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CONTENTS

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EDITORIAL

Technology today is considered the most important facet of development. The development and application of technology is influencing our lives in diverse ways. But it appears that we are not accepting the fact that technology per se is no panacea for human problems. On the other hand the excessive obsession that technology will continuously upgrade the quality of life is increasingly become evident. The fact being just the reverse, the result is heightening social tension, breakdown of traditional value system which evolved over thousand of years and sustained a well-knit society. The degradation in public life being witnessed world over is a testimony to the fact that we have allowed indiscrimirate application of technologies in the name of societal development, leading to materialistic society, loosing its moors form the anchor-blocks of values like self-less service to humanity, love, affection, conservation of nature, tolerance, humility etc. There trends are extremely disturbing for such a situation can never be stable. The signs are clearly visible in micro and macro levels, both of our society. Of the many noticeable features of such a situation is also the extreme lack of leadership of all kinds which may lead the humanity out of the dark recesses of unbridled consumption and materialism. Therefore, those few who understand the dynamics, have the conviction and acceptibility will have to take urgent steps in the form of bold initiatives of galvanising people's movement for clean and value based selfgovernment. It they too remain mute spectator than there is no chance and then perhaps, after sinking to the nadir, the society will have to again pass through the pangs of rebirth of civilisation. This is the only question which stares before us and seeks, immediate answers, let us therefore break the shackles of inertia. Let every right thinking person be a leader in his micro-cosmos and lead a silent transformation in every home. Then only perhaps we stand a chance of coming out of this quagmire. Otherwise the days ahead are dark and no technological marvel will ever be able to bring the dawn of hope for survival.

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1. **Rural Technology :** Report of National Seminar, 1981, 20 Papers on Rural/Appropriate Tachnology English, Pp 288, Rs. 200/-
2. **Renewable Source of Energy :** Proceedings of Short Term In-Service Training Programme, 1983.20 papers on Solar Cookers, Smokeless Cookstove, Micro Hydro Power, Wind Energy, Biomass and Biogas etc. English, Pp 250, Rs. 200/-
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PROPORTIONING OF FLYASH CONCRETE AND SOIL STABILISATION FOR CONVERTING WASTE TO NON-WASTE

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Flyash is a waste material resulting from the combustion of pulverised coal in boilers and is very hazardous as it pollutes air, water and soil besides causing damage to structures. There are some important engineering characteristics/properties of this material which can be utilized for various purposes. The pozzolanic properties of flyash are being exploited to a limited extent, of the order of 3%, in construction industry and land fills etc. Many research and development organisations have given specifications for designs and conducted field trials for utilization of flyash which needs to be commercialized at rapid pace. One of the main applications of flyash in construction industry is : flyash concerete mix. Investigations have shown that when flyash is used as a part replacement of cement in mass concerete mixes, the strength of the mix at 28 days is lower than that of corresponding normal portland cement concrete without flyash and its only at later stage that the strength becomes equal. This paper gives the proportioning procedure for flyash concerete mix design by which equal strengths at 28 days can be attained. The paper also highlights the procedure to utilize the flyash in base course of pavement construction without compromising the stability of these roads. It is expected that commercialization of mass consumption of this non-waste will follow these studies.

INTRODUCTION

In the era of rapid globalisation and industrialization thermal power plants are being set up in large numbers to meet the increasig energy demands. Coal is the most economic and easily available fuel for power generation in India and ever

growing future demands of energy will certainly be making use of this source more and more. The present known coal reserves at the present demand rate are to last for more than 400 years and are likely to increase as new discoveries of coal fields have been reported and more discoveries might follow. In India, high grade coal is reserved for metallurgical industries and the railways and the thermal power stations have to use high ash low grade coal. Due to the low calorific value (about 3500 kcals per kg) and high ash content (30% to 50%) of such coals, our coal fired thermal power stations produce huge quantities of coal ash as a by-product of coal combustion, of average to the tune of 5 tonnes/MW/day of power generated.

This finely divided residue resulting from the combustion of pulverised coal in boilers is known as FLYASH. Flyash is a waste material which poses a great disposal problem besides causing atmospheric pollution due to its being easily air-borne. Flyash is prevented from polluting atmosphere by extracting it from the flue gases by cyclone separation, electrostation precipitation, fabric filtration or combination of these techniques. The flyash collected in the ash hoppers is removed from the boiler house by either 'the wet system' or 'the dry system'. In the wet system flyash is mixed with water in a mixing sump to form an ash slurry and is pumped out into settling tanks/lagoons/dumping yards. In the dry system the ash collected in directly discharged into covered transport vehicles for storage in flyash silos for supply to customers or disposal. The wet system is comparatively easy to operate and is cheaper, so it is most commonly adopted. Disposal of flyash in such a manner requires very large stretches of prime land and then this land cannot be used for shelter, agriculture and other productive purposes..

HAZARDS POSED BY FLYASH

There are, at present, more than 80 thermal power plants in the country burning coal as fuel which altogether produce a reported 60 million tonnes of coal ash per annum and flyash constitutes about 80 percent of the total ash produced. Followig are some of the hazards posed by flyash :

- It creates serious environmental and ecological problems on account of its potential to contaminate air, surfaces water, ground water and soil in contact.

- It creates dust nuisance due to fugitive emission in surrounding air
- It often contains traces of some highly toxic element like arsenic, cadmium, beryllium etc.
- Pond ash effluent and run off in rainy season contaminates surface water in the nearby streams, lakes and revoirs
- Contamination of underground aquifers may occur where pond ash effluent percolates through the bottom
- It may cause severe soil pollution either by poisoning the soil or crops grown on it
- It adversely affects power plant efficiency by interfering with the heat transfer through fouling of boiler tubes and increasing the wear and tear by abrasive and erosive action on heat transfer surfaces
- Flyash dust corrodes structural metal surfaces and adversely affects horticultural developments in the region around thermal power stations.

In view of the frightening potential of the immense harm that the growing accommodation of this solid waste from thermal power plants could cause to the community at large in the long run, it is imperative to utilize flyash and also devise new ways and means to cut down the growth of waste ash accumulations in future.

ENGINEERING PROPERTIES OF FLYASH

It is necessary to understand the characteristics of flyash before we consider its applications, as the characteristics govern its suitability for various end uses. The quality of flyash varies not only from one thermal plant to another, but also within the same plant depending on the chemical composition and fineness of the coal used, mode of collection of flyash, combustion technique etc.

Chemical Composition

The major constituents of flyash are oxides of silicon, aluminium, iron, calcium and magnesium making up 95-99% of the total composition by weight. Minor constituents such as titanium, sodium, potassium, sulphur and phosphorus comprise 0.5%. to 3.5%. Flyash also contains 20 to 50 trace elements in minute quantities, some of which are highly toxic. Table-I shows some of the physical and chemical properties of Indian flyash.

Table-1

PHYSICAL & CHEMICAL PROPERTIES OF INDIAN FLYASHES

Properties	Range
Physical properties :	
Percent passing 75 micron I.S. sieve	71.4-95.9
Percent passing 45 micron I.S. sieve	45.0-88.8
Fineness-specific surface in cm^2/gm	3300-6250
Reactivity-lime reactivity strength	50.0-62.4
Chemical properties :	
	Range in percentage
Silicon Oxide	49.2-66.7
Aluminium oxide	22.0-26.6
Ferric Oxide	6.6-21.8
Calcium Oxide	1.3-2.8
Magnesium oxide	0.5-5.37
Sodium oxide	0.1-0.2
Potassium oxide	0.3-0.5
Sulphur trioxide	traces-0.3
Losses on ignition	0.3-15.8

Pozzolanic Reactivity

Although flyash does not generally have much cementious property of its own, it reacts with free lime in the presence of water to farm hydrated products of calcium and alumino silicates which have increased strength and durability. When mined with cement and water, flyash forms calcium silicate hydrate, calcium monosulpho aluminate, calcium trisulphoaluminate and calcium hydroxide. These products are highly dense, strong and less permeable. However, pozzolanic activity of flyash is highly sensitive to temperature of curing.

