21st NATIONAL CHILDREN'S SCIENCE CONGRESS 2013

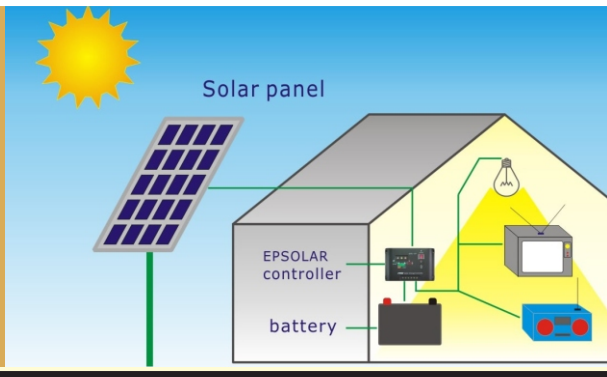
ACTIVITY GUIDE

ENERGY
EXPLORE, HARNESS & CONSERVE

Focal Theme:

ENERGY

EXPLORE, HARNESS AND CONSERVE



State Co-ordinating Agency

Karnataka Rajya Vijnana Parishat

'Vijnana Bhavan' 24/2, 21st Main Road, Banashankari II Stage, Bangalore - 560 070

20th State Level Children's Science Congress 2012 - Madikeri

A view of Photos Gallery

21st National Children's Science Congress 2013

ACTIVITY GUIDE

Focal Theme:

Energy:
Explore, Harness and Conserve

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21st NCSC Activity Guide-2013

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The softcopy of the NCSC 2013 Activity Guide is available at www.ncstc-network.org & www.krvp.org

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Contents

NCSTC- NETWORK

NCSTC-Network

The NCSTC-Network, a voluntary network of over 70 voluntary and government organizations, is a unique organization for science popularization and for stimulation of scientific temperament among the people. It was registered in 1991 under Societies Registration Act-1860 of Delhi as an autonomous society.

The NCSTC-Network was formed through the effort of the National Council for Science and Technology Communication (NCSTC) under the Department of Science and Technology, Government of India to give a common platform to like minded organizations in science communication, with an objective to strengthen the science communication movement in the country.

What followed has watched by all. The Network remains a unique and successful experiment in science popularization, bringing the government and non-government sectors together in nation building exercise. It publishes books, co-ordinates and organises National Children's Science Congress (NCSC), arranges science programmes, organizes trainings / workshops and in short, bridges science and the common person.

Major Activities:

1. The most visible activity of the Network is the National Children's Science Congress (NCSC) which is being catalysed and supported by NCSTC. It is a unque programme for children in the age group 10 - 17. NCSC gives a common platform for the children of the country to present their scientific realization through small research project on given focal theme. It records participation of around five lakh children every year.
2. National Teachers' Science Conference (NTSC): It is a nationwide activity. Network has been entrusted to organize this activity since the year 2005 by NCSTC. It organized the 3rd NTSC at Mysore during 27-30 January 2006 and would continue to provide this platform for the teaching community for sharing their experience of innovation in teaching - learning process.
3. Appreciating Physics in Everyday Life: the year 2005 was celebrated as the International Year of Physics. During the celebration the necessity of a nation wide campaign was felt to take applications and concepts of physics to a large number of young people through some intensive science communication activities. Network has taken up the challenge, which is being catalysed and supported by NCSTC, and has already organised a series of activities through its membeer organizations throughout the country.
4. Apart from all these activities Network was an active component in the Bharat Jan Gyan Vigyan Jatha 1992 and the Year of Scientific Awareness (YSA) 2004. In both these activities most of the Network members took active part at state and regional level. In YSA-2004 the network played a crucial role in printing and dissemination of the software.

The NCSTC-Network is now ready to take some more challenges like popularizing the concept of donation of body after death, science communication programme for girl child, etc.

To know more about the NCSTC Network you may visit its website www.ncstc-network.org

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Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad

Rastriya Vigyan Evam Prodyogiki Sanchar Parishad (RVPSP), New Delhi, Department of Science and Technology, is an apex body set up with the objectives of communication of science and technology (S&T) and stimulation of scientific and technological temper among the people. Among other things RVPSP:

- Catalyzes and supports research and development in the area of S&T communication and devising more effective communication methods, tools and technologies;
- develops software in different languages in the form of films, websites, radio and television programmes and magazines in different languages;
- helps prepare competent science communicators, through short and long-term courses in selected S&T based voluntary organizations, Universities, etc.
- encourages and recognizes outstanding, communicators and institutions involved in S&T communication through national awards.
- Organizes state / country wide field projects for fulfilling its objectives by involving other agencies and network of science based voluntary organizations, etc. These can be in the form of Jathas, melas, science exhibitions, science conferences, seminars, etc.
- It also orchestrates and coordinates S&T communication programmes and activities nationally. RVPSP is initiating process to encourage creativity among youth and invites suggestions and inputs for this.

रावित्रौसंप NCSTC

For further details, please contact:

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From the Secretary's Desk…

Due to explosion of population and the greed of man, the misuse of energy is more than the use of energy. The demand for energy has been increasing in industries, agriculture and other highly developed activities. Already, there is a crisis of energy in India and as also worldwide. Energy resources are the lifeblood of our economic development. The analysis of economists as well as scientists is that the possibility of conventional energy resources and particularly oil and natural gases depleting completely by the end of this century is more. Therefore, there is an urgent need for research, conservation and management of different energy resources.

The All Karnataka Children's Science Congress is being organized by KRVP for the last 20 years, which has been a successful programme. This Compendium has been prepared to enable smooth functioning of the creative activities of the All Karnataka Children's Science Congress. This important conference would be more active with such compendium.

KRVP is grateful to the National Council For Science and Technology Communication, Dept. of Science and Technology, Govt. of India, New Delhi and Karnataka Science and Technology Dept. We are also grateful to the NCSTC Network, New Delhi who prepared the National Resource Handbook.

We owe our gratitude to Smt. NagashreeTyagaraj, M.N. Mushturappa, Sri Kantharaj, Sri K.G.KrishnamurthyrajUrs, Sri Prashanth G.R. and Smt. ShreematiHariprasad who translated the main theme and sub themes of this year "Energy: Explore, Harness and Conserve" with their expertise within the short span of time.

1-06-2013
Bangalore

Dr. VasūndharaBhupathi
Honorary Secretary, KRVP

Foreword

National Council for Science and Technology Communication, Dept. of Science and Technology, Govt. of India launched the programme "National Childrens Science Congress" in 1993. It has successfully conducted Childrens Science Congress for the past two decades. This programme is being implemented by Karnataka Rajya Vijnana Parishat in Karnataka ever since

This year's main theme is "Energy : Explore, Harness and Conserve". It has a six sub themes which have been discussed in detail in the main text.

This book serves as a resource material for both students and teachers who are interested in participating.

It gives guidelines to the evaluators too.

KRVP hopes that this compendium of resource material would go a long way in enthusing the teachers, children and others alike.

Dr. H.S. Niranjana Aradhya
President, KRVP

1-06-2013
Bangalore

Part-I

1.0. About Children's Science Congress (CSC)

1.1. CSC – the beginning

The seeds of the programme of children's science congress (CSC), in the way of an exercise to carry out small research activities at micro-level were planted in Madhya Pradesh by an NGO called Gwalior Science Center. It was later adopted by National Council for Science and Technology Communication (NCSTC), Department of Science and Technology (DST), Government of India for carrying out national level activities through NCSTC-Network (a network of Non-Government and Government organizations working in the field of science popularization) as national organiser. It was a time when many of the country's crusaders of science communication were experienced with massive science communication exercise of *Bharat Jana Bigyan Jatha* and *Bharat Jana Gyan Bigyan Jatha*. It was felt that the large scale activities for developing scientific awareness among the masses are to be continued as regular activity, so, this programme was launched nationwide in 1993, under the nomenclature of National Children's Science Congress (NCSC), with an expectation that it would generate scientific temperament among the teachers and students, and spread among various stakeholders of the society. The programme of NCSC has been fruitfully conducted for the last 20 years.

1.2. CSC – an overview

Children's Science Congress is targeted to spread the concept of the method of science among the children through their project activities adopting the principle of '**Learning through doing**'. The mandate of participation is that, the children will carry out a project on a particular topic in relation to theme and sub-theme decided for the year. The study is to be carried out in the neighbourhood of the children where they live in. For this, the students form a group with their like-minded friends/classmates and the study is carried out under the supervision of a guide. It is noteworthy that, CSC programme is not only for the school going children but is also open for the children outside the formal boundary of schools, in the age group of 10 to 17 years (where 10 to 14 years is considered as junior group and 14 to 17 years as senior group). Further, it is not mandatory that a guide must be a school teacher; any person with fair knowledge of dealing with children and method of science is considered eligible to guide the children.

The exercises of project activities, as a thumb rule, encourage the children to ***explore, think, serve and wonder***. It is capable to imbibe the following temperament/quality/skill of the children:

- ***Observation,***
- ***Making measurement,***
- ***Making comparison and contrasts,***
- ***Classification,***
- ***Estimation,***
- ***Prediction,***

- ***Interpretation,***
- ***Critical thinking,***
- ***Creative thinking,***
- ***Drawing conclusion and***
- ***Cooperative skill***

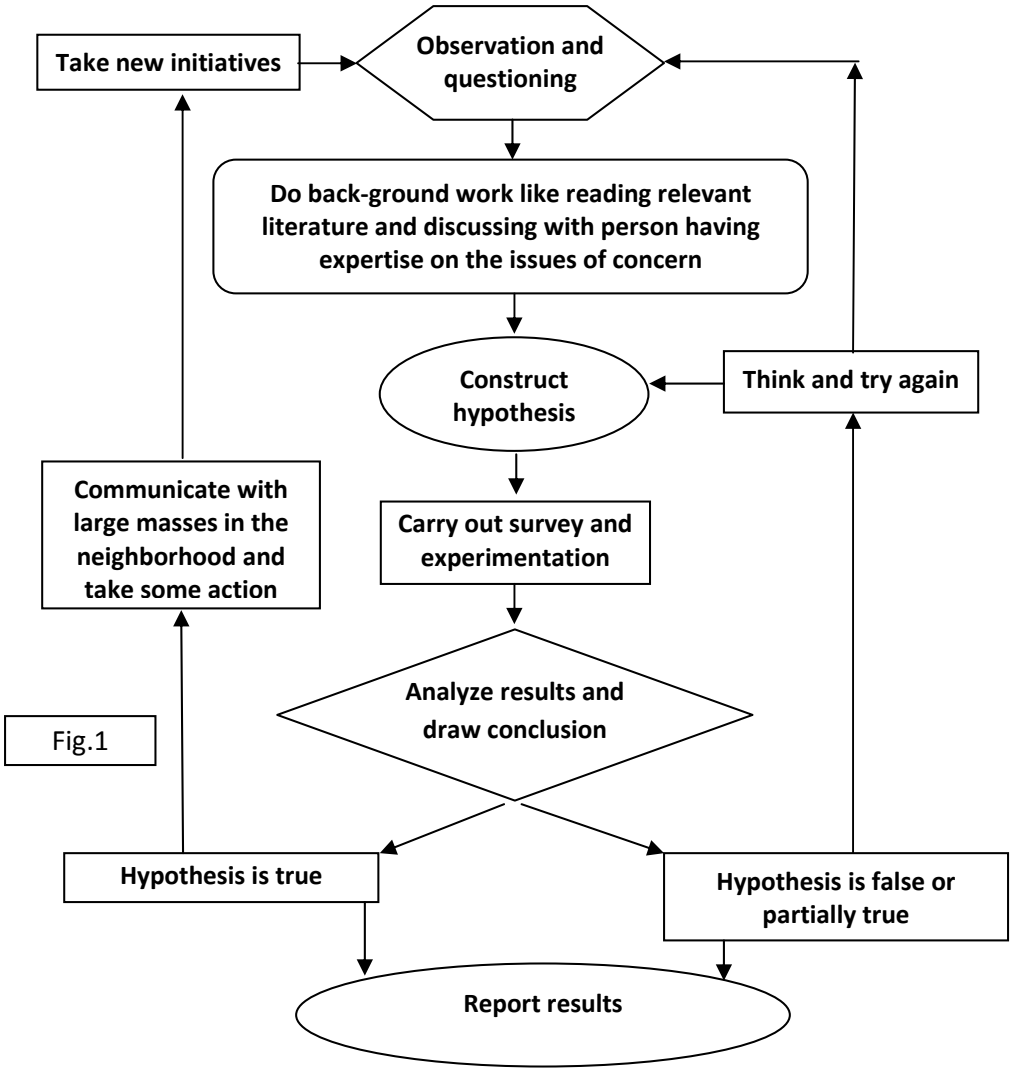


Fig.1

Therefore it is ideally expected that any group of children will undertake a project work with a perspective of continuous effort of questioning and experimentation (as in fig-1).

Here, observation incorporates anything the children observe in their daily life in the locality, in relation to the theme defined for the year. The observation should to be followed by relevant questioning such as ***"What? Where? When? Why? How? Whom?".*** In the search for finding out the answer to the question(s), one is required to ***review different literature*** concerning the issues in the study. Review of such literature basically and ideally helps in framing the steps towards the study and experimentation. In the process, one may also discuss ***with experts of the relevant fields to get information and advice***. Initiatives for such activities must be encouraged by the guide associated

with the project. These steps will help to ***frame assumption/hypothesis***. Hypothesis is an assumption of some causes and its impact on the basis of observation, information collected from different literature and emerged from discussion with experts. After these phases, actual study through ***survey or experimentation or survey followed by experimentation*** would start. In the case of ***survey-based*** work, ***identification of respondent, their unit of observation, sample coverage, design of survey in relation to designing of interview schedule or questionnaire*** is supposed to be the most critical steps. Such decisions may vary with the issues of study. On the other hand, in case of ***experimentation, setting the objective of experimentation, defining different parameters, identification of ideal instruments, framing of procedures/ steps and control along with repetitive observatio*n** of the experiments are critical decisions, which will determine the path towards the result. Again in relation to issues of study, such experiment may be either ***laboratory experiments*** or ***field experiments***.

It is expected that in course of time, the children's project will bring in lots of new information about problems and prospects of their locality along with innovative ideas to address these issues. Moreover, in the course of project work, the children may develop different new approaches of study along with the development of different instruments for their experiments. Such tools/instruments may be developed with the material in their access / available to them nearby. Another expectation was that the outcome of different studies will be communicated among the local populace, which in turn, helps in generating scientific temperament among the general mass.

In a nutshell, the CSC projects are simple, innovative, concerned with local issues related with day to day life, carried out in very nominal cost, where the focus is more on logical interpretation and analysis of issues, and finding out pragmatic solutions of generic nature to the possible extent, and not merely confined to the study topic and corresponding model making.

1.3. Objectives

The primary objectives of the Children's Science Congress is to make a forum available to children of the age-group of 10-17 years, both from formal school system as well as from out of school, to exhibit their creativity and innovativeness and more particularly their ability to solve a societal problem experienced locally using the method of-science.

By implication, the CSC prompts children to think of some significant societal problem, ponder over its causes and subsequently try and solve the same using the scientific process. This involves close and keen observation, raising pertinent questions, building models, predicting solutions on the basis of a model, trying out various possible alternatives and arriving at an optimum solution using experimentation, field work, research and innovative ideas. The Children's Science Congress encourages a sense of discovery. It emboldens the participants to question many aspects of our progress and development and express their findings in vernacular.

1.4. Relevance of CSC in the light of contemporary educational initiatives

The basic approach of CSC on the principle of learning through doing on the issues of children's immediate environment significantly caries the sprit and mandate of

Education for Sustainable Development (ESD) of UNESCO, National Curriculum Framework (NCF,2005) and Right to Education(RTE,2009).

The modalities and approaches of CSC cater to the five pillars of learning of Education for Sustainable Development vividly, viz. learning to know, learning to do, learning to live together, and learning to be, learning to transform one self and society (Declaration of ESD in the 57th meeting of the United Nations General Assembly in December 2002, which proclaimed the UN Decade of Education for Sustainable Development, 2005- 2014, refer – **www.desd.org** and www.unesco.org**)**

> *"A social movement along the lines of Children's Science Congress should be visualised in order to promote discovery learning across the nation, and eventually throughout South Asia."* - National Curriculum Framework 2005, Executive Summary, Page (ix)

The mandate of CSC which encourage Children's to observe, explore, experiments and wonder through a project activities and its associated ways of participation and evaluation rightly take care of the guiding principles of the NCF,2005. Therefore, example of Children's Science Congress is rightly cited in the NCF documents under executive summery section, page ix (http://www.teindia.nic.in/Files/NCF-2005.pdf) .

Similarly CSC activities also helps in materializing the approach of learning as framed in the Right of Children of Free and Compulsory Education (RTE) Act, 2005 (particularly in relation to article 6.1, section C (ii, iii, iv and v)).

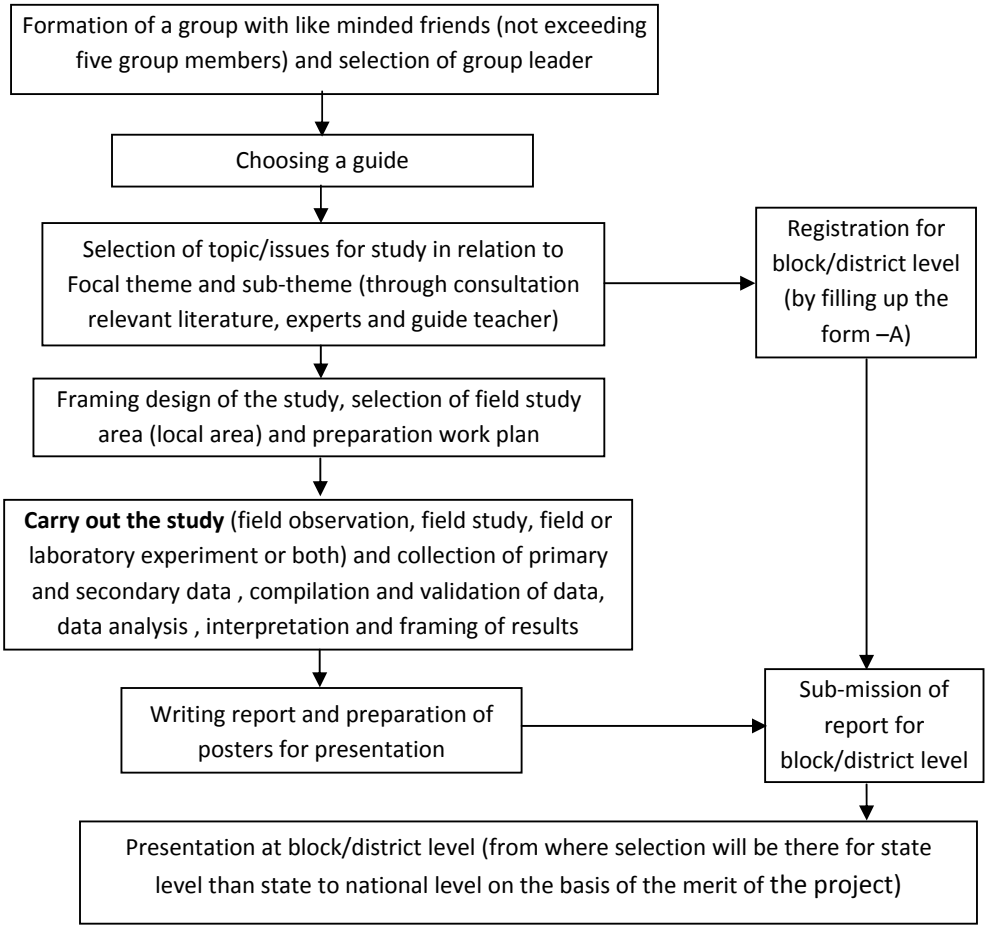
More over the CSC activities, since 1993, has catered to many of the approaches and priorities of science education visualized in the National Programme of Sarba Siksha Abhijan (SSA) (refer SSA framework, htp//ssakarnataka.gov.in/pdfs/aboutus/ ssa_framework%20.pdf) and Rastriya Madhamik Siskha Abhijan (RMSA) (refer - http://www.educationforallinindia.com/rastriya-madhymic-shiksha-mission-RMSM.pdf).

1.5. Eligibility of participants

- It is open for children **in the age of 10 to 14 years (lower age group) and from 14+ to 17 years (upper age group) as on December 31 of the calendar year.**
- A group of children not exceeding five, can do the project –study under a teacher guide.
- A child scientist, who had already presented as a Group Leader at the National Level in one age-group, can act as a co-worker in the subsequent year, in the same age group (lower / upper).
- Parents, whose child would participate in the Children's Science Congress in the ensuing year, should not hold any portfolio in the organizing committee of the CSC conducted at any level.

1.6. Modalities of participation

Following are major steps involved for participation in the CSC



1.7. Nature of CSC Project

The CSC projects are:

- Innovative, simple and practical;
- Representing teamwork;
- Based on exploration of everyday life-situations;
- Involving Experimentation and/or field based data collection;
- Having definite outputs, arrived through scientific methodology;
- Related directly to community work in the local geographical area;
- Having follow-up plans.

1.8. Criteria of Good Projects

As per past experience it has been found that projects which were rated very good had the following elements while implementing and documenting the project:

- Proper understanding and definition of the problem undertaken.
- Quality and quantity of work, including team work, learning process, subject understanding and efforts to validate the data collected.
- Relevance of the proposal to the community/school problem and impact of project on schoolmates, neighbourhood community.

- Originality, innovation and creativity shown to understand the problem and find solution i.e. in methodology and experiment design.

The Project may follow the steps of **SMART** approach

S – **Specific** – The subject/issues of study must be specific

M – **Measurable** – The issues of study must be measurable in quantitative/ qualitative forms so that component of comparability is maintained

A – **Appropriate -** The topic must be appropriate to focal theme and subthemes, along with field study area, methodology must be appropriate to nature of the issues considered for the study,

R – **Realistic – The issues of the study must be realistic along with the methodology adopted for the purpose**

T – **Time bound –** study must be carried out in limited time frame. The project activities may not destabilized normal activity schedule of the Child.

1.9. Points to remember

The project work of CSC must be carried out in a systematic way so that it can rightly reflect the method of science in the works. The issue of the study may demand experimental or survey works or both. In case of experimental works design and principle of the experiments are very important factor which may help to get a better result in a rational way. In such case parameters of observation and verification through the experiment and its logical selection must be reflected vividly along with sets of control and approaches of data validation. Similarly, in case of survey based project universe of the study, criteria of sample selection, sample coverage, design of questionnaire or interview schedule are very important along with approaches of data compilation, validation, analysis and interpretation. Prototype model or functional models are only encouraged to use in project presentation if issues and methods of study really demands for it.

Log-Book- Proper work diary has to be maintained while carrying out the project work. The day-to-day activity has to be neatly noted in the form of a log-book, and should be submitted with the project report at the time of submission. All the details, such as Project title, name of the group leader etc should be written clearly on the cover.

1.10. Structure of the project report

The structure project report of CSC is as follow

i. Cover page – must incorporate
   - Title of the project
   - Name and address of Group leader and co-workers
   - Name and address of guide

ii. Form – A (Registration form)

iii. Abstract – in 250 words for lower age group and 300 words upper age group (one copy in English)

iv. Contents- list of chapter with detail heading and sub-heading, list of table, chart, maps, etc. along with references against page numbers

v. Introduction- description on background of the study
vi. Aims and objectives of the study
vii. Hypothesis
viii. Need statement
ix. Work plan
x. Methodology
xi. Observations
xii. Data analysis and interpretation
xiii. Results
xiv. Conclusions
xv. Solution to the problem
xvi. Future plan
xvii. Acknowledgement
xviii. References

The word limit for the written report for the lower age group is 2500 and that for the upper age group is 3500. The written report can be substantiated by including limited number of photographs, sketches, illustrations and / or drawings, etc.

Plagiarism would lead to disqualification

1.11. Oral presentation:

Oral presentation at the technical sessions of the congress is a very important component of the entire process. Effective communication during briefing the issues of study, its objectives, and methodology adopted for the study, important observation and findings, vital aspects on the way and approach to solve the problem or address problems is a very critical part of the exercise. Because only 8 minutes time is allotted for the purpose. Therefore, one has to plan pragmatically for the purpose. Children can use 4 different posters (which is mandatory). Poster must be prepared on 55 cm x 70 cm (21.6" x 27.5") drawing sheets (i.e. chart papers). If needed power point presentation may be used.

Your posters should contain information on (1) The project title, (2) Names of the group members, (3) Objectives, (4) Map of the area, (5) Methodology, (6) Results, (7) Conclusion, (8) Solution to the problem. Depending upon the nature of the project the poster may or may not have a map and/or results.

1.12. Different level of Congress

Children's Science Congress is organised in three levels where the child scientists and their project works are screened under common evaluation criteria. The evaluation of the project is done for its **innovativeness, simplicity and practicality**. On the basis of the merit of the project is selected for the next level. The three levels are as follows:

- Block /district level
- State level
- National level.

The **District/Block level Congress** is the first level in which projects compete with one another and are screened for presentation at the **State level Congress**, the second level. Projects as per State-wise quota indicated at Annexure- are selected from the State level for the Grand Finale – the **National Children's Science Congress**. Seven to eight lakh child scientists participate at various levels from the States and the Union Territories.

1.13. Screening

(i) The selection ratio at District/State Level and at State/National Level should be as follows:

State: District = 1: 15

(Out of 15 projects presented at District 1 will be screened for State Level.)

(ii) State/National = As per State quota indicated at Annexure -

(iii) The selection ratio of Lower age group (10 to 14 years of age) to Upper age group (14+ to 17 years) should be 40:60.

1.14. Tentative Activity Schedule

- Selection of subjects and activity for registration of teams : June-July
- Working on the project: Minimum two months
- District level Congress: By September -October
- State level Congress: By November
- National level Congress: 27-31 December
- 'Kishore Vigyani Sanmmelan' (at Indian Science Congress) from 3-7 January

1.15. Approaches of Evaluation

The innovative ideas and scientific methodology are the basis of a good project but one has to prove his communication skills also to make others listen and understand his findings. For doing this, a total cooperation in the group is a must. Accept positive criticism within the group or even from outside and improve the work plan. This will bring award and recognition.

1.15.1. Evaluation Criteria

i) **Originality of idea and concept**: A unique or novel project idea which attempts to answer a specific question - (a hypothesis driven by curiosity to understand any concept related to focal theme). The idea should not be an exact replication of the model projects as in this Activity Guide. A proper explanation of origin of the idea may be demanded by the evaluator.

ii) **Relevance of the project to the theme**: This section focuses on how the project is relevant to the focal theme/sub-theme.

iii) **Scientific understanding of the issue**: Refers to the extent of knowledge the child scientist has in relation to the project idea.

iv) **Data collection**: Systematic collection of information using relevant tools/interviews/ questionnaire. Sample size should be sufficient to support the issues under study.

v) **Analysis**: This includes tabulation, categorization/classification, and simple statistics as applicable to the study.

vi) **Experimentation/Scientific study/validation**: Conducting of experiments/field study and validation applying simple methods of science. Experiment need not be every sophisticated or lab based, they could be simple, self developed and inexpensive too.

vii) **Interpretation and Problem solving attempt**: To what extent the team has addressed the proposed hypothesis and the issue of the locality through the project.

viii) **Team work**: It refers to work division, cooperation and sharing among and beyond the team members (the child scientists).

ix) **Background correction (Only for District level)**: In this case the background of the children is verified like geographical location of their school, village, town etc. in relation to infrastructure, information and other input related facilities available with them. The logic is that children from difficult geographical situation must get some weightage in comparison to the children from advantageous geographical location. Non-school going children should also get some weightage in this criterion.

x) **Report and Presentation**: Written Report and Oral Presentation are evaluated separately. Reports are evaluated for its systematic presentation, tabulation of data in support of the project idea and the clarity with which the study is documented and explained. A Log Book (actually a Daily Diary) is mandatory and should be authenticated over the signature of the guide teacher daily. The cover page of the Log Book should carry the names of the child scientists, the district and the Sate, in English. Marks awarded for the presentation covers question and answer with evaluators, presentation of charts/posters, illustrations and other visuals.

xi) **Follow up Action Plan (Only for State and National levels)**: The child scientists should try to find out scientific solution to the bothering problem. Has the team conveyed the message to the community? How it was communicated? Will effort continue to involve more people till the problem is solved? Was any action plan suggested? Credit shall be given for similar efforts.

xii) **Improvement from the previous level (Only for State and National levels):** This is to encourage the child scientists towards their continuous involvement with the project for its improvement. Improvements on the work from District to state level and then from State level to the national level will be given marks separately. The evaluators shall specify the areas of improvement on a separate sheet of paper.

xiii) **Additional page(s):** These must be there in the Project Report with detail description of works of improvement done after the previous level (particularly on the basis of the evaluators' suggestion in the previous level).

1.15.2. Evaluators

i) Evaluators may please note that the participating children are budding scientists from the age group of 10 to 17 years with limited access to knowledge centres and therefore require encouragement. Having understood their capabilities and capacities, the evaluators should provide them with constructive inputs and positive feed-back.

ii) Evaluators should appreciate and value the efforts, innovativeness and confidence of the participating child scientists and ensure that their honest assessment work as a guiding light for future endeavours of the child scientists and each one goes back motivated, intellectually rich and more confident.

iii) Evaluators should evaluate the projects on the basis of subject matter and scientific content and are not influenced by the gadgetry used or oratory skills of the participants. They should avoid unwarranted comments and also avoid comparing the works of the child scientists with those carried out by senior members or scientists.

iv) Evaluators should avoid being any source of distraction to the child scientists while presentation is going on and do not take the interactions with the participants as a test what the participating child does not know, rather, they make efforts to know what the child scientist know about the subject area.

