is available now a day. Few of them are: 1)Silicon Solar Cells: The vast majority of today's solar cells are made from silicon and offer both reasonable prices and good efficiency (the rate at which the solar cell converts sunlight into electricity). These cells are usually assembled into larger modules that can be installed on the roofs of residential or commercial buildings or deployed on ground-mounted racks to create huge, utility-scale systems.

2) Thin Film Solar Cells: Another commonly used photovoltaic technology is known as thin-film solar cells because they are made from very thin layers of semiconductor material, such as cadmium telluride or copper indium gallium diselenide. The thickness of these cell layers is only a few micrometers. Thin-film solar cells can be flexible and lightweight, making them ideal for portable applications such as in a soldier’s backpack or for use in other products like windows that generate electricity from the sun.

3) III-V Solar Cells: A third type of photovoltaic technology is named after the elements that compose them. III-V solar cells are mainly constructed from elements in Group III e.g., gallium and indium and Group V e.g., arsenic and antimony of the periodic table. They convert sunlight into electricity at much higher efficiencies. Because of this, these solar cells are often used on satellites, unmanned aerial vehicles, and other applications that require a high ratio of power to weight.

4) Next Generation Solar Cells: Solar cell researchers are pursuing many new photovoltaic technologies such as solar cells made from organic materials, quantum dots, and hybrid organic-inorganic materials. These next-generation technologies may offer lower costs, greater ease of manufacture, or other benefits.

Status of India and Bihar on Solar Energy: India added a record 10 Gigawatt (GW) of solar energy to its cumulative installed capacity in 2021. This has been the highest 12-month capacity addition, recording nearly a 200% year-on-year growth. India has now surpassed 50 GW of cumulative installed solar capacity, as on 28th February 2022. Rajasthan has the highest solar power generation potential. On 9th august 2022 Modhera village of Gujarat became India's 1st 24*7 solar powered village. In Bihar, Bihar Renewable Energy Development Agency has been established to promote development of schemes on non- conventional energy sources. It has been nominated as nodal agency to carry out the remote village electrification program. The State Govt. provides plan funds to BREDA for expenditure on subsidies for the schemes and also for the expenditures on establishment.

Conclusion:

With rapid growing Population all over the world and increase in pollution due to the use of traditional fossil fuels it is a right time to adopt sustainable source of Energy. Solar Energy being the best alternative has the huge potential to meet Energy demand of India. Government and research agency all over the world is engaged in developing techniques to harness Solar Energy more efficiently. Indian Institution is also including solar technology in its curriculum to make this topic familiar among students and encourage them to develop the same. For citizens government is providing subsidies to make it cost efficient. So as a responsible Citizen we should also use solar technologies for the fulfillment of our day to day life energy demand.

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Photovoltaic system

Dr. Amaresh Kumar Rai, FIE
Past Chairman, MLC

Figure 1. A photovoltaic system comprised of a solar panel array, inverter and other electrical hardware.[1]

A **photovoltaic (PV) system** is composed of one or more solar panels combined with an inverter and other electrical and mechanical hardware that use energy from the Sun to generate electricity. PV systems can vary greatly in size from small rooftop or portable systems to massive utility-scale generation plants. Although PV systems can operate by themselves as off-grid PV systems, this article focuses on systems connected to the utility grid, or grid-tied PV systems.

How do these Systems Work?

The light from the Sun, made up of packets of energy called photons, falls onto a solar panel and creates an electric current through a process called the photovoltaic effect. Each panel produces a relatively small amount of energy, but can be linked together with other panels to produce higher amounts of energy as a **solar array**. The electricity produced from a solar panel (or array) is in the form of direct current (DC). Although many electronic devices use DC electricity, including your phone or laptop, they are designed to operate using the electrical utility grid which provides (and requires) alternating current (AC). Therefore, in order for the solar electricity to be useful it must first be converted from DC to AC using an **inverter**. This AC electricity from the inverter can then be used to power electronics locally, or be sent on to the electrical grid for use elsewhere.

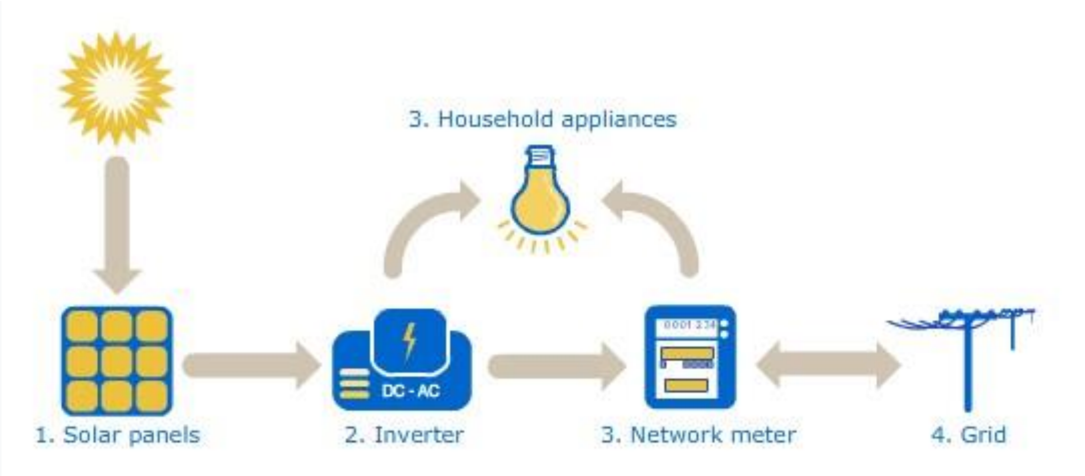

Figure 2. Residential grid -tied solar PV system diagram.[2]

System Components

In addition to the solar panels, there are other important components of a photovoltaic system which are commonly referred to as the "balance of system" or BOS.[3] These components (which typically account for over half of the system cost and most the of maintenance) can include inverters, racking, wiring, combiners, disconnects, circuit breakers and electric meters.