Particle Characteristics

The general characteristics of particles of flyash are as below :

Grain Size

The grain size of flyash is primarily related to coal quality and fineness of feed coal grinding and also the stage of collection. The quality control parameters of flyash which determines its ultimate suitability for a particular engineering application includes measurement/adjustment of residue carbon content, fineness, particle size distribution, chemical composition.

Particle Shape

This factor influences the physical properties such as water requirement and workability. The flyash particles are mostly spherical and uniformly graded thus reducing the friction at the interface of flyash particles and particles of aggregate and cement. Addition of proper quality flyash thus increases workability of the mixture, reduces water demand and thereby increasing strength. The general requirements of flyash as per IS: 3812 (1981) are given in Table-2.

Table-2

GENERAL REQUIREMENTS OF FLYASH AS PER IS: 3812-1981

S.No.	Test	Requirements	
		Grade-1	Grade-2
1.	Fineness: Specific surface in cm^2/gm by Blaine's permeability method (minimum)	3200	2500
2.	Reactivity: Lime reactivity strength kg/cm^2 (minimum)	40	40
3.	Sulphur tioxide content (maximum)	2.75%	2.75%
4.	Loss of ignition (maximum)	12.0%	12.0%

PRESENT PRACTICES OF UTILISATION OF FLYASH

Presently flyash is utilised in India in the cement and concrete construction industries, manufacturing flyash based bricks, hollow bricks, tiles etc. and in land fills and road bases. It is assumed that the present annual consumption is not more than 2 million tonnes per annum against a reported annual production of 60 million tonnes of flyash. Thus the rate of utilisation comes slightly more than 3% which is the lowest in the world. Research and development work on flyash utilisation is an on-going process at CBRI, CFRI, CSMRS, IITs, SERC, technical institutes etc. The technologies, technically and economically viable for utilisation of flyash, can be broadly grouped into three categories, based on the commercial value of end product and the volume of flyash that can be utlitised in the application. The proven technologies have accordingly been categorised as below and shown in Table-3.

(a) Low value added, high volume application

(b) Medium value added, substantial volume application

(c) High value added, less volume applications.

The present paper gives detailed procedure for designing concrete mixes and flyash stabilised soils.

Table-3

VIABLE TECHNOLOGIES FOR UTILISATION OF FLYASH

Low Value	Medium Value	High Value
1	2	3
(a) Mine Fills/Embankments	(a) Portland Cement Clinker	(a) Extraction of Alumina
(b) Use in Road Construction	(b) Portland Pozzolana Cement	(b) Extraction of Magnetite

1	2	3
(c) Lime-Fly Ash stabl-ized soil	(c) Masonary Cement	(c) Extraction of Cen-sophere
(d) Lime-Fly Ash Con-crete	(d) Oil Well Cement	(d) Floor and Wall Tiles
(e) Lean-Cement-Fly Ash Concrete	(e) Fly Ash Building Bricks	(e) Insulating and Semi-insulating Bricks
(f) Lime Fly Ash Bound Macadam Fly Ash Blocks	(f) Fly Ash Blocks	(f) Fly Ash Building Dis-temper
(g) Cement Fly Ash Concrete	(g) Pre-Cast Fly Ash Building Units	
(h) Partial Replacement of Cement in Mortars and Mass Concrete	(h) Lime-Fly Ash Cel-lular Concrete	
(i) Reinforced Fly Ash Cement Concrete	(i) Cement Fly Ash Concrete and Ready Mixed Fly Ash Con-crete	
(ii) Fly Ash in Grouting	(ii) Sintered Fly Ash Light Weight Ag-gregate and Con-cerete.	

FLYASH CONCRETE MIXES

Flyash as a partial replacement of cement in concrete mixes has been under investigation since long because it saves cement and provides a useful way of disposing flyash. When flyash is used as a part replacement of cement in mass concrecte works it has been observed that the strength of the concrete, using partial replacement of cement by flyash, at 28 days is lower than that of the normal portland cement. It is only at the later stages that the strength becomes equal.

Water Cement Ratio and Compressive strength of Flyash Cement Concrete

The proportioning techniques were subsequently developed to achieve compressive strength of flyash concrete mixes at 28 days more or less equal to that of plain concrete mines at that age. The proportions of different ingredients are adjusted as under:

- Replacing cement up to 20 per cent from the plain concrete mixes by 30 per cent flyash
- The sand content as a proportion of total aggregates was reduced by three to five per cent

It is worth while to mention here that the cementing efficiency primarily depended upon the characteristics of the flyash added it also varied with other parameters of the mix and the age of curing. In addition, it was found to be increasing with warmer curing temperatures. From this method of proportioning following conclusions have been drawn:

(a) The compressive strength of the flyash concrete mixes is related to the water cement ratio in a manner similar to plain concrete mixes. However, for a particular watercement ratio, the compressive strength at 28 days is to a degree higher than that of plain concrete as shown in Fig. 1

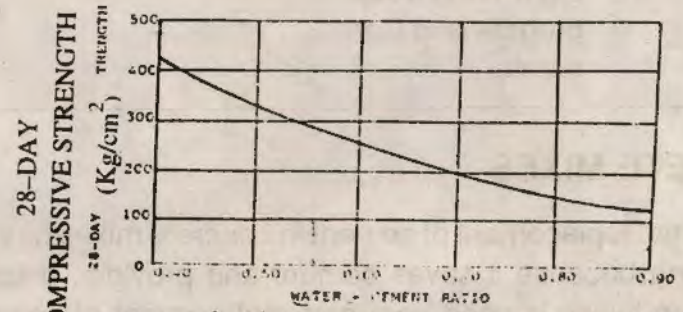

Fig.1 Water-Cement ratio vs 28-days compressive strength for flyash concretes

Fig. 1

(b) For the same requirement of workability of fresh concrete, the water

content in the flyash concrete mixes is lower by about 3 to 4 per cent due to spherical shape of flyash particles and lower specific gravity of flyash than cement.

(c) The proportion of sand in the total aggregate is lower by about 3 to 5 per cent.

(d) If the curing temperature is higher the part of cement possible to be replaced is more.

Water Content And Workability

The variation in resultant workabilities (in terms of compacting factor) for different amounts of mixing water in flyash concrete for nominal maximum size of aggregate of 20 and 40 mm. have been experimented. It was seen that the workability increases with water content in the mix. The water requirement of flyash concrete having 20 mm MSA and workability of about 0.80 compaction factor was found to be about 3 to 5 per cent less than that of the corresponding concrete. The compaction factor vs water content ratios using 20 mm MSA and 40 mm MSA have been shown in fig.2.

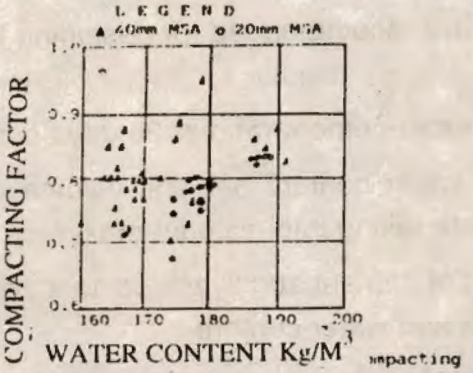

Fig.2 Water content vs compacting factor for flyash concrete having different water-cement ratio

Optimum Flyash Content

The variation in the workability of concrete for different flyash contents is shown in figure 3. The trends of results indicated that the workability was greater when the flyash content was less. For 15 per cent flyash the mixes were quite

workable but there was small saving in the quantity of cement used. Use of 20 per cent flyash gave workability in the range 0.80 ± 0.05 compacting factor. With 25 per cent flyash content the workability became lower than the desired value for most of the concrete mixes. Hence flyash with 20 per cent by weight of cement was considered as optimum.