1.15.3. Model consolidated Evaluation Sheet

For District level

Sl. No.	Criteria	Max. marks	Written Report	Oral Presentation	Total
1.	Originality of idea and concept	10			
2.	Relevance of the project to the theme	10			
3.	Understanding of the issue	15			
4.	Data collection & analysis	15			
5.	Experimentation/validation	10			
6.	Interpretation and Problem solving attempt	10			
7.	Team work	10			
8.	Background correction	10			
9.	Oral presentation/ written report (as applicable)	10			
	Total:	100			

For State Level

Sl. No.	Criteria	Max. marks	Written Report	Oral Presentation	Total
1.	Originality of idea and concept	5			
2.	Relevance of the project to the theme	5			
3.	Understanding of the issue	15			
4.	Data collection & analysis	15			
5.	Experimentation/validation	10			
6.	Interpretation and Problem solving attempt	15			
7.	Team work	5			
8.	Follow up action plan	10			
9.	Oral presentation/ written report (as applicable)	10			
10.	Improvement over the previous level suggested	10			
	Total:	**100**			

1.16. Organisers

NCSC is organised nationally by the National Council for Science and Technology Communication (NCSTC), Department of Science and Technology Government of India, with active support from NCSTC-Network as a national co-ordinating Agency. NCSTC-Network is a registered Society, comprising of 76 organisations (Annexure-), Government and Non-Government, spread over all the states and Union Territories of India, who are working for science popularization. To organise CSC at the State Level, each State/Union Territory has a coordinating body viz. State Co-ordinating Agency, which is a member of the NCSTC-Network (see list at Annexure-).

1.16.1. Role of District Coordinating Agency, District Coordinators and District Academic Coordinators

i) To agree in writing, on being selected, to act as a District Coordinating Agency and abide by rules and regulations prescribed in this Activity Guide Book and also by the State Coordinating Agency;

ii) To constitute a District Organizing Committee (DOC) and a District Academic Committee (DAC) , minimum 7 (seven) members can be selected from teachers, activists, ex-child scientists, government officials, officials of the local bodies etc. and send the lists to the State Coordinator by the date specified. The District Coordinators shall act as the Member-Secretary of both the Committees;

iii) To register groups of children (2 to 5 in one group) in Form A and provide them with necessary reference materials, kits and guidance. Number of groups registered to be intimated to the State Coordinator by the date specified;

iv) While registering the District Co-ordinator should be assured that, the age of the child scientist falls within the age as on 31st December of the calendar year. If need be a copy of the age-certificate may be retained by the District Co-ordinator, to avoid any confusion at later stages. Even while participating at the National Congress, the State Co-ordinator may also keep a copy of the certificate.

v) To select schools from rural and urban area in an equal ratio;

vi) To organise District level Teachers' Orientation Workshops with the help of the State Coordinators;

vii) To interact with local scientist and arrange for their periodic interaction with the registered group of children, if required;

viii) Try to involve at least 50 schools and 250 numbers of project in the district including those from informal education system

ix) Organize District level Congress, Orientation of Evaluators in consultation with the State Coordinators;

x) To submit Feed-back Reports on all activities, containing names of schools and number of projects at district level and follow up action taken on projects likely to become part of community action, photocopies of all Registration/Attendance Sheets for all Workshops/Meetings, Evaluation Sheets in original, samples of certificates issued, mementos presented to child scientists, photo-documentation etc. related to CSC at the District level to the State Coordinator in the manner and by the date specified;

xi) To maintain a Bank Account and maintain Accounts at the District level and submit an audited Receipts & Payment Account to the State Coordinators by the date and in the manner specified;

xii) To maintain infrastructural facilities, including electronic communication facility such as internet connectivity, fax etc.

xiii) To arrange review and mentoring of the projects selected for presentation at the State Level NCSC.

1.16.2. Role of State Coordinating Agency, State Coordinators and State Academic Coordinators

The State Coordinating Agency shall have the overall responsibility for the implementation of NCSC at the State level. The specific responsibilities shall be –

i) Constitute a State Organizing Committee (SOC) and a State Academic Committee (SAC) where minimum 7 (seven) members to be selected from teachers, activists, ex-child scientists, government officials, officials of the local bodies, Network members in the State and other non-Network organizations specifically active in a region in the State, where the State Coordinating Agency does not have a reach). Submit the list of SOC, SAC, DOC and DAC along with project proposal for districts and state. The State Coordinators shall act as the Member-Secretary of both the Committees;

ii) To constitute Regional Coordinators, if found necessary in case of big States and to involve SCERT, DIET, IRIS and organizations working with handicapped children/ elder citizens and media representatives. Distribution of geographical area for organizational purposes etc. will be the prerogative of the State Coordinators;

iii) To locate individuals, schools specially interested in other curricular activities;

iv) To select District Coordinating Agencies and obtain consent letter from the respective organization, where they have to agree to abide by the guideline of CSC and willing to follow the guideline of NCSTC,DST; NCSTC – Network and respective State Coordinating agency of the state.

v) Organise Orientation Workshops of District Coordinators and teachers with the help of subject experts;

vi) To coordinate translation of the Activity Guide Book to be used by the children, in local language and make them available to the District Coordinators;

vii) To maintain a Bank Account and maintain Accounts at the State level and submit an audited Receipts & Payment Account to the funding agencies within three months of the date of event with a Project Completion Report and a Utilization Certificate in the manner prescribed;

viii) To submit Feed-back Reports on all activities, samples of certificates issued, mementos presented to child scientists, photo-documentation etc. related to CSC at the State level to the funding agency in the manner and by the date specified;

ix) To remit funds to District Coordinating Agencies by account payee cheques;

x) To form linkages with Testing and Monitoring facilities available in the State (with NGOs as well as Government), Municipal Corporations and other local bodies etc. to help children in better implementation (information collection/sample testing) of their activities(Identity Cards may be issued to children registered for activities) through District Coordinators/State Coordinator;

xi) To arrange review and mentoring of the projects selected for presentation at the NCSC.

xii) To ensure that Evaluation sheets, both written and oral are forwarded to the next higher level, i.e. from district to State and from State to National level, else the district / State contingent might not be registered during State/National level CSC.

xiii) State Academic Coordinators should work in close association with the district/State Coordinators for arranging evaluation process and shall make an effort to send one member from State Academic Committee as an Observer to the district level CSC. His/her signature on the selection list is mandatory. The entire process of evaluation is to be supervised by the Observer. Decision of the State Academic Committee shall be final word on the selection.

1.16.3. Note for State Coordinators and District Coordinators

i) The age limits for participation must not be less than 10 years and more than 17 years on December 31 of the year.

ii) Relatives of District Coordinators, District Academic Coordinators, State Coordinators and State Academic Coordinators will not be selected for National CSC. They may leave the post for the year if participation of the ward is desired.

iii) Any child will not participate more than twice in national CSC as Group Leader – once from each age group.

iv) Two selected projects (one from lower age group and one from upper age group) from each state to 'Kishor Vigyani Sanmelayan' of Indian Science Congress held every year during January 3-7.

v) Technology Entrepreneurship Promotion Program selected CSC projects meeting the following criteria may apply for support under this program –

- The idea should be new/novel,
- The idea should have potentiality for translating it into working model/ prototype/ process,
- The idea should be based on known scientific principle,
- The idea should have commercial feasibility/ technical viability.

vi) Proposals from individual innovators to convert an original idea / invention / know-how into working prototype / processes. These proposals can be made by individuals or jointly with any sponsoring organizations.

Selected projects will be provided by financial support to undertake the above developments, patent support and guidance, scientific / technical consultancy, fabrication assistance, market information and networking with related research lab/ institutes as required.

For detailed information you may contact:

Techno-entrepreneur Promotion Programme
Ministry of Science & Technology
Post Bag No. 66, Hauz Khas, New Delhi -10016.

Dr B.P. Singh
Head, NCSTC

Dr D. K. Pandey
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General Secretary, NCSTC Network

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E-56, Pandav Nagar, New Delhi - 110091
Email: ncstcnetwork@gmail.com; ncstcnet@hotmail.com
Telephone: 011-22799236, Mobile: 09868404002

Karnataka State details:

State Co- ordinator :
Shri T.G. Krishnamurthy Raj Urs
Govt. High School, Anur Post
Chikmagaluru Taluk & Dist.
Mobile : 9448555608; Email : tgkurs@gmail.com

State Academic Co-ordinator :
Shri M.N. Mustoorappa
No.2009/2, Dr. Modi Road, M.C. Colony,
"A" Block, Davangere – 577 004
Mobile : 9448857122, Email : mustoorappa@gmail.com

Part- II

2.0. Focal theme and Sub-theme

2.1. FOCAL THEME:

2.2. "Energy: Explore, Harness and Conserve"

Energy is considered as a crucial input parameter for day to day work and for economic development of a country. Per capita energy consumption is one of the key deciding factors of the level of well-being of any society or for any country. It is also referred through the relationship between economic growths with energy consumption.

In reality, economic development of every region or country largely depends on how its energy requirements are satisfied. Every production process has certain amount of energy requirement. Hence, availability of quality energy sources is crucial for overall scientific and technological progress of any country.

Energy is central to sustainable development and poverty reduction efforts. It affects all aspects of development - social, economic, and environmental - including livelihoods, access to water, agricultural productivity, health, population levels, education and gender-related issues. None of the Millennium Development Goals (MDGs) can be met without major improvement in the quality and quantity of energy services in developing countries.

The issue of energy is always linked to its sources. Nowadays energy sources are categorised as Non-renewable and Renewable with a large frame of coverage (fig.1)

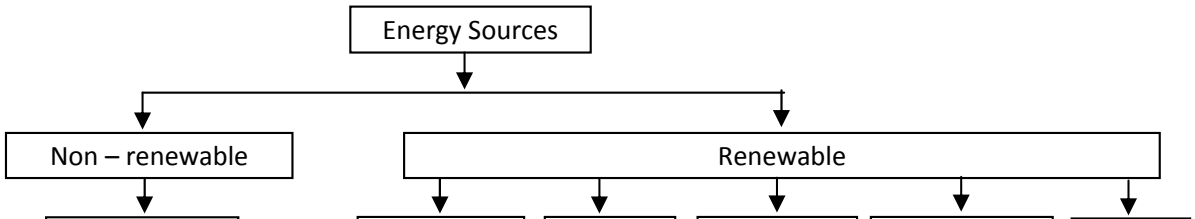


Fig.1

Such sources are used in multiple levels and areas, which in reality activate the entire processes of economy (fig.2)

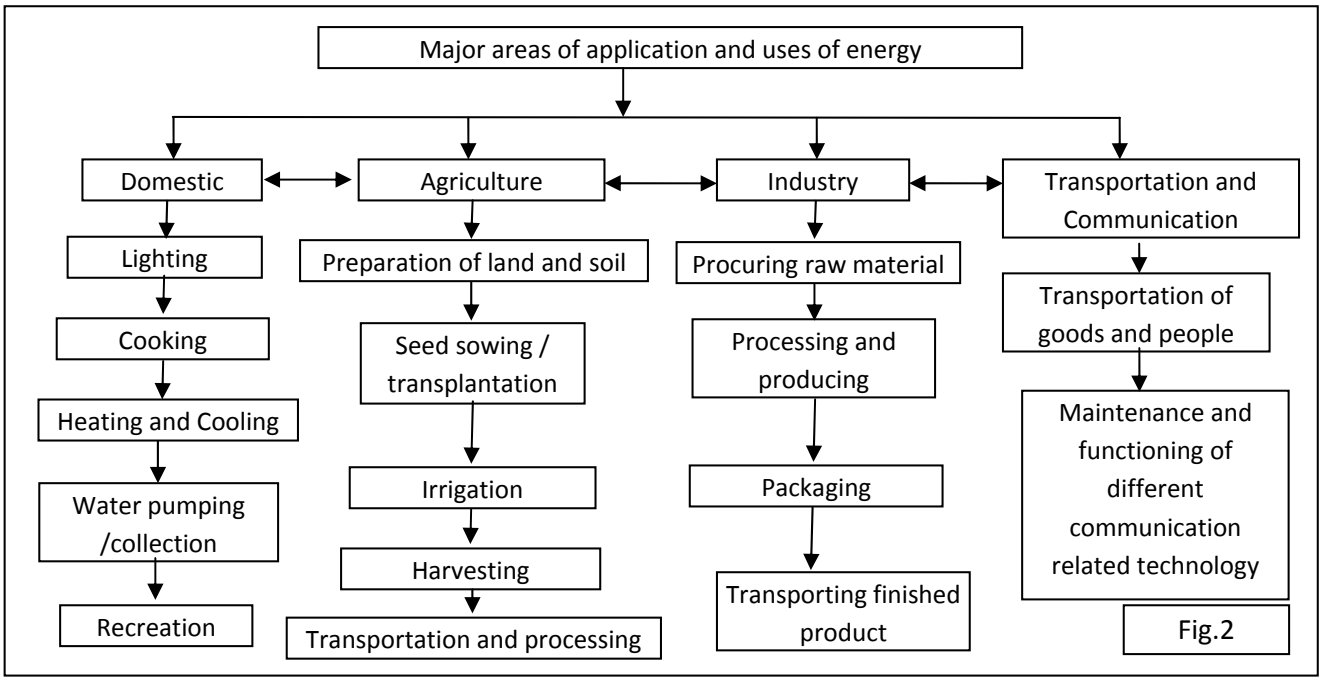


Fig.2

Here, energy is mainly used in domestic, agriculture, industry, transport and communication sectors and they are interlinked. All these energy applications basically provide energy services.

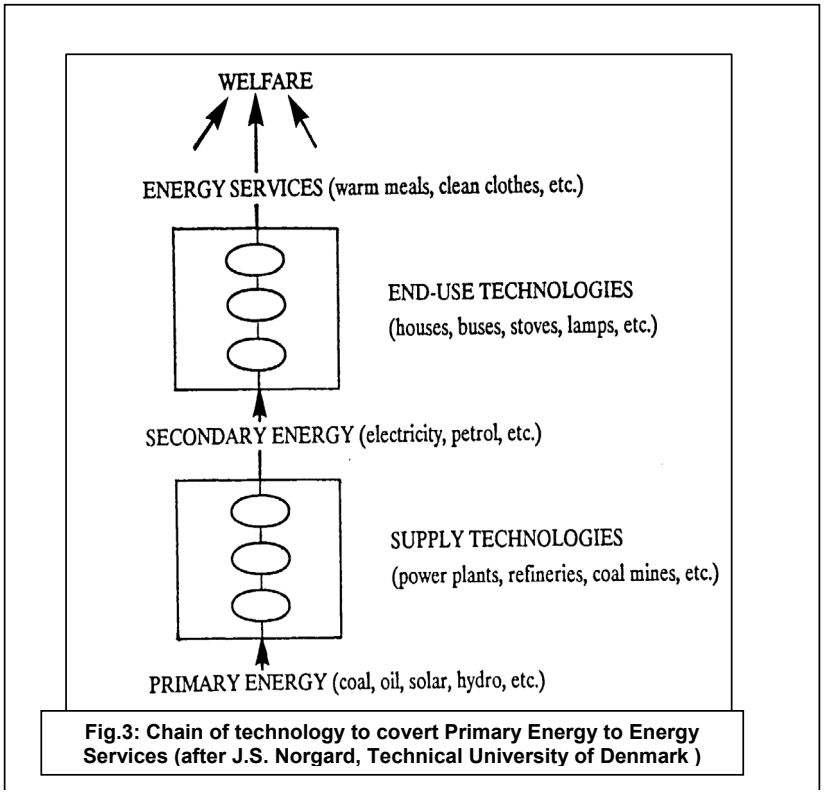
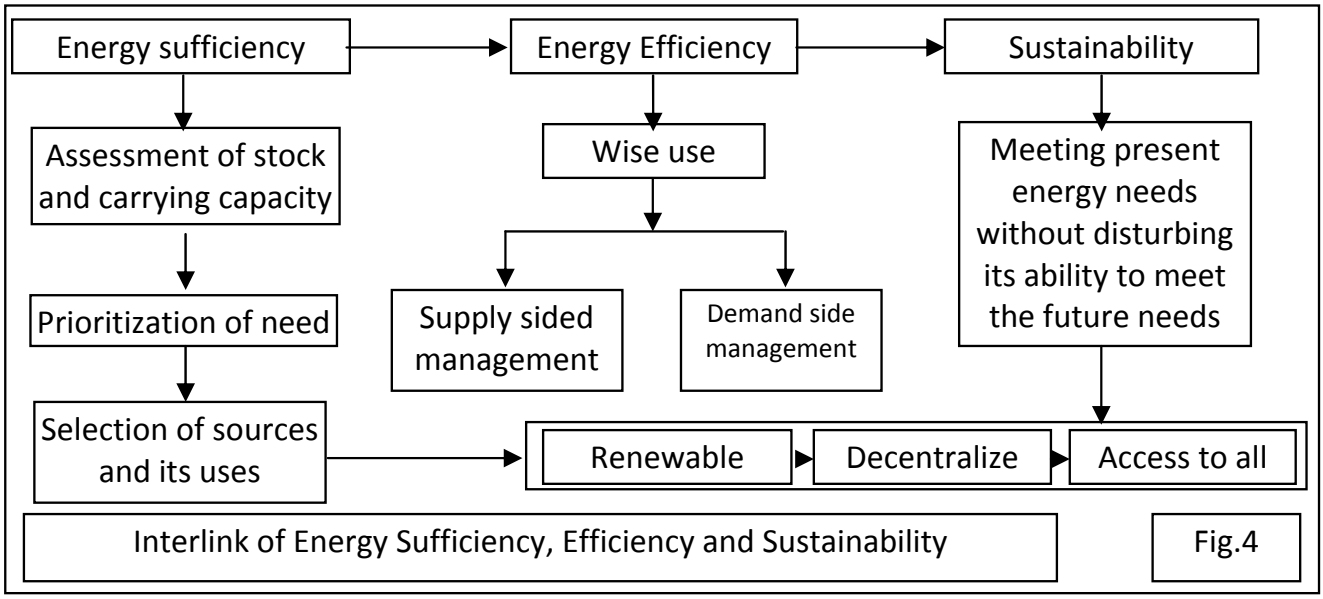


Fig.3: Chain of technology to covert Primary Energy to Energy Services (after J.S. Norgard, Technical University of Denmark)

Such processes are basically effective in a way where energy is input to the technology which produces services as outputs (fig.3). So, efficiency of the technology in use and its purposes to produce services are important which determine the situation of energy sufficiency. In these perspectives, to achieve energy sufficiency and efficiency for suitability each one is interlinked through proper value setting, management principles, technological efficiency with policy measures (fig.4).



Interlink of Energy Sufficiency, Efficiency and Sustainability

Fig.4

In the above perspectives Sustainable energy issues are reflected as follows:

Sustainable energy is the sustainable provision of **energy** that meets the needs of the present without compromising with the ability of future generations to meet their needs. Technologies that promote sustainable energy include **renewable energy** sources, such as **hydroelectricity, solar energy**, wind energy, **wave power**, geothermal energy, and **tidal power**, and also technologies designed to improve energy efficiency

(http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/sustainable-energy.html).

Energy efficiency and renewable energy are said to be the *twin pillars* of sustainable energy. Some ways in which *sustainable energy* has been defined are:

- "Effectively, the provision of energy that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable Energy has two key components: ***renewable energy*** and ***energy efficiency."***
- "Dynamic harmony between equitable availability of energy-intensive goods and services to all people and the preservation of the earth for future generations." And, "the solution will lie in finding sustainable energy sources and more efficient means of converting and utilizing energy."
- "Any energy generation, efficiency & conservation source where resources are available to enable significant portion of energy generation in long term.
- "Energy which is replenished within a human lifetime and causes no long-term damage to the environment.".

- Energy efficiency remains a cost effective way of improving the environmental impact of energy use, increasing security, improving competitiveness and providing affordable services. *(**"The Twin Pillars of Sustainable Energy: Synergies between Energy Efficiency and Renewable Energy Technology and Policy".** www.aceee.org.)*

Energy sufficiency is some time considered as normative concept to make differences between need and greed and prefer for the best. However, the growing concern for climate change and energy security now means that energy sufficiency is something that warrants serious consideration. It looks beyond technical energy efficiency measures and address the challenging issue of curbing consumer demand for energy services in an ethically acceptable fashion. It also implies a need to recognize limits and to establish acceptable minimum standards for energy services. (*Derby Sarah "Enough is as good as a feast- sufficiency as policy" ECEEE-2007, Summer Study, Saving Energy- Just do it! P. 111-119).*

From the aforesaid discussion it is clear that to achieve energy efficiency and sufficiency, we have to go for an integrated approach, where Public understanding, initiatives for research and development are some key components to meet the requirement of energy sectors and policy measures may play a critical role (Fig.5).

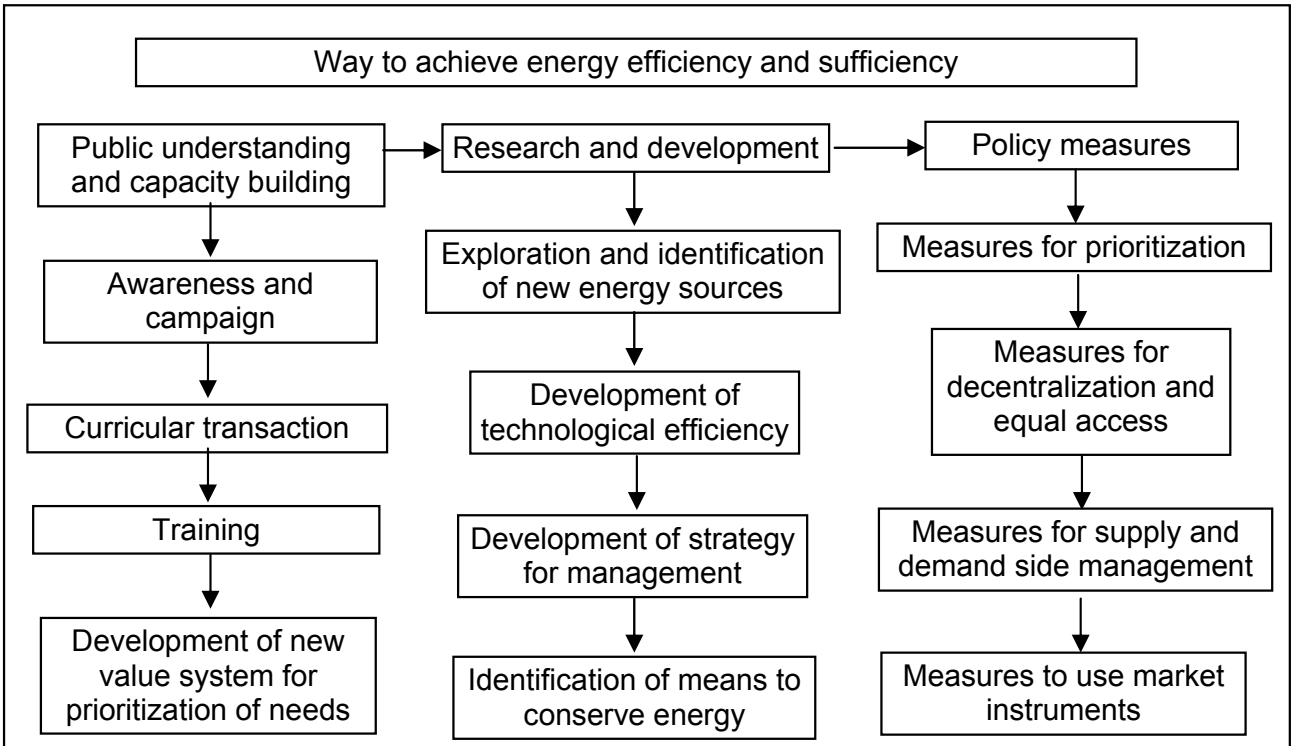


Fig.5

With reference to the above discussion and taking consideration of our required initiatives in this era of global climate change challenges, efficient energy use and replacement of carbon based fuel with non-carbon based fuel are the key areas by which we can reduce our carbon footprint to a large extent and undertake some pragmatic measures for mitigation and adaptation of climate change. It is noteworthy that awareness and understanding in such areas in many cases encourage us for taking self initiatives for conservation, rational uses and strategies for enhancing efficiency. Therefore, "***Energy: Explore, Harness and Conserve***!" has been proposed as the focal theme for the CSC

of 2012 and 2013, with an expectation that young minds will be able to realize the need, take different initiatives to explore, identify the energy resources and find ways to harness it, identify approaches to achieve optimum use through enhancing energy efficiency and energy conservation along with creating awareness among the masses through their project works.

2.3. SUB-THEME: I - ENERGY RESOURCES:

2.3.1. Energy Resources:

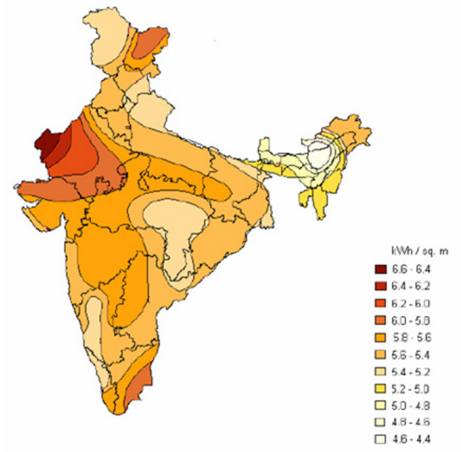
Energy inputs are the critical components of national economic activity of our country, which contributes in increasing the gross domestic product (GDP) at an average annual rate of over 7% since 2004. However, it is believed by all concerned around the world that the conventional sources of energy, particularly the fossil fuels, will get exhausted by the turn of this century. It is, therefore, essential to identify the different energy resources, their potential reserves, and sustainability.

All the energy sources are divided into two groups- Renewable and Non- renewable.

Renewable Energy:

Renewable energy includes solar, wind, hydel, bio-mass and geothermal resources.

Solar: The sun's rays, or solar energy, have been used since the beginning of time and is vital to all living things. In addition to solar energy being a constant resource, heat and electricity are other forms of energy those can be made from free and unlimited source of solar energy. The sun is although 93 million miles away, but there would have been no life on earth without it. From growing crops to heating our homes, the sun is becoming more dependable than ever before, as new technologies harness its energy to supply the needs of our present-day society.



It is the unique source from which directly or indirectly fuel is made. The sun creates convective heat currents that stir the winds in our atmosphere. The sun drives the hydrological cycle causing water to evaporate and condense. Plants also process radiant energy through a process called photosynthesis.

India is endowed with rich solar energy resource since it is located in the equatorial sun belt of the earth. Theoretically, India receives about 5000 trillion kWh solar radiations (power) with about 300 clear sunny days in a year. The daily average solar energy incident over India varies from 4 to 7 kWh/m^2 with about 2,300–3,200 sunshine hours per year, depending upon location, which is far more than the current total energy

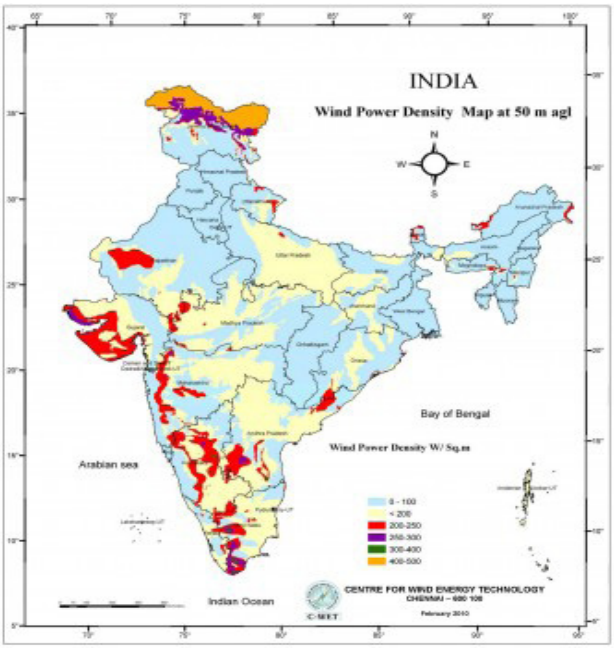
consumption. While India has technology and sunlight in abundance, and while these are key ingredients for a green energy future, it is daunting to think solar thermal and solar electric power can increase their share of energy production from today's negligible percentage to provide all needed growth in energy production within a generation. For conventional human usage, sunlight must be captured and converted. Solar-powered devices are the most direct way to transform raw thermal energy into electricity.

Wind: Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. The earth's surface is made of different types of land and water. These surfaces absorb sun's heat at different rates, giving rise to the differences in temperature and subsequently to winds. During the day, the air above the land gets heated up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the winds are reversed because the air cools more rapidly over land than over water. In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles. From ancient times till nineteenth century, the manufacture and use of sailing ships determined the economic and political power of nations. The first known use of sailing ships was by the Egyptians in 2800 B.C. Further, the first uses of the wind for mechanical power appear to have been developed in Persia where water was pumped for irrigation by windmills. Between the seventh and tenth centuries, windmills were firmly established in Persia. By the thirteenth century, windmills were common in Europe, with significant advances being made by the Dutch and the English. Wind mills were evolved only for grinding grain and water pumping purposes. But at present the wind turbines convert the kinetic energy of the moving wind into electricity. Wind Energy, like solar energy, is free resource, but is much intermittent than the solar. Wind speeds may vary within minutes and affect the power generation and in cases of high speeds it may result in overloading of generator. The range of wind speeds that are usable by a particular wind turbine for electricity generation is called productive wind speed. The power available from wind is proportional to cube of the wind's speed. So as the speed of the wind falls, the amount of energy that can be received from it falls very rapidly. On the other hand, as the wind speed rises, so the amount of energy in it rises very rapidly. However, productive wind speed ranges between 4 m/sec to 35 m/sec. The minimum prescribed speed for optimal performance of a wind mill is about 6 m/s. Wind power potential of a place is mostly assessed considering wind power density higher than 200 W/m^2 at 50 m height.