Solar Panel

main article


Figure 3. A solar panel, consisting of many photovoltaic cells.[4]

A solar panel consists of many solar cells with semiconductor properties encapsulated within a material to protect it from the environment. These properties enable the cell to capture light, or more specifically, the photons from the sun and convert their energy into useful electricity through a process called the photovoltaic effect. On either side of the semiconductor is a layer of conducting material which "collects" the electricity produced. The illuminated side of the panel also contains an anti-reflection coating to minimize the losses due to reflection. The majority of solar panels produced worldwide are made from crystalline silicon, which has a theoretical efficiency limit of 33% for converting the Sun's energy into electricity. Many other semiconductor materials and solar cell technologies have been developed that operate at higher efficiencies, but these come with a higher cost to manufacture.

Inverters

main article

An inverter is an electrical device which accepts electrical current in the form of direct current (DC) and converts it to alternating current (AC). For solar energy systems, this means the DC current from the solar array is fed through an inverter which converts it to AC. This conversion is necessary to operate most electric devices or interface with the electrical grid. Inverters are important for almost all solar energy systems and are typically the most expensive component after the solar panels themselves.

[5]

Figure 4. A solar inverter (yellow) mounted to the solar racking converts DC electricity from the solar array to useful AC electricity.

Most inverters have conversion efficiencies of 90% or higher and contain important safety features including ground fault circuit interruption and anti-islanding. These shut down the PV system when there is a loss of grid power.[3]

Racking

Racking refers to the mounting apparatus which fixes the solar array to the ground or rooftop. Typically constructed from steel or aluminum, these apparatuses mechanically fix the solar panels in place with a high level of precision. Racking systems should be designed to withstand extreme weather events such as hurricane or tornado level wind speeds and/or high accumulations of snow. Another important feature of racking systems is to electrically bond and ground the solar array to prevent electrocution. Rooftop racking systems typically come in two variations including flat roof systems and pitched roof systems. For flat rooftops it is common for the racking system to include weighted ballast to hold the array to the roof using gravity. On pitched rooftops, the racking system must be mechanically anchored to the roof structure. Ground mounted PV systems, as shown in figure 4, can also use either ballast or mechanical anchors to fix the array to the ground. Some ground mounted racking systems also incorporate tracking systems which use motors and sensors to track the Sun through the sky, increasing the amount of energy generated at a higher equipment and maintenance cost.

Other Components

The remaining components of a typical solar PV system include combiners, disconnects, breakers, meters and wiring. A **solar combiner**, as the name suggests, combines two or more electrical cables into one larger one. Combiners typically include fuses for protection and are used on all medium to large and utility-scale solar arrays. **Disconnects** are electrical gates or switches which allow for manual disconnection of an electrical wire. Typically used on either side of an inverter, namely the "DC disconnect" and "AC disconnect" these devices provide electrical isolation when an inverter needs to be installed or replaced. Circuit breakers or **breakers** protect electrical systems from over current or surges. Designed to trigger automatically when the current reaches a predetermined amount, breakers can also be operated manually, acting as an additional disconnect. An **Electric meter** measures the amount of energy that passes through it and is commonly used by electric utility companies to measure and charge customers. For solar PV systems, a special bi-directional electric meter is used to measure both the incoming energy from the utility, and the outgoing energy from the solar PV system. Finally, the **wiring** or electrical cables transport the electrical energy from and between each component and must be properly sized to carry the current. Wiring exposed to sunlight must have protection against UV exposure, and wires carrying DC current sometimes require metal sheathing for added protection.

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SOLAR ENERGY

Er. Krishna Kanhai & Er. P.R. Bhardwaj
Executive Committee Member
IE (I), Muzaffarpur Local
Centre

Solar energy, radiation from the Sun capable of producing heat, causing chemical reactions, or generating electricity. The total amount of solar energy incident on Earth is vastly in excess of the world's current and anticipated energy requirements. If suitably harnessed, this highly diffused source has the potential to satisfy all future energy needs. In the 21st century solar energy is expected to become increasingly attractive as a renewable energy source because of its inexhaustible supply and its nonpolluting character, in stark contrast to the finite fossil fuels coal, petroleum, and natural gas.

The Sun is an extremely powerful energy source, and sunlight is by far the largest source of energy received by Earth, but its intensity at Earth's surface is actually quite low. This is essentially because of the enormous radial spreading of radiation from the distant Sun. A relatively minor additional loss is due to Earth's atmosphere and clouds, which absorb or scatter as much as 54 percent of the incoming sunlight. The sunlight that reaches the ground consists of nearly 50 percent visible light, 45 percent infrared radiation, and smaller amounts of ultraviolet and other forms of electromagnetic radiation.