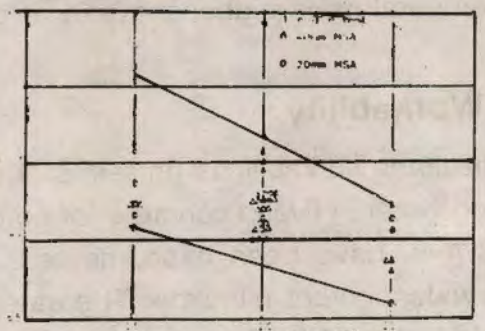

Fig. 3 Workabilty of flyash concrete for different flyash contents

Design Procedure For Flyash Concrete Mix Design

Following steps are recommended for designing flyash concrete mixes for grade M15 & M20:

(a) Selection of water-cement ratio at 28 days compressive strength

(b) Selection of water content per unit volume of concrete and sand in percent of total aggregate taking into account maximum size of aggregates

(c) Determination of cement and flyash content per cubic meter of concrete from water-cement ratio and water content

(d) Determination of aggregate content.

By the above procedure an example has been worked out for Flyash concrete mix design as discussed below:

Grade of concrete	- M20
Target strength at 28 days	- 260 kg/cm^2
Maximum size of aggregate	- 40 mm

Degree of workability - 0.90 compaction factor

Flyash content by weight of cement - 20 per cent.

Keeping the above factors as targets, the mix proportions obtained are shown in Table-4.

Table-4

FLYASH CONCRETE MIX PROPORTIONS

Mix design in terms of	Water	Flyash	Cement	Fine aggregates	Coarse aggregates
Contents	175.35 kg	55.4 kg	308 kg	389.8 kg	1390.2 kg
Proportion	0.57	0.18	1	1.26	4.51

Quantities of materials per 50 kg of cement, on the basis of above proportion are as under:

(a) Cement = 50 kg

(b) Flyash = 09 kg

(c) Sand = 63 kg

(d) Coarse aggregate = 225.5 kg

(e) Water = 28.5 litres

(for watercement ratio of 0.57)

CBRI Recommendations For Flyash Concrete Mix Design

The method of proportioning as proposed by CBRI, India is as under:

The concrete mix should be proportioned on absolute volume basis. The proportions of different ingredients are then adjusted as follows:

(a) Substitute 20 per cent of cement with 27.5 per cent of flyash by weight

(b) Reduce the quantity of sand in the concrete mix by an amount equal to the weight of flyash

(c) Increase the quantity of coarse aggregates in the concrete mix by an amount equal to the weight of flyash added

(d) Add water eight per cent less than water required to keep water/cement plus flyash ratio equal to the water/cement ratio decided for the corresponding cement concrete without flyash

(e) Place the concrete by vibration. Mix proportions of different flyash concrete mixes corresponding to different grades of cement concrete has been shown in Table-5

Table-5

FLYASH CONCRETE MIX DESIGN FOR DIFFERENT GRADE

Grades of concrete	Quantities of Material (in kg) per Cubic meter of Concrete				
	Cement	Flyash	Sand	Coarse Agg.	Water
M 150	247.2	85.0	680.0	190.0	168.0
M 200	312.5	108.3	515.5	1202.0	194.6
M 250	433.0	148.8	314.0	1200.0	214.0

Advantages Of Flyash Cement Concrete

(a) Lean concrete mixes due to lack of fines generally have poor workability which leads to bleeding of mixing water and segregation of aggregates. It also has low plasticity and low cohensiveness. Addition of flyash as a part replacement of sand in these mixes have been found to eliminate these defects and decrease water requirement for the same workability which ultimately results in increased strength

(b) Flyash when added in place of sand also acts as an additional binder material due to pozzolanic reaction with lime released on cement hydration. By proper proportioning it is possible to save cement up to 15 per cent which renders it cheaper than the lean- cement concrete

(c) It can be most suitably used in building foundations particularly where water table is high and for base and sub-base of roads and airfields.

FLYASH SOIL STABILIZATION

Comprehensive laboratory and field studies conducted by CRRI have established that flyash can be usefully employed in combination with lime and soil for stabilization of pavement sub-base. This method is most suitable for areas where good quality flyash and lime are locally available and local soils respond to the technique. Normally soil having medium plasticity index (5 to 20) and clays that do not respond to lime can be improved by this technique.

Proportioning Of Lime-Flyash Mix

Since it involves use of three materials i.e. lime, flyash and soil, the selection of proper mix proportion is complicated. The problem is in the selection of proper mix proportion which gives not only the needed amount of cementation i.e. strength and durability at the lowest cost but also an easily workable mix.

Specific Proportioning Method

(i) Mixtures are prepared to represent all feasible combinations of soil, lime and flyash. In fig. 4 batches are prepared to give a grid like plot with points at each intersection of the marked percentage lines. Strengths are then shown by contours

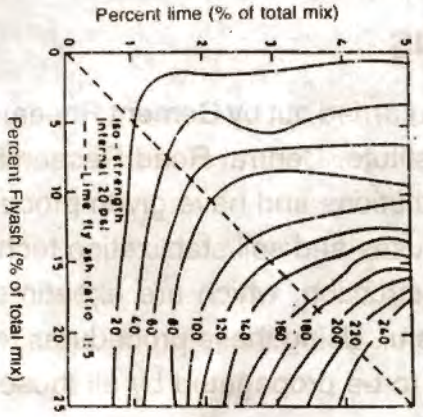

Fig. 4

(ii) Suitable proportioning is also illustrated below:

Lime-Flyash-Soil = Lime 2 - 3 per cent
+ Flyash 6 - 12 per cent
+ Soil 85 - 92 per cent

Essential requirement of flyash is to have minimum lime reactivity as 40 kg/cm^2. A successful soil stablisation work using flyash is reported from Neyveli Lignite Corporation where an area of 10,000 sq.m. has been stabilised.

ADVANTAGES

- Treatment of soil by lime flyash mix increases its optimum moisture content and reduced its maximum dry density
- Improvement in engineering properties like plasticity, gradation and strength requirements
- When soils are treated with lime alone they have slower rate of strength development and there is possibility of leaching of lime. When flyash is used along with lime for soil stabilisation leaching can be considerably inhibited
- It can be succesfully used as sub-base and base course
- This type of construction results in 20-30 per cent saving in cost over conventional type of construction.

RECOMMENDATIONS

Studies have been carried out by Cement Research Institute of India, Centre for Building Research Institute, Central Road Research Institute and many other R & D Organisations/Institutions and have given procedures, for design of flyash concrete for various end uses and soil stablization techniques using flash in base course of pavement construction, which are experimented and field trials have been found to be successful. Using these procedures for converting flyash to non-waste from waste needs to be propagated by all those related to field.

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* * *

More Food For Increasing Population

Agricultural research in the past 20 years has led to food increases sufficient to feed one billion more people but despite success, 700 million people are still hungry. The world's population will increase by 85 million people every year for the next 20 to 30 years, putting pressure to produce more food to feed the largest annual population increase in history over 90 per cent of it in developing countries, mostly Asia and Africa.

MICRO, MINI & SMALL HYDEL POTENTIAL IN UTTARA KANNADA DISTRICT, KARNATAKA

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Mini, Micro and small hydro plants combine the advantages of large hydro on one hand and decentralised power supply on the other. The disadvantages associated with large hydel plants like high transmission costs, environmental issues like submergence of prime lands (like forests, crop land etc.), displacements of families are not present in the case of small plants. More over, the harnessing of local resources like small hydro resources, being of a decentralised nature, lends itself to decentralised utilisation, local implementation and management, making rural development possible mainly based on self reliance and the use of natural, local resources. In this paper the assessment of potential carried out in some of the streams in Bedthi catchment in Uttara Kannada district of Western Ghats is discussed.

INTRODUCTION

Hydro power owes its position as a renewable resource to the variable but more or less continuous flow of a certain amount of water in the stream. This water, supplied by the rain and always moving, constantly flows from the main land to the sea, where it evaporates back to the atmosphere in an unending cycle controlled by two opposing force namely the heat of the Sun and the earth's gravity. Thus, Hydro potential is a combination of the possible flows and the distribution of

gradients. Hydro power is a precipitation dependent resources and thus subject to the uncertainties which this entails. Water runoff can vary within wide limits.