It is a known fact that wind high above the ground is stronger than winds near the ground. On average a five-fold increase in elevation, say raising the height of the wind machine from 10 feet to 50 feet, the power of available wind will be double. That's why wind turbines are placed on tall towers and is often located on mountains or hilltops. On the other hand, in our country 'on-shore' potential for utilization of wind energy for electricity generation is of the order of 65,000 MW. India is also blessed with 7517km of coastline and its territorial waters extend up to 12 nautical miles into the sea. This unexploited resource availability has the potential to sustain the growth of wind energy sector in India in the years to come. Total installed capacity of electricity generation from wind is 13,065 MW; out of the estimated potential it is more than 65000 MW. But, if sea based opportunities are taken into consideration then it will be much higher (Sukhatme, 2011).

Air temperature is also an important factor in wind power generation. Cold air is denser than hot air. Thus, wind turbines are able to generate about 5% more power at any given wind speed in the winter than they are during the hot days of summer. Wind in India is, thereby, influenced by the strong south-west summer monsoon, which starts in May-June,

when cool, humid air moves towards the land and the weaker north-east winter monsoon, which starts in October, when cool, dry sir moves towards the ocean. During the period march to August, the winds are uniformly strong over the whole Indian Peninsula, except the eastern peninsular coast. Wind speeds during the period November to march are relatively weak, though higher winds are available during a part of the period on the Tamil Nadu coastline. However, our country is used to use wind energy from ancient times for domestic as well as community purposes. At present, wind energy is directly used to produce electricity



A simple equation for the Power in the Wind is described below. This equation describes as the power found in a column of wind of a specific size moving at a particular velocity.
P = 1/2 ρ ∏ r2 V3
Where,P = Power in the Wind (watts), ρ = Density of the Air (kg/m3),
r = Radius of your swept area (m2), V = Wind Velocity (m/s), and ∏ = 3.14

Hydel: This is one of the earliest known renewable energy sources, in the country since beginning of the 20th century. In fact, for the last few hundred years, people living in the hills of the Himalayas have been using water mills, or *chakki*, to grind wheat. The 130 KW small hydropower plant in Darjeeling set up in 1897 was the first in India.

The production of electricity using the energy of flow of water in rivers, small streams, water falls and dams is based on the basic scientific concept of mechanical energy converted into electricity exploiting the Faradays law of electromagnetic induction. Waves result from the interaction of the wind with the surface of the sea and represent a transfer of energy from the wind to the sea. Energy can be extracted from tides by creating a reservoir or basin behind a barrage and then passing tidal waters through turbines in the barrage to generate electricity. Hydro power is one of the best, cheapest, and cleanest sources of energy, although, with big dams, many environmental and social problems have been seen as in the case of Tehri and Narmada Projects. Small dams are not only, free from such problems, but also free from problems like affecting the lives of thousands of people living along the banks of the rivers, destruction of large areas under forest, and

seismological threats. New environmental laws affected by the danger of global warming have made energy from small hydropower plants more relevant.

Energy is also obtained from waves and tides. The first wave energy, project with a capacity of 150MW, was set up at Vizhinjam near Trivandrum. Till date India has installed hydroelectric power plant of 32,326 MW against a potential of 1,50,000 MW. The power plant with capacity greater than 25MW is called large hydel plant. Water energy of any small stream flowing in a hilly terrain can also be harnessed for generating electricity to meet energy needs of remote rural areas. These small hydropower plants can serve the independently. Till date, small or micro hydro plants of total capacity of 2953 MW have been installed against an estimated potential of 15400MW (Sukhatme, 2011).

Energy from the sea - Ocean thermal, tidal and wave energy

Large amounts of solar energy are stored in the oceans and seas. On an average, the 60 million square kilometer of the tropical seas absorb solar radiation equivalent to the heat content of 245 billion barrels of oil. Scientists feel that if this energy can be tapped a large source of energy will be available to the tropical countries and to other countries as well. The process of harnessing this energy is called OTEC (ocean thermal energy conversion). It uses the temperature differences between the surface of the ocean and the depths of about 1000m to operate a heat engine, which produces electric power.

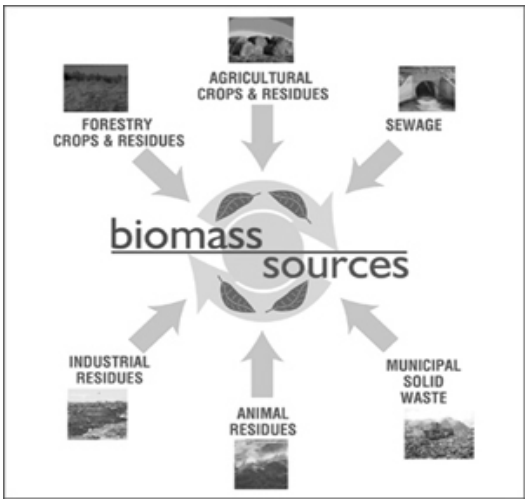
Theoretical formula for producing the power from a hydel project is as follows:
$P = kdQgh$
Where, P is the power in Watt, d is the density of water in kg/cubic meter, Q flow in cubic meter/sec, g is the acceleration due to gravity in m/second square, h in meter is the difference in height of the of the inlet and outlet water, and k is a dimensionless parameter whose value lie between 0 and 1; it determines the efficiency of the plant (Herman-Josef & Jyotirmoy Mathur)

Bio-energy: Bio-energy is an important form of renewable energy that is stored in biological material like wood, wood-waste, manure, straw and other-products of agricultural processes. Bio-energy in these sources can be converted and used to generate heat or electricity, or to produce transport fuel. The source of bio-energy is organic material – which refers to biomass, which is effectively a store of solar energy, Energy from the sun is captured through photosynthesis and stored as the plant or tree grows. It is either:

- the direct product of photosynthesis (for example plant matter – leaves, stems, etc.) or
- the indirect product of photosynthesis (for example animal mass resulting from the consumption of plant matter).

Biomass is defined as the total mass of living organisms in a given area or of a given species is usually expressed as dry weight. Organic matter consisting of or recently derived from living organisms (especially regarded as fuel) excluding peat. Biomass includes products, by-products and waste derived from such material. Cellulosic biomass is biomass from cellulose, the primary structural component of plants and trees (IPCC 2007). An alternative name for biomass used to produce bioenergy is a "feedstock." The main categories of feedstock are: oil seed crops, grains, sugar crops, and agricultural residues, trees, grasses, and algae (Pena 2008). The last category containing trees and grasses is commonly referred to as cellulosic biomass. Different parts of the plants are used depending on the category of feedstock. For example, fats and oils from oil seed crops, such as soybeans, can be directly converted to biodiesel using the processes

of transesterfication or hydro- treating. The possible products that can be derived from biomass include biodiesel, ethanol, butanol, methane, hydrocarbons, and natural oils, which can be further processed into any number of desirable fuels (Pena 2008). Rotting garbage, and agricultural and human waste, all release methane gas—also called "landfill gas" or "biogas."



(a) *Bio fuel*: About 51% of solar energy reached on the earth can be converted into bio-fuel energy by green plants. The Rural people of India depend mostly on fuel-wood for cooking but there is a great gap between demand and supply. India has a great scope for energy plantation on 70 million ha and can generate wood biomass to the tune of 560 million tones of fuel biomass. From the energy plantation on an average 4000 kcal/kg energy can be produced.

(b) *Bio-ethanol*: Bio-fuels are potential alternatives to the liquid fossil fuels as they can directly be blended with petrol / diesel. Bio-fuels are of two types : alcohols (ethanol and butanol) and diesel substitutes (bio-diesel and hydro-treated vegetable oils). Ethanol produced from starch and sugar has remarkable characteristics of having high latent heat of vaporization, high octane number, rating; emission of toxic compounds on combustion is also low as compared to gasoline. Presently, approximately 1 million ton against a potential of10 million ton is being produced in India. The raw materials used for production of ethanol are cellulose available from wood, agricultural residue, waste from paper industries, municipal solid waste etc.

(c) *Bio diesel*: Bio diesel is another type of liquid fuel which is produced from non edible tree seed's oil. By the process of trans-esterification of these oils, glycerin and bio diesel are produced. The potential of such resources in India is 20 million ton per year.

(d) *Wood*: Wood is considered humankind's very first source of energy. Today it still is the most important single source of renewable energy providing over 9% of the global total primary energy supply. Wood energy is as important as all other renewable energy sources altogether (hydro, geothermal, wastes, biogas, solar and liquid biofuels). Fuelwood and charcoal production is often the predominant use of woody biomass in developing countries and economies in transition. A common hardwood has an energy content of 14.89 mega joules per *kilogram* (6,388 *BTU* per pound), and 10.423 mega joules recoverable if burned at 70% efficiency.

The carbon content of vegetation is surprisingly constant across a wide variety of tissue types and species. Schlesinger (1991) noted that C content of biomass is almost always found to be between 45 and 50% (by oven-dry mass).In many applications, the carbon content of vegetation may be estimated by simply taking a fraction of the biomass, say

C = 0.475 * B

Where, C is carbon content by mass, and B is oven-dry biomass.

Ref: http://www.fao.org/forestry/17111/en/

Bio-energy also includes human and animal energies. From ancient times the power vis-à-vis energies of these two resources were extensively used for wellbeing of the society. Till date more than 55% of the total cultivated area is still being tilled by draught animals. In India bullocks, buffaloes and camels are the major draught animals for field operations. Horses, mules, donkeys, yak and mithun are the pack animals for transport. We are also resourceful in human labour as well.

Non-renewable Energy Resources:

The non-renewable energy resources include fossil fuels viz. coal, lignite, crude oil as well as natural gas along with fossil-fuel-like substances like coal-bed-methane, gas hydrates etc. Nuclear energy is the other important non-renewable source which produces energy in exothermic nuclear reactions involving uranium, plutonium and thorium.

Coal & lignite: India has 38,930 million ton reserve of lignite, called brown coal, but even then we are to import coal to meet our deficit. In 2009- 10 around 73 million ton of coal was imported (Sukhatme, 2011) and with the passage of time we have to import more and more coal to meet our energy needs.

When coal is burnt in the presence of oxygen, carbon dioxide (CO_2) is produced in an exothermic chemical reaction, as shown below:

$$C + O_2 \rightarrow CO_2 + \text{Energy (Heat)} .$$

It has been observed that burning of 1 kg coal yields 6150 Wh (22.14 MJ) of heat energy.

Crude oil and natural gas: In 2009-10 India imported 159 million ton of crude oil (Sukhatme, 2011). Current crude oil reserve is also gradually diminishing, which will not meet the demand for more than 20 years. Further, natural gas production was around 30 billion cubic meters in 2002 and remained same till 2009. With new discoveries of oil reserve base in Krishna-Godavari basin annual production has increased up to 47.91 billion cubic meters during 2009-10 (Sukhatme, 2011). In recent past, a significant amount of crude oil has been explored in western part of Rajasthan. Natural gas is used for production of electricity as well as domestic and industrial consumption and till date 17,456 MW of electricity has been produced using natural gas (Sukhatme, 2011).

Besides these energy resources, coal-bed-methane and gas hydrates are also considered as most important source; and coal-bed-methane is the major component of natural gas found in the coal mines. It may be mentioned as example - while drilling well, water comes out first and then methane flows out of the well due to reduction of pressure. There are abundant reserves of gas hydrates in the deep sea of Andamans and Krishna-Godavari basin (Sukhatme, 2011).

Geo- thermal energy: Deep inside the earth, the rocks are in a super heated molten form called magma. Sometimes water that seeps into the earth, through cracks in the rocks, comes in contact with this molten magma. This results in the water getting super-heated.

This hot water can reach temperatures of more than 15° C. That's a lot hotter than boiling water, which boils 100° C. As the water heats up, it rises up to the surface of the earth and spews out of the cracks. The steam and water that comes out with so much force that it sometimes rises as high as 500m. This heat energy, hidden under the surface of the earth, is called geothermal energy.

However, geothermal energy is difficult to handle. First, there are very few areas of such geothermal activity. Secondly, the areas where such activities occur are highly prone to earthquakes. Lastly, the chemicals that come out of the earth, as part of the steam, can be very harmful to the machines and equipment used to generate electricity.

Nuclear energy sources: Nuclear energy is an important non renewable energy source, which produces energy in the exothermic nuclear reactions involving uranium, plutonium and thorium. This source is used to generate electricity and it is produced through nuclear fission and fusion.

Fission of 1gm of uranium (235) produces energy of 22.8 $X10^3$ kWh. With this energy one can run a 1 kw electrical heater nearly for 1000days. Further, in nuclear fusion, deuterium is used, which is abundantly available in sea water. Several countries, including India, has initiated together a programme called the International Energy Reactor for gaining experience of setting a fusion based nuclear plant.

Story From the field

Use of Solar Energy for Cooking

At Shanti kunj Haridwar for cooking of daily food 3 LPG cylinders were being used daily. Now, the institute has installed a 160m^2 Steam Generating Parabolic Dish Solar Cooking System for preparation of daily meal (Dalia and Khichiri) for 1000 persons.

The system is consisting of 10 parabola of 16 m. dia each with headers, pipeline and auto tracking system etc. The steam generated is transferred to stainless steel utensils for cooking of food.

After installation of dish system in April, 2010, the institute is saving 1 LPG cylinder daily on an average and approximately 300 cylinders annually, i.e., Rs. 1.20 Lakh annually.

The cost of system Rs. 27 Lakhs has been subsidized by MNRE, GoI & State Govt.

(Rs. 16 Lakh). The balance cost has been born by beneficiary organization.

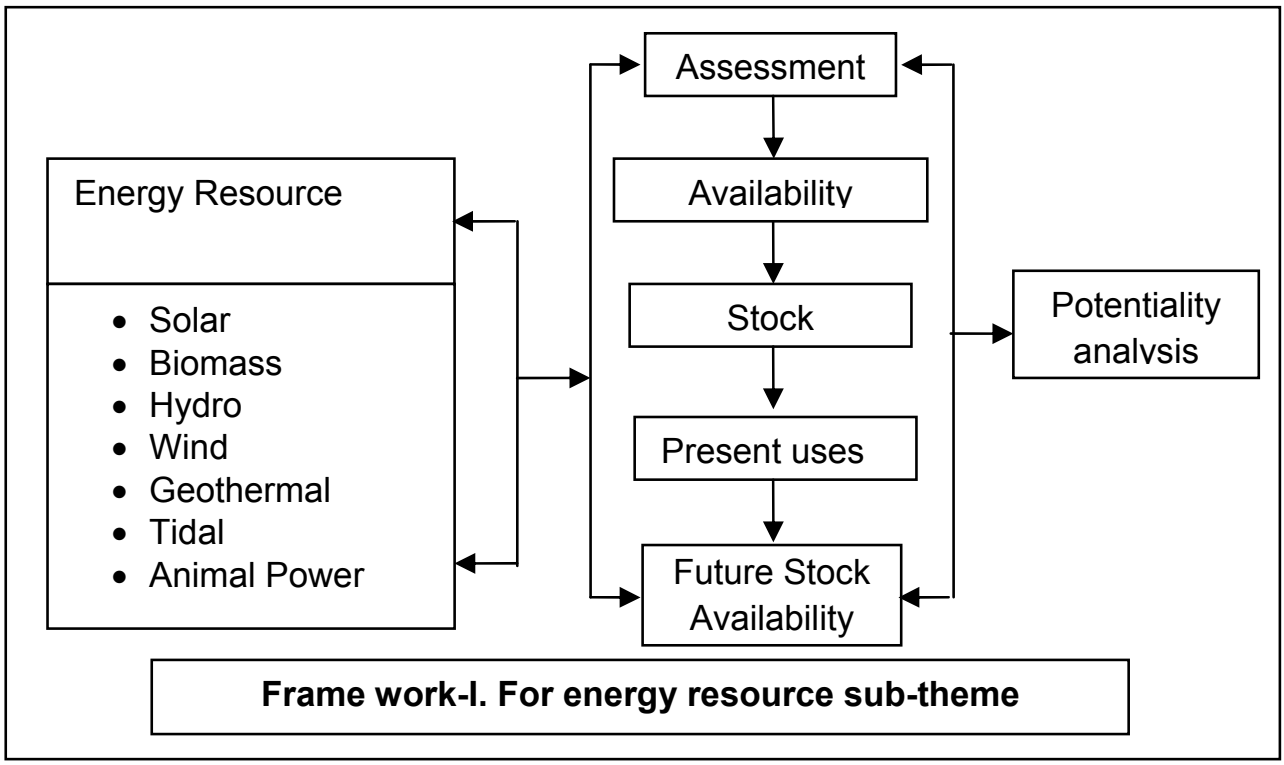
Bio-gas for refrigeration

At Deep frozen Semen preservation centre of Uttarakhand live stock development centre, Rishikesh, Dehradun, of 50 bulls dung was being used for manure production only. By the financial help of MNRE GoI & State Govt. the centre has installed a bio gas plant of 25 m^3 capacity with 3 Kw power generations. The power generated is being used for chaff cutting for bulls. Thus, 3 kw electricity is being saved daily assuming maximum load of 2 Kw @ Rs. 3 per unit, which approximately saves

Rs. 4000/-per day.

2.3.1.1. Framework

The flow chart below depicts the framework for undertaking projects by the children under the sub-theme, Energy Resources.



Frame work-I. For energy resource sub-theme

2.3.1.2. Model Project

Project–I. : Explore and identify energy resources in and around you

STEP 1: A group of children explores the sources of energy in a locality. They maintain an observation sheet and interview people to know about the sources of their day to day energy requirement. At this time they don't do the classification and only list down the sources, i.e. –

a. Sun
b. Biomass (firewood, cowdung cake, charcoal, food & fodder etc.)
c. Wind power
d. Animal muscle power
e. Human muscle power
f. Petroleum (Petrol, Diesel, Kerosene, Candle)
g. Coal
h. Water flow
i. LPG

STEP 2: Now the children, with help of local expert and books try to know the origin of the sources and try to classify them into BIOTIC and ABIOTIC -

Biotic	Abiotic
a. Biomass b. Animal muscle power c. Human muscle power	a. Sun b. Wind c. Petroleum* (Petrol, Diesel, Kerosene, Candle) d. Coal e. Water flow f. LPG

*Petroleum sources although originates from plants and animals, by the time they transform to usable energy forms, they become abiotic.

STEP 3: Then Children try to classify the sources as renewable and non-renewable

Renewable	Non-renewable
a. Sun b. Biomass c. Animal muscle power d. Human muscle power e. Wind power f. Water flow	a. Petroleum (Petrol, Diesel, Kerosene, Candle) b. Coal c. LPG

STEP 4: Then Children explore various usage of the different forms of energy found in the locality through observation and interview of local people in the following format–

Sources	Current usage (imaginary)	Possible usage
a. Sun	a. Drying, heating, lighting (small scale)	a. Cooking, water heating, electricity generation, vehicle running. Large scale rural electrification/ Solar power grids
b. Biomass	b. firewood, charcoal, food & fodder etc.	b. Energy cake, bio-electricty using biomass gasifier, bio diesel
c. Wind	c. Water lifting	c. Electricity generation
d. Animal muscle power	d. Agriculture, Transport	
e. Human muscle power	e. Agriculture, Transport, other physical work	
f. Petrol	f. Vehicle running, electricity generation	
g. Diesel	g. Vehicle running, electricity generation	
h. Kerosene	h. Household lighting, cooking	
i. LPG	i. Cooking	d. Vehicle running, industrial use,
j. Coal	j. Cooking	e. Thermal power,
k. Water flow	k. Not used	f. Micro/ Pico-hydel

Step – 5. Experimentation for possible use/effective –optimum use

Identify any one of the sources already identified and try to bring out some way to establish possible uses or enhancing effectiveness of optimal use through an experiment and observation based on a functional model/ field base experiment -observation.

Example :

ONE EXPERIMENT: How micro-hydel power generation in a small scale is possible

Objective: To demonstrate generation of electricity using a micro/ pico hydel in a locality using the available water flow in a stream/ water fall

Methodology:

1. Identify a stream in the locality with natural water flow
2. If needed, make a small check dam to retain water temporarily to give enough pressure for turbines to move at optimum speed
3. Make a generator using magnet, handmade coil and turbine (may be a fan)
4. Use the generator and the water flow of the stream to generate electricity
5. Connect the generator to a bulb to demonstrate generation of energy

Expected outcome:

Understand the basic principle of hydro-power generation and have a model production unit. It gives the opportunity to have a decentralised, community managed production unit, which can be operated by the community without depending on the public supply system.

Project – II. Nature of availability of solar and thermal energy resources in a village

Although several sources of energy are available for exploitation on earth (e.g., geothermal, nuclear decay), the most significant is solar energy. Light and other radiation streaming out from the sun strikes the earth 93 million miles distant, providing energy to the atmosphere, the seas, and the land, warming objects that absorb this energy; that is, radiant energy is converted to heat energy (molecular motion). Differential heating causes winds and currents in the air and water, the heat energy becoming *kinetic energy* of motion. Warming results in evaporation of water into the atmosphere, setting up the hydrologic cycle. The lifting of water into the atmosphere becoming *potential energy* that will convert to kinetic energy when the water begins to flow back downhill. So, solar energy not only plays most significant role in determining the resource base of any geographical situation, but also essentially required for growth and survival of living organisms.

Further, considering climate change scenario, the nature of availability of solar vis-à-vis thermal energy at different time periods of any location is to be known for planning living quality.

Objective: To study nature and availability of solar and thermal energy resources in an area.

Materials required:
(i) A simple thermometer
(ii) A Sun-dial (to be made by the children)
(iii) Arrangement for hanging thermometer (a wooden pole with hook)
(iv) Field note book

Methodology:

Step – 1. An open area in the dwelling village of the children who will take up the project is to be identified; keeping in view that the area should not be influenced by tree shade or any other interference at any time of the day. A play ground will be the ideal area.

Step – 2. The pole and the sun-dial are to be placed at the centre of the area.

Step – 3. Temperature readings to be recorded at (i) at ground level and (ii) 1.5 m height at different time in a day (preferably at 08, 12, and 16 hours).

Step-4. The day length (preferably bright sun-shine hour) is to be recorded with sun-dial from dawn to dusk.

- This should be recorded every day and to be continued for two months in the following tabular form-

Table:1. Diurnal air temperature (°C)

Day	Date	At ground level			At 1.5 m		
		8 hr (A)	12 hr (B)	16 hr (C)	8 hr (A)	12 hr (B)	16 hr (C)
Mean							

Table:2. Day-length/ Bright sunshine hour by days

Day	Date	Day length, hr	Total radiation available*	Energy, Watt/d
Mean				

Table:3. Mean temperature at different day time and inversion layer

Day	Mean Temperature (oC) at ground level (A+C)/2	Mean Temperature (oC) at 1.5 m height (A+C)/2	Inversion Layer* (C – A)

Note: * A layer of air that is warmer than the air below it is called an **inversion layer** (Gordon et al.1980). Such a layer traps the surface air in place and prevents dispersion of any pollutants it contains.

Table:4. Cumulative temperature

Day	Date	Mean temperature		Cumulative temperature**	
		At ground level	At 1.5 m height	At ground level	At 1.5 m height
		X1	y 1	x1	Y1
		x2	y2	x1 + x2 = xa	y1 + y2 = ya
		x3	y3	xa + x3 = xb	ya + y3 = yb
Total					

Note: ** Cumulative temperature, which gives total thermal energy for a given period is important for selection of crop and adoption of cultivation practices

- The two month's data can be converted to weekly data and respective mean values to be calculated.
- Finally total amount of energy availability from these two sources can be calculated both by weeks and months.
- The profile of energy from temperature can be compared through graphical analysis,
- Variation at two different situations can also be compared.
- The diurnal temperature can be correlated with day length
- Cumulative temperature, which indicates thermal energy availability at a given time for a place, can also be compared by weeks and months.

This study can be taken up in any geographical situations. Further, there may be two different projects on thermal and solar energy or both can be considered together to study the interrelations of the two energy resources.

From the mean values of Table -3, the children can calculate both Growing Degree Days (GDD) and Heliothermic Unit (HTU). GDD is in practice for more than 200 years. The concept assumes that there is direct and linear relationship between plant growth and temperature. A degree-day or a heat unit is the departure from mean daily temperature from minimum threshold temperature, known as base temperature. The base temperature is the temperature below which no growth takes place. The base temperature varies from 40 – 12.50C for different crops. Its value is higher for tropical and lower for temperate crops. As a thumb rule for Indian condition, 50C is considered as base temperature irrespective of crops. The GDD is expressed as Degree Celsius Days (0C days) and calculated using the following equation –

$$GDD = \sum_{i=1}^{n} [(Tmax - Tmin)/2] - Tbase \quad \ldots\ldots\ldots (i)$$

The product of GDD and actual bright sunshine hours is Heliothermal Units (HTU). In addition to GDD, it takes into account the effect of actual bright sunshine received by the crop on a particular day. It is expressed by Degree Celsius Day hour (0C day hour) and calculated as follows –

PTU = GDD x Actual bright hours …….. (ii)

In context of climatic degradation these parameters will give an idea of thermal energy availability in a particular location.

Project – III. Study on bio-resource potential in a village

Biomass can be understood as regenerative (renewable) organic material that can be used to produce energy. These sources include aquatic or terrestrial vegetation, residues from forestry or agriculture, animal waste and municipal waste. In fact, it is composed of organic matter found in flora throughout the world as well as manure of some animals. The simple explanation is that the natural plants collect energy from the sun. This is converted, through photosynthesis with the other compounds, within the plants, making a source of solar energy. This energy is displayed in the use of wood for home and industry use. With the exception of manure, which is converted by the use of yeast, the materials are burned to produce the energy. The use of municipal waste has been very effective in the production of electricity, as well as gas using this theory.

For many years there has been much controversy over the disposal of animal waste such as manure. In large animal farm this can be a problem. It has now been found that this waste can be turned into methane gas by using anaerobic digestions plants. It is expected that biomass products will one day supply the entire world's energy in place of many of the forms now used. Thus, one can be assured that when the secret of really unleashing biomass power is revealed and applied it will greatly benefit the entire world. Hence, Estimating of resources from different bio-sources is required to be known as first hand information for planning and management for improving quality of life of rural mass.

Objective: To estimate different bio-resources in a village.

Materials required:

(i) Village map
(ii) Questionnaire

(iii) Basket (preferably bamboo made)
(iv) Rope for hanging basket in the spring balance
(v) Spring balance

Methodology:

Step -1: A village where the participating children dwell the need to be selected

Step – 2. Using questionnaire following information is to be collected.

(i) Name of the village (with JL number)

(ii) Area of the village (To be marked in the map)

(iii) Number of household

(iv) Number of people per household

(v) Number of labour force

(vi) Amount of farm and/or kitchen waste

(vii) Types and number of domesticated animals

Type of animal	Number
Cow	
Bullock	
Buffalo	
Sheep	
Goat	
Hen	

Amount of animal dung/ excreta available/household/day

Step – 4. If the village is very large, children will have to undertake survey in some randomly selected households of the village. The number of household should be more than 50. They will visit the cowshed and measure the amount of cow dung with the help of basket and spring balance. This should be repeated for 3 – 5 days in the sample households.

Step – 5. The amount of farm waste available per day is also to be measured and estimated for yearly availability

Step – 6. The average amount of dung/excreta available in the sample household will be used to calculate total amount of dung/excreta available in the village in a year. The seasonal differences, where ever possible, can also be calculated.

Step – 7. Finally total amount of excreta and waste are to be calculated for the village as a whole.

Step – 8. The whole bio- resources are to be converted in form of energy using conversion factors.

Step – 9. The total labour force also to be converted in terms of energy multiplying by the conversion factor

Table: Conversion factors

Particulars	Energy conversion factor
Human labour	0.1779 MJ/man-hr
Bullock	1.34 MJ / bullock
Cow dung	
Farm waste	80 – 200 kCal/kg

- Children will then compare yearly and/or seasonal availability of different resources in that particular village.

Project – IV : Assessment of hydel energy (Water) in a flowing water body

Objective: To study the kinetic energy in a stream flow

Materials required:

1. Map of the area
2. Colour pen
3. Tracing paper
4. A piece of small float
5. A long string
6. Bamboo poles
7. A float (may be a piece of thermocol or cork)
8. Stop watch
9. Measuring tape
10. Note book

Methodology:

Step – 1. A stream or an open channel is to be identified

Step – 2. Map should be traced in the tracing paper and the location of the stream flow/ open channel is to be marked showing direction of flow,

Step – 3. The children will visit the place and identify a segment of the channel.

Step – 4. The bamboo poles are to be put in two ends of the segment.

Step – 5. They will then measure the length of the flow in the channel.

Step – 6. Using bamboo poles depth of the flow is to be measured.

Step – 7. The bamboo poles are also to be put just opposite side of the channel in a line of the previously placed the poles (as shown in the diagram).

Step – 8. The strings are to be tied across the channel at both the ends.

Step – 9. The float will be placed at the top of the channel (marked A)

Step – 10. With the stop watch the time of run of the float will be recorded.

Step – 11. Then the calculations will have to be performed –

(i) cross sectional area of the channel, A (sq. M)

(ii) depth of the flow, h(m)

So, the volume of water in the section, V = A* h (m^3)

Since density of water is 1, so V = M (mass), g

(iii) Velocity, P = L (length of the channel section)/ time , m/sec

Finally, Kinetic energy of the flow will be calculated using the following equation

$$KE = ½ M* V^2$$

Note: This study can be undertaken before and after the rainfall, thereby a comparative study on energy in flowing channel can be made.

2.3.1.3. Suggestive project idea

(i) Quantification of heat generated in exothermic chemical reactions (such as burning of coal, wood, charcoal, gas etc

(ii) Identification of estimation of components of the gas produced from cow dung, kitchen waste, human waste, tree leaves etc.

(iii) To study potential wind velocity in an area.