The potential for solar energy is enormous, since about 200,000 times the world's total daily electric-generating capacity is received by Earth every day in the form of solar energy. Unfortunately, though solar energy itself is free, the high cost of its collection, conversion, and storage still limits its exploitation in many places. Solar radiation can be converted either into thermal energy (heat) or into electrical energy, though the former is easier to accomplish.

THERMAL ENERGY

Among the most common devices used to capture solar energy and convert it to thermal energy are flat-plate collectors, which are used for solar heating applications. Because the intensity of solar radiation at Earth's surface is so low, these collectors must be large in area. Even in sunny parts of the world's temperate regions, for instance, a collector must have a surface area of about 40 square meters (430 square feet) to gather enough energy to serve the energy needs of one person.

The most widely used flat-plate collectors consist of a blackened metal plate, covered with one or two sheets of glass that is heated by the sunlight falling on it. This heat is then transferred to air or water, called carrier fluids that flow past the back of the plate. The heat may be used directly, or it may be transferred to another medium for storage. Flat-plate collectors are commonly used for solar water heaters and house heating. The storage of heat for use at night or on cloudy days is commonly accomplished by using insulated tanks to store the water heated during sunny periods. Such a system can supply a home with hot water drawn from the storage tank, or, with the warmed water flowing through tubes in floors and ceilings, it can provide space heating. Flat-plate collectors typically heat carrier fluids to temperatures ranging from 66 to 93 °C (150 to 200 °F). The efficiency of such collectors (i.e., the proportion of the energy received that they convert into usable energy) ranges from 20 to 80 percent, depending on the design of the collector.

Another method of thermal energy conversion is found in solar ponds, which are bodies of salt water designed to collect and store solar energy. The heat extracted from such ponds enables the production of chemicals, food, textiles, and other industrial products and can also be used to warm greenhouses, swimming pools, and livestock buildings. Solar ponds are sometimes used to produce electricity through the use of the organic Rankine cycle engine, a relatively efficient and economical means of solar energy conversion, which is especially useful in remote locations. Solar ponds are fairly expensive to install and maintain and are generally limited to warm rural areas.

On a smaller scale, the Sun's energy can also be harnessed to cook food in specially designed solar ovens. Solar ovens typically concentrate sunlight from over a wide area to a central point, where a black-surfaced vessel converts the sunlight into heat. The ovens are typically portable and require no other fuel inputs.

ELECTRICITY GENERATION

Solar radiation may be converted directly into electricity by solar cells (photovoltaic cells). In such cells, a small electric voltage is generated when light strikes the junction between a metal and a semiconductor (such as silicon) or the junction between two different semiconductors. (See photovoltaic effect.) The power generated by a single photovoltaic cell is typically only about two watts. By connecting large numbers of individual cells together, however, as in solar-panel arrays, hundreds or even thousands of kilowatts of electric power can be generated in a solar electric plant or in a large household array. The energy efficiency of most present-day photovoltaic cells is only about 15 to 20 percent, and, since the intensity of solar radiation is low to begin with, large and costly assemblies of such cells are required to produce even moderate amounts of power.

Small photovoltaic cells that operate on sunlight or artificial light have found major use in low-power applications—as power sources for calculators and watches, for example. Larger units have been used to provide power for water pumps and communications systems in remote areas and for weather and communications satellites. Classic crystalline silicon panels and emerging technologies using thin-film solar cells, including building-integrated photovoltaics, can be installed by homeowners and businesses on their rooftops to replace or augment the conventional electric supply.

Concentrated solar power plants employ concentrating, or focusing, collectors to concentrate sunlight received from a wide area onto a small blackened receiver, thereby considerably increasing the light's intensity in order to produce high temperatures. The arrays of carefully aligned mirrors or lenses can focus enough sunlight to heat a target to temperatures of 2,000 °C (3,600 °F) or more. This heat can then be used to operate a boiler, which in turn generates steam for a steam turbine electric generator power plant. For producing steam directly, the movable mirrors can be arranged so as to concentrate large amounts of solar radiation upon blackened pipes through which water is circulated and thereby heated.

Other applications

Solar energy is also used on a small scale for purposes other than those described above. In some countries, for instance, solar energy is used to produce salt from seawater by evaporation. Similarly, solar-powered desalination units transform salt water into drinking water by converting the Sun's energy to heat, directly or indirectly, to drive the desalination process.

Solar technology has also emerged for the clean and renewable production of hydrogen as an alternative energy source. Mimicking the process of photosynthesis, artificial leaves are silicon-based devices that use solar energy to split water into hydrogen and oxygen, leaving virtually no pollutants. Further work is needed to improve the efficiency and cost-effectiveness of these devices for industrial use.

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Resiliency in non-structural members of buildings considering alternative energy

Vijay Kumar, Assistant Professor, Dept. of Civil Engineering, MIT Muzaffarpur

Email: kumar2vijay@gmail.com

Introduction

Human casualties and economic losses caused by natural disasters have been dramatically increased in the last couple [1]. Among these natural disasters, earthquake has been the most catastrophic phenomena. According to CATDAT damaging earthquake database, the 2010 Haiti earthquake resulted in a death toll that was estimated to be in the range of 46,000–316,000 casualties. 12 months later in Japan, the Tohoku earthquake in 2011 caused 20,475 fatalities and left 1.108 million people homeless. Besides the population losses that occurred in the 2011 Tohoku earthquake, the economic loss was $140 billion. Furthermore, on the economic front, a financial loss caused in Turkey was $2.2 billion after the occurrence of Van earthquake event in 2011, and was estimated as $1.7 billion when Sikkim earthquake event struck India in 2011 [2]. Seismic assessment performance of structural and non-structural members of current buildings and infrastructure are need to be consider for resilient buildings. This was taken by many of the seismologists, geotechnical and structural engineers and researchers.