The amount of power available at a given site is determined by the volummetric flow of water and the hydraulic head or water pressure. In hydro schemes the turbines that drive the electricity generators are directly powered either from a reservoir or the "run of the river". Large scheme may include a water storage reservoir providing daily or seasonal storage to match the production of electricity to the demand for the power. Large scale hydro electric schemes have been producing power in the Karnataka state of many years, with the first Hydro Electric station is built in 1942. Due to environmental constraint further construction of storage reservoir is limited and attention has now focussed to developing small scale hydro schemes in an environmental friendly way to cater to the needs of the region.

A micro/mini/small hydro power station can divert only potential energy of the water which would have been dissipated to no benefit in the natural flow along the water course. The domain where mini, micro and small hydropower can have potential impact on development is in domestic lighting and in providing stationary motive power for such diverse productive uses as water pumping, wood and metal work, grain mills and agro processing industries etc.

ENERGY SCENARIO IN KARNATAKA

Karnataka state depends both on commercial and non-commercial forms of energy. Non commerical energy constitutes 53.2%, met mainly by sources like firewood, agricultural residues, charcoal and cowdung, which caters 92% of rural population. Non commercial energy is mainly used for thermal energy requirements such as cooking and water heating in households and in agro processing. From household survey conducted in villages of Uttara Kannada District of Karnatak State reveals that on an average fuelwood consumption for cooking is in the range of 0.8 to 1.25 kg per person per day. While for water heating fuel requirement is in the range of 1.1 to 1.9 kg per person per day. To cater the growing demand of population for domestic use and for industries it is necessary to (1) look for alternate

sources of energy which is renewable in nature (2) improving efficiency of end use devices like motor, irrigation pumpsets, cooking and water heating stoves etc. (3) optimising energy source-end use matching to ensure not to use high grade energy such as electricity for low grage thermal applications as cooking etc. This would enable sustainable development of a region.

69.07% population resides in rural areas (3, 10, 69, 413 persons out of 4, 49, 77, 201 as per 1991 census) in Karnataka State. In a large number of villages, the population density is often low, and settlements are frequently far apart and the prevalent simple life style requires less high grade energy per capita compared to urban dwellers. Industrial energy demand is mainly for activities such as agro processing and cottage industries. Thus, electricity demand per unit of area is low and hence supply from grid over long distances and difficult terrain to many low demand consumers spread over a large area, due to present enormous transmission and distribution losses and inefficient end uses is economically not feasible. The consequence of this unfavourable situation regarding electricity supply to rural areas is that a great proportion of the population is remote rural areas has so far not benefitted from the amenities of electricity. In the following section We discuss the possibility of harnessing hydel energy in Uttara Kannada District in Western Ghats region.

Western Ghats : The Western Ghats in Karnataka, which lies along the path of south west monsoon, receives rainfall in the range 1200 to 8000 mm a year, bear good forest cover which includes virgin evergreen forests, moist deciduous forests that harbor timber trees like teak, rosewood etc. and the dry deciduous forests sheltering a wealth of wildlife. Karavali and Malnadu in Karnataka (covering Uttara Kannada, Dakshina Kannada, Chikmagalur, Hassan, Belgaum, Shimoga, Kodagu and Mysore districts are the two regions dominated by Western Ghats. And with the all great rivers like Malaprabha, Tunga Bhadra, Kaveri, Kabini, Sharavathy, Netravathy, Kali, Gangavalli, Aghaniashini, the Western Ghats region has been the backbone of ecology and economy of Karnataka.

Uttara Kannada District : Uttara Kannada district lies between 13° $55^{'}$ and

15° 31' N latitude and 74° 9' and 75° 10' E longitude. It has an area of 10,291 sq. km and with a population of 12, 18, 367. It is located in the mid western part of the state. It is a region of gentle undulating hills, rising rather steeply from a norrow coastal strip bordering the Arabian sea to a plateau at an altitude of 500 m with occasional hills rising above 600 m to 860 m. The annual precipitation largely confined to the monsoon months of June to September, ranges between 3500 mm on coast, rising to 4500-5000 mm on the crestline and declining to 1000 mm on the eastern plateau. As per the landsat imagery of 10291 sq. km geographical area, 67.04% is under forest, 1.94% under paddy and millet cultivation 1.26% under coconut and areca garden, 1.94% under rocky outcrops and the balance of 27.82% is under habitation and reservoirs.

There are four leading rivers, the Kalinadi in the north, the Bedthi or Gangavalli about 32 km south, the Aghanashini or tadri rising far to the south but falling into the sea only about 10 km south of gangavalli and the sharavathi or Gerusoppa river about 24 km south of tadri, when it reaches the foot of the hills and becomes a tidal creek.

Developmental projects in Uttara Kannada :

(A) Hydel Projects

(i) 810 MW	Nagjhari power house	completed project
(ii) 100 MW	Supa dam	of Kali river
(iii) 120 MW	Kodasalli dam	on-going projects
(iv) 150 MW	Kadra dam	of Kali river

(B) Proposed Hydel Projects

Bedthi Basin :

Bedthi stage I	210 MW
Bedthi stage II	210 MW
Sonda pattanadahalla	

Kali Basin :

Dandeli dam	60 MW
Kali stage III	400 MW

Aghanashini Basin :

Aghanashini	435 MW
Bennehole scheme	

(C) Nuclear Plants :

Kaiga (under construction)	2 x 235 MW
Kaiga II (proposed)	4 x 235 MW

In the geographic area of 10,291 sq. km so many developmental projects have been taken up or completed. The nuclear power plant, which was supposed to be tried as last resort for power is also being set up in the midst of evergreen forests of Uttara Kannada district. These completed porjects have already caused serious environmental damage in the form of submergence of productive natural virgin forest, horticulture and agricultural lands. This is mainly due to fallacy in planning process, whose main goal is to go in for energy supply expansions. This approach adopted so far in the planning process links economic growth to energy on the assumption that there is correlation between energy use and GDP (Gross Domestic Product). With this approach energy becomes an end in itself, and the focus shifts on meeting increased energy demand through energy supply expansion alone. Currently the energy planning is not an integrated activity. There are many organisations that deal with different aspects of energy. The plans for electricity, coal, oil and firewood are done by respective organisation mostly based on the projection of energy damand. This supply and damand based planning for individual energy form has resulted in problems like more losses, more conversions and low efficiencies. This is evident from the disappearance of forests, village woodlot, and construction of giant hydro electric dams, thermal plants and controversial nuclear plants. This demands for proper Integrated energy planning taking into consideration : Satisfying basic human needs through economically feasible, energy efficient, environmentally sound and viable options,

Promoting energy efficiency improvements,

Beginning a transition to renewable energy sources,

Optimising energy source—enduse matching. This highlights the necessity for Integrated regional energy planning, based on a detailed book at how energy is used rather than the traditional preoccupation with energy supply and aggregate demand.

OBJECTIVES

Our main objective in this paper is to identify feasible micro/mini/small hydel sites and assessment of power potential in these sites based on 18 months field survey carried out in the basin of Bedthi river.

METHODOLOGY

Various terminologies and definitions used in this section and results section are listed in appendix.

Reconnaissance Study or Pre-feasibility Study : Pre- feasibility study is carried out in all streams with water head greater than 3 meters water head in the basins of Bedthi And Aghanishini river located in Uttara Kannada District of Karnataka state. There are 26 feasible sites in Bedthi basin to generate electricity in a decentralised way.

Feasibility Study : Measurement of catchment area of all identified sites (in pre feasibility survey) and stream discharge measurements were carried out at some sites. Indirect method of estimating stream flow based on the relation ship of variables run off and precipitation and a rational method by assuming suitable runoff coefficient based on catchment characteristics were also tried. This indirect method of stream flow helps in estimating discharge at ungauged sites in this region. The methods tried by us are discussed in greater detail below :

Measurement of Catchment Area : Catchment boundaries are located by using the contour lines on a topographical map. Boundaries are drawn by following the ridge tops which appear on topo maps as down hill pointing V-shaped crenulations. The boundary should be perpendicular to the contour lines it intersects. The

tops of mountain are often marked as dots on a map and the location of roads which follow ridges are other clues. Catchment area thus marked is measured directly from the marked maps using a planimeter.