(iv) Estimation of incidence of solar radiation

(v) Estimating biomass energy stock in a school compound

(vi) Measuring kinetic energy in a stream

(vii) Comparative study on thermal energy availability in open and closed spaces in urban area.

(viii) Collection and recording of different plant parts and seeds available for use as food and fuel.

(ix) Estimating Growing Degree Days (GDD) using time-scale recording of atmospheric temperature

(x) Measuring and correlating air and soil temperature and thermal resources

SUB-THEME: II - ENERGY SYSTEMS:

2.3.2. Energy System

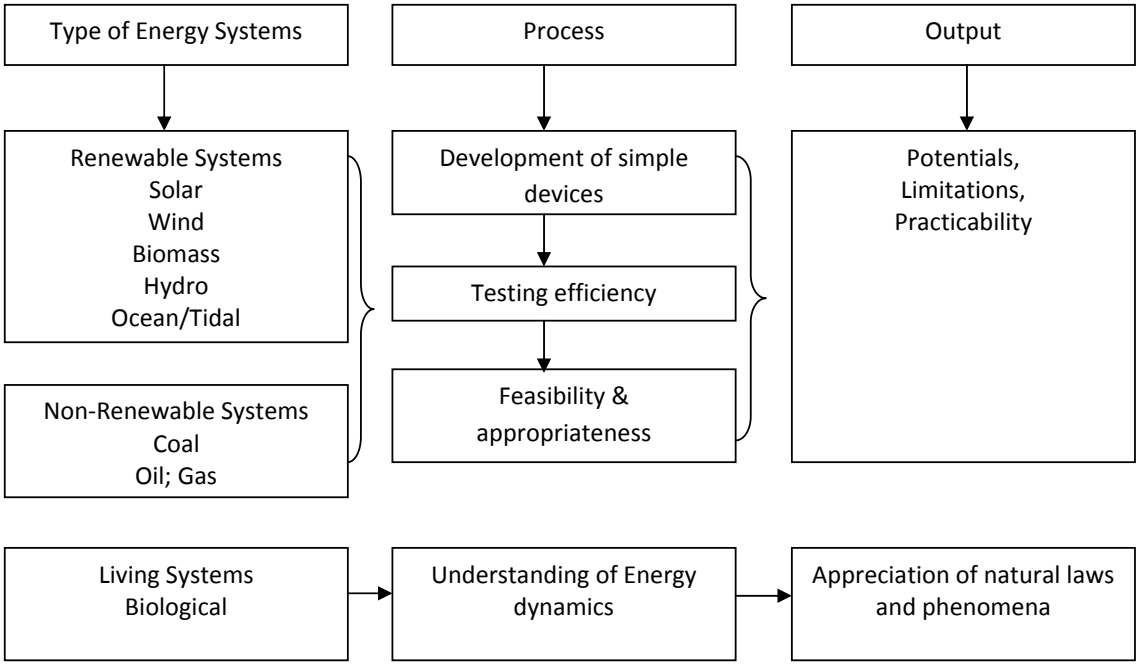
Energy is the capacity or capability to do work. All matters possess energy, because they can all be utilised in some form of energy conversion process. For example, most substances will burn or vaporise, and the consequent heat energy can be harnessed within mechanical energy systems that create motion. The use of energy usually involves transformations between different forms of energy - a process known as energy conversion. Any conversion between different energy forms is imperfect in that some of the energy has to be used to facilitate the conversion process. The converted energy output is lower than the energy input and this feature is usually described as the conversion efficiency.

Energy is usually defined as the ability to do work or the capacity of any system to perform work. Though this is an anthropocentric and utilitarian perspective of energy, it is a useful definition for engineering where the aim of machines is to convert energy to work. As a more general description, energy is a fundamental entity whose availability and flow are required for all phenomena, natural or artificial. An understanding of how energy is generated and measured is central to our decisions concerning the use and conservation of energy. Everything that takes place in the planet is the expression of flow of energy from one form to another form.

The term energy systems, refers to the interrelated network of energy sources and stores of energy, connected by conversion, transmission and distribution process. In the energy systems, the energy converts from one form to another useable form of energy.

Framework

The flowchart below depicts the framework for undertaking projects by the children under the sub-theme of Energy System .



Projects under the sub-theme 'energy system' can go at various spatial scales connected functionally through the various energy transfer mechanisms. This sub-theme represented is the study and projects that deal with the energy under *transformation* or the different aspects of the system in which the conversion or transmission of energy occurs. During this conversion, certain amount of energy is lost to the environment, and cannot be converted to useable forms of energy. Hence, though energy conservation law states that energy cannot be created or destroyed, but it converts to un-useable forms, which cannot be used for our purposes. Energy flows take place at all scales, from the quantum level to the biosphere and cosmos.

At the children's level, our aim is to deal with Natural systems such as physical, chemical and biological processes, the human centric process of generation/harnessing of energy and its utilization systems. The energy systems are classified based on the source or the processes.

Source based Energy Systems

- Renewable Energy Systems (based on renewable energy sources like solar, wind, biomass etc.)
- Non-Renewable Energy Systems (based on non-renewable energy sources like coal, oil etc)

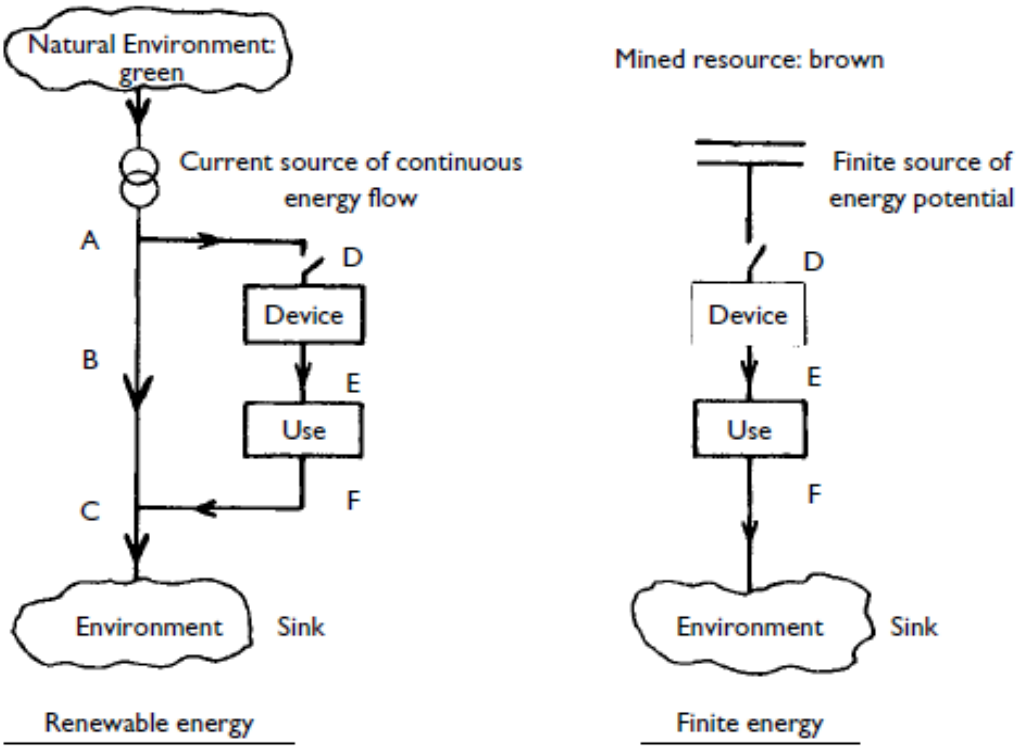


Figure 2.1 Energy flow (ABC) and harnessed energy flow (DEF) for renewable and finite sources of energy

(Ref: Twidell and Weir. Renewable Energy Resources. ELBS, 2008)

Renewable Energy Systems

Renewable energy systems are based on the energy sources, which are obtained from the continuing or repetitive currents of energy occurring in the natural environment such as Solar energy, wind energy or biomass energy base systems. Figure 2.2 represents the natural energy current on earth. Here, we will elaborate a few renewable energy systems.

Solar Energy Systems

Solar energy has the greatest potential of all the sources of renewable energy. Only a small fraction of this form of energy could be sufficient for all energy requirements of earth. The solar energy can be converted to heat energy or electricity. In solar thermal energy systems, the solar energy is converted to heat energy by using an absorber or reflecting surface. This heat energy can then be used to heat water or air, or to cook food. This heat energy can also be used for power generation. In case of solar photovoltaic systems, solar energy falls on solar cell, which directly converts the solar energy to Direct Current (DC) electricity.

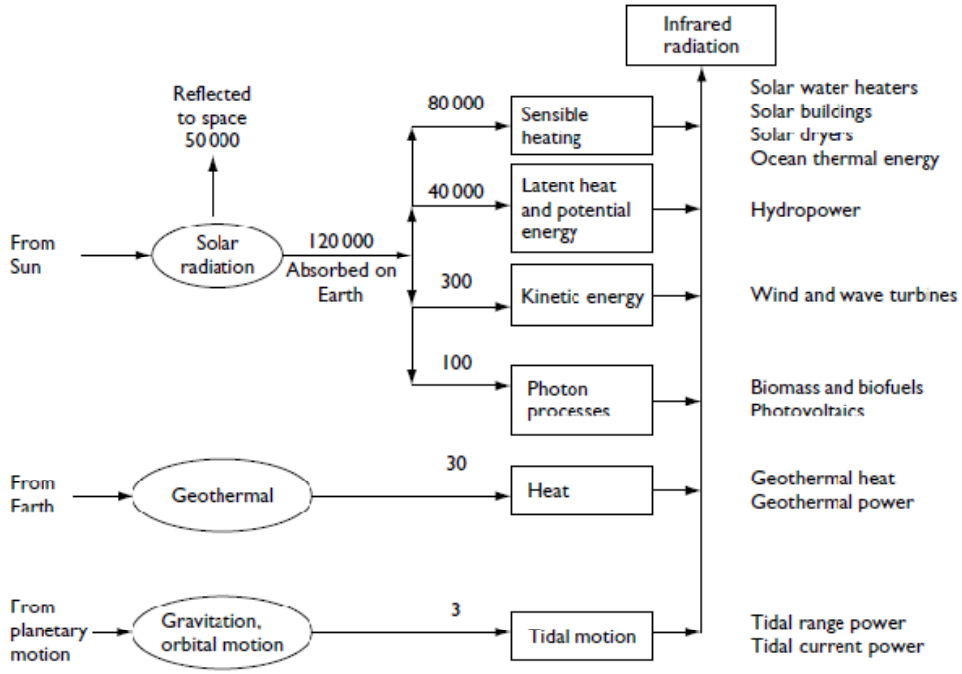


Figure 2.2 Natural energy current on earth, showing renewable energy systems; Units terawatts (10^{12} Watts)

(Ref: Twidell and Weir. Renewable Energy Resources. ELBS, 2008.)

Solar Thermal Energy Systems

Applications

- Solar water heating
- Solar drying of agricultural and animal products
- Solar cookers
- Solar distillation
- Solar electric power generation
- Heating or cooling of residential buildings etc.

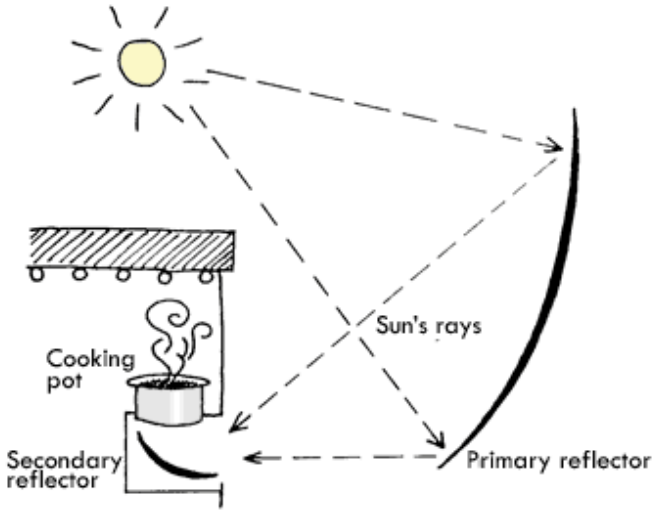


Figure 2.3 concentrating type solar cooker

Solar Photovoltaic Energy Systems

Application

- **Stand alone systems**
  - ♦ Lighting (Solar Lantern, Solar home lighting system, Solar Street light etc.)
  - ♦ Water Pump, Health clinics
  - ♦ Power for mobile towers (Telecommunications)
  - ♦ Consumer Electronics (Calculator, watches)

- **Off-grid systems**
  - ♦ Remote Village Electrification
- **Grid-connected systems**
  - ♦ Direct Connection with the utility grid
- **Hybrid systems**
  - ♦ Coupled with Diesel generator / Wind systems/ Biomass gasification systems etc.

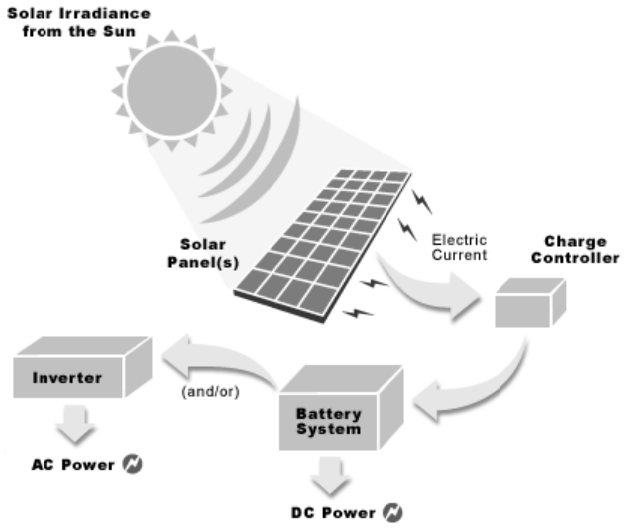


Figure 2.4 Schematic diagram of a solar photovoltaic system

Wind Energy Conversion Systems

"Windmills have fascinated us for centuries and will continue to do so. Like campfires or falling water, they're mesmerizing; indeed, entrancing."

Since early recorded history, people have been harnessing the energy of the wind. Wind energy was used to propel boats along the Nile River as early as 5000 B.C. The first windmills were developed to automate the tasks of grain-grinding and water-pumping and the earliest-known design is the vertical axis system developed in Persia about 500-900 A.D. The first use was apparently water pumping. Vertical-axis windmills were also used in China, which is often claimed as their birthplace. While the belief that the windmill was invented in China more than 2000 years ago is widespread and may be correct, the earliest actual documentation of a Chinese windmill was in 1219 A.D. by the Chinese statesman Yehlu Chhu-Tshai. Here also, the primary applications were apparently grain grinding and water pumping. The first windmills to appear in Western Europe were of the

horizontal-axis configuration. In 1390, the Dutch set out to refine the tower mill design, which had appeared somewhat earlier along the Mediterranean Sea.

Wind is the result of horizontal differences in air pressure. Air flows from areas of higher pressure to lower pressure. Differences in air pressure are caused by uneven heating of the Earth's surface. Therefore, we can say that the wind energy is derived from sun (solar energy).

- Renewable Energy
- Site specific
- Windmill and Wind Electric Generator
- Battery Charging, Grid-connected WEG
- Water pumping, Grinding Grains
- Cost-effective Renewable Energy Application
- No Green-House Gas Emissions (Pollution Free)

Wind energy conversion systems are classified in two ways- Horizontal axis wind turbine and Vertical axis wind turbine. This classification is based on the rotational axis of turbine. Most of the present application of wind energy systems are horizontal axis wind turbine, as efficiency of these systems are high in compare to vertical axis wind turbine.

The available power in the wind depends on the wind speed. The relation can be written in the following way

$$P = \frac{1}{2}\rho A V^3$$

Where, P is the available power, r is the air density (can be considered as 1.12 kg/m^3, however, this value varies with temperature and pressure of the place), A is called swept area and V is the wind speed. In the following Figure 2.5, you will be able to understand the meaning of swept area. So, if we know the wind speed of a place and the swept area, we will be able to calculate the power available from the wind. Wind speed is measured by the instrument called Anemometer. Here, power output varies with cube of the wind speed. So wind speed is the most important parameter in the above relation. Or, a place with higher wind speed, the power output will be also higher. Figure 2.6 represents a wind energy conversion system.

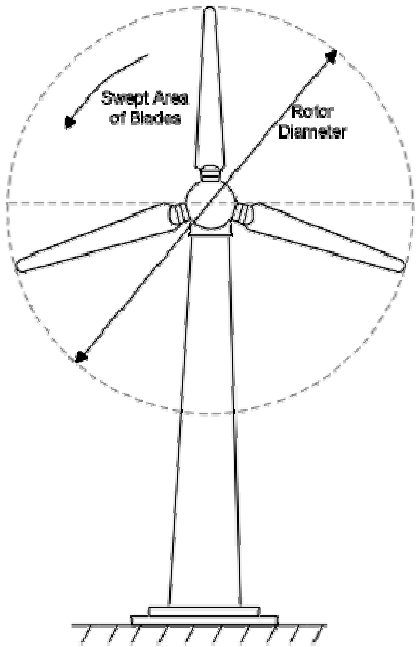


Figure 2.5 Swept area of blades in a wind energy conversion system

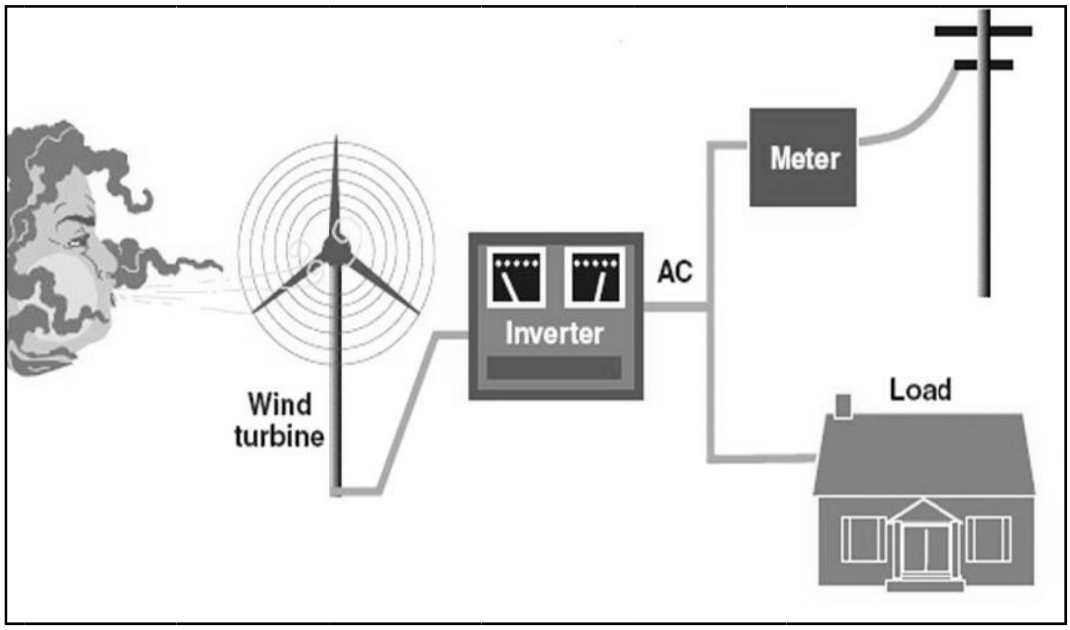


Figure 2.6 Wind Energy Conversion System

Hydro Energy Systems

It is the largest source of renewable energy in the world accounting for 6% of worldwide energy supply or about 15% of the world's electricity. In India, it accounts 24% of electricity. The kinetic energy contained in falling water is converted to electricity with the help of hydro-electric power plants and the power thus obtained is hydro-electric power or simply hydro-power. The first recorded use of water power was a clock built around 250 BC. The first use of moving water to produce electricity was a waterwheel on the Fox River in Wisconsin (USA) in 1882. The history of hydropower generation in India goes back more than 100 years. It's first hydropower station was a small 130 kW facility commissioned in 1897 at Sidrapong near Darjeeling in west Bengal.

A hydropower resource can be measured according to the amount of available power, or energy per unit time. The power of a given situation is a function of the hydraulic head and rate of flow or discharge. When dealing with water in a reservoir, the head is the height of the water level in the reservoir relative to its height after it is released. Each unit of water therefore can produce a quantity of work equal to its weight times the head. The amount of energy *E* released by lowering an object of mass *m* by a height *h* in a gravitational field is: $E = mgh$; where *g* is the acceleration due to the gravity. The energy available to *hydroelectric dams* is the energy that can be liberated by lowering water in a controlled way. In these situations, the power is related to the *mass flow rate.*

$$P = \rho Q g h \eta$$

Where Q is the rate of flow or discharge (m^3/s), r is the density of the water (kg/m^3), g is the acceleration due to gravity (m/s^2), h is the head or height (m) and h is the efficiency of the system. The power generated is represented by the above equation can be simplified by considering the efficiency of 80% and the acceleration of gravity, of 9.81 m/s^2 to

P (kW) = 7.84 x H (m) x Q (m3/s)


Figure 2.7 Photographs of Pico Hydro power

Geothermal Energy Source base systems

Human utilized geothermal energy systems for a variety of uses for a long time. The Romans used geothermally heated water in their bathhouses for centuries. They also used water to treat illnesses and warm homes. In Iceland and New Zealand, many people cooked their food using geothermal heat base systems. Some North American native tribes also used geothermal vents for both space comfort and cooking. Most of these early uses of the Earth's heat were through the exploitation of geothermal vents. The first modern geothermal power plants were built in Lardello, Italy (1904). They were destroyed in World War II and rebuilt again. Today after 90 years, the Lardello field is still functional.

Geothermal energy *i.e.,* Heat from the Earth is a proven resource for direct heat and power generation. Average geothermal heat flow at the earth's surface is only 0.06 W/m^2, with a temperature gradient <30 ^0C (which is much lower than other renewable energy intensity on the earth's surface). However, at some locations, this temperature gradient is higher, indicating significant geothermal resource. The reasons for the geothermal energy sources is based on

- Natural cooling and friction from the **core**
- **Radioactive decay of elements**
- **Chemical reactions inside the earth surface**

Geothermal Heat Source are classified into following three sections

- *Natural Hydrothermal circulation* (Water percolates to deep aquifers to be heated to dry steam, vapor/liquid mixture, or hot water. Emissions of each type are observed in nature).
- *Hot igneous systems* (Heat associated form semi-molten magma that solidifies lava).
- *Dry rock fracturing* (Poorly conducting dry rock, *e.g.,* granite, stores heat over millions of years with a subsequent increase in temperature).

Power generating capacity of Indian geothermal provinces

Indian has 400 medium to high temperature geothermal springs, clustered in seven provinces. The most promising provinces are:

- The Himalaya
- Cambay
- Son-Narmada-Tapi (SONATA)
- The Godavari
- Bakreswar province
- The Barren island

Province	Surface Temperature (^{0}C)	Reservoir Temperature (^{0}C)	Heat Flow (mW/m^2)	Thermal gradient (^{0}C/ km)
Himalaya	>90	260	468	100
Cambay	40-90	150-175	80-93	70
West coast	46-72	102-137	75-129	47-59
SONATA	60 - 95	105-217	120-290	60-90
Godavari	50-60	175-215	93-104	60

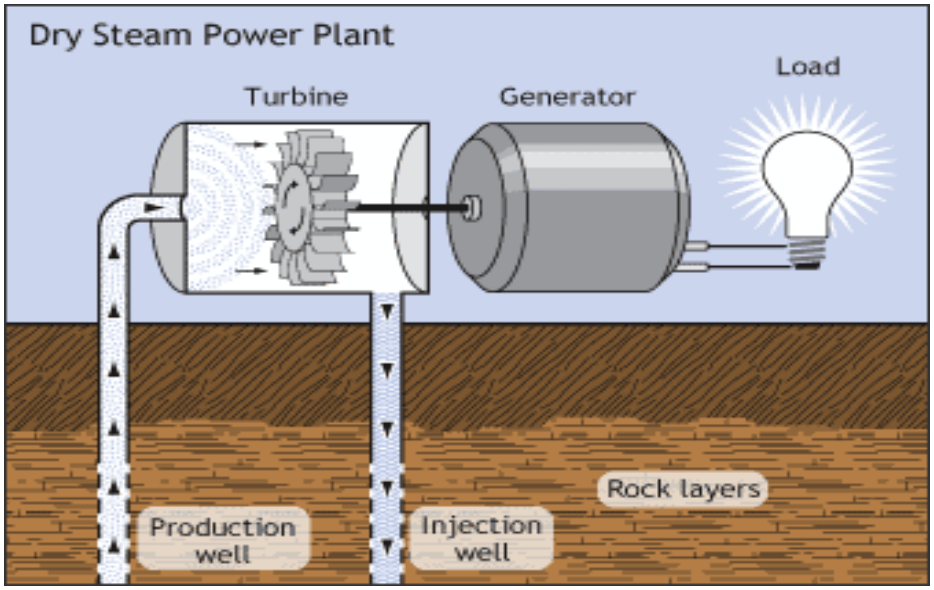


Figure 2.8 Dry Steam Electrical Power Generation through geothermal energy source (ref: Twidell and Weir)

Biomass energy based systems

A wide variety of conversion technologies are available for converting biomass based energy sources to high grade fuel. Each biomass resource like wood, cow dung, vegetable waste can be converted in many ways to provide a wide spectrum of useful products. Figure 2.9 represents the various conversion processes of biomass. Biomass conversion can be performed in various ways

- Direct combustion (such as firewood burned in traditional chulha etc.)
- Thermo-chemical conversion (biomass converts to producer gas in gasification systems)
- Bio-chemical conversion (cow dung, vegetable waste to high grade fuel in anaerobic digestion)

Direct combustion

Biomass is burnt to provide heat for cooking, comfort (space heat), crop drying, factory processes and raising steam for electricity production and transport. Traditional use of

biomass combustion includes (a) cooking with firewood, and (b) commercial and industrial use for heat and power. A significant proportion of the world's population depends on fuel wood or other biomass for cooking, heating and other domestic uses. Average daily consumption of fuel is about 0.5 – 1 kg of dry biomass per person, i.e. 10–20MJ/day. The conventional method for cooking practice is actually inefficient cooking method, the most common of which is still an open fire. This 'device' has a thermal efficiency of only about 5 - 10%. That is, only about 5-10% of the heat that could be released by burning of the wood reaches the interior of the cooking pot. The rest is lost by incomplete combustion of the wood, by wind and light breezes carrying heat away from the fire, and by radiation losses, etc. resulting from the mismatch of fire and pot size. Considerable energy is also wasted in evaporation from uncovered pots and from wet fuel. Smoke (i.e. unburnt carbon and tars) from fire is the evidence of incomplete combustion.

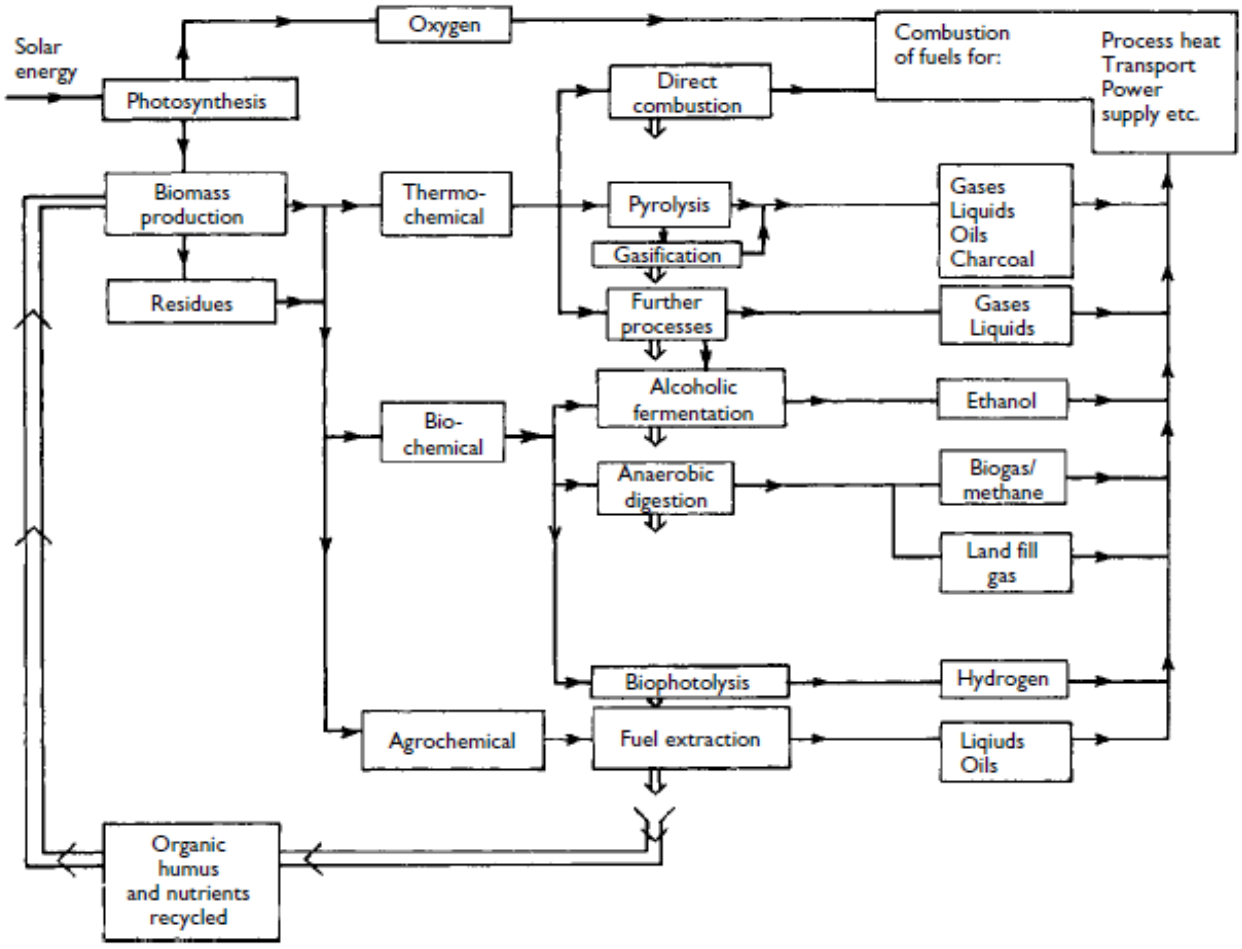


Figure 2.9 Biofuel production process

Thermo-chemical conversion

This process takes into two forms: gasification and liquefaction. Gasification takes place by heating the biomass with limited oxygen to produce producer gas. The composition of producer gas is CO (20%), CO_2 (12%), H_2 (20%), CH_4 (2%) and N_2 (46%). The calorific value of the producer gas is in the range of 4-5 MJ/kg. This producer gas can be used for thermal application by direct burning in a burner or can be used to produce electricity by using a gas engine.