A disaster situation prevails only when the hazard and vulnerable conditions meet at the time of sudden occurrence of any event [3]. A hazard may be a source of potential damage and its capacity to induce a disaster at any extent. Many times its harm or adverse effect on health, economy, organizations, property, equipment's and environment, it depend on the level of vulnerable things in the surroundings. However, hazard is any things that will cause harm but sometimes this causes the risk factor in the disaster. So, risk is basically combination of two things one is the chance that hazard will cause harm and second is how serious that harm could be.

Vulnerability is the quality of being easily damaged. It is the inability to resist a hazard or to respond when disaster has occurred. This may be in form of physical, economic, social and environmental vulnerability. A structure is vulnerable if any damage produces consequences that are disproportionate to that damage; conversely, a structure is robust if it can withstand arbitrary damage. Structural vulnerability analysis may concerned with the identification of five important vulnerable failure scenarios. These are as follows:

- **(i)** The minimum demand failure scenario,
- **(ii)** The minimum failure scenario,
- **(iii)** The total failure scenario,
- **(iv)** The maximum failure scenario, and
- **(v)** Failure scenarios that are of specific interest to the designer.

Natural and Man-made hazard vulnerability of India

The Indian subcontinent is vulnerable to many natural hazards like cyclones, earthquakes, floods, landslides, avalanches, and tsunami. Among 29 States and 7 Union territories in the country, all except 3 are prone to various natural disasters as shown in Fig. 1.

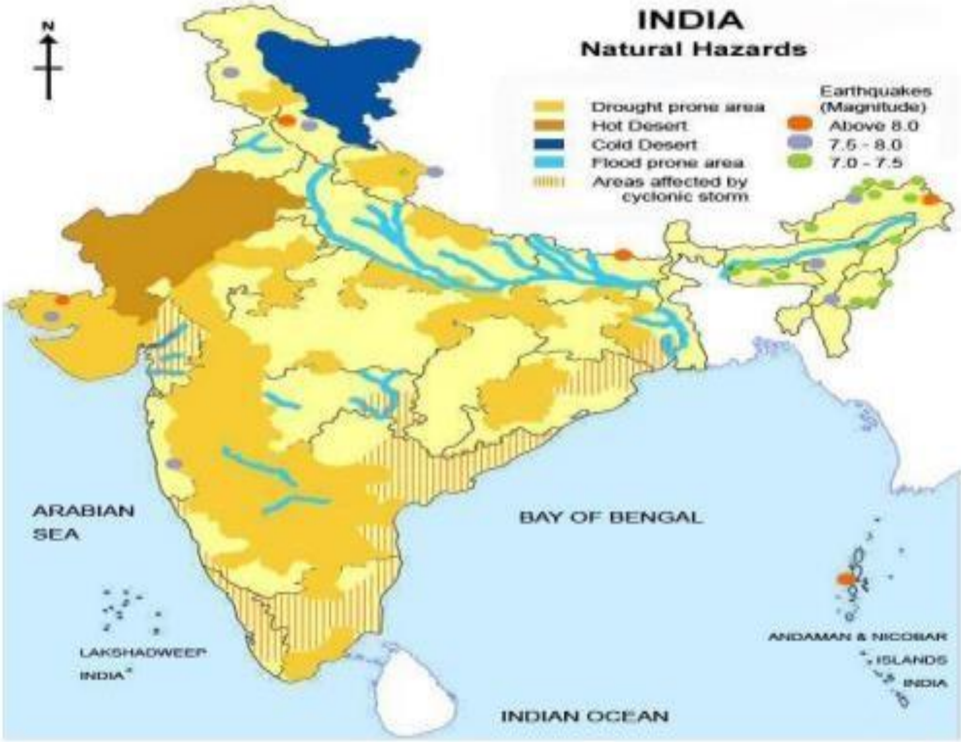


Figure 1: Natural disasters risk map of India

The following data shows the various vulnerability which found in our country as per natural condition as follows:

- **(a)** 58.6% of land is vulnerable to Earthquakes and 8.5% of land mass is vulnerable to Cyclones. 13 Coastal States/UTs are vulnerable to Tsunamis.
- **(b)** 12% of land (40 million hectares) is vulnerable to Floods and 28% is vulnerable to Drought.
- **(c)** Out of 7516 km coast line, approximately 5700 km is prone to Cyclones/high wind velocity.
- **(d)** Hilly regions of North and NE are prone to Landslides/avalanches. West coast is also vulnerable to Landslides.

The following data shows the various vulnerability which found in our country as per man-made condition as follows:

- **(a)** Urban Fires (due to human errors and technical faults, mostly short-circuit).
- **(b)** Terrorist Related Disasters, Civil Disorder, Rail, Road and Air accidents and Stampedes
- **(c)** Boat Capsizing/Ship wreck, Industrial Accidents, Building Collapses, Epidemics,

As we know that the building are the main source of damage of life and cause disruption during and after earthquake (see Fig. 2). Therefore structural and non-structural members should be focused at the time of disaster resilient structure [3].