Stream Discharge : We have adopted both direct and indirect methods to estimate the flow at site. Methods followed in these methods are discussed below:

(a) Direct Estimation of Flows : Stream Discharge is the rate at which a volume of water passes through a cross section per unit of time. It is usually expressed in units of cubic meters per second (m^3/s). The velocity-area method using current meter is used for estimating discharge. The cup type current meter is used in a section of a stream, in which water flows smoothly and the velocity is reasonably uniform in the corss section. As far as possible a cross-section is chosen where the current is reasonably regular over the whole width. The measurement is carried out, for three consecutive days every month for 18 months and 5 readings are taken at each point in order to take into account day to day fluctuations and seasonal variations.

(b) Indirect Estimation of Flows at Site : Runoff is the balance of rain water, which flows or runs over the natural gound surface after losses by evaporation, interception and infiltration. The yield of a catchment is the net quantity of water available for storage, after all losses, for the purposes of water resources utilisation and planning. The runoff from rainfall is estimated both by (1) Empirical formula (2) Rational Method.

(1) Empirical Formula : Regression analysis of variables run off and precipitation for a period of eighteen months, shows the linear relationship between variables Runoff and Precipitation of the form R=0.849*P+30.5, where R=runoff, P=rainfall in cms. This is in conformity with C.C.Ingli's formula for ghat areas.

(2) Rational Method : A rational approach is to obtain the yield of a catchment by assuming a suitable runoff coefficient. Hence , Yield = C*A*P

Where C=runoff coefficient, A=catchment area, P=rainfall. The value of "C" varies depending upon the soil type, vegetation, geology etc.

Type of Catchment	Value of C
Rocky and Impermeable	0.8-1.0
Slightly permeable, bare	0.6-0.8
Cultivated or covered with vegetation	0.4-0.6
Cultivated absorbent soil	0.3-0.4
Sandy soil	0.2-0.3
Heavy forest	0.1-0.2

Power and Energy : The hydraulic power which is naturally available at a given site is defined by P=9.81*Q*H where Q is the discharge in cubic meters per second and H is the height of the waterfall or head in meters. The corresponding electrical energy produced could be E=P*t*n*f, where E is the electrical energy produced in kilowatt-hours, P is the hydraulic power in kilowatts, t is the operating time in hours, n is the efficiency of turbine-generator assembly (usually between 0.5 and 0.9), and f is a coefficient to allow for seasonal flow variations for run-of-river installations.

RESULTS AND DISCUSSION

Catchment Area : Catchment area measured from the marked topo sheets using planimeter for the streams where exploratory survey is carried out is listed in Table – 1.

Table – 1

CATCHMENT AREA COMPUTED FOR VARIOUS STREAMS

Stream/Site	Catchment Area
1	2
Muregor	25.87
Boosangeri	11.29

1	2
Mattigatta	99.30
Bili halla	99.52
Hire halla	66.82
Togse halla	72.92
Shivganga falls	88.48
Sonda River	380.47

Muregor jog has a catchment of 25.97 sq.kms. while Boosangeri stream has a catchment of 11.29 sq.kms. The average channel slope (S_c) is one of the factors controlling water velocity, while the slope of the catchment (S_b) influences surface runoff rates. These two parameters gives an idea about the nature of a stream. Hence S_c and S_b are computed and listed in Table – 2. Shivganga and Mattigatta streams have slopes 43.83^o and 40.03^o, while Muregor has a slope of 6.27^o.

Table – 2

COMPUTATION OF STREAM SLOPE AND CATCHMENT SLOPE

Stream	Stream slope		Catchment slope	
	Slopes	Degrees	Slopes	Degrees
1	2	3	4	5
Muregor jog	0.11	6.27	0.18	10.2
Boosangeri jog	0.04	2.29	0.04	2.29
Mattigatta	0.83	40.03	0.69	34.66
Hasehalla	0.19	10.75	0.24	13.49

1	2	3	4	5
Bili halla	0.161	9.14	0.196	11.09
Hirehalla	0.69	34.6	0.64	32.61
Togse halla	0.49	26.1	0.48	25.64
Shivganga falls	0.96	43.83	0.76	37.23
Pattanada halla	0.18	10.2	0.20	11.3
Sonda River	0.19	10.75	0.20	11.3

Catchment Shape : The shape of Boosangeri catchment is short and wide (fan shape), while Muregar, Mattigatta, Shivganga catchments are elongated.

Stream Flow Measurement and Compuation of Power (kW) : Stream gauging carried out as explained in methodology using current meter every month. Stream discharge ranges from 1.12 cum/see (in the month of August) to 0.015 cum/sec (in the month of February) for Boosangeri stream. In the case of Muregar range is from 1.395 to 0.026 cum/sec. The hydraulic power computed for these streams on monthly basis is listed in Table – 3. This indicates that streams of these kinds are seasonal. Power generated during June-sept. is sufficient to meet the energy needs of the nearby villages for agro proceesing and domestic lighting etc. (Fig. 1 & 2).

Rational Method : As an alternative study, monthly yield is derived by assuming a runoff coefficient of 0.25, and hence power is estimated that could be harvested from the streams. This is listed in Table – 4. Comparison of Table – 3 and 4, shows that power computed by rational methods compares with the power computed by gauging streams namely Boosangeri and Muregar. This comparative assessment by both direct and indirect methods, would help in assessing potential of remaining ungauged streams in this region.

Fig. 1 Estimated power in Muregar & Boosangeri (based on field experiments)

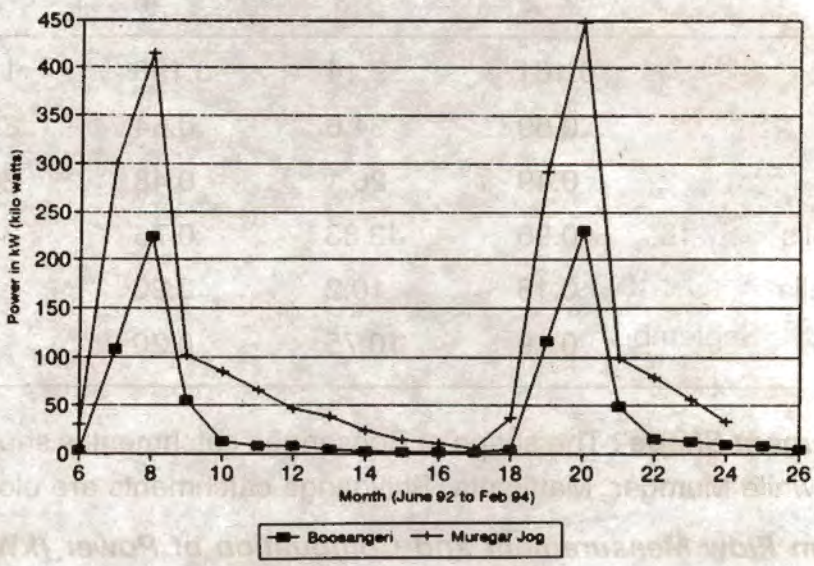

Fig. 2 Estimated power in Muregar & Boosangeri Jog (Rational method)