Bio-chemical conversion

Bio-chemical conversion takes places in two forms: Anaerobic digestion and fermentation. Anaerobic digestion involves the microbial digestion of biomass. This process takes place in bio-gas plants (commonly called Gobar gas plant) and produce biogas. Biogas is a mixture of 55-65% methane and 30-40 % CO_2 , and rest the impurities. This gas can be produced from the decomposition of animal, plant and human wastes. The calorific value of the gas is of the order of 20-23 MJ/kg. This gas can be directly used for cooking or lighting purpose. Even this gas can be used for power generation by feeding into an engine. Fermentation is the breakdown of complex molecules in organic compounds under the influence of a ferment such as yeast, bacteria etc. This is a widely accepted conversion process where, grains, sugra crops converted into ethanol.

Non-Renewable Energy Systems

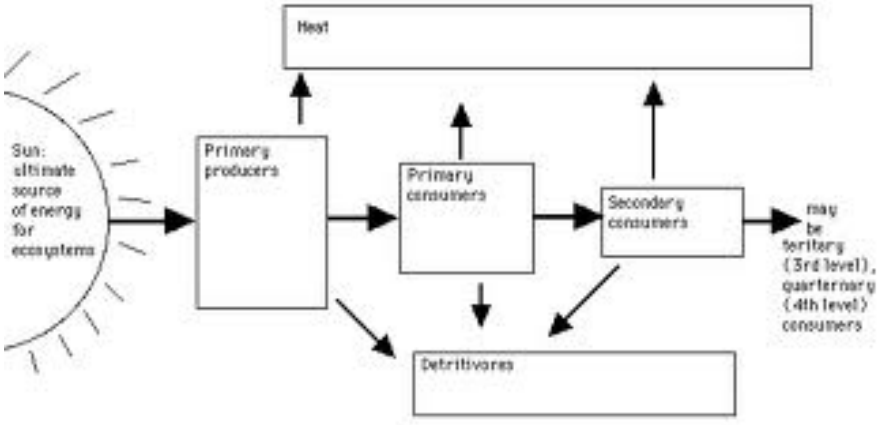
Thermal based energy systems

The thermal power station is a *power plant* where coal is mainly used as fuel. Here, water is heated, turns into steam and spins a *steam turbine* which drives an *electrical generator*. After it passes through the turbine, the steam is *condensed* in a *condenser* and recycled to where it was heated. Natural gas, nuclear fuels are also used to produce steam in place of coal. A large part of human CO_2 emissions comes from fossil fuel based thermal power plants. In case of Nuclear power plants, this CO_2 emission is not there. The average CO_2 emission is 0.81 kg/kWh from the coal based power plants of India.

Process based Energy systems

Biological energy systems (Living Organisms and ecosystems)

A living organism depends on an external source of energy—radiation from the Sun in the case of green plants; chemical energy in some form in the case of animals—to be able to grow and reproduce. Energy from Sun which is stored by the plants in its body parts passes through a series of users. The mechanism made to facilitate this energy transfer is the basis of wonder what we call as life on earth. The energy flow in each of the ecosystem depends on the complexity of the food chain and food web of the ecosystem.



(this figure needs to be redrawn or omitted, looks very bad)

Any animal body including human is a best example of energy system for study. Adenosine triphosphate (ATP) is the immediately usable form of chemical energy for muscular activity. It is stored in most cells, particularly in muscle cells. Other forms of chemical energy, such as that available from the foods we eat, must be transferred into ATP before they can be utilized by the muscle cells. Since energy is released when

ATP is broken down, energy is required to rebuild or resynthesize ATP. The building blocks of ATP synthesis are the by-products of its breakdown- adenosine diphosphate (ADP) and inorganic phosphate (Pi). The energy for ATP resynthesis comes from three different series of chemical reactions that take place within the body. Two of the three depend upon the food we eat, whereas the other depends upon a chemical compound called phosphocreatine. The energy released from any of these three series of reactions is coupled with the energy needs of the reaction that resynthesizes ATP. The separate reactions are functionally linked together in such a way that the energy released by the one is always used by the other.

Chemical energy systems (battery, fuel cell)

Chemical energy is the potential of a chemical substance to undergo a transformation through a chemical reaction or, to transform other chemical substances. Breaking or making of chemical bonds involves energy, which may be either absorbed in or evolved from a chemical system. Energy that can be released (or absorbed) because of a reaction between a set of chemical substances is equal to the difference between the energy content of the products and the reactants. **Battery** is one or more *electrochemical cells* that convert stored chemical *energy* into electrical energy. Batteries are connected in series, to increase the voltage. Cells may be either of primary or secondary types. A primary cell is discarded when its chemical energy is exhausted. A secondary cell can be recharged. The most common primary cell is the zinc/carbon (Leclanché) as used in torches, portable radios etc.

Fuel cells are classified primarily by the kind of electrolyte they employ. This classification determines the kind of chemical reactions that take place in the cell, the kind of catalysts required, the temperature range in which the cell operates, the fuel required, and other factors. These characteristics, in turn, affect the applications for which these cells are most suitable. There are several types of fuel cells currently under development, each with its own advantages, limitations, and potential applications.

Mechanical energy (fly wheel, compressed air systems)

Mechanical energy is the sum of *potential energy* and *kinetic energy* present in the components of a *mechanical system*. It is the energy associated with the motion and position of an object. Many modern devices, such as the *electric motor* or the *steam engine*, are used today to convert mechanical energy into other forms of energy, e.g. *electrical energy*, or to convert other forms of energy, like *heat*, into mechanical energy. A flywheel is a rotating mechanical device that is used to store *rotational energy*. The amount of energy stored in a flywheel is proportional to the square of its *rotational speed*. Energy is transferred to a flywheel by applying *torque* to it, thereby increasing its rotational speed, and hence its stored energy. Conversely, a flywheel releases stored energy by applying torque to a mechanical load, thereby decreasing its rotational speed. Compressed air is *air* which is kept under a certain *pressure*, usually greater than that of the atmosphere. Compressed air is regarded as the fourth utility, after electricity, natural gas and water. However, compressed air is more expensive than the other three utilities when evaluated on a per unit energy delivered basis.

2.3.2.1. Model Project

Project I. Evaluate the energy efficiency of different chullahs in a village

Introduction

Chullahs are the major energy system working in the villages for preparation of food. The issues related to chullah directly linked to the amount of firewood consumed, time required for cooking and pollution free environment inside the kitchen.

Objectives:

i. To identify the different types of chullahs in practice in a village.

ii. To study the differences in structure, location and other details of chullahs.

iii. To evaluate the relative energy efficiency of the chullahs and to recommends the best design aspect available in the village of study.

Methodology

- Identify the different types of chullahs used in a village.
- Note down the different structural aspects of the chullahs with measurements.
- Draw a rough picture of each of these chullahs in the note book
- Classify the chullahs into different types.
- Analyse the differences in the design aspects of each type.
- Identify one representative chullah of each type.
- Cook a specific amount of food in similar way with similar utensils and same fuel and record the time taken for cooking and amount of fuel used.
- Analyse the result and identify the best and efficient system and try to interpret the reasons for it.

Expected Outcome:

- Understanding of the village cooking energy system
- Developing scientific awareness among the children and villagers on energetic of cooking.

Project II : Comparison of Food web of two different natural ecosystems in an area (this model needs to be reviewed)

Introduction

Food chain and food web represents the complexity of energy transaction or energy flow in an ecosystem. By careful observation and recording, children can identify various elements of different food chain operating in the area and construct the functional food web.

Objectives

i. To identify the food chains of two different natural ecosystems in the area

ii. To construct the food web of each of these area and study the difference.

iii. To construct the approximate energy flow diagrams applicable for the ecosystems under study.

Materials required:

Binoculars, Magnifying glasses, microscope, notebook, pen/pencil etc

Methodology:

- Identify the two different ecosystems of similar special extent for study.
- Mark the boundaries and make an approximate manual map of the area depicting the changes of micro ecosystems of the area.
- Spend 10 hours per week for at least two months in each of the area and note down all observations of organisms.

- Identify directly or by taking photos, in the case of soil insects collect a few of them and identify using the magnifying / microscope.
- Record all the observation of eating and being eater with details of time and date.
- Construct the simple food chains first later develop in to the working food web of the system.
- It is estimated that only less than 7 % of the solar energy is used in photosystheis at each trophic level of energy transfer ther is similar loss of energy.
- Construct an approximate energy flow diagram and appropriate energy pyramid for the two ecosystems under study.
- Compare the energy flow scenario between the ecosystems, interpret the result discuss the energy transaction and its implications.

Expected Outcome:

Understanding and appreciating the energy transactions in the natural ecosystems.

2.3.2.2. Suggestive project idea

i. Using a solar module, calculate the maximum power output at different solar radiation and also try to evaluate the power output at different inclination angle of the solar module.

ii. Try to make a concentrating type solar cooker and measure the temperature at the focal point at different solar radiation throughout the day.

iii. Make a box type solar cooker by using ply-board and cook your food. Note down the time taken for cooking of different kind of food items.

iv. Measure the amount of gas output from different kinds of organic waste materials (cow dung, vegetable waste, food waste, municipal solid waste etc.).

v. Evaluation/estimation of human energy used for the human activities such as procuring water from the well, bringing the fodder, ploughing of cattle and estimate the amount of other conventional energy sources required to substitute them.

vi. Evaluation/estimation of energy supplied by cattle in the village ecosystem for the traction power, cow dung as fuel etc and estimates the amount of other conventional energy sources required to substitute them.

vii. Study the amount of fuel required to boil water/cook a certain amount of food in different structured utensils and identify the most energy efficient one.

viii. Study the components of energy systems supporting in maintaining a garden and relative roles.

ix. Study the relative role of different energy systems in development of a green building.

x. Study the energy systems involved in the road transport.

xi. Study the relative energy systems that are in use in operating a boat.

xii. Comparison of energy usage and energy system contributions in food processing.

xiii. Compare the heating value of different biomass (fire wood) by noting the time taken to boil a certain fixed amount of water and the amount of biomass consumed.

xiv. Try to note down the different kinds of chullahs in the village (draw the details and quantify the minor differences). Check the performance of each type and rank them on the basis of performance.

xv. Write down the different energy conversion systems in a village. This need to include the energy source conversion devices, output work and kind of losses and try to rank them based on the work performance.

xvi. Use one solar module to charge the battery. During charging, note down the voltage vs. time and plot the profile. Repeat this experiment during the discharge by connecting with the battery for different rating of LED lamps.

xvii. Construct a zero energy refrigeration system. Measure the inside and outside temperature at different seasons of the year. Observe the freshness of vegetables kept in the refrigeration system.

xviii. Record and analyse the room temperature inside the building with different types of roofs.

xix. Charcoal production potential of different types of biomass.

xx. Use two GI sheets and try to make blades of a wind turbine. Now connect the system with a dynamo motor. Measure the power output from the system at different wind velocity.

SUB-THEME: III - ENERGY AND SOCIETY:

2.3.3. Energy and Society

The last century evidenced an exponential growth of human population and it has altered the life style of the people from ecosystem based approach to a market base approach. In this context, the development index is controlled by GDP and associated with the pattern of consumption. As a result of which growth of different sectors like agriculture, industry etc is highly dependent on energy consumption. These processes create more demand for energy generation. Eventually to full fill these demand now a day's focuses is given more on power generation either from hydel or from thermal. But normally in planning and designing such project only economic perspectives is considered while ignoring the issues related to environment, human life and society. Such non-futuristic and unsustainable approach leads to the problems of global warming, developmental inequality, conflicts, and health and ecosystem damage.

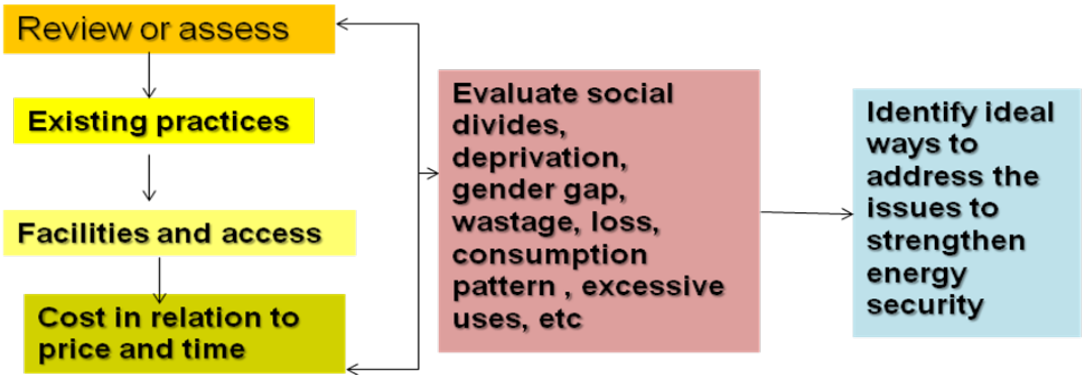
There are other example of energy related societal issues, e.g. decrease of forest coverage increases workload on women to collect fuel wood particularly in forest fringe area because they have to walk long distances in search fuel wood; similarly degradation of common property resources within the village deprived the poorer section of families from bio-energy sources. So degradation natural resources deprived economically weaker section of rural society to large extent.

On the other hand a section of high income group design their housing and other activities such way which is shifted to mechanization, where uses of electricity also increases; e.g. washing of cloth is shifted from manual to washing machine base, where manual labour is replaced by machine with energy inputs of electricity. So issues of optimal use of energy are also related with lifestyle and life style change is also important for optimization of energy use.

It is therefore essential to address these issues to take care of all the evolving system related to development. If the development process has to be sustainable, it is necessary to increase the efficiency of energy utilities and processes, conserve energy and explore renewable sources of energy. From such perspectives, efficient and equitable energy access and supply system can creates an ideal situation for energy sufficiency and provides energy security to all.

In these contexts, this sub-theme will give focuses on developing an understanding about relationship between energy and society. It is linked with understanding the relationship between societal system and the energy system, e.g. relation between life style and energy consumption, social/traditional practices and energy consumption etc.

2.3.3.1. Framework



2.3.3.2. Interrelated areas /dimensions

Concepts/Areas	Concerns/ prospects	Approach	Expectations
HOUSEHOLD LEVEL ENERGY a. Cooking fuel b. Lighting energy c. Heating/ cooling d. Water lifting	• Fossil fuel replacing traditional biomass • Wastage of energy in lighting, cooking, water lifting, heating, cooling etc. • Loss of traditional practices of cooling/ heating/drying • Shift to an energy intensive lifestyle	• Diverse biomass and efficient stoves or cooking devices • Shift to CFL, LED, use of day light and preventing wastage • Exploring traditional methods of cooling, reducing need for refrigeration • Awareness about lifestyle issues	• Making the cooking energy renewable • Optimum use of energy at household level and prevent wastage • Minimize energy use in heating/cooling • Motivation to make houses solar passive • Positive and sustainable lifestyle
ENERGY AND LIVELIHOOD A. Agriculture a. Ploughing – Use of animal Vs. Tractor b. Harvesting – Use of hand grinder Vs. Rice mills c. Post harvesting d. Use of modern machinery for agricultural practices B. Energy and Enterprises C. Availability of energy resources and economy of the society	• Fossil fuel run implements replacing the human/animal muscle power • Joblessness due to replacement of human power by machines • Entrepreneurial opportunity not being trapped as yet	• Promotion of low impact livelihood options and practices • Creation of more jobs at local level using appropriate technologies • Adopting sustainable practices to increase productivity • Diversified livelihood to reduced competition	• Understanding about the role of energy inputs in creating and diversifying livelihood • Improvement in the economic status of the society by harnessing energy resources consciously and sustainably • Reduced competition

ENERGY IN SERVICE AND HOSPITALITY INDUSTRY A. Hotels B. Tourism	• Use of excessive energy and wastage for lighting, water lifting, heating and cooling • Use of excessive energy and wastage for transport • Water table depletion and pollution in the neighbourhood • High investment hotels and tourism industry depriving local community of opportunities and livelihood	• Promoting Energy efficient equipments • Promoting Effective mode of transport and design of routes to minimise use of energy for transport • Promoting the Eco-tourism involving of community	• Replacement with energy efficient equipments • Promotion of Locally managed, small scale low impact (Sustainable) tourism • Conservative use of natural resources
ENERGY AND TRANSPORT SECTOR a. Road b. Water ways c. Air ways d. Railways e. Animal muscle power	• Fossil fuel replacing traditional modes of transport • Poor public transport system • Social inequity due to lack of access • Impact on daily mobility of people • Widening of gaps due to personalized transport and not meeting people • Poor transport facilities pose barrier for producers, students etc.	• Promotion of public transport • Promotion of eco-friendly and indigenous modes of transport • Controlling and minimising the use of energy resources in transport facilities by adopting responsible habits	• More people use eco-friendly mode of transport • More people use public transport • Appreciate the use of modern means of transport in view of the economic growth • Reduction in energy resources in operating various means of transport at their disposal
ENERGY AND DEVELOPMENT OF INFRASTRUCTURE FOR THE SOCIETY (Roads, Buildings, Community Halls, Schools, etc.) A. Energy and social development B. Street lighting C. Water supply system D. Education E. Health and Sanitation F. Impact of electrification	• Wastage of energy in social institutions • Social vandalism due to absence of street lights • Women walking long distance for carrying water • Impact of lack of electric light, poor road etc. on education	• Promotion of Green building concept • Promoting solar for street lighting • Decentralised, no energy water supply system (spot sources) • Promotion of micro-hydel • Promotion of common facilities like public toilets, agriculture facilitation centre etc.	• Understanding about the green building and traditional housing patterns • Spot sources of water supply promoted • Micro-Hydel promoted • Common facilities like public toilets promoted

TRADITIONAL KNOWLEDGE AND USE OF LOCAL RESOURCES FOR ENERGY A. Practices of using local resources for energy B. People's awareness about the economic use of the resources C. People's awareness about the conservation of the resources	• Loss of traditional knowledge and practices • Modernisation of society by ignoring the local knowledge of energy resources	• Appreciation of traditional knowledge and practices to harness local energy resources • Revival of traditional knowledge system	• Adoption and adaptation of some traditional use or conservation practice for energy, i.e. rain water harvesting
ENERGY AND LIVESTOCK A. Fodder B. Modern methods of rearing livestock	• Shift from biomass to enriched feed for livestock • Introduction of energy intensive implements for livestock rearing • Wastage of water due to introduction of stall feeding and sedentary farming • Reduced employment scope due to advent of energy intensive implements	• Diverse biomass and adequate storage • Evaluating the modern methods of rearing the livestock • Conserving native breeds of livestock	• Enough biomass for fodder • Promotion of traditional breeds that are less energy dependent • Enhancing peoples' awareness about the sustainable ways to rear the livestock • Adopting energy efficient models/ methods for rearing the livestock
ENERGY AND HEALTH CARE a. Hospitals b. Gyms c. Day to day physical exercise	• Lack of health care facilities due to lack of electricity /regular supply of electricity • Increased physical un-fitness due to an energy intensive sedentary lifestyle • Use of heavy energy dependant equipments in Gyms	• Promotion of a healthy lifestyle and exercise schedule • Decentralised and sustainable sources of energy for healthcare • Minimising the impact of energy systems on human health	• A healthy and productive society

2.3.3.3. Some important areas:

- Gender-wise energy consumption pattern
- Change in the pattern of energy consumption and impact on lifestyle and society
- Energy for basic needs and livelihood
- Availability of bio-resources and efficient uses in the kitchen
- Energy implications of dietary habits

- Festival and energy consumption pattern– impacts on society
- Change in energy dynamics due to shift in agricultural practices (crop, cattle, fertiliser use)
- Common public facilities and impacts on energy consumptions.

Story from the field

Changing lifestyle through lighting: "There is a remote village in kamrup district of Assam where no electricity was available till 1995. Inhabitants used to end their daily routine just after the sunset and go to bed. They had limited income opportunities and had to earn livelihood from their surrounding jungle and jhum cultivation. In late 1995 Government took up village electrification programmes through solar photovoltaic module (SPV) . The modules were installed in the houses of all the inhabitants. This changed the lifestyle of the people dramatically. Children started reading in the evening under light, women started to take up weaving works in the evening, villagers went to community halls in the evening for interaction. Some enterprising people started battery charging units with solar panels, thereby helping the batteries of the domestic solar systems to sustain and generate earning for themselves too. Women started to earn through weaving and all inhabitants could go to community video hall that run through SPV. By running community video hall, some youths could also earn their livelihood. This is an example how a society can be transformed through efficient energy input"

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The PURA community bio-gas experience: Engineers at ASTRA, IISc working in the village of Pura in Kunigal Taluk of Karnataka convinced the villagers that as individual bio-gas plants were not possible to construct due to various reasons (non-availability of land, resources, etc), a community bio-gas plant would benefit the entire village. They designed and built a bio-gas plant using cow dung as raw material. Each household delivered cow dung to the site after recording the weight. Cow dung in the plant evolved bio-gas (methane and carbon dioxide) which was used to run a diesel engine with 80% bio-gas and 20% diesel. The plant was operated for 8 hours a day; two hours for pumping water from the borewell to the overhead tank, two hours for grinding grains in the floor mill and four hours in the evening from 6-10 pm for lighting the homes.

The entire village got reliable energy services by way of water, flour milling and lighting with only 20% diesel (fossil fuel) consumption. They also got back enriched manure from the bio-gas plant in proportion to the cow dung they contributed.

2.3.3.4. Model Projects

Project-I. Gender-wise energy consumption pattern

Introduction:

The study helps to bring out gender wise energy consumption pattern with respect to age groups, education, occupation, economic class and helps determine the gender that consumes the most, and also find the gender that can control the society in terms of conservation. This study in turn supports the energy conservation efforts.

Objectives:

To understand the gender wise consumption pattern and their influence in deciding the energy consumption in a society and also to graphically plot the area of their influence in the society.

Methodology

Select an area and identify few houses for study.

- Collect information about gender and the age classes of the area from the village records
- Classify the gender according to the age
- Classify the gender and age with respect to economic status
- With the help of questionnaire survey and village information sources, list the occupation of the people into classes with respect to gender and express them in percentages such as agriculture, factory, office, school and house.
- Mode of transportation: frequency of movement per month and extrapolate to per year against each categories of transportation (this can be done by interviewing people)
- Record the frequency of their electricity use by noting the time spent for watching television, lighting (number of bulbs with respect to kitchen, bed rooms, drawing room etc.), so that relative use of gender in each room/area can be calculated – this is the example for a house.
- Compare the relation between economic classes and the gender wise energy expenditure
- Similarly, compare the education and occupation also with gender wise energy consumption
- Tabulate the results for comparison; come to a conclusion and suggest alternatives for better management

Expected Outcome

1. Gender role in determining and influencing the energy consumption
2. The gender wise pattern of resource use in the area

Project–II. Energy implications of food and diet

Introduction

Food is the energy source of all living beings. With the invention of fire and with the social evolution, varieties of food habits arose. Food preparation also accordingly evolved and has grown complex over time. Nowadays the food preparation activities have started consuming a lot of energy and time. From survival it has moved on to become a lifestyle statement. It will be interesting to compare the calorific output of each food item and the energy necessary to prepare it.

Objectives

To assess the energy required to prepare quantities of different food items, which will provide equal calorie of energy

Methodology

1. Select different food items of different food styles (Traditional Indian, Traditional to your locality, modern food items, Chinese, etc.)

2. Identify the calorific value of each of the food items, by an expert consultation if necessary
3. Identify the quantities of different types of food items required to provide a particular, given calorie of energy
4. List out the processes and duration in the course of preparation of each food item
5. Calculate the energy input in all the cooking processes for each item
6. Estimate the energy required for preparing each types of food required to produce particular quantities of energy
7. The results can be illustrated by graphs, box plots etc.
8. Draw your conclusion.

Social relevance of the project

This study will help to identify the students to understand the energy costs of taste and lifestyle, which will give a new outlook to the students about the real value of food and their energy implications.

Project – III. Energy spent to stay fit

Introduction

Energy is a valuable resource of mankind. The resources should be conserved and used for constructive purposes. Nowadays lot many people are regularly exercised in the health clubs and gymnasiums to stay fit. Such exercises lead to burning extra calories of energy from the food taken and avoid the cholesterol formation in the body. This can be easily overcome by managing the qualities and quantities of food consumed,(which is very important in case of country facing food security problems), and by a physically active lifestyle. An assessment of the energy spent in health clubs and gymnasiums, we will get an idea about how much of the energy which has to be used for the constructive purposes are being used to "stay fit".

Objective

Quantify the energy requirement to stay fit

Materials required

Pen, papers, etc.

Methodology

1. Calculate the energy required in making a single step of one exercise by one person, e.g. lifting 3kg of weight to a height of say 1 meter.

   Thus , W=mgh

   =3kgx9.8m/secx1meter (where, m= mass, g=acceleration, h=height)

2. Note the numbers of times (**n**) the exercise is repeted.
3. Multiply **n** with **w** to get total energy **(E_1)** spent by one person in one exercise**.**

4. Similarly calculate the total energy spent by one person in other type of exercises **(E_1,E_2,E_3..... etc)**
5. Find the total (E) and average energy spent by one person in one exercise

   $E_1 + E_2$+..... + E_x / X = E

   Where, X is the number of exercises .
6. Convert the energy in terms of calories
7. This spent energy on exercises can also be converted to some equivalent amount of typical food.

Social relevance of the project

The students can identify better methods of energy used to" stay fit. This will also highlight the significance of a physically active and productive life styles of people.

Project – IV. Festivals and change in energy consumption pattern– Impact on Society

Introduction:

Celebration of festivals in different parts of country witnesses increased energy interactions. This may be by way of cooking, transportation, lighting, firecrackers, etc. Students may be encouraged to explore the ways in which the celebration practices have changed over time and their impact on the health of the community and eco-system.

Objectives:

1. To study the change in the pattern of energy uses in festivals
2. To find out the amount of energy consumed by a group of households during the festival days.
3. To compare the energy consumption pattern in the society during festival days and non-festival days.
4. To suggest ways to reduce the excessive/ unwanted use of energy during festival celebrations

Methodology:

Sample: For the study the students should select, randomly, a group of households in their locality. A suggested sample size could be 25-40 households.

Tools: Students should prepare the following types of tools under the guidance of their teachers;

1. Check Lists of devices used, during the festivals, which consumes energy and the quantity of material/fuels etc. procured and consumed during festival days.
2. Interview Schedules to collect information from the Heads of households about the practices that require energy for celebrating festivals
3. Collection and analysis of electricity bills for the festival month(s) and non-festival month(s) to find out the difference in the energy consumption, if any.

Techniques:

1. The students should visit the households before the festival and after the festivals to collect relevant data and information.
2. If possible, they should collect the information from the field/sample by observing the households during the festivals.

Analysis and Interpretation of the Data:

The data/information so collected should be analysed in view of the objectives of the study and it should be interpreted to arrive at conclusions.

Expected outcome:

1. Suggestion of Eco-friendly efforts/measures to be taken up by the society while celebrating the festivals
2. Awareness levels of public about energy saving techniques particularly for celebrating festivals
3. Examining people's sensitivity towards energy conservation while celebrating festivals

Project – V. Common transport facilities to minimize energy inputs and its social impacts

Introduction:

Human beings are mobile entities and movement from one place to the other is a basic human requirement. We use energy to move from place to place. Before the advent of the modern transport means, people used to walk, ride bi-cycle or go by pull rickshaw or animal pull carts. The use of human and animal muscle power was utilized extensively during those days.

At present the dominant energy sources used for transportation is the fossil fuel or electricity. It is noteworthy that in the absence of readily available public transportation system, people take resort to private transportation system. Relying more and more on private transportation increases the consumption level of energy for transportation. Moreover, such individualistic approach of movement isolates the individual from society, reducing the social connectivity. Adaptation of public transportation system helps not only reducing the overall energy consumption but also promotes social connectivity irrespective of class creed and caste.

The idea of this project is to see how a good public transport system can impact the economic growth of a society, equity, social harmony apart from reducing energy consumption.

Objectives:

The objective of this project is to –

1. Assess the change in means of transport in a locality over a long period of time and the associated energy consumption pattern
2. Observe how the modernization of transport helped in economic growth of an area
3. Review people's perception about equity and how common transport can foster harmony in the society

Methodology:

1. Select an area for the study
2. Develop a questionnaire and interview senior citizens in the area about the change in transport system and how it has impacted them
3. Interview common people about their perception of equity and their idea of travelling together
4. If there is a school bus / car pool system in any of the local school, interview some students who come by bus and who come alone and find out their perception about 'friendship', 'togetherness' and 'cooperation'
5. Find out the fuel consumption of a bus and a personal four wheeler / two wheeler. Calculate the per capita consumption in public transportation system and in private transportation system. Compare the results.