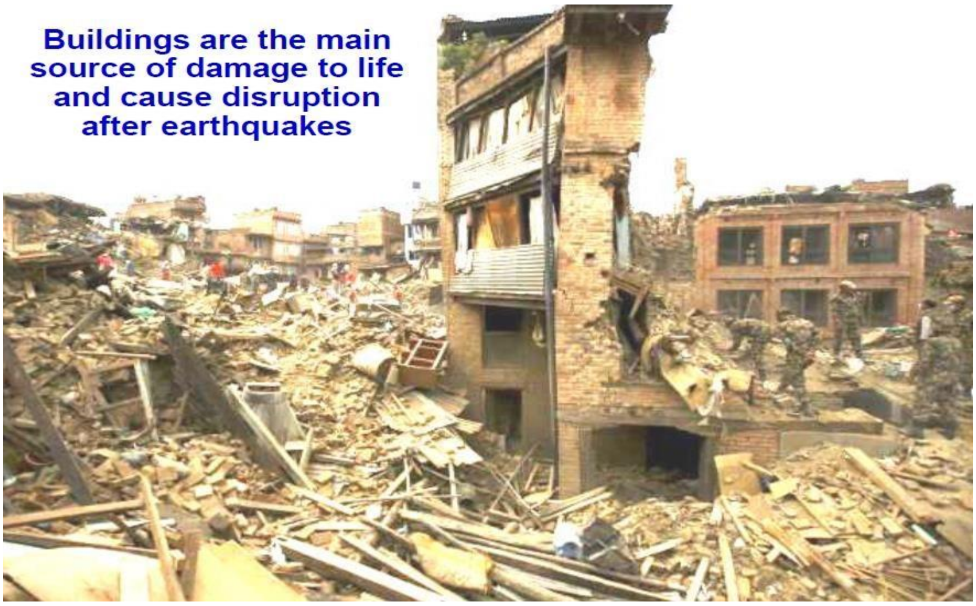


Figure 2: Damage of building after earthquake

The non-structural members need to be fixed in proper way because earthquake may exert forces in any direction on the buildings and parts of buildings. Seismic vibration of building normally adopted in design and Translation in X and Y direction and rotation about Z. The behavior of building and direction of forces at the time of earthquake has shown in the Fig. 3.

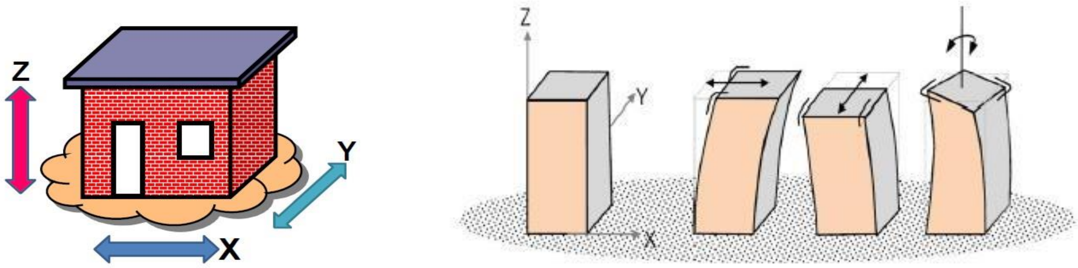


Figure 3: Damage of building after earthquake [4]

The non-structural components of a building include all parts of the building and its contents apart from the structure (columns, floors and beams). Common non-structural components include ceilings; windows; office equipment; computers; inventory; file cabinets; water tanks; generators; transformers; heating, ventilating, and air conditioning (HVAC) equipment; electrical equipment; furnishings; and lights. These non-structural components of a building are classified into: architectural components (i.e. ceilings, windows and doors), medical and laboratory equipment, lifelines (i.e. mechanical, electrical and plumbing installations) and safety and security issues.

Non-structural components are essential to be implemented in order for better preparedness. The preparedness program is the only key which are potency to maintain the resiliency in the building or any structure and system. Disaster preparedness provides a platform to design effective, realistic and coordinated planning, reduces duplication of efforts and increase the overall effectiveness of National Societies. The National Societies should priorities disaster preparedness and integrate it into their overall programming efforts [5].

There are nine preparedness tools which are internationally accepted are as follows and pictorial representation has shown in Annexure - 1:

1. International federation approach
2. Community preparedness
3. Early warning: Indian Tsunami Early warning (See Fig. 4)
4. Better Programming Initiative (BPI)
5. Vulnerability and Capacity Assessment (VCA)
6. Well-prepared National Societies
7. Contingency planning
8. Training in disaster management
9. Logistics preparedness