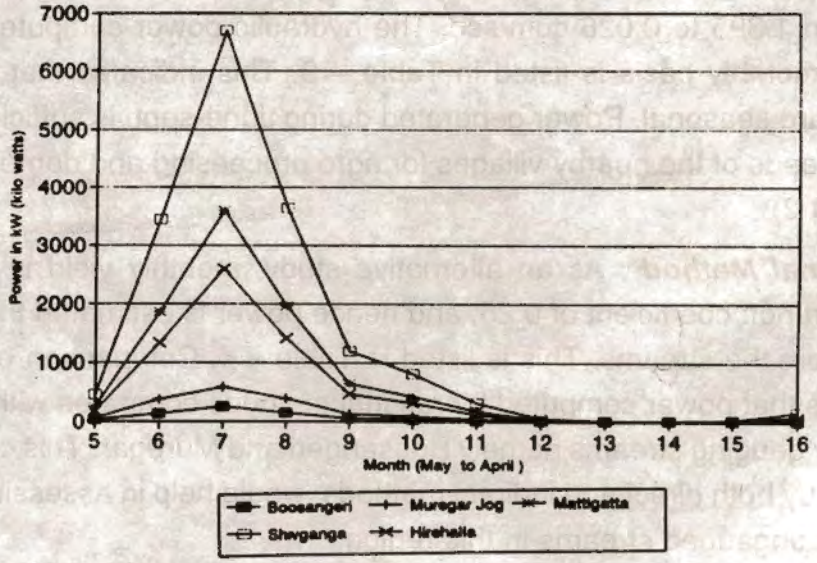

Table – 3

ESTIMATED POWER (MONTH WISE) IN BOOSANGERI STREAM AND MUREGAR JOG

		Based on field measurements	
		Boosangeri	Muregor
6	12 June 1992	2.94	30.09
7	12 July 1992	108.31	300.12
8	12 August 1992	224.99	414.78
9	12 September	55.09	101.85
10	12 October	12.14	84.76
11	12 November	8.27	65.42
12	12 December	7.6	45.65
13	12 January	4.19	38.54
14	12 February	2.68	23.37
15	12 March 1993	1.72	14.56
16	12 April 1993	1.6	10.75
17	12 May 1993	1.49	5.23
18	12 June 1993	4.19	36.92
19	12 July 1993	116.45	292.12
20	12 August 1993	230	447.48
21	12 September	48.72	99.47
22	12 October	15.12	79.45
23	12 November	12.54	56.33
24	12 December	9.41	32.61
25	12 January	7.65	30.06
26	12 February	4.44	23.04

Table – 4

RATIONAL METHOD WITH THE KNOWLEDGE OF CATCHMENT AREA, PRECIPITATION (100 Years)

		Boosangeri	Muregar	Mattigatta	Shivganga	Hirehalla
5	May 1992	17.50	48.02	242.23	450.45	174.96
6	June	138.38	379.69	1853.68	3447.02	1338.85
7	July	260.19	576.83	3601.43	6697.07	2601.19
8	August	141.70	388.82	1961.39	3647.32	1416.64
9	September	48.23	132.33	646.04	1201.35	466.61
10	October	31.17	85.52	431.42	802.22	311.59
11	November	12.73	34.92	170.48	317.02	123.13
12	December	1.85	5.08	25.63	47.66	18.51
13	January 1993	0.24	0.65	3.29	6.11	2.37
14	February	0.24	0.73	3.34	6.22	2.42
15	March	1.04	2.86	14.41	26.80	10.41
16	April 1993	6.67	17.08	83.41	155.10	60.24

CONCLUSIONS :

This study highlights the possibility of harnessing hydel potential in ecologically sound way to suit the requirements of the region. Sirsi, Siddapur, Yellapur taluks of Uttara Kannada District being located in a hilly terrain amidst evergreen forests with large number of streams ideally suitable for micro/mini/small hydel plants. Monthly stream gauging at Muregar and Boosangeri has revealed that mini hydel plants could be set up at these sites. Stream at Muregar is perennial, during

summer with a flow of about 0.26 m3/sec power of the order 10-20 kW could be generated. While during seasons power of 300-400 kW could be harnessed.

Computations of discharge on empirical basis/rational method based on precipitation history of last 100 years and power calculated is in conformity with the power calculations done based on stream gauging. This method may be used for calculations of power in ungauged streams in these taluks. These exercise provides insight to the regional requirement through integrated approaches like harnessing hydel power in decentralised way during seasons and meeting lean season requirement through solar or other thermal options.

APPENDIX

Definitions :

Catchment Area : Catchment Area is the area above a specific point on a stream from which water drains towards the stream. Catchment boundaries are located by using the contour lines on a topographical map. Boundaries are drawn by following the ridge tops which appear on topo maps as down hill pointing V-shaped crenulations. The boundary should be perpendicular to the contour lines it intersects. The tops of mountain are often marked as dots on a map, and the location of roads which follow ridges are other clues. Catchment area can be measured directly form the marked maps using planimeter or (b) superimposing a grid of squares or a dot grid over a map and then counting the number of squares or the number of dots which fall within the catchment *area*. Stream flow and ecology are both affected by catchment conditions. Changes in stream discharge and sediment loading caused by the modification of the catchment are reflected in variations in the rate of sediment transport, channel shape and stream pattern. Responses to a change may be immediate, delayed or dependent upon a critical factor reaching a threshold level.

Stream Length : Stream length will influence the amount of stream habitat area in a catchment. The lengths of a streams also affect the travel time of water in a drainage system and availability of sediment for transport. Opisometers (map

wheels) which measure distance as they roll across a map are used to measure stream length.

The longitudinal Profile : The longitudinal profile of a stream describes the way in which the stream's elevation changes over distance. The x-axis represents the distance along a stream as measured from some outfall point such as a stream junction, a lake, or an ocean.

Perennial Streams : Perennial streams are those which flow year-round. They are primarily effluent, and consist of base flow during dry periods.

Intermittent Streams : Intermittent streams are those which flow for only certain times of the year, when they receive water from springs and runoff. Depending on the season they are either influent or effluent. During dry years they may cease to flow entirely or they may be reduced to a series of separate pools.

Euphermal Streams : Euphermal streams are influent, having channels which are above the water table at all times.

Gross Head : Difference in level form the upper surface of the water at the highest usable point to the lower level of its use by the turbine.

Mean Catchment Slope : The slope of the catchment will influence surface runoff rates and is related to drainage density and basin relief.

$$S_b = \frac{(\text{Elevation at } 0.85\ L) - (\text{Elevation at } 0.10\ L)}{0.75L}$$

Mean Stream Slope : is given by —

$$S_c = \frac{(\text{Elevation at Source} - \text{Elevation at mouth})}{\text{Length of Stream}}$$

Net Head : Equivalent to the gross head less the hydraulic losses in the different elements conveying the water to the turbine.

CLASSIFICATION OF HYDEL PLANTS

1. Systems based on power and head : Mini/Micro/Small Hydel Plants

	Power (kW)	Low Head	Medium	High Head
Micro	up to 50	< 15	15–50	> 50
Mini	50-500	< 20	20–100	> 100
Small	500-5000	< 25	25–130	> 130

Note : Head is in metres

The upper and lower head and output limits adopted for any classification are indicative only.

2. According to intake :

Run of river (lateral intake from a main water course) with reservoir or dam

3. According to its regulation :

Adjustable flow which may be either manual or automatic.

Constant load, whether because of the actual nature of the load or through dissipation of excess energy.

4. According to its links to the grid :

Isolated plants

Plants connected to small electric grids

Plants connected to major zonal or national networks

5. According to technological concepts :

Plants using conventional technology : This implies quality civil engineering works for the intake, canal and forebays : silt basin at the intake, steel piping, expensive electro- mechanical equipment constructed to strict material and manufacturing criteria and fully instrumented switchboards.

Plants using non-conventional technology : They often use intakes from existing irrigation canals which are improved, the forebay installed in line on the canal and incorporating the silt basin, electro-mechanical equipment designed and constructed with technologies appropriate to the level of industrial development of the country and the availability of local materials, standardised equipment and modular switchboards with minimum instrumentation.

6. Classifications of basins and sub basins :

Based on a study of geographic and topographical maps a preliminary approximations are to be carried out. It includes the approximate determination of the hydrographic and physical parameters of the basins and sub basins of the region either on the basis of measurements and studies which have been carried out or by inference from mathematical models. Overall evaluation studies of the resources in the region to be carried out covers the studies of ecology, hydrology, geology, geomorphology and the availability of aggregates.

CRITERIA FOR SITE SELECTION

The choice of site is to be based on a close interaction between the various conditions like the pattern of the stream, the integrity of the site works, environmental integration. It is necessary to establish the inventory of energy demand in various sectors and assessment of various other sources like Isolar, biomass, wind etc. Various factors involved in estimating hydro potential are : (1) the head (2) hydrological pattern : defined from measurements or form interrelationships between effective rain and discharge. (3) usage of water, upstream of the intake to determine the flow which is available, and downstream to determine the effects of diverting the water from present and furture uses. (4) Distance from the intake to the power station and from the power station to the consumer site. (5) Size of the scheme involved and evaluation of their stability depending on various lithological, morphological and topographical conditions.