Expected outcome:

1. Children will understand how muscle power has been gradually taken over by the modern conventional energy forms
2. Children will understand the impact of improved transport on the local economy
3. Children will understand the concept of 'equity' and value of 'togetherness'

Extension/variation:

1. Similar projects may be carried out for common facilities in a village/ locality like a common agriculture facilitation centre where all implements are commonly bought and shared or a common biogas plant or a public toilet etc.

2.3.3.5. Suggestive project idea:

i. Assessing livestock value from energy perspective

ii. Innovative energy efficient stoves to utilise locally available bio-residues

iii. Carbon sequestration through community initiatives

iv. Comparison of animal draught power with machines

v. An investigation about the impact of energy availability on the change on lifestyle of the people

vi. Traditional practice of backyard farming of the non-timber firewood species

vii. Experimental study on conscious reduction in energy use in the household

SUB-THEME: IV - ENERGY AND ENVIRONMENT :

2.3.4. Energy and Environment

Energy is a basic necessity for survival and a critical factor affecting economic development. The production and consumption of energy places a wide range of pressures on the environment and on public health. Energy-related greenhouse gas (GHG) emissions remain dominant, accounting for 80 % of the total emissions, with the largest emitting sector being electricity and heat production, followed by transport.

The impact of energy on environment can be dealt at five levels: Production, Processing, Transmission, Consumption and Disposal. Energy production, let it be hydel, thermal, nuclear, fossil fuel, biomass or non conventional, has some impact on environment. Oil refineries pump a large quantity of GHS into the atmosphere. The high voltage transmission line and petroleum transmission pipes cause some mishaps in the environment. The greatest quantity of pollutants are emitted during the consumption of energy and fuels. The consumption of energy in industry, health care, cooking, agriculture, entertainment, housing, transportation, communication and in domestic domains have direct or indirect far reaching impact on life supporting systems like air, water, land and ecosystems like forests, wetlands, rivers, water sources, and biodiversity at large.

Beginning of agriculture and industrial revolution are considered as landmarks in human civilization. During the progress of civilization the demand on energy also increased. Energy consumption rate is considered an indicator of standard of living and development index of a country.

Coal was the source of energy to the early industries. The automobile explosion paved way for the drilling of more fossil fuel, ultimately contributing to global warming and climate change. Hydel energy is mainly at the expense of forest and other natural ecosystems and the livelihood of ecosystem people. The fly ashes from the coal based thermal power plants pollute air, land and water. There are two main environmental concerns about nuclear power, both mostly with regard to its potential impacts on human health. One involves the highly radioactive products produced by nuclear fission inside power reactors. The other is the disposal of nuclear waste. Safe disposal of nuclear plants whose life span is expired is still a question.

Renewable energy technologies usually have less environmental impacts than fossil fuel, although some concerns exist with respect to the environmental sustainability of particular types of biofuels. About half of the world's households use solid fuels (biomass and coal) for cooking and heating in simple devices that produce large amounts of air pollution that is probably responsible for 4–5 percent of the global burden of diseases.

The chief ecosystem impacts relate to charcoal production and fuel wood harvesting. The negative impact of fuel collection on the local environment is also quite well known.

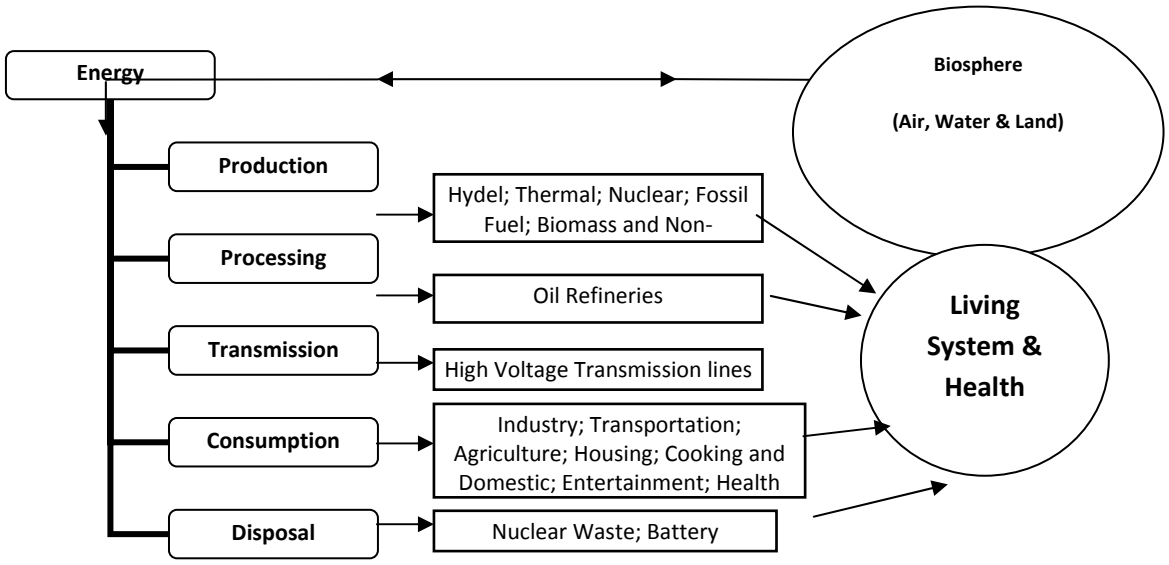
In India nearly 80 percent of rural domestic energy needs are derived from biomass. Typically, biomass fuels such as fuel wood, dung, or crop residues are burned in traditional stoves, which are highly inefficient and harmful to health.

Diesel-fuelled vehicles, which are more prominent in developing countries, pose a growing challenge for urban health. At the global scale, energy systems account for two-third increase in human-generated greenhouse gases. The pre-industrial concentration of carbon dioxide in the atmosphere was estimated to be 280 ppm by volume. At present it has gone up to 392 ppm. More than 190 nations have signed and approved the Kyoto Protocol which is aimed at achieving the goal of stabilisation of green house gases concentration in the atmosphere at a level that would prevent dangerous anthropogenic

interference in the climatic system. Taking a long-term perspective, it is also important to consider the potential impact of climate change on energy production and consumption.

Thus energy use is the human activity most closely linked to potential climate change. In this context the question is how to develop sustainability and maintain the quality of life for a growing population with higher standards of living.

2.3.4.1. Framework



Story from the field

Silent Valley- a success story

Silent Valley is a tropical rain forest, about 90 square kilometers, in the Western Ghats, on the south -western flank of the Nilgiris, in Kerala. There was a proposal from the Kerala State Electricity Board for constructing a large dam across river Kunthi which originates from the valley, for power generation. There is no human habitation in the Silent Valley or in its immediate vicinity. The move to construct the dam was intensified in the mid 1970s. Many enlightened environmentalists in the state and also from the country started voicing against destroying a prime evergreen forest ecosystem in the name of electricity. Soon it became a movement – the Save Silent Valley Movement. India's Great ornithologist Salim Ali also was there in the forefront. They argued that power can be generated in many ways, but if the rain forest is destroyed once will be lost for ever. Silent Valley and nearby forests supported a good population of endemic Lion Tailed Macaque (*Macacca silenus*), which has been listed as "Endangered" by the IUCN. At last in 1984 Prime Minister Smt. Indira Gandhi decided to abandon the project on ecological reasons and the area was declared a national park. On 7th September 1985, Silent Valley national park was formally inaugurated by Rajiv Gandhi, the then Prime Minister of India.

2.3.4.2. Model Project

Project –I. Environmental impact of large Coal based Thermal Power Plants

Background:

The large thermal plants exhaust a large quantity of fly ash to the surroundings. This is found to be having impact on the ecosystem and human health in the vicinity. Knowledge on the impact of such projects will help us plan better and mitigate the problems.

Objective

- Impact assessment of fly ash and other pollutants on human health
- To analyse the impact of pollutants to the local ecosystems
- To study the impact of pollutants at different distance zones in the locality

Methodology:

1. **Back ground information on the power plant**
    - The year of installation
    - Capacity
    - How much fuel is used per day during the operation
    - The approximate quantity of fly ash and other pollutants generated per unit time while operation
    - How much water is used for the operation and source of the water
    - The method of disposal of fly ash and pollutants
2. **Collection of information on the impacts on environment**
    - First a rough map of the area with the power plant in the center and the human habitations and other ecosystems in the surrounding area
    - Two or three circles around the power plant should be determined at various radii say, with in 1 km, between 1 and 3 km, between 3 and 5 km.
    - Collect direct information on health problems if any by a standard survey method from the households within the selected circle.
    - Here the student will have to probe from the elders incidents of lung, skin and other health problems before and after the installation of the plant.
    - The information thus collected can be substantiated by studying the records in the nearby health centre and hospitals.
    - Interviews with doctors and other health workers in the vicinity is to be conducted to assess the health status of the people living at various distances from the plant.
    - Surface and ground water quality are to be assessed in terms of colour, solids, pH etc.

Outcome

- The student will be getting an idea on the impact of large coal based power plants on environment and on human health and the living systems.
- By taking samples at different distances from the plant the distribution of the pollutants in the environment and the impact at different zones can be assessed.
- This will help in understanding the probable impacts of any such large installation in the populated areas.

Project -II. The impact of deposition of suspended particles on photosynthesis

Background:

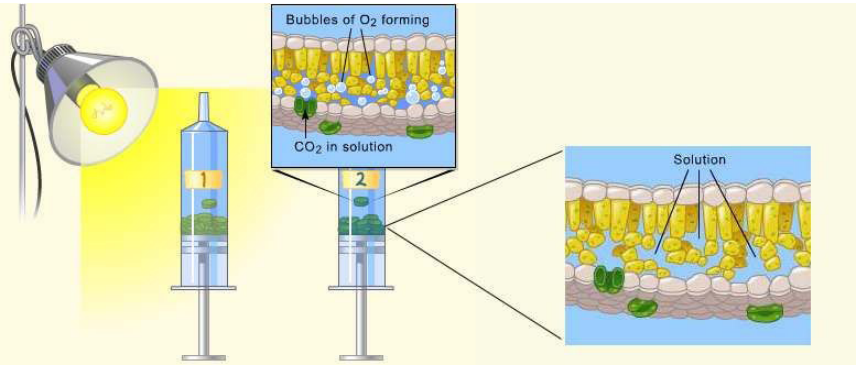
The suspended particles generated from the industries and big thermal power plants get settled on the surface of leaves blocking the sunlight and stomata openings. This will have an impact on the capacity of plants in fixing of solar energy. Plants being the primary producers all the units in the food chain, the whole ecosystem will be adversely affected.

Objective:

- To find out the impact of solid deposition on foliages on the rate of photosynthesis

Methodology:

- Potted plants or plants in the garden or in natural condition the vicinity can be used for experiment.
- The plants should be in the out door in convenient places.
- The leaves of one group of plants should be washed twice in the morning and in the afternoon.
- The other group of plants of the same species are kept in similar condition. Leaves are left as such with the natural dust deposits on them.
- The photosynthetic ability of the plants may be assessed by Floating Leaf Disk method as described by Brad Williamson as follows:



["The Floating Leaf Disk Assay for Investigating Photosynthesis (Exploring Life Community), http://www.elbiology.com/labtools/contact.html (accessed, May 03, 2012).]

- The quantity of starch fixed in both group of plants can also be compared periodically by appropriate methods.

Outcome:

- The atmosphere in the vicinity of large industries like power plants, cement factories and coal mines is always polluted with suspended dust particles. The experiment will give insight in to the impact of the dust deposited on the leaves on the rate of photosynthesis.
- Less photosynthesis means less fixing of carbon by the plants.
- We now speak about global warming mainly because of the increase of carbon dioxide in the atmosphere due to various anthropogenic activities.

- On the land, plants are the carbon sinks helping in mitigating the global warming. So less photosynthesis can contribute more to global warming.
- The out come of the experiment will help the students in understanding the importance of trees in fixing atmospheric carbon and the role of forests as a carbon sink.

Project –III. The energetics of the human driven cycle rickshaws

Back ground:

Even in the metros in India we can see many human driven cycle rikshaws transporting commuters and goods. It would be worth analysing the efficiency and benefits of such rickshaws in terms of energetics and their contribution in mitigating environment pollution. It is sure that these people who work for a livelihood and unknowingly contribute to a great environmental cause should be rewarded with the dividends from some green funds. Most of the people bargain for a cheaper ride with these people. Such a bargaining is usually not made with the motorised rickshaws and taxis. If at all we try to begin a bargain suddenly we are silenced by putting forth the periodic hike in the petroleum fuel and spare parts price. Here we pay more money and also cause to contribute to global warming.

Objective

- To assess the energetics of the human drawn cycle rickshaws
- To assess the contribution of certain strata of people in mitigating the global warming

Methodology:

- To begin with it is better to gather information on the number of cycle rickshaws operating in the proposed area of work.
- In large towns and metros the students can target a particular locality and later extrapolate the result for the entire town.
- It is better to befriend with the rickshaw peddlers/pullers and gather information on the average distance they travel every day/ every week by a structured questionnaire method.
- The student can calculate the quantity and cost of the fuel for riding similar distances in motorised rickshaws.
- From the quantity of fuel that would have been used for these travels in rickshaws using fuels, the environment cost also can be calculated in terms of carbon dioxide and other pollutants.
- Extrapolation of the result will give an indication on the energetics of travel in the entire town or metros and the contribution of the people driving the rickshaws.

Out come:

- The result generated by way of this project will give the student an idea on the energetics of the travels in motorised rickshaws/ vehicles and other vehicles.
- It is better to understand that the people at the lower strata of the society contribute to the cause of environment protection during their livelihood processes.

Project -IV. Use of bio-resources as fuel in the kitchen and the impacts on health of women

Introduction:

Human beings need tremendous amount of energy for their day to day life. One of the main household energy requirements is the fuel for cooking. The cooking energy depends to a large extent on the locally available bio-resources. Due to inefficient device and choolhas the fuels are partially burnt and produce more smoke and less energy. The women who are continually exposed to noxious gases in the poorly ventilated kitchen suffer from various health problems. This project highlights the importance of need of efficient chullahs and devices that will safe guard the health of women.

Objective:

To explore the traditional use of bio-resources as cooking fuel and the probable impact on the health of women

Methods:

i. Select a study site in the vicinity

ii. Questionnaire may be developed and survey can be done to understand the cooking device used in the households and the health problems suffered by the women.

iii. The records in the local health centres and hospitals may be verified for further information and the general trend in the village. Additional information may be collected from the doctors in the local hospitals.

iv. Look for any correlation between the health problems and the energy devices in the kitchen

v. Suggestions may be made for minimising the health hazards in the kitchen and the probable modifications in the devices.

Expected outcome

- Understanding the correlation between the energy sources, efficiency of the devices in the kitchen and the probable health hazards.
- Enabling the children to suggest more energy efficient type of chullahs and saving of fuel wood safe guarding the healthy environment in the households.
- Saving fuel by way of efficient devices will safe guard the bio-resources in the vicinity

2.3.4.3. Suggestive project idea

- Environment impact of power plants -fly ash and the probable impact on biodiversity and human health
- Automobile pollution- impact on human health- Sufficient samples can be drawn from Traffic police and auto drivers in the urban areas who had at least 10 year exposure to urban exhaust ridden environment. The pollution status can be assessed by some simple methodologies. The medical record and health history of the selected human samples can be looked into with their permission and cooperation. Can be analysed for any possible correlation.
- Impact of hydel dams on the local environment, ecosystem, biodiversity and local tribal community

- Environmental impact assessment of a proposed hydel or any other power project on the local ecosystem and communities
- Kitchen Smoke – In large majority of houses in the rural India fire wood or coal are used in poorly ventilated kitchens. Continuous exposure to CO and other pollutants in the kitchen can result in some kind of health problems among the house wives and small children getting exposed to such noxious gases in poorly ventilated environment.
- Pollution of the aquatic bodies by the water disposed off from the thermal plants
- Animals dead on the power lines: many animals are electrocuted in the rural and urban areas. An analysis can be made on such incidents and suggestions can be given to mitigate such mishaps
- Insects congregating around lights and probable impact on its population
- Congregation of insects around lights and congregation of predators like geckos and probable impacts
- Impact of wind generators of birds and other animals: Though a devise for non conventional energy there are reports how with the blades of wind turbines are causing death of birds, including the migrants.
- Impact of pollution from the coal mining areas on the drinking and irrigation water
- Impact of sulphur and dust accumulation on agriculture in the neighbourhood of mining areas.
- Energy consumption in the brick industries- firewood utilisation and probable impacts
- Fire wood collection and probable impact on forest and biodiversity
- Photosynthesis – in dust polluted environment and dust free environment.
- Agriculture- energy utilisation in different agriculture practices and its impacts
- Energy utilisation in different irrigation practices and efficiency of the system
- Energy in land preparation, harvesting, transportation and processing and cost benefit analysis and probable alternate ways.
- Energy efficiency of food in terms of energy consumption and energy yield
- Energetics of human driven rickshaws
- Battery disposal and impact on environment- impact on animals like earth worms and other soil micro-fauna.
- Solid waste – probable impact on environment while energy production. A lot of dioxin, sulphur dioxide, carbon monoxide, carbon dioxide and other toxic gases are released into the atmosphere during the process. The students can suggest alternate ways for the disposal of the wastes.

SUB-THEME: V - ENERGY MANAGEMENT AND CONSERVATION:

2.3.5. Energy Management and Conservation

Energy is the driver of growth. International studies on human development indicate that India needs much larger per capita energy consumption to provide better living conditions to its citizens. But such growth has to be balanced and sustainable. Two important concepts here are energy management and conservation.

Planning commission of India has estimated that India has conservation potential at 23% of the total commercial energy generated in the country. India's energy requirement comes from five sectors; agriculture, industry, transport, services and domestic, each having considerable saving potential. For example, energy costs amount to 20 percent of the total production cost of steel in India which is much higher than the international standards. Similarly the energy intensity per unit of food grain production in India is 3 – 4 times higher than that in Japan. Sustainable growth also implies that our energy management and energy conservation measures are eco-friendly and accompanied by minimum pollution, in particular minimum carbon emission. The key concepts of this subtheme are elaborated below.

Energy Management

The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect.

Definition

Energy management is a process that not only manages the energy production from different energy harvesting resources (solar, nuclear, fossil fuel) but also concerns optimal utilization at the consumer devices.

Another comprehensive definition is *"The judicious and effective use of energy to maximize profits (minimize costs) and enhance competitive positions"*

Objective

*The objective of Energy Management is to achieve and maintain optimum energy procurement and utili*sation, throughout the organization and:

- To minimise energy costs / waste without affecting production, comfort and quality To minimise the environmental effects.

Energy Conservation

Energy, irrespective of its form is a scarce commodity and a most valuable resource. However, if we look at the predicted future human population figures and consider the probability that the individual life expectation will increase, we see that energy could, in the future, be in short supply. Unless that supply is increased, it will be a source of friction in human affairs.

Energy Conservation is the deliberate practice or an attempt to save electricity, fuel oil or gas or any other combustible material, to be able to put to additional use for additional productivity without spending any additional resources or money.

Objective

Broadly energy conservation program initiated at micro or macro level will have the following objectives:

a. To reduce the imports of energy and reduce the drain on foreign exchange.

b. To improve exports of manufactured goods (either lower process or increased availability helping sales) or of energy, or both.

c. To reduce environmental pollution per unit of industrial output - as carbon dioxide, smoke, sulphur dioxide, dust, grit or as coal mine discard for example.

What is Energy Conservation?

Energy conservation is achieved when growth of energy consumption is reduced, measured in physical terms. Energy conservation can, therefore, be the result of several processes or developments, such as productivity increase or technological progress.

Energy conservation and Energy Efficiency are separate, but related concepts.

Energy Efficiency

Energy Efficiency is achieved when energy intensity in a specific product, process or area of production or consumption is reduced without effecting output, consumption or comfort levels. Promotion of energy efficiency will contribute to energy conservation and is therefore an integral part of energy conservation promotional policies.

For example, replacing traditional light bulbs with Compact Fluorescent Lamps (CFL) (which use only 1/4th of the energy to same light output). Light Emitting Diode (LED) lamps are also used for the same purpose.

Energy Conservation Opportunities (ECOS)

Opportunities to conserve energy are broadly classified into three categories:

i) Minor ECOs

These are simple, easy to implement, and require less investment implementation time. These may correspond to stopping of leakage points, avoiding careless waste, lapses in housekeeping and maintenance etc.

ii) Medium ECOs

These are more complex, and required additional investment and moderate implementation time. For example, replacement of existing household appliances by new energy efficient ones.

iii) Major ECOs

These provide significant energy saving. They are complex and demand major investment and long implementation periods. For example, replacement or major renovation of old buildings, machineries etc.

Barriers to Energy Conservation

While there is considerable scope for energy conservation in our country, there also exist many barriers to it. For example Psycho – social (people do not like to change: social taboos and traditions), Economic (replacement is often costly).

Energy Audit

Energy Audit is the key aspect of energy conservation and management.

Definition

Energy audit is defined as "The Verification, Monitoring and Analysis of use of energy including submission of Technical Report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption". (Ref: Bureau of Energy Efficiency Guidelines; http://www.beeindia.in/)

- **Energy Accounting**

Energy accounting simply means record of energy used in an establishment for comparison against a budget or another standard of performance.

- **Systematic Approach To Decision Making**

Energy Audit is the key to systematic approach for decision making in the areas of energy management. It attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility. It quantities the energy usage according to its discrete functions.

- **Effective Tool for Energy Management**

Energy Audit is an effective tool in defining and pursuing comprehensive energy management programme. In this field also, the basic functions of management like planning, decision making, organizing and controlling, apply equally as in any other management subject.

- **Ways of Usage of Energy**

Energy Audit will help to understand more about the ways energy and fuel are used in any establishment, and help in identifying the areas where waste can occur and where scope for improvement exists.

- **Construction and Stream Lining**

The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programme which are vital for production and utility activities.

- **Ideas and Feasible Solution**

In general, Energy Audit is the translation of conservation ideas into realities, by blending technically feasible solutions with economic and other organizational considerations within a specified time frame.

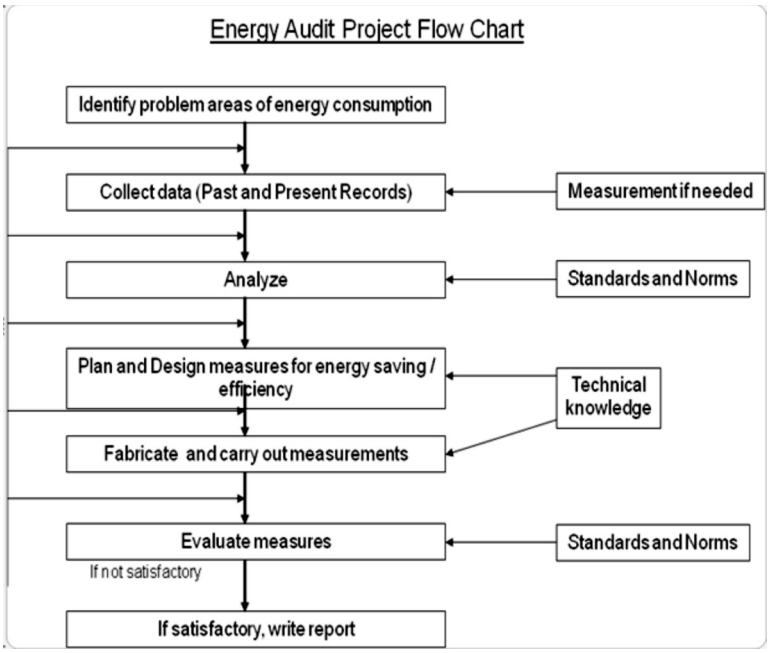
In brief energy audit is an in-depth study of a facility to determine how and where energy is being used or converted from one form to another, to identify opportunities to reduce energy usage, to evaluate the economics and technical practicability of implementing these reductions and to formulate prioritized recommendations for implementing measures to save energy.

Scope of Energy Audit

1. Analyse present consumption and past trends in detail.
2. Review energy uses requirements
3. Consider sub-metering
4. Compare standard consumption to actual
5. Produce an energy balance diagram for the establishment
6. Review existing energy recording systems
7. Compare consumption with other locations, other establishments, previous period, norms.
8. Check capacities and efficiencies of equipment.
9. Consider users' training
10. Review new projects with respect to energy use.

11. Consider changing the management information system to include energy parameters.
12. Develop energy use indices to compare performance/ productivity.
13. Introduce energy use monitoring procedures.
14. Examine and monitor new energy saving techniques.
15. Examine need for energy saving incentives.
16. Consider publicity campaign and incentives.

The flow chart below shows steps in a typical energy audit project



Story from the field

Village level biogas plant as source of cooking fuel

A village in Kolhapur district of South Maharashtra has very effectively implemented this eco-friendly project. It uses gobor from the villege for running a Gobor Gas Plant which supplies cooking fuel to the village. Earlier the villagers used wood as a fuel for cooking. They are now saving 113 Tonnes of wood per year, which means saving forest trees over a large area. The villagers are very proud of their achievement which they have been able to do with the help of a NGO.

Irrigation without expenses for energy

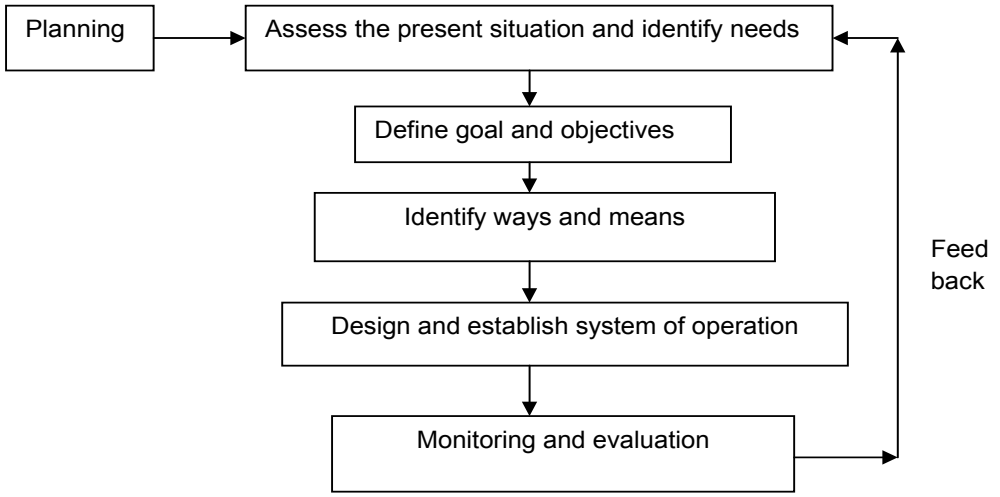
The same village under the guidance of the same NGO has taken up another energy saving project. The village has set up a water reservoir on a hill 4.5 Km. Away. The reservoir supplies water almost round the year. The villagers have laid pipe lines which reach their farms and irrigate them. The water flows from the reservoir to the farms by gravity and no pump is needed for the irrigation. It is estimated that the villagers are saving about 70,000 units (KWHrs.) of electricity annually by this method. In money terms, this is saving of about Rs. 4,00,000/- per year. It is to be noted that, the farms are set up on 48 acres of waste land. So, land which was useless, has been made productive at practically zero recurring cost, an achievement certainly remarkable.

Source: www. Venumadhuri.org

SUB-THEME: VI - ENERGY PLANNING AND MODELLING:

2.3.6. Energy Planning and Modelling

Planning is a process for developing a system and approach to full fill a predefined goal and objectives on the basis of reviewing the present scenario. Planning is meant for betterment. This betterment can be the strengthening resource base, efficient resource utilization and fulfilment of human needs. In case of energy planning it is targeted for fulfilling the present energy needs in an optimum and efficient way so that it may not destroy its ability to fulfil the future needs.



Planning is a process for accomplishing purposes. It is a blue print of growth and a road map of development. It helps in deciding objectives both in quantitative and qualitative terms. It is setting of goals on the basis of objectives and keeping in the resources. A plan can play a vital role in helping to avoid mistakes or recognize hidden opportunities. Planning helps in forecasting the future, makes the future visible to some extent. It bridges between where we are and where we want to go. Planning is looking ahead.

Forecasting is the process of making statements about events whose actual outcomes (typically) have not yet been observed. A commonplace example might be *estimation* for some variable of interest at some specified future date. *Prediction* is a similar, but more general term. Both might refer to formal statistical methods employing *time series, cross-sectional* or *longitudinal* data, or alternatively to less formal judgemental methods. In any case, the data must be up to date in order for the forecast to be as accurate as possible. **Forecasting can be described as predicting what the future *will* look like, whereas planning predicts what the future *should* look like.**

Scientific modelling is the process of generating abstract, *conceptual, graphical* or *mathematical* models of an event. Science offers a growing collection of *methods*, techniques and *theory* about all kinds of specialized scientific modelling. Modelling is an

A scientific model brings out the simplified pattern out of complex data collected, analysed and interpreted in a study. This sub-theme differs from the rest of the sub-themes by bringing out the general concept and future predictions in a more abstract form. Without this specific generalization, the concerned project may become part of the other sub-themes. Please note that planning and modelling processes are completely different from making physical or working models of the systems under study. *Model making is discouraged, in principle, in Children's Science Congress at all levels*

essential and inseparable part of all scientific activity, and many scientific disciplines have their own ideas about specific types of modelling. There is an increasing attention for scientific modelling in fields such as of *philosophy of science*, *systems theory*, and *knowledge visualization*. Traditionally, the formal modelling of systems has been via a *mathematical model*, which attempts to find analytical solutions enabling the prediction of the behaviour of the system from a set of parameters and initial conditions.

One application of scientific modelling is the field of "Modelling and Simulation", which has a spectrum of applications which range from concept development and analysis, through experimentation, measurement and verification, to disposal analysis. Projects and programs may use hundreds of different simulations, simulators and model analysis tools.

A simulation brings a model to life and shows how a particular object or phenomenon would behave. Such a simulation can be useful for testing, analysis or training in those cases where real-world systems or concepts can be represented by models.