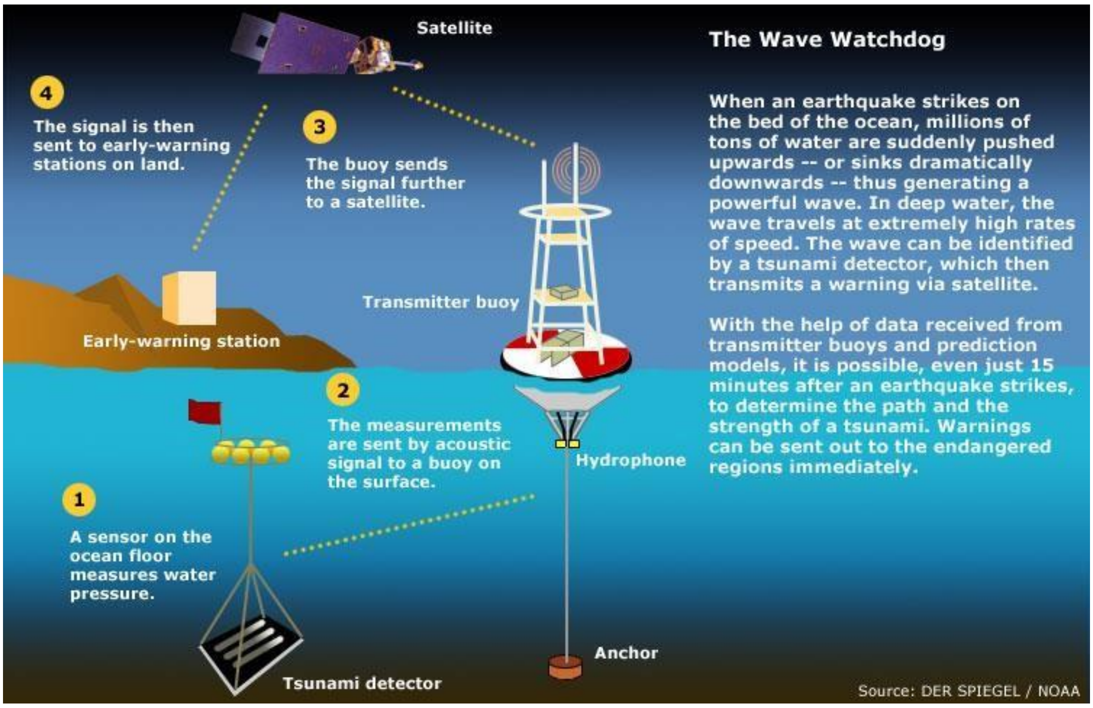


Figure 4: Early warning system network

Alternative energy in resiliency

For the stated issue in case of disaster researchers and engineers have taken many way to find the sustainable buildings. Therefore, green building is one of the alternative way to rectify this issues of non-structural hazard. Various features of green building may be sustainable site development, materials selection, water efficiency, energy efficiency, waste and toxic reduction, indoor environmental quality [5]. Green building that is environmentally responsible and resourceefficient throughout its life-cycle. Its uses less water, optimizes energy efficiency, conserve natural resources, generate less waste etc. as compared to conventional buildings. It also reduce the adverse impact of the built environment on human health and natural environment. The fundamental principles of green building as a construction materials and its features are shown in Fig. 5 and 6.