EQUIPMENTS REQUIRED FOR FEASIBILITY STUDY

(1). A spirit level or dumpy level, (2), Plumb line with about 15 m string, (3).

Graduated poles (in cms) 2 meters length, (4). 50 m length tape, (5). Current meters with accessories, (6), 50 m length nylon rope and 2 pegs, (7). Stop watch.

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A BRIEF NOTE ON NEW AGRICULTURAL STRATEGY IN INDIA

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For revolutionising Indian Agriculture India was not wiling to adopt the American Agricultural strategy. The Planning commission was concerned about the Foreign exchange cost of importing the fertilizer needeed for application to the High Yielding Variety (HYV's) in a period of a severe balance of payments crisis. Present study compares Pre and Post Green Revolution Periods of agriculture. According to the author Green Revolution was promoted as a strategy that would simultaneously create material abundance in agricultural societies and reduce agrarian conflicts. Author criticise the strategy that after two decades. Green Revolution have become visible. This (Green Revolution) aimed at engineering not just seeds but social relations as well. Punjab is an example of how this engineering went out of control both at the material as well as the political level.

The new agricultural strategy adopted in the mid-sixties has helped in revolutionising Indian agriculture. The new strategy is characterised by the adoption of HYV seeds, fertilizers, pesticides, irrigation, machinery, improved implements, soil conservation and institutional credit, etc. The adoption of these components has resulted in increase in output. The success of the new strategy depends on factors like irrigation, size of the farm, capital, price, institutional credit, extension services, etc. Regions with better factor endowment are the first to adopt modern inputs to reap the benefits. Therefore, the differential adoption of new strategy due to differential opportunities in terms of factors result in differential gains.

The study makes a comparison of two periods : Pre-Green Revolution period to the Post-Green Revolution period.

The success of the new strategy, called as Green Revolution, depends on its package approach, *viz.*, High Yielding Variety (HYV) seeds, fertilizers, controlled water supply, insecticides and mechanical equipment. But to achieve optimum results from the investments, certain actions preced the operations in the field and certain others proceed those operations after the harvesting stage. The former category includes consolidation of fragmented holdings, preparation of the land especially under command area development (CAD) schemes, supply of agricultural credit, short, medium and long term, whether given by Government agencies, co- operatives or commercial banks ; institutional arrangements for research, education and extension in agriculture through agricultural universities and/or agriculture departments, and last but not least, rural electrification to work the tube-wells and mechanical equipment. The later category would include : Post-harvesting operations, rural roads and marketing, price support operations preceded by remunerative price fixation to safeguard the interest of the farmers[1].

Agricultural production in the Indian economy would have been much more had there been strict and timely implementation of these measures. In the following paragraphs, we shall deal with the above mentioned components of the Green Revolution in the following order.

CONSOLIDATION OF LAND HOLDINGS

The Punjab State took the lead in consolidation of holdings on a voluntary basis under the Co-operative Consolidation Societies Act, 1912 (A Central Act). There was not much success for various reasons in States like Uttar pradesh and CP.

Punjab and Uttar Pradesh again started with their own Consolidation Act in 1936 and 1939 respectively, introducing some compulsory clauses, but again the effort had failed as public support was lacking.

It was only after 1947 that the matter was taken-up seriously and statutorily and compulsory consolidation took the place of voluntary consolidation in all the States at different levels. Bombay took the lead in 1947. Punjab followed suit in 1948. Then came Uttar Pradesh, Himachal Pradesh, Rajasthan, West Bengal, Andhra Pradesh and Bihar. But, implementation was uneven in the States[2].

If Punjab has provided for such a sound base for intensive agricultural activity, particularly for HYV seeds of Mexican wheat which require frequent irrigation[3]. Even in Punjab, there appears to have been no proper Green Revolution. Some economists are of the opinion that this is only wheat revolution. Green revolution, according to them, is the revolution in the production of all agricultural commodities. Little attention apears to have been given to it in most parts of the country in the Ist decades. Punjab, Haryana and Western Uttar Pradesh, which made an early start with consolidation, are reported to have completed the work. They have also demonstrated the potential it carries for raising agricultural productivity. However, according to the Planning Commission, even a beginning has yet to be made in Rajasthan, the southern states and in the eastern states. Some work has been initiated in Bihar and Orissa also. About three-fourths of the total area in the country that can be covered by consolidation, therefore, remained still to be consolidated[4]. The State-wise consolidation of holdings in India upto 1985 are available and have been shown in Table-1.

Table - 1

PROGRESS OF CONSOLIDATION OF HOLDINGS (STATE-WISE)

(Area in '000 hect)

State	Net Shown Area	Total cultivable Area	Area consolidated upto IV plan 1972-73	Fifth plan target by 1979-80	Fifth plan upto consolidated 1979-80	Sixth plan total consolidated till Mar. 1985
1	2	3	4	5	6	7
Andhra Pradesh	11,269	15,498	355	–	331	331
Assam	2,235	2,700	–	–	–	–

1	2	3	4	5	6	7
Bihar	8,267	11,535	300	607	647	769
Gujarat	9,322	11,062	1207	405	1264	1831
Haryana	3,567	30,763	183	121	306	320
Punjab	4,076	4,282	9126	–	9020	9041
Himachal	548	773	233	16	220	306
Jammu & Kashmir	706	972	23	–	47	47
Kerala	2,187	2,310	–	–	–	–
Karnataka	10,331	12,418	1009	810	1083	1083
Maharastra	16,576	20,800	9768	6073	14027	16699
Manipur	140	140	–	–	–	–
Madhya Pradesh	18,461	22,128	3552	1215	3866	3866
Meghalaya	162	162	–	–	–	–
Nagaland	62	62	–	–	–	–
Orissa	6,119	7,606	–	–	–	368
Rajasthan	15,263	25,021	1730	–	1712	1712
Tamilnadu	6,348	8,228	–	–	–	–
Tripura	240	247	–	–	–	–
Uttar Pradesh	17,317	20,095	11773	3036	13350	15170
West Bengal	5,712	5, 872	–	–	–	–
Other Union Territories	448	892	–	–	–	–
All India Total	139,365	176,568	39326	14000	46178	51800

Source : (i) Report of the National commission on Agricultural 1976, Vol. XV. pp. 233-234, (upto Columns 5).
(ii) Proceeding on conference in Land Reforms etc., 18 May, 1985, New Delhi, Government of India, pp. 157-58.

LAND REFORMS

Soon after the attainment of Independence, the Government of India realised that if agriculture was to be modernised in the country and new technology spread in all the States for augmentation of agricultural production, land reforms must be implemented in right perspective. Absentee landlordism, tenancy-at-will and share-cropping would never generate enough enthusiasm for making improvements in traditional agriculture much less to opt for the modern technology[5].

In 1947, half of India was under the Zamindary system in which 80 percent of the agricultural land was in the hands of the absentee landlords. Actual cultivation was done by those who did not own the land. Hence, the policy of the Government of India was to provide security of tenure to tenants-at- will/sub-tenants, reduce rents and regulate them on an equitable basis, besides abolishing the Zamindari system. As such consolidation of holdings are the prevention of further fragmentation were also part of the policy. All these objectives were laid down specifically in the Plan documents.

Legislation for tenancy reforms, *i.e.*, rent regulation, security of tenure and ceilings on holdings. Surplus land was to be distributed among landless tenants. But the implementation of laws was tardy. According to the All India Agriculture Census of 1961, out of 100 cultivators, 76 were owner cultivators, 16 were owner-cum-tenant cultivators and only eight were pure-tenant cultivators[6]. Hence, the Report of the Commission on agriculture stated, 'the laws for the abolition of intermediary tenures have been implemented fairly and efficiently, while in the fields of tenancy reform and ceiling on holdings, legislation has fallen short of the desired objectives and implementation of enacted laws has been inadequate'[7].