Energy planning and modelling:

Economic growth of a country is strongly dependent on the availability and access to energy. More than half the population of India does not have access to electricity or any form of commercial energy. Meeting the energy access, challenges and ensuring lifeline supply of clean energy to all, requires planning in capacity building and supply. The challenge is to ensure cost-effective energy supply at the same time conforming to norms set for minimizing global warming. Since the energy section involves large gestation lags, long-term planning is essential. The projected energy requirement of the fossil energy source in 2030 is cited below.

Projected Primary Energy Requirement for India, 2030

(All in Mtoe)

Fuel	Range of Requirements	Assumed Domestic Production	Range of Imports#	Import (%)
Coal including lignite	632–1022	560	72–462	11–45
Oil	350–486	35	315–451	90–93
Natural gas including coal bed methane (CBM)	100–197	100	0–97	0–49
Total commercial primary energy	1351–1702	–	387–1010	29–59

According to planning commission of India, the country needs to increase its primary energy supply by 3 to 4 times, and electricity generation capacity by 5 to 6 times, if it is to meet the energy needs of all its citizens by 2032 and maintain an 8 % GDP growth rate. Despite a continuous increase in total installed capacity, the gap between supply and demand continues to increase. The underlying reason for such a demand is a growing population, urbanisation, industrial production, and income.

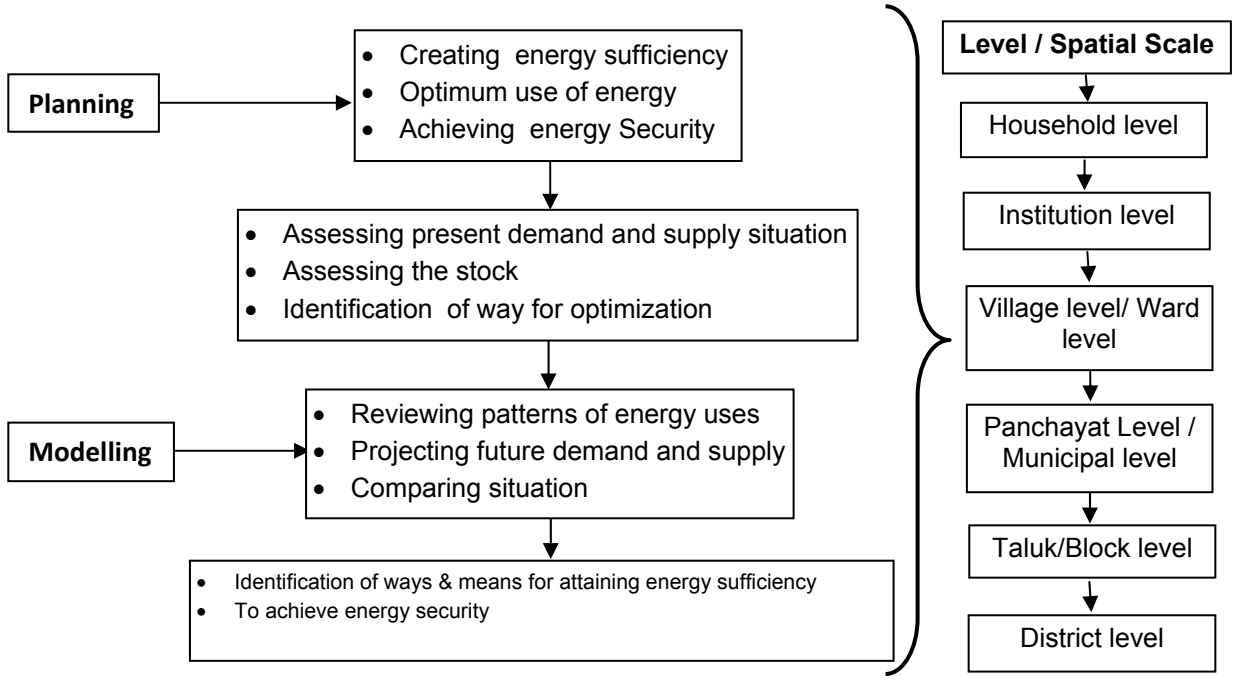
As far as India is concerned, coal will remain the major energy resource. Coal demand in 2011-12 is projected to be 731.1 million tonnes, whereas the projected domestic availability is only 680 million Tonnes. So, there is a shortage of 51.1 million Tonnes for 2011-12 even in the projected scale. The energy demand-supply gap (peak) in 2009, 2009 and 2011 were 11.7%, 12% and 13.4%, respectively. The distribution of primary commercial energy resources in the country is quite skewed. 70% of the total coal reserves is concentrated in eastern India, whereas the western part accounts for over 70% of the hydrocarbon reserves. Similarly the north has more than 70% of the total hydro potential. This leaves the south with only 6% of the total coal reserves and 10% of the total hydro potential. The above data summarises the need to plan the augmentation

of renewable energy resources and strategies for effective distribution of energy to the entire populace. With energy saving potential of 25%, 30, 20%, 20%, 20% and 23% in industrial, agricultural, domestic, commercial, transport, and other sectors, respectively, there is plenty of scope for planning.

For India there is a need for integrated energy planning. This means that at a particular place we must have multiple energy sources and these sources can be used depending upon the particular requirement i.e., for low grade work high grade energy should not be used. Hence there is need of integrated energy planning and for that appropriate models are required and in these models renewable energy sources will play a very vital role. Hence we need to explore renewable energy options at all levels.

The need and relevance of energy forecasting is hence obvious. .Various new tools and methods for forecasting have been developed. In the past, straight-line extrapolations of historical energy consumption trends served well. However, with the onset of inflation and rapidly rising energy prices, emergence of alternative fuels and technologies (in energy supply and end-use), changes in lifestyles, institutional changes etc, it has become imperative to use modelling techniques which capture the effect of factors such as prices, income, population, technology and other economic, demographic, policy and technological variables. The ethical pressure to use more of renewable and green energy has further complicated the prediction process. There is an urgent need for precision in the demand forecasts. In the past, the world over, an underestimate was usually attended to by setting up turbine generator plants fired by cheap oil or gas, since they could be set up in a short period of time with relatively small investment. On the other hand, overestimate was corrected by demand growth. Short-term demand forecasting also plays a role in the process of regulation. A precise estimate of demand is important for the purpose of setting tariffs. A detailed consumer category-wise consumption forecast helps in the determination of a just and reasonable tariff structure wherein no consumer pays less than the cost incurred by the utility for supplying the power.

2.3.6.1. Framework



2.3.6.2. Model Project

Project-I. : Micro-level energy planning and modelling – start from your school

At micro-level, which comprise of your home, classroom, school, village or the likes, you can take up projects on energy planning and modelling. But before venturing into this let us understand the reason for undertaking it. Applications of energy are varied and for same application, different energies can be utilized, thus at the first step we need to understand energy services. Say for example, if drying clothes is an objective, it can be achieved by electricity (dryer in washing machine) or sunlight (spreading under the sun). So we need to identify the application and options available for energy services. In short, planning is nothing but matching the need with sources available for optimization.

An exercise to be carried out at your school

Children like you who tried their hands on such ideas, not only developed the models but won the laurels at national and international levels.

Electricity production at Sabarimala

Sabarimala, a pilgrimage site in Kerala, is thronged by around ten million devotees who offer coconut filled with clarified butter (ghee) which is placed in the burning fire. The continuous fire burning for almost three months period generates a lot of heat energy, which if is trapped and utilized for steam generation; enormous amount of electricity can be produced thereby to take care for the requirements for festival period.

Self-cooling of CPU

CPU, which gets heated with continuous use of the computer, if is covered with jacket carrying water, the water gets condensed and in turn keep the CPU cool.

1. Identify any one key area which you intend to plan for, let us say, fuel consumption.
2. We know that students reach school either walking, cycling, by school bus, public transport or their own vehicles. Now fuel is being consumed while you and / or your friends are being dropped and / or picked up from the school. Since vehicles are not only guzzlers of fuel but also loads the environment with pollution, which necessitates planning for optimal utilization of energy resources, and this can be done in the following way;
3. To begin with you need to collect some basic information like;
   a. Number of students in your class / school
   b. Number of students coming to school by different modes (i) walking, (ii) cycling, (iii) two wheeler, (iv) four wheeler, (v) shared vehicle, (vi) school bus, (vii) public transport, or (viii) others
   c. For two and four wheelers used, how much is the mileage given by the vehicle (km/litre) and how many trips are made by the vehicle (it would be 4 if dropped and picked up by someone and 2 if vehicles are self-driven
   d. Also gather information about the distance of their residence from the school
   e. Depict the data graphically and analyse.
4. Analysis of data would include fuel consumption by two and four wheelers used on daily basis. This would provide you with an idea about level to which fuel can be

conserved. In addition, how much level of air and sound pollution (carbon dioxide load and decibel levels) is added to the environment.

5. Next step is to identify options available, say for example switching to walking, cycling, school bus or public transport or any other idea that you have (like car pool, motorized bicycle)

Continuing with the same idea let us further expand and find out how energy modelling can be done?

We have understood that the present trend is to use vehicles including self-driven, which speaks of the pattern for future. Presuming that in times to come everyone would be driving motorized vehicles (e.g., motorized bicycle) to reach school let us develop a model for the same.

Issues related to such vehicles are needed to be identified; charging of batteries of these vehicles being the most important of the all. Can we tap solar energy for this purpose? If yes, where can we install the charging units, at home or at school? How many hours we are at school, and can that period be utilized for charging the vehicles?, If yes, then where and how many solar panels are to be installed, how much charging is required for one vehicle, presuming 10% of the students switch over to such vehicles, what would be total requirement in your school? Go on working with open ended questions and at the end you would come up with certain model which would indeed be a cost-effective and eco-friendly solution to the problem you had identified at the beginning.

Project-II.: Planning for energy-efficient buildings

At present the buildings are using a lot of energy, even in the day when sun is there the buildings are designed in such a way that we need to switch on the lights and this results in wastage of energy. The buildings also require a lot of cooling for comfort. If the buildings are designed for north south orientation, glare free daylight and with appropriate shading devices this would reduce a lot of energy requirement in the buildings. If the predominant wind direction is also taken into account while planning for buildings then this would reduce a lot of cooling requirement in the buildings. If the building walls are properly insulated this would reduce a lot of cooling requirements in the buildings.

Each and every building should be a hub of innovation and energy efficient practices. The building should be aesthetically designed with several features of passive solar design, energy-efficiency and water and waste management systems. Following is the detailed outline of the different energy conservation measures that should be taken at any building

- Passive solar design
- Glare-free daylight
- North South orientation
- Minimum windows on East West and South facades
- Shading devices on

The predominant wind direction should be taken into account in designing the open space.

Energy-efficient lighting and daylight integration

- Recess mounting luminaire fitted with CFL for task lighting.

- Surface mounted single/twin horizontal mounting CFL downlighter for task lighting and common areas.
- High lumen output and controlled light distribution
- Fitted with mirror optics reflectors and batwing louvers for glare-free uniform illumination
- Energy saving electronic ballast should be used
- Lighting load reduced can be reduced from 2 W/sqft to 1 W/sqft
- Where daylight is available, fixtures fitted with continuous dimming electronic ballast These fixtures controlled by light sensors
- In areas with non-uniform illumination, occupancy sensors should be installed
- Overall energy-saving potential is 70%

Thermal Insulation of Walls

Use of efficient double glazing window units helps significantly reduce the heat gained through window glazing in the summers and the heat lost in the winters without compromising on the day lighting integration and the levels of visual comfort. The walls that are exposed to the harsh solar rays have a stone cladding which is fixed to the wall by channels. The air gap between the wall and the stone cladding by itself acts as an insulation layer. On the facades rock wool insulation is also provided in the wall. Energy efficiency is further proposed to be enhanced by insulation in the roof slab

The Campus should be equipped with three types of cooling systems;

The variable refrigerant system Volume (VRS) system.

This modern type of Air conditioning system which is similar to a split AC is highly efficient under partial loading conditions and beneficial to areas with varying occupancy. It allows customized control of individual zones, eliminating the use of chilled water piping, ducting and piping room.

Earth Air Tunnel (EAT)

The EAT can be used in rooms uses the heat sink property of the earth to maintain comfortable temperatures inside the building. The air that passes through the buried pipes gets cooled in summer and heated in winter. Depending upon the severity of the climate, supplementary system can be used. This gives energy saving of approximately 50% as compare to conventional system.

Thermal mass Storage

Thermal mass storage involves storing energy when available and using when required. Here cooling of thermal mass is done during night. This cool thermal mass is used to cool air in day time. This system gives an energy saving of almost 40%.

Water Management

- Buildings in the campus should be provided with low-flow fixtures such as dual flush toilets and sensor taps
- This would result in 25% savings in water use

Waste Water management

- Treatment of waste water generated from the by biological process using a combination of micro-organisms and bio-media filter

- Low area requirement for this treatment plant
- Treated water meets the prescribed standards for landscape irrigation
- Very low energy consumption for operation of the treatment plant

Rain Water harvesting

- Rainwater run-off from roof and the site will be used for recharge of aquifer through
- Enhance the sustainable yield in areas where over-development has depleted the aquifer
- Conservation and storage of excess surface water for future requirements
- Improve the quality of existing groundwater through dilution

Project-III. : Modelling grey water recycling in a colony

Factors such as growing population, decreasing quality of water resulting from pollution, and augmenting requirement of expanding industries and agriculture all lead to increasing demand for drinking water. It is estimated that one third of the world's population will suffer from chronic water shortage by the year 2025. India has already started facing impending crisis, most visible in the cities. The receding water level in supply sources also result in the shortage of water. On top of it the limited supply hours amplify the scarcity effect of water.

Under these circumstances one needs to plan for optimizing the utilization of the precious commodity - water. There are several ways by which we can plan for the conservation of this nature's gift and one of which is recycling. Again, recycling could be achieved through various means and one of which is recycling of grey water. Grey water, the water drained out from our bathrooms and kitchen, is being wasted in enormous amounts every day, by each household.

Before you plan to design a model for grey water recycling in your locality or colony, you need to collect some basic information, including;

1. No. of houses
2. No. of households
3. Amount of water consumed per day (from monthly water bill of individual house or entire building as the case may be)
4. No. of vehicles of the residents
5. Amount of water used for washing the vehicles and frequency (daily, alternate days, weekly)
6. Presence of garden in the colony or locality
7. Duration and frequency for which the park is watered
8. Amount of water used up in watering the garden

Based on this information and with the help of certain standards available, calculate amount of water being drained out as grey water from bathrooms and kitchen in the colony. Now add the amount of water being used up by washing of vehicles and watering the garden area. Can you make a plan for your colony or locality on these facts and figures, wherein grey water if recycled can be used for washing of vehicles, watering of the garden, and in addition, provided for flushing purpose to the toilets in every house.

Projection for optimal utilization and conservation of water would not only cheer you up but also ensure the smile on the faces of future generation.

Project IV. : Assessing present energy usage and projection for future requirement

Now let us consider your village or locality, wherein we would explore usage of energy and based on which we would try to project future requirements. To begin with, we would find out and collect following information on different applications and types of energy used;

1. Total energy used for cooking
   a. No. of LPG cylinders required for a month
   b. Total weight of fuel woods required
   c. Other sources used like electricity for heating (total wattage /1000 * number of hours used per day), kerosene, charcoal etc.
2. Total energy used for other types of heating
3. Total energy required for lighting like electricity, kerosene or other types of lamps used
4. Total fuel consumed for travelling including daily usage like going to school/office etc. and occasional travelling
5. Total energy used for agriculture, may be in the homestead for watering, ploughing and also the man-days used.
6. Total energy used for entertainment like TV, music systems etc. or AC.

After summing the energy used for different purposes, divide the total by the number of members of each of the sample household of each group. The average of the total energy utilized for each group would give us the per capita energy requirement.

Based on the trend of rise in population, the data for which can be obtained from the census information or competent authorities, of previous three decades, we can project the future population of the locality. This would give us the total energy requirement for an area. Likewise, we can also assess the energy requirement for different applications; like cooking, lighting, agriculture, etc.

2.3.6.3. Suggestive Project Idea

i. Assessing the energy (solar, wind and biomass) generation potential of any particular society or village
ii. Economic projections for energy generation from local energy resources
iii. Model for optimization of energy usage
iv. Planning for low energy buildings
v. Energy planning for transport sector
vi. Modelling of windows for optimal utilization of energy
vii. Modelling of home/office interiors for efficient power consumption
viii. Modelling of energy efficient cooking systems

Project idea put forwarded by the participants in the national orientation workshop - (Project title only)

1. Advantage of public transportation – an evaluation
2. Awareness on energy conservation
3. Assessment of energy consumption school campus
4. Assessment of electricity loss in an human habitat area
5. Assessment energy consumption pattern in preparation of different type of food
6. Evaluation of energy requirement of different cooking device and identification of energy efficient devices
7. Energy audit in home
8. Energy audit of residential school
9. Assessing energy potentialities of different biomass
10. Assessing pattern of solar energy over an area
11. Assessing energy potentialities of different plant parts
12. Assessing wind energy potentialities in a coastal area
13. Assessing energy potentialities of cow dung cake
14. Estimation of energy consumption in irrigation using water pump
15. Identification different cooking fuel and evaluating their energy efficiency
16. Assessing intensity of solar radiation
17. Assessing electricity consumption in a locality
18. Assessing cold energy from fire fly
19. Assessing potentialities of zero energy refrigeration system uses in traditional society
20. Harnessing energy through microbial fuel cell using mud of lake/pond/tank/river
21. Improvisation of traditional chulla for multipurpose uses
22. Studies on use of firewood as fuel and its impact on indoor pollution
23. Impact electricity transmission line and street light on flora and fauna of a locality
24. Impact of raw coal transportation on human life
25. Traffic jam, energy consumption and pollution
26. Assessing impact of firewood collection on flora and fauna of a locality

27. Assessing energy potentialities and scope of improvisation of traditional water mill
28. Identification non-edible oil bearing seeds and its energy potentialities
29. Assessing biomass waste generated from agricultural practices and its energy potentialities
30. Assessing cow dung availability of village and estimating its energy potentialities
31. Comparing efficiency of cooling and heating of houses made of different building material
32. Housing orientation and its impact on indoor light availability and heating and cooling conditions
33. Assessing the impact of surrounding environmental situation of houses and its impact on indoor housing environment with special reference to energy issues
34. Assessing the role of landscape in environmental balance and energy conservation
35. Study on energy efficient habitat planning
36. Modeling of energy efficient irrigation system
37. Evaluation of energy efficiency of different cooking practices
38. Assessing access to different infrastructure of services and its impact on energy consumption for transportation and planning for improvisation
39. Mimicking nature and designing energy efficient system/device
40. Evaluation energy efficiency of different traditional devices use for lighting
41. Assessing energy dynamics of traditional and mechanized agricultural practices
42. Energy audit of rural industries/cottage industries of a locality
43. Driving habit and its impact on fuel consumption
44. Behavioural aspects of using electronic gadgets and its impact on energy consumption
45. Planning for energy plantation for household energy security

Annexure-1

Tips for Child Scientists for doing / writing CSC Projects

Project Work:

- Go through this Activity Guide throughly.
- Identify a local problem and try to correlate with the theme and sub-theme(s).
- Form a group (maximum 5 members including the group leader).
- Take help of a project guide (he/she may be your teacher, expert in the field, ex-child scientist, etc.).
- Draw a rough geographical boundary of problem area.
- Maintain a log-book and enter all your project activities datewise.
- Give a project title and register your name as per Annexure 2 with the district coordinator of your district.
- Collect as much information on the problem as possible.
- Collect field based data through survey (if necessary). Discuss with your guide for designing the survey format.
- Design experiment(s)-field based and / or laboratory based.
- Present the data generated through experimentation and / or survey in a systematic manner and try to correlate.
- Draw conclusion(s) from different information you have generated through the project. Never try to jump into erroneous and quick conclusion without proper scientific validation.
- Never use living objects for your study / experimentation without proper permission from the concerned authority. Avoid handling living objects as far as possible.
- Initiate some actions to address the problem through the findings.
- (NB: Always follow the process - observation, questioning, formulation of hypothesis, testing, collection of data, analysis of data, conclusion or inference)

Report Writing:

- Use A4 size paper
- You can write your report in Kannada or in English
- In the Cover page write the title of the project, yours and your group member's name, guide's name, district and state's name in English / Kannada
- Project report should be hand written.
- Enclose the Form A with the project report in English.
- Write the abstract in about 250 words in English
- Your sequence for writing the report may be cover page, Form A, Abstract, Introduction, Need Statement, Work Plan & Methodology, Results, Data Analysis, Conclusion, Solution to the Problem, Acknowledgement and Reference.
- Total length of the report for lower age group should not exceed 2500 words and that for upper age-group should be 3500 words.
- Prepare four posters / charts for presenting the findings of your project. The size of each of the Posters / Charts should be 55 cm x 70 cm.

Oral Presentation:

- Total time given for presentation at the national level is 8 minutes and 2 minutes for interaction.
- You can use four posters / charts and overhead projector for presentation.
- Your voice should be clear and audible to the last bench in the presentation hall.
- Remember, Oral and Poster Presentations are like advertisement of your work.

Oral presentations will be followed by presentations of your posters / charts in a specially arranged venue.

Annexure-2

ಪ್ರಾಜೆಕ್ಟ್ ವರದಿಯ ಸ್ವರೂಪ
Project Report Format

ರಕ್ಷಾಪುಟ 1 Coverpage 1
ಪ್ರಧಾನ ವಿಷಯ
Main Theme
ಪ್ರಾಜೆಕ್ಟ್ ಶೀರ್ಷಿಕೆ
Title of the project
ತಂಡದ ನಾಯಕ / ನಾಯಕಿಯ ಹೆಸರು
Name of the group leader
ಅಖಿಲ ಕರ್ನಾಟಕ ಮಕ್ಕಳ ವಿಜ್ಞಾನ ಸಮಾವೇಶ 2012
All Karnataka Children's Science Congress 2012

ಪುಟ 2 Page 2

ಪುಟ 3 Page 3
ಪ್ರಾಜೆಕ್ಟ್ ಶೀರ್ಷಿಕೆ
Title of the Project
ಸಾರಾಂಶ
Abstract
500 ಪದಗಳಲ್ಲಿ ಇಂಗ್ಲೀಷ್ / ಕನ್ನಡದಲ್ಲಿ
500 words in English / Kannada

ಪುಟ 4 Page 4
ಪರಿವಿಡಿ Contents
ಕ್ರ.ಸಂ. ವಿಷಯ, ಪುಟ ಸಂ
Sl. No. Subject Page No.
1.
2.
3.
4.

ಪುಟ 5 Page 5
ಪ್ರಾಜೆಕ್ಟ್ ಶೀರ್ಷಿಕೆ
Title of the Project

ಪುಟ 6 Page 6
ವಿವರಣೆ
Description
ವಿಧಾನ ಕ್ರಮ
Methodology

ಪುಟ 7 Page 7
ನಿಮ್ಮ ಸರ್ವೆ / ಪ್ರಯೋಗಗಳಿಂದ ದೊರೆತ ಮಾಹಿತಿ ಕೊಡಿ
Give the data obtained from your survey / experiments

ಪುಟ 8 Page 8
ಮಾಹಿತಿಯ ವಿಶ್ಲೇಷಣೆ
Analysis of Data

ಪುಟ 9 Page 9
ಸಮಸ್ಯೆಗೆ ಪರಿಹಾರಗಳು ನೀವು ಪ್ರಾಜೆಕ್ಟ್ ನಡೆಸುವ ಕ್ಷೇತ್ರದಲ್ಲಿ ಕಾರ್ಯ ಯೋಜನೆಯ ರೂಪಣೆ ಮತ್ತು ಕಾರ್ಯಗತ ಮಾಡುವಿಕೆ
Solutions to the problem, formation & implementation of action plan in your project area

ಪುಟ 10 Page 10
ಜಾಗೃತಿ ಮೂಡಿಸುವ ಕಾರ್ಯತಂತ್ರ, ಅದರ ಪ್ರಭಾವ ಮತ್ತು ಸಮಾಜ ಭಾಗವಹಿಸುವುದು
Awareness Strategy, impact and involvement of Society

ಪುಟ 11 Page 11
ತೀರ್ಮಾನಗಳು
Conclusions

ಪುಟ 12 Page 12
ಸಮಾಜ ಭಾಗವಹಿಸುವುದು
Follow up action

ಪುಟ 13 Page 13
ಕೃತಜ್ಞತೆಗಳು
Acknowledgements

ಪುಟ 14 Page 14
ಆಕರಗಳು
References

Annexure-3

GUIDELINES FOR EVALUATORS

We welcome you to the national movement to link environment to education which provides opportunities to young budding scientists to showcase their talent. To begin with we would like to tell you about this programme, initiated in 1993, for children in the age group of 10 - 17 years. It is open to all - school going or out-of-school children in this age group, belonging to rural as well as urban areas.

National Children's Science Congress (NCSC) provides budding scientists from all over the country a unique opportunity to use their scientific temperament and knowledge to make their own ideas come true. NCSC is held annually from December 27 to 31. After a thorough scrutiny at district and state levels, about 500 children take part in this five day deliberations and funfilled science activities.

Thc basic objectivcs of this program are:

- To provide a forum to the young scientists to pursue their natural curiosity and to whet their thirst for creativity by experimenting on open-ended problems;
- To effect a change in the way science is taught and learnt by relating the learning process to the physical and social environment around of the neighbourhood;
- To encourage children throughout the country to visualise future of the nation and help building a generation of sensitive and responsible citizens;
- To stimulate scientific temperament and learning the Scientific methodology of observation, collection of data, experimentation analysis, arriving at conclusions and presenting findings.

Creativity and the internalization of the method-of-science is given, a major stress. Children learn by problem-solving/ method and thus develop confidence to handle situations in real life. We have to encourage these young minds to dream and develop an urge to find solutions themselves. It is equally important to identify the talented ones and provide them opportunities to pursue their ideas further. Many of these creative participants will become active researchers. Some of them may not opt for science as a career but they will use their skills of logic and experimentation in overcoming problems that they encounter. The effort through NCSC has to continue till major parts of formal science teaching in high school convert to a discovery oriented approach.

The instructions given to children on "How to do a project'" and "How to document it" are enclosed at Annexure 1, 2 and 3 respectively.

We bank on YOU to help us realise this hope and thank you for joining hands with us.

1. Our expectations from judges:

The role of judges at District and State level congresses is very important as inputs given by you always helps children to learn more and improve their work. You are not only a subject expert but have the ability and inclination to understand the children and their capabilities and capacities.

The primary objective of this program Children's Science Congress' is to provide the children an opportunity to learn in a co-operative manner. This is not a competition in the usual sense though due to the screening involved at district and state level, there is bound be a comparison. Innovativeness of the idea and methodology have to be appreciated and valued. All the projects reaching national level are treated at par and the nurturing academic environment helps free exchange of ideas and results. All participants receive citations containing an honest assessment of their efforts under different headings. These are explained later in a particular section of the evaluation criteria.

The bottom line is that each participant should go back not as a dejected but as a motivated, intellectually richer and more confident child. The child may not have succeeded in his effort to find proper solution to the chosen problem but his effort to analyze the problem, formulate the hypothesis, collect data and its analysis for drawing the inference should be logical.

The expression of innovativeness and talent used, his mental and physical skills to scientifically solve an issue bothering him/her, needs proper recognition and guidance from experts working in those areas

2. For deciding the eligibility of participation in Children's Science. Congress the following has to be kept in mind:

- Both school-going as well as non-school-going children are eligible to participate.
- The participation ratio of 1:1 of lower age group / (10 years to 14 years to upper age group (above 14 years and up to 17 years as on 31 December, 2012) is encouraged.
- Students should not have passed class 12th.
- A group can have up to 5 team members. Whether a group is in junior (between 10 & 14 years) or senior (between 14 & 17 years) category is decided by the age of the oldest student of the group. Only one member (group leader) is eligible to represent the group and make presentation. Others can provide assistance in the presentation.
- No child scientist, as team leader, can represent more than once in the Dist., State, National level CSC.
- In case of any dispute it may be referred to the National Coordinator (Acad.) and to the Registration committee.

3. **Theme and Sub themes:** The activities taken up by the children should fall within the theme or subtheme defined for the year. **A copy of the Activity Guide should be provided to you. In case you do not get one please ask district / state coordinator for the same.**

4. Presentation: Each group will make an oral presentation and also submit a project report. The students are encouraged to submit neatly hand written project reports and present their findings in their mother tongue. The abstract can only be in English or Hindi.

4.1 Oral Presentation: The oral presentation should finish within 6 to 8 minutes to be followed by question-answer session for 2 minutes. Each panel may have 3 judges.

- The oral presentation is to basically judge the real value of the project and the child scientist's comprehension of the work done. The attributes to be marked for are given in the annexure. Some times the contribution is more from the guide and other people. The oral presentation gives an opportunity to check that. The weight given to oratory is not much, though, obviously, the one with better communication skill conveys his ideas better.
- In the national event the child scientist is allowed to use OHP, Slide projector and Tape recorder which will be provided at the hall. No computer or Video presentation are allowed.
- Normally not more than 5 colour photographs are encouraged. You may not deduct marks if some one uses too many, while one could do with less but may convey the undesirability of the same if you feel it was not necessary.
- They shouldn't use expensive things in making the models, etc., unless absolutely essential. Please remember that we are not checking their material resourcefulness. We don't prefer one over the other if shown a laser printed file and legible hand-written file.
- It will be appreciated if the child scientist is not disturbed during presentation unless absolutely essential. The question-answer session should be kept at the end. The children/young scientists present should ask questions first. The same person should not be allowed to dominate the questioning. Other adults present should not be allowed to ask questions.
- Judges should ask questions to help them evaluate the attributes specified and should in no way be intimidating. They should be friendly in manners to bring out the best in the child. Many of the child scientists may be coming from remote place with little exposure and may feel nervous.
- Immaterial of how badly (if so) the child has done, there must be something good in the project to be spoken of by the judges at the end. Then you may point out the lacunae or make suggestions. The idea is that the child should go back satisfied that he received attention which his hard work deserved and also some feedback.