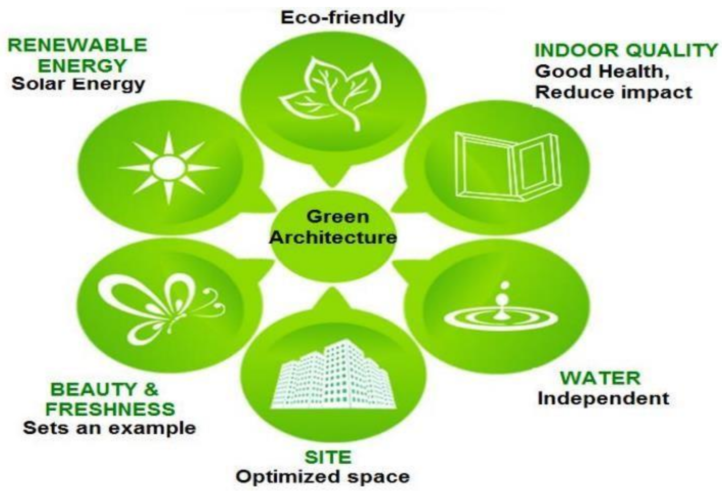


Figure 5: Fundamental principles in alternative energy

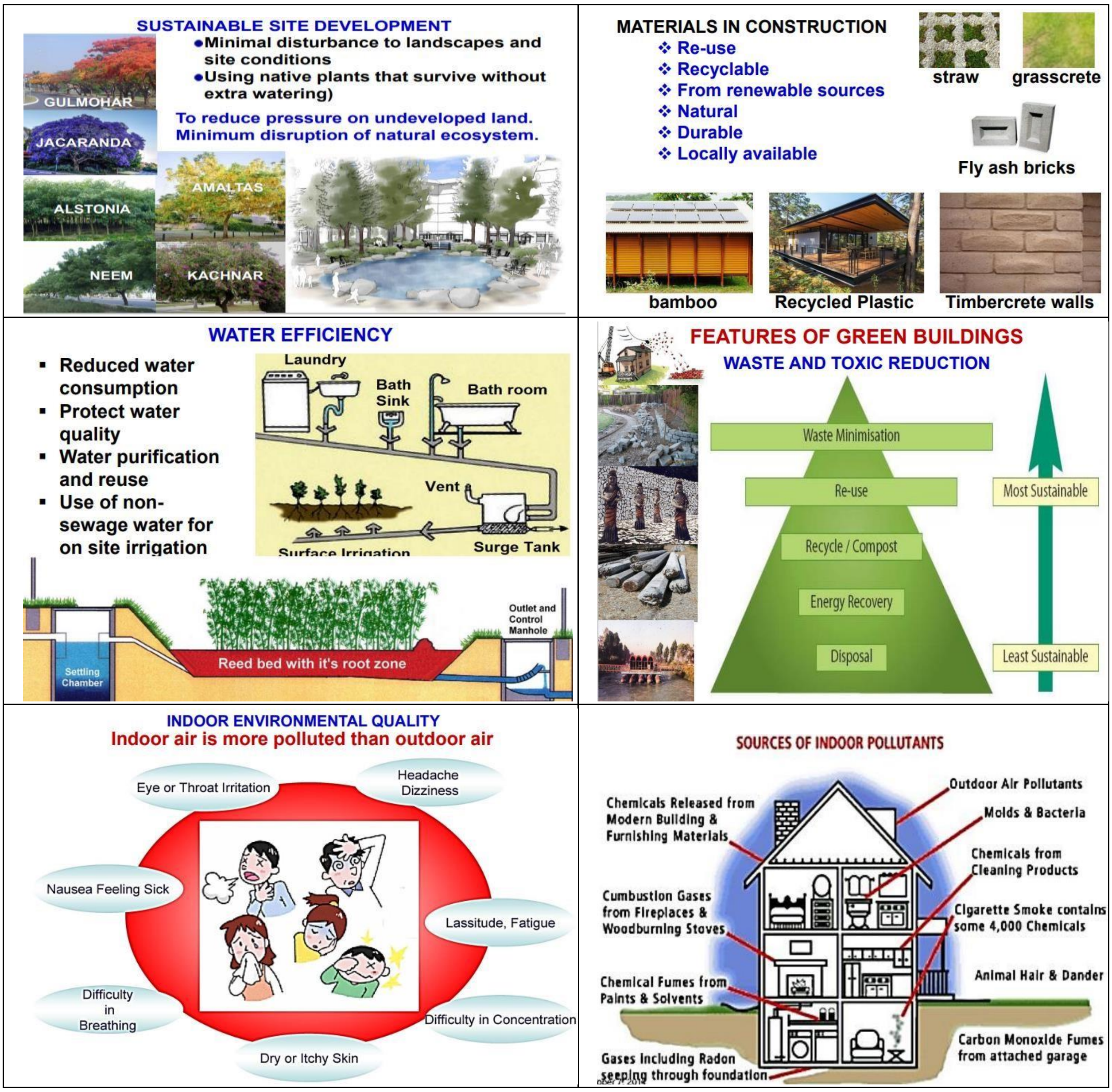


Figure 6: Features of green buildings

Energy efficient non-structural members in buildings

The alternative source of energy can be used which can help our structures to damage in case of disaster. The some of the features are described in the following section. **(a) Energy efficiency: Active system**

This uses the renewable energy through solar power, wind power, hydro power, biomass and geothermal power (see Fig. 7)

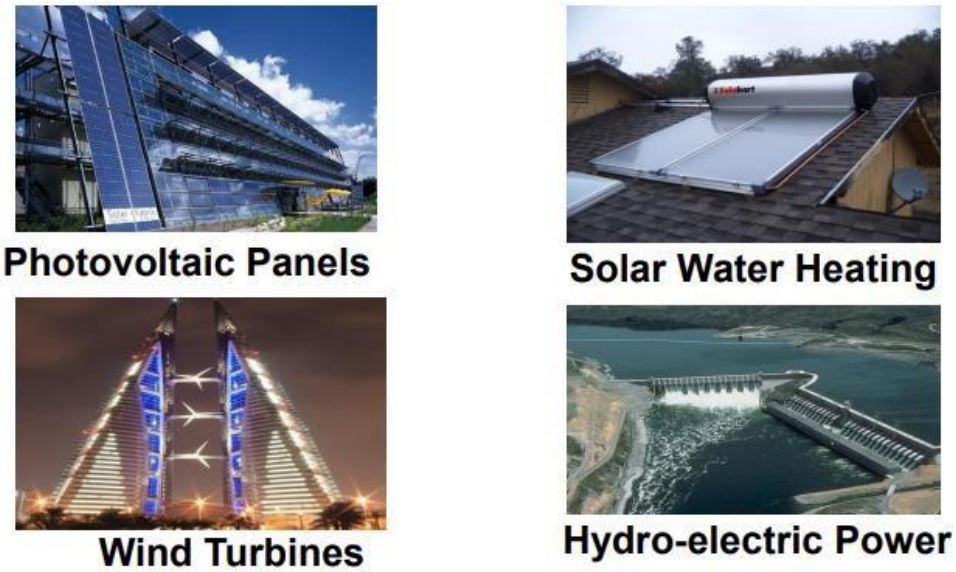


Figure 7: Energy efficiency in active system

(b) Energy efficiency: Passive system

Its direct uses the natural resources on the requirements of weather condition as shown in following figures (see Fig. 8-11).

It is concluded that the alternate source of energy act in a very efficient way to keep our structures, systems away from hazard and vulnerable things, hence disaster can be prevented through these techniques of alternate system. These methodology adopted can be extended for finding an impact of seismic excitation for various complex engineering structures and systems. This study also helpful in context of multi-hazard places.

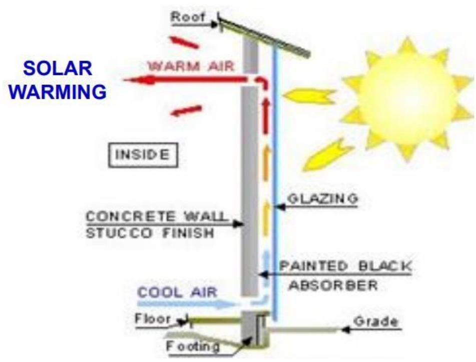


Figure 8: Energy efficient passive system in solar season

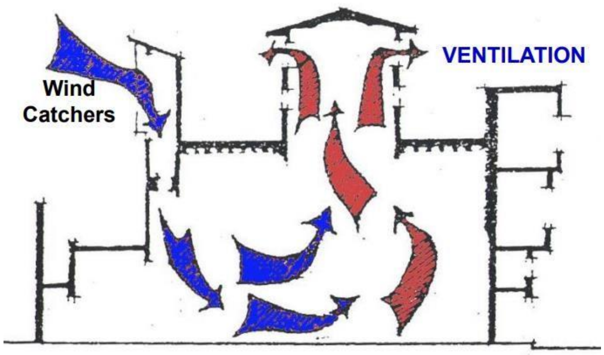


Figure 9: Energy efficient passive system through ventilation

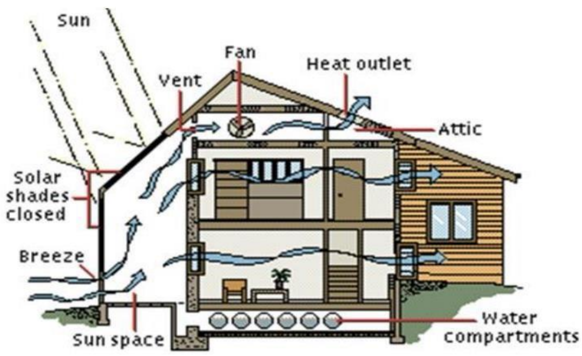


Figure 10: Energy efficient passive solar cooling in summer

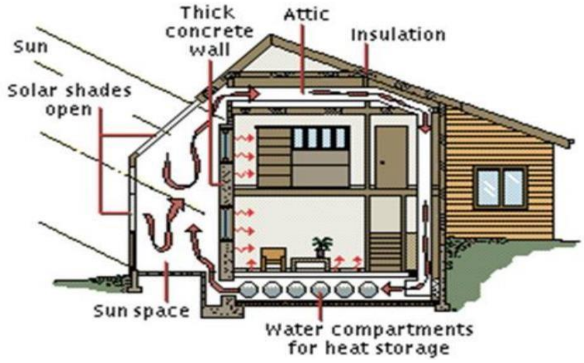
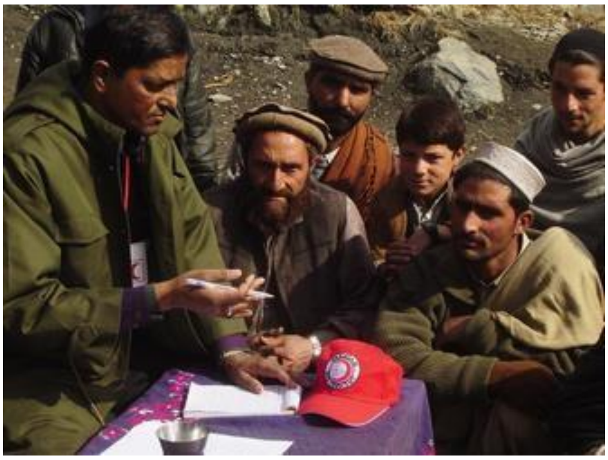


Figure 11: Energy efficient passive solar heating in winter

Annexure 1



(a) Community preparedness

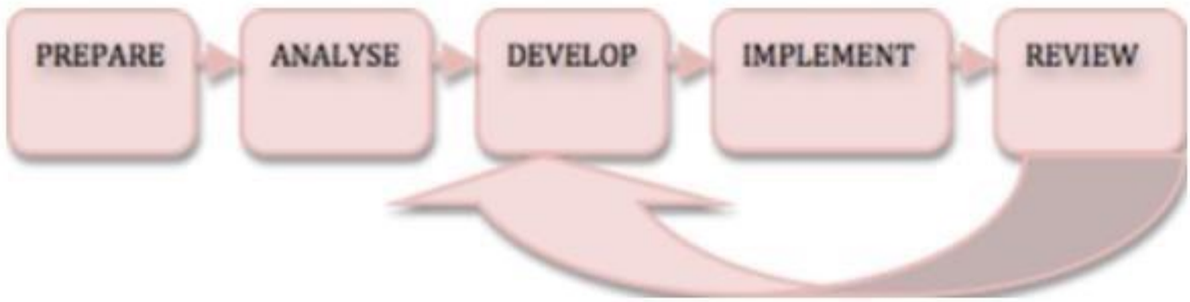
(b) Better Programming Initiative

(c) Vulnerability and Capacity Assessment

(d) Well-prepared National Societies

(e) Logistics preparedness

(f) Training in disaster management



(g) Contingency planning

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3.	Dr. Anjani Kr. Mishra	FIE	Past Chairman	Principal, G.P. Vaishali	Civil
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