4.2 About the File (Project Report):

REPORT LENGTH - The report of junior children (10 to 14 years) is allowed to be within 2000 words and that of the senior ones (Above 14 to 17 years) within 3500 words. They are allowed to write and speak in any language listed in the Constitution.

The group is required to prepare an account of their work and submit it. Different judges (at least 2) will evaluate each report independently. They may call the child scientist for discussion if they wish. The child may present the project orally and then proceed for discussion with the other set of judges. For this, it is essential that list of child scientists and copies of projects should have been made available in those rooms. If you do not find them please ask the evaluation committee convener or me rapporteur attached to the room for a.-ranging these. It's the quality of work and not the paraphernalia which matters. When you assign marks for presentation it is not the quality of typing which is a function of material resources but neatness (which is also possible with neat handwriting) and style of presentation rather

than the quality of paper. file cover or number of colour photographs.

5. The evaluation criteria - The projects presented by the child scientists are to be judged in 2 forms - oral presentation and file. The evaluation will be based on several considerations. At the national level there is no competition. Instead the child scientists will be provided a citation which summarises the standard of their projects under different heading (in some cases judges may like to point out if the work may be extended further if it has sufficient potential). At the district and state level selection of the best projects for the higher level congress becomes necessary. The basic elements which should be taken care of are as follows:

- **Quantum of Work done**
  a) Amount of documentation / Data Collection
  b) Efforts put in testing /experimenting
  c) Meaningful conclusions drawn
- Quality of Data / information - originality/ innovation in
  a) Approach to problem
  b) Innovative element in experimenting/ testing / model or chart
  c) Proper Log book

Originality shown in implementation of conclusions or popularizing the results

- Oral Presentation: language, clarity of expression and ideas
- **File:** Neatness, Clarity, quality of file, log book o Also, there may be comments on -Scope for further work and Overall grading. The points scored against in each attribute will be cumulated.

6. Special Task - We wish to have a record of any major highlights presented by the child scientists. This will be useful not only for record but for several other purposes. So please ask the organizers to provide you with one sharp person who will keep a record of such points during the session. A special orientation with judges is held usually before the CSC.

GUIDELINES FOR MARKING

Given below are the attributes which are important for evaluating a research presentation. The weightage given to them is to give an idea of their inter se importance. For example while marking for project selection, you do not have to mark for relevance to focal theme, local relevance, problem analysis etc. separately but please keep in mind that originality of idea and local relevance of the selected problem weigh more than problem selection or it's relation to the focal theme. These guidelines are being used at national level. It will be appreciated that marking on similar lines is done at district and state level so that quality projects reach at national level and National Children's Science Congress becomes a forum of creative, talented budding scientists.

Common Evaluation Criteria Maximum Marks

1. Originality / relevance of the project idea **10**

- Relevance to focal theme 2
- Local relevance 3
- Problem selection 2
- Originality of the idea 3

2. Presentation **15**

- Project Title Formation 1
- 'Abstract' well written 2
- Problem definition & hypothesis 1
- Relevant (limited) photographs 1
- Logically structured project report 2
- Data presented graphically 2 (charts, bars, graphs)
- Visual aids used properly 1
- Clarity of presentation 2
- Questions answered adequately 3

3. Scientific understanding of the issue **15**

- Identification and understanding of core problem / research questions 5
- Logic adopted in the study confrom to scientific principles 10

4. Data Collection & Analysis **15**

(A) Data Collection **10**

(i) Survey based data

a. Adequate sample size (>50) 2
b. Adequate no. of questions. (>20) 2
c. Questions well designed 2
d. Questionnaire contains full names & address of interviewers 2
e. Questionnaire records the local, time, situations 2

OR

(ii) Observation based data

a. Maintained proper records, logbooks 3
b. Data collected on regular task 2
c. Date, time, place etc. recorded 2
d. Method & accuracy of data recording 3

(B) Data Analysis **5**

a. Categorisation/Classification/ 3
Tabulation structure

b. Sufficient data & correct analysis 2

5. Experimentation/ Scientific study /Validation **15**

a. Data tested/compared with other knowledge 3

b. Any experiment designed & performed 3

c. Innovation in experiment/measurement 4

d. Efforts to quantify 5

6. Problem solving attempt
(for district level CSC projects only) **10**

a. Only suggestion or corrective effort done 3

b. Understood the social connection of the 3
Scientific problem chosen

c. Rational selection of scale of effort 2

d. Implementation effort documented 2

7. Problem solving attempt and followup
(for State and National level CSC projects only) **10**

a. Findings of scientific solution 3

b. Has the message convinced to the community? 2

c. Involved others in solving the problem 2

d. Suggested action plan 3

8. Team Work **10**

e. Proper credit given to team members 3

f. Help taken & credit given to teacher(s) 3

g. Cooperation with others & acknowledgement 2

h. Presenting persistently as I did/We did 2

9. Back ground correction
(for District level CSC projects only) **10**

a. From big city/small town/village 2

b. Type of Schools 3

c. Language/communication factors 2

d. Economic/social status 3

10. Improvement from previous level
(for State and National Level only) **10**

a. Improvements on work done from
district to state level as well as for National level 10

Annexure-4

National Children Science Congress -2013
List of Dist Coordinator and Academic Coordinator

Sl. No.	State Coordinator		State Academic Coordinator
	Shri T.G. Krishnamurthy Raj Urs Govt. High School Anur Post Chikmagaluru Taluk & Dist. Mo : 9448555608 Email : tgkurs@gmail.com		**Shri M.N. Mustoorappa** No.2009/2, Dr. Modi Road M.C. Colony, "A" Block, Davangere – 577 004 Mo : 9448857122 Email : mustoorappa@gmail.com
	District Coordinator		**District Academic Coordinator**
1.	**Bagalkote Dist.** Shri M.G. Hebli Asst. Teacher Basaveshwar High School Kadapatti, Jamakhandi Taluk Bagalkote Dist. Mo : 9731097379		Shri I.H. Nayak Lecturer Husena, No.1349 Near Lingada Katte Hungund Post, Hungund Taluk – 587118 Bagalkote Dist.
2.	**Bengaluru Rural Dist.** Shri C. Ashok Kumar Mahatma Gandhi High School Channarayapattana Devanahalli Taluk Bengaluru Rural Dist. – 562135 Mo : 9535243899		Shri G.R. Narayanaswamy Govt. P.U. College Vishwanathapura Devanahalli Taluk Bengaluru Rural Dist. -562135 Mo : 9448180811
3.	**Bengaluru Urban – South Dist.** Shri G. Venkataswamy Convenor, KRVP Unit Suchitra Balajagth No.36, 9th Main Road Banashankari 2nd Stage Bengaluru – 560 070.		Shri Umashankar Secretary Pavithra Cultural & Academic Weavers Colony, Gottigere Bengaluru – 560 083 Mo : 9449483396
4.	**Bengaluru Urban – North Dist.** Shri Sathish G. Science Teacher R.V. Girls High School 2nd Block, Jayanagar Bengaluru – 560 011 Mo : 9449988207		Shri Surendranath Malkapur No.5, Lakshminarayan Nivas 2nd Cross, M.R. Garden K.E.B. Layout, Sanjaynagar Bengaluru – 560094 Mo : 9590379058

5.	**Belgaum Dist.** Shri S.D. Patil C/o. Director Dr. S.J. Nagalotimath Science Centre Shivabasavanagar, Belgaum – 590 010 Mo ; 9242158785		Smt. H.R. Kulakarni Swadhyaya Vidya Mandir High School Tilakvadi Belgaum. Mo : 9481557170
6.	**Bellary Dist.** Shri Prabhuraj S. Patil Teacher Balakiyara Govt. PU College Hospet Taluk Bellary Dist. Mo : 9480629626		Shri Kottruswamy S.M. Basaveswara Nilaya Lalbahaddur Sastri Layout Kotturu, Kudligi Tq. Bellary Dist. Mo : 9449628680
7.	**Bidar Dist.** Shri Kalal Deviprasad Science Teacher No. 9/8/127, Bhavani Krupa Basavanagar Bidar – 585 403 Mo : 9845605148		Shri Prakash Lakkashetti Lakshmibai Kamathane Girls High School Bidar Mo : 9916268871
8.	**Bijapur Dist.** Shri Sharanu Hirapur Asst. Teacher, Kashinakunti Road Nidagundi, Basavanabagewadi Tq., Bijapur Dist. -586213 Mo : 9945872492 Email : sharunuhirapur@gmail.com		Shri Santosh Kalligudda Asst. Teacher Lakshmi Nivas, D.No.67 Opp. Sangameshwar High School Raghavendra Colony Bijapur – 586 101 Mo : 9480565568
9.	**Chamarajnagar Dist.** Shri M. Bhavanishankar C/o. Mahadevaiah Retd. A.S.I, Maruthi Layout, Housing Board Colony Near Aranya Narsari Chamarajanagar – 571 313 Mo : 9901218600		Shri G.K. Kantharaj Lecturer, 8/180, 'Panchajanya' Devangapet Kollegala-571440 Chamarajnagara Dist. Mo : 9844976767
10.	**Chikkaballapur Dist.** Shri K. Nagaraj Asst. Teacher Dr. H.N. National High School Hosur, Gowribidanur Taluk Chikkaballapur Dist. – 561210 Ph : 08155-285798 Mo : 9243986736		Shri G.N. Ramesh Asst. Teacher Nrusimha Nilaya Kalloodi Post, Gowribidanur Taluk Chikkaballapura – 561208 Mo : 9449728844

11.	**Chikkodi Dist.** Shri R.S. Hebbale Science Teacher Shri Shankaralinga High School Gokak, Belgaum Dist. Mo : 9481325811		Shri Y.M. Sanadi Plot No.19, Mahalingeshwar Nagar Gokak Taluk Belgaum Dist. Mo : 9448636425
12.	**Chikmagalur Dist.** Shri Thyagaraja Lecturer Govt. P.U. College, Mailanahalli Chikmagaluru Taluk & Dist. Mo : 9448341021 E-mail : thyagarajtnd@gmail.com		Shri Phaniraj S. Lecturer, S/o. A.S. Sheshagiri, Retd. Teacher Swarnamba Colony, Kote Kaduru Taluk – 577548 Chikmagaluru Dist. Mo : 9481837530 Email : pani.raju@yahoo.com
13.	**Chitradurga Dist.** Shri H. Manjunath Karnataka Academy of Mathematics Behind L.I.C. Office Challakere – 577522 Chitradurga Dist. Mo : 9448144373		Shri M.D. Lathif Sab Science Teacher Shri Durga High School Near Railway Station Molakalmuru Post, Taluk Chitradurga Dist. – 577535 Mo : 9611293585
14.	**Coorg Dist.** Shri C.S. Suresh Asst. Teacher, Netaji High School Ballamavati, Taluk Madikeri, Dist Coorg. Mo : 9900370842 Ph : 08272-270332 (School Email : sureshcsmadikeri@gmail.com		Shri G. Sriharsha Teacher, High School Section Govt. P.U. College Somavarpet Taluk, Coorg Dist. Mo : 9481431263
15.	**Dakshina Kannada Dist.** Shri H.S. Karunakara Science Teacher Govt. P.U. College Uppinangadi, Puthur Taluk Dakshina Kannada Dist.-574241 Mo : 98800362264		Shri N. Udayakumar Rai Science Teacher Vidyabodhini High School Balila, Sulya Taluk Dakshina Kannada Dist. Mo : 9448548550
16.	**Davangere Dist.** Shri Gurusiddhaswamy Basaveshwara Krupa Behind Jim, 7th Cross Nitavalli, Davangere Mo : 9880531823		Smt. R. Vagdevi Akkamahadevi Girls High School N.R. Road Davangere – 1

17.	**Dharwad Dist.** Shri Lingaraj V. Ramapur Teacher No.33, Sadashivanand Nagar Near Bus Stand, Bhairidevarakrupa Post Taluk Hubli – 580 025, Dharwad Dist. Mo : 9964571330 E-mail : lingaraju78@gmail.com		Smt. Jayashri Indi Govt. Higher Primary School Managundi Taluk & Dist. Dharwad Mo : 9663009163
18.	**Gadag Dist.** Shri S.I. Dindur Asst. Teacher, V.F. Patil High School Rona, Gadag Dist. Mo : 9900236772		Shri Ganji S.S. Asst. Teacher Vidyadana Samithi Girls High School Gadag, Gadag Dist.
19.	**Gulbarga Dist.** Shri Chandrakanth S. Ksheerasagar Teacher, Govt. High School Mugalanagaon, Chittapur Taluk Gulbarga Dist. Mo : 9902838345		Shri Ravi Biradara Govt. High School Desai Kallura, Afzalpur Taluk Gulbarga Dist. Mo : 9886631483
20.	**Hassan Dist.** Shri M.G. Santhosh Kumar Lecturer, Govt. P.U. College Balenahalli, Arasikere Taluk Hassan Dist. Mo : 9964063630		Shri Manjunath M.G. Asst. Teacher S.M.S.N.S. High School Bendekere, Arasikere Taluk Hassan Dist. Mo : 9449630190 Email : manjunath_mg@yahoo.com
21.	**Haveri Dist.** Shri A.H. Kabiinakantimath Teacher S.J.M. Angavikalara Vasati High School Shri Hosamata, Haveri 581 110 Mobile: 9448341695		Shri R.S. Patil Secretary, Science Centre, Haveri Gandhi Grameen Gurukula Hosarithi, Haveri Dist. Ph : 08375-2887536 (Res.) 08375-287725 (School) Mo : 9448867705
22.	**Koppal Dist.** Shri Marishanthaveera Shettar Teacher Gavisiddeswara High School Koppal Dist. Mo : 9449515611		Shri Sranappa Sunkad Asst. Master, Govt. PU College (High school Sec) Hosabandi, Haralapura Tq. & Dist. Koppal Mo : 9964416712

23.	**Kolar Dist.** Smt. Manjula Bheemarao Principal Chinmaya Grameena Vidyalaya Chokkahalli, Medihala Post Kolar Taluk & Dist. Mo : 9448853960		Smt. Beena Asst. Teacher Vivekananda High School Robertson Pet, K.G.F. Kolar Dist. Mo : 9449620051
24.	**Madhugiri Edn. Dist.** Shri M. Gangadharappa Shanthinagar Extn., Pavagada, Tumkur Dist. Ph : 08316-244856 Mo : 9449912918		Shri Katta Narasimha Murthy Head, Near Maremma Temple Roppa, Pavagada Tumkur Dist. Mo : 9448333082
25.	**Mandya Dist.** Shri M.K. Nagaraju Science Teacher Govt. P.U. College (High School Section), Arakere Srirangapatna Taluk, Mandya Dist. Mo : 9844180222		Shri R.G. Mahadevaswamy Teacher Govt. High School, Doddabuhalli Malavalli Taluk Mandya Dist. Mo : 9986837699, 9449373130
26.	**Mysore Dist.** Shri R. Sreenivasan C/o. Director, Mysore Science Centre Maharani Govt. Womens Prashikshana College Campus, Narayanashastri Road Mysore – 570 024 Phone : 0821 – 2444376		Shri R.V. Shankar Head Master Vani Vidya Mandir High School Vidyaranyapuram Mysore – 570008 Mo : 9900503817
27.	**Ramanagar Dist.** Shri T. Swamy Govt. High School Tagachagere, Channapatna Taluk Ramanagar Dist. Mo : 9844049078		Shri C. Rajashekhar Asst. Teacher Govt. P.U. College for Girls Channapatna, Ramanagar Dist. Mo : 9964474189
28.	**Raichur Dist.** Smt. T. Arunakumari D.No.4-8-142 Mangalavarapet Raichur – 584101 Mo : 8105293511 Email : arunagopalellus@gmail.com		Pro. Prabhudeve Kurle No. 1-12-70/2 Opp. Papareddy House Gunj Road Raichuru – 584 102 Mo : 9449433249

29.	**Shimoga Dist.** Shri Lokeshwarappa Asst. Sahyadri High School Rajendranagara, Shimoga Ph : 08182-272482, Mo : 9449472882 Email : lokeshshivapoje@gmail.com		Shri B. Satish Science Teacher St. Jose High School Gadi Koppa, Shimoga Mo : 9951156507
30.	**Sirsi Education Dist.** Shri M. Rajashekhar Asst. Teacher Holirojar School Yallapur, U.K. Dist. Ph : 08419-262093 (School) 08419-238423 (Res.) Mo : 9449787901		Smt. Markandeya Sharadamba High School Bairumbe, Sirsi Taluk U.K. Dist Ph : 08384-279312 (Res.) 279392 (School)
31.	**Tumkur South Dist.** Shri P. Prasad Co-Secretary Tumkur Science Centre Balabhavan, M.G. Road Tumkur Mo ; 9740773349		Shri K.N. Madhusudhan Rao Co-Secretary Tumkur Science Centre Balbhavan, M.G. Road, Tumkur Ph : 0816-2211220 Mo : 9448173978
32.	**Udupi Dist.** Shri Dinesh Shettigar Govt. P.U. College, Hebri, Karkala Taluk, Udupi Dist. Ph : 0820-544697 (Res.) 0820-771102 (College) Mo : 9449045697		Shri Nagendra Pai Manipal P.U. Colelge Manipal Udupi Dist. Mo : 9886118891
33.	**Uttara Kannada Dist.** Shri Sudhir D. Nayak Govt. High School, Hillur Taluk Ankola Dist. Uttara Kannada Mo : 9448530620		Shri Veerabhadrappa Asst. Teacher Popular New English School, Chandiya Karwar, Uttara Kannada Dist. Mo : 9483617705
34.	**Yadagiri Dist.** Shri B. Rajashekhara Gowda Asst. Teacher, Govt.P.U. College Yadagiri Mo : 9449697282		Shri Suryaprakash Ghanathe Science Teacher, Govt. High School Lingeri, Yadagiri Dist. Mo: 9448874029

Annexure-5

ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಸಾರ್ವಜನಿಕ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಆಯುಕ್ತರ ಕಛೇರಿ ನೃಪತುಂಗ ರಸ್ತೆ, ಬೆಂಗಳೂರು–01

ಸಂಖ್ಯೆ:ಸಿ4(3)ಶಾ.ಸಂ.ನಿ/04/2011–12 ದಿನಾಂಕ:21/05/2011

ಸುತ್ತೋಲೆ

ವಿಷಯ: ಅಖಿಲ ಕರ್ನಾಟಕ ಮಕ್ಕಳ ವಿಜ್ಞಾನ ಸಮಾವೇಶದ ಅಂಗವಾಗಿ ಜಿಲ್ಲಾ ಹಂತದಲಿ ಭಾಗವಹಿಸುವ ವಿದ್ಯಾರ್ಥಿ ಮತ್ತು ಮಾರ್ಗದರ್ಶಿ ಶಿಕ್ಷಕರಿಗೆ ಶಾಲಾ ಸಂಚಿತ ನಿಧಿಯಿಂದ ಪ್ರಯಾಣಭತ್ಯೆ ಹಾಗೂ ಯೋಜನಾ ವರದಿಗೆ ತಗಲುವ ವೆಚ್ಚಕ್ಕಾಗಿ ರೂ.400/– ಗಳನ್ನು ಭರಿಸಲು ಅನುಮತಿ ನೀಡುವ ಬಗ್ಗೆ.

ಉಲ್ಲೇಖ: ಮಾನ್ಯ ಪ್ರಾಥಮಿಕ ಮತ್ತು ಪ್ರೌಢಶಿಕ್ಷಣ ಸಚಿವರ ವಿಶೇಷ ಕರ್ತವ್ಯಾಧಿಕಾರಿಯವರ ಪತ್ರ ಸಂಖ್ಯೆ:ಪ್ರಾಪ್ರೌಶಿಸ/ಒಎಸ್ ಡಿ/75/2011 ದಿನಾಂಕ:10/05/2011.

&&&&&&&

ಮೇಲ್ಕಂಡ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಅಖಿಲ ಕರ್ನಾಟಕ ಮಕ್ಕಳ ವಿಜ್ಞಾನ ಸಮಾವೇಶದ ಅಂಗವಾಗಿ ಜಿಲ್ಲಾ ಹಂತದಲ್ಲಿ ಭಾಗವಹಿಸುವ ವಿದ್ಯಾರ್ಥಿ ಮತ್ತು ಮಾರ್ಗದರ್ಶಿ ಶಿಕ್ಷಕರಿಗೆ ಶಾಲಾಸಂಚಿತ ನಿಧಿಯಿಂದ ಪ್ರಯಾಣ ಭತ್ಯೆ ಹಾಗೂ ಯೋಜನಾ ವರದಿಗೆ ತಗಲುವ ವೆಚ್ಚಕ್ಕಾಗಿ ರೂ.400–00 ಗರಿಷ್ಠ ಭರಿಸಲು ಅನುಮತಿ ಕೊಡುವಂತೆ ಉಲ್ಲೇಖದ ಪತ್ರದಲ್ಲಿ ಸೂಚಿಸಿರುತ್ತಾರೆ.

ಶಾಲಾಸಂಚಿತ ನಿಧಿಯ ಚಾಲ್ತಿ ಹಣದಲ್ಲಿ ಪ್ರಯಾಣ ಭತ್ಯೆ ಹಾಗೂ ಯೋಜನಾ ವರದಿಗೆ ತಗಲುವ ರೂ.400–00 ಗಳನ್ನು ಭರಿಸಲು ಈ ಮೂಲಕ ಅನುಮತಿ ನೀಡಲಾಗಿದೆ.

21-05-11

ಕೆ.ಪಿ.ಹನುಮಂತರಾಯಪ್ಪ
ನಿರ್ದೇಶಕರು(ಪ್ರೌಢಶಿಕ್ಷಣ)

ಇವರಿಗೆ,
01.ರಾಜ್ಯದ ಎಲ್ಲಾ ಉಪನಿರ್ದೇಶಕರು(ಆಡಳಿತ) ಸಾರ್ವಜನಿಕ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರಿಗೆ ಮುಂದಿನ ಕ್ರಮಕ್ಕಾಗಿ.
02.ಗೌರವ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕರ್ನಾಟಕ ರಾಜ್ಯ ವಿಜ್ಞಾನ ಪರಷತ್ತು, ವಿಜ್ಞಾನ ಭವನ,ನಂ.24/2,21ನೇ ಮುಖ್ಯ ರಸ್ತೆ,ಬನಶಂಕರಿ 2ನೇ ಹಂತ ಬೆಂಗಳೂರು–560 070.
03.ಕಛೇರಿ ಪ್ರತಿ.

Annexure-6

Government of Karnataka

No.ED/100/RGN/90 Karnataka Government Secretariat
Education Department
M.S. Building, II Stage, VI Floor
Bangalore, Dated 10th December 1990

CIRCULAR

Sub: O.O.D. facility for Government Employees participating in Karnataka Raja Vijnana Parishat activities.

*****

It is brought to the notice of Government that the teachers of schools and lecturers of Junior Colleges/ Colleges in the state are assisting in the various activities of Karnataka Rajya Vijnana Parishat. Some times they are required to visit other places in Karnataka in connection with the parishat's work like attending Annual Executive Committee meetings, Participating in Science Exhibition, Science Melas and delivering popular lecturers, etc. This is a part and parcel of the efforts of Karnataka Rajya Vijnana Parishat to develop science and technology in the state.

In these circumstances, the teachers / lecturers who participate in the activities of Karnataka Rajya Vijnana Parishat are treated as on other duty subject to the following conditions.

1. Total period shall not exceed 15 days in a year.
2. The participants shall obtain permission of the competent authority before hand;
3. No additional financial commitments shall arise due to this; and
4. The Participants shall obtain Attendance Certificate and produce to the Authority concerned.

Sd/-
(Neelakanta Murthy)
Under Secretary to Government
Education Department

Copy to:

1. The Commissioner for Public Instruction, Bangalore
2. The Director of Collegiate Education Department, Bangalore
3. The Director of Technical Education Department
4. The Joint Director of Public Instruction, Bangalore, Gulbarga, Mysore, Bellary (Administration)
5. Weekly Gazette
6. Copy for information to:
   Sri Abdul Khadir, Under Secretary, Department of Science & Technology with reference to U.O. Note No.DST 15 KRVP 90 dated 9-10-1990.

Annexure-7

Karnataka Rajya Vijnana Parishat

Chief Patron

Padmavibhushana Prof. C.N.R. RAO., FRS

National Reserch Professor and
Chairman, Science Advisory Council to the Prime Minster

List of Executive Committee members

1. **Dr. H.S. Niranjan Aradhya**
   PresidenT - KRVP
   No.27, 2nd Cross , Municipal Layout
   Siddhaganga Extn., Tumkur – 02.
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21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-I
Selected Participants for National Level Children's Science Congress - 2013

S. No	Name of the Group Leader and Group members	Age As on 31 Dec'12	Sex		Area		Language Used	Complete address*	District's Name	Guide Teacher	Designation & Complete Address	Project Title	Sub-Theme code**
			F	M	R	U							
1	(i) Group Leader												
	(ii) Member												
	(iii) Member												
	(iv) Member												
	(v) Member												

***School address for school going children**
**** Please check code list**

Details of State Level CSC held

Date and Venue of State Level CSC: _____

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS

NCSC-2013

Proforma-II

State Level Children's Science Congress - 2013 - at a glance

Total No. of projects presented	Total No. of group members	Sex		Age group		Area		No. of Schools represented	No. of Guide teachers	No. of evaluators	Total No. of districts
		F	M	U	L	R	U				

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-III
Details of Projects Presented in State Level CSC-2013

Venue : _____ **Date :**_____

S. No	Name of the Group Leader and Group members	Age As on 31 Dec'12	Sex		Area		Language Used	Complete address*	District's Name	Guide Teacher	Designation & Complete Address	Project Title	Sub-Theme code**
			F	M	R	U							
1	(i) Group Leader												
	(ii) Member												
	(iii) Member												
	(iv) Member												
	(v) Member												

***School address for school going children**
**** Please check code list**

Details of District Level CSC

a. Total No. of Districts: _____

b. No. of Districts participated in the State CSC : _____

c. Total Districts representing in 19th National Level CSC:_____

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-IV
District Level CSC - 2013 - at a glance

District	Date	Venue	No. of projects presented	No. of schools participated	No. of children participated	Sex		Age group		Area		No. of Guide Teachers	No. of Evaluators	No. of Guide Teachers Trained
						F	M	L	U	R	U			
Total														

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-V

Details of Projects Presented in District Level CSC

Name of the District:_____ Name of the District Coordinator: _____

Date:_____ Venue: _____

S No	Name of the Group Leader and Group members	Age As on 31 Dec'12	Sex		Area		Language Used	Complete address*	Guide Teacher	Designation & Complete Address	Project Title	Sub-Theme code**
			F	M	R	U						
01	(i) Group Leader											
	(ii) Member											
	(iii) Member											
	(iv) Member											
	(v) Member											

***School address for school going children**
**** Please check code list**

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-VI

List of Schools Participated at the District Level

S No	Name of The District	Name of the Headmaster/Headmistress/Principal of the school & Full Postal Address along with Pin code	Phone & Fax No with STD Code & Email Id

Proforma-VII

List of District Coordinators

S.No.	District	Name of District Coordinator	Profession	Complete Correspondence Address	Phone & Fax No with STD Code & Email Id

Proforma-VIII

List of District Academic Coordinators

S.No.	District	Name of District Academic Coordinator	Profession	Complete Correspondence Address	Phone & Fax No with STD Code & Email Id

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-IX

Details of the State Level Resource Persons' Training Workshop

a. Venue : _____

b. Date : _____

c. Total No. of Resource Persons attended : _____

Detailed List of the Participants in the state level training workshop

S No	Name of Resource Persons (participants)	District	Profession	Complete Address	Phone & Fax No with STD Code & Email Id

Proforma-X

Detailed List of the Participants in the District Level Training Workshop

S No	Name of the Participants	District	Profession	Complete Address	Phone & Fax No with STD Code & Email Id

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-XI
Details of Resource persons/Evaluators involved at State Level CSC-2013

S No	Name	Profession	Area of Specialisation	Complete Address	Phone No. with STD Code &Email ID	Participated as Resource Persons / Evaluators

Proforma-XII
Details of Resource persons/Evaluators involved at District Level CSC-2013

S No	Name	Profession	Area of Specialisation	Complete Address	Phone No. with STD Code &Email ID	Participated as Resource Persons / Evaluators	District

Sub Theme Code List:

Code	*Sub-Theme*
1	ಶಕ್ತಿಯ ಸಂಪನ್ಮೂಲಗಳು
2	ಶಕ್ತಿ ವ್ಯವಸ್ಥೆಗಳು
3	ಶಕ್ತಿ ಮತ್ತು ಸಮಾಜ
4	ಶಕ್ತಿ ಮತ್ತು ಪರಿಸರ
5	ಶಕ್ತಿಯ ನಿರ್ವಹಣೆ ಮತ್ತು ಸಂರಕ್ಷಣೆ
6	ಶಕ್ತಿಯ ಬಗೆಗೆ ಯೋಜಿಸುವುದು ಮತ್ತು ಮಾದರಿ ತಯಾರಿಸುವುದು

21ST NATIONAL CHILDREN'S SCIENCE CONGRESS
NCSC-2013

Proforma-XIII
Projects selected for *Indian Science Congress-2014*

S No	Name of Gr. Leader & group members	Age group U/L	Sex (M/F)	Area (U/R)	Name & Address of the school	District	Guide teacher	Project title
1	(i) GL (ii) (iii) (iv) (v)							
2	(i) GL (ii) (iii) (iv) (v)							

20th State Level Children's Science Congress 2012 - Madikeri

A view of Photos Gallery

20th National Level Children's Science Congress 2012 - Varanasi

A view of Photos Gallery

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