In a way we do not need to redistribute land and broaden the base of land ownership for modernisation of agriculture because, HYV seeds have universal application. The factor responsible for differential spread of HYV seeds among regions and states is the uneven development of water resurces. Most impressive spread of HYV seed has occurred in Punjab, Harayana, Tamil Nadu and Western Uttar Pradesh—by no means known for successful land reform legislation or its

Table-2
STATE WISE LAND PARTICULARS (SURPLUS) IN INDIA

Sl. No.	States/Union Territories	Excess land Declared	Land Seized by Govt.	Land distributed land	No. of beneficiaries	Land not availed for distribution				Total
						Under trial	Pulic Welfare	Waste land	Other causes	
1.	Andhra Pradesh	766531	482862	362180	308756	300856	4773	65479	–	371100
2.	Assam	604172	52023	389164	358697	76000	56397	18423	59600	210420
3.	Bihar	448190	3344371	217739	240669	150173	-	13345	51119	214637
4.	Gujarat	239977	145184	107667	24719	94793	25524	-	8993	129310
5.	Hariana	383432	110482	110311	37000	8748	180	-	264193	273121
6.	Himanchal Pradesh	284046	281454	3340	4400	259	50928	136220	15048	205787
7.	Jammu &kashmir	456000	450000	450000	450000	-	-	-	6000	
8.	Karnataka	295950	152891	114695	26437	169744	10295	338	878	181225
9.	Kerala	126241	88881	58383	1177034	28827	19900	-	16450	65183
10.	Madhya Pradesh	200090	208362	136954	48788	93942	11719	26819	18127	100607
11.	Maharashtra	708705	607484	508501	126215	53727	90294	26171	21022	192234
12.	Manipur	1652	1632	1632	326	5	–	–	–	5
13.	Orissa	183504	155404	144270	120744	20076	2675	2154	12662	37567
14.	Punjab	295706	103440	99619	25628	36189	–	–	159308	195497
15.	Rajasthan	661739	542517	395662	72474	109012	46329	8744	5701	169786
16.	Tamil Nadu	166757	157392	124275	97785	26804	14017	–	–	40821
17.	Tripura	2012	1929	1521	1517	64	269	45	18	396
18.	Uttar Pradesh	508084	482989	344502	287592	45256	113529	93	2758	161636
19.	West Bengal	239887	1109585	833191	1711589	181195	44000	121000	1934	348129
20.	Dadra & nagar Haveli	8953	7524	4952	2282	38	38	17		
21.	Delhi	1153	1141	312	654	169	123	–	481	773
22.	Pondicheri	2353	1195	935	1134	1156	–	–	–	1156
Total		7633134	5953742	4409465	4067248	1400756	491789	420356	640100	2953001

Source : ralupu, Sept. 16-30. 1989. 0.18 (Fornightly Talugu)

implementation compared with the slow speed in Gujarat and Maharashtra which have a better record in respect of land reforms,[8] Table-2.

IRRIGATION

Irrigation is one of the fundamental factors in the adoption of the new agricultural strategy. Moreover, it saves agriculture from the gamble of rainfall and averts famine and semi-famine conditions. Multiple-cropping facilities, intensive and effective use of land can be achieved through irrigation. We take irrigation as assured supply of water to agriculture, both in the time and quantity. Assured irrigation facilities not only help in increasing productivity, but their availability is a pre-condition for application of new agricultural strategy. It, thus, helps in increasing production per unit of land, particularly when used in an appropriate combination with other inputs[9] (Table - 3).

Table-3

IRRIGATION POTENTIAL AND ITS UTILIZATION IN INDIA

(Million Hect.)

	Major and Medium Schemes		Minor Schemes		All Schemes	
Year	Potential	Utilisation	Potential	Utilisation	Potential	Utilisation
1	2	3	4	5	6	7
1950-51	9.7	9.7	12.9	12.9	22.6	22.6
1980-81	27.3	22.7	31.4	31.4	58.7	54.1
1981-82	28.2	23.2	32.8	32.8	61.0	56.0
1982-83	29.1	24.0	34.2	34.2	63.3	58.1
1983-84	30.0	24.6	35.6	34.0	65.6	58.6
1984-85	30.0	25.3	37.5	35.2	67.5	60.5
1985-86	30.6	25.8	39.2	36.4	69.4	62.2

1	2	3	4	5	6	7
1986-87	31.3	26.4	40.9	37.7	72.2	64.1
1989-90*	34.8	29.2	46.0	42.1	80.8	71.3
ultimate potential	58.5	-	55.0	-	113.5	-

Source : Seventh Five year Plan, 1985-90 and Economic Survey 1986-87.

Note : Target for the Seventh Five year Plan.

WATER USAGE

In countries like Japan, Korea and China, irrigation system is well organised and drainage systematised and both systems operate in these countries are on push button technology. In India, irrigation and drainage systems operate through same channels and irrigation hardly reaches the individual holdings except in the north western states, including Uttar Pradesh. Modern technology concerning water use such as time, stage and quantum are all in a crisis as water flow is not under control. Modern technology, modern concepts, and water use efficiency the present level of soread, it may take more time to except better returns from unirrigated field crops[10].

FERTILIZER

Apart from irrigation, the other important component of new strategy is application of fertilizers. Organic manures and chemical fertilizers are crucial inputs in agricultural production and these help in providing the nutrients to the soil and plant growth. As a result, productivity of agriculture is raised in a short period. The continuous use of land for agriculture usually deteriorates the fertility of soil, owing to the fact that the application of manures and fertilizers, among others, are the most important inputs for restoring fertility of the soil. Mellor[11] estimated that, 53 percent of the incremental foodgrain production in India during 1973-74 was attributed to fertilizer use and its contribution was expected to increase to 79

percent during 1983-84. In the new strategy, fertilizer has been assigned the role of king-pin because it increased yield tremendously. FAO annual study has described the importance of fertilizer use as a 'spearhead of agricultural development, because wherever efforts are made to raise agricultural efficiency and production for expanding populations, more fertilizers and manures have been invariably needed. Perhaps even more important, on many soils they make possible good yields of valuable crops that would not grow at all without them or would grow more poorly. This possibility of diversification is more flexible in farm management and to adjust more readily to changing economic conditions'[12].

The importance of fertilizers to increase production in India was realised in the 1960's. Prior to it, extension of agricultural land under cultivation was the main strategy for increasing production. But, therefore, the scope to bring additional area under cultivation remained at a low ebb. As a result, the main emphasis was laid on intensive agriculture to raise productivity in agriculture so that production per unit of land could be increased. Various attempts were made in this regard in 1960 through IADP and in the 1966 through the HYV programme. Both these programmes increased the importance of fertilizers phenomenally.

In general, fertilizer use has been high where it has been found profitable by the farmer. It also depends upon the availability of factors like irrigation and credit facilities. In southern States like Andhra Pradesh, Tamil Nadu and Kerala, consumption of fertilizers per hectare has been significantly higher in the pre-and post-green revolution period than the all India average consumption of fertilizers. Consumption of fertilizers is higher in Punjab, Harayana, Uttar Pradesh and Tamil Nadu where irrigation facility has increased tremendously due to the increase in investment in tube wells. Punjab is using the highest doses of fertilizers per hectare of cropped area. It is followed by Tamil Nadu. Moreover, fertilizer consumption continues to be concentrated in about 60 districts (out of a total of 405), which account for a about 50 percent of the overall fertilizer consumpton[13]. The total produce and consumption of fertilizers at all India level during the Plan period had shown in Tables-4 and 5.

Table-4

PRODUCTION AND CONSUMPTION OF CHEMICAL FERTILISERS IN INDIA

('000 Tonnes)

Year	Domestic Production	Imports	Total Availability	Consumption	Consumption hectare of Gross Cropped Area (K.G.)
1960-61	150	419	596	294	1.9
1970-71	1,061	629	1,690	2,257	13.6
1980-81	3,005	2,759	5,765	5,516	31.83
1981-82	4,093	2,042	6,135	6,067	34.99
1982-83	4,413	1,132	5,545	6,387	36.94
1983-84	4,556	1,335	5,911	7,710	44.66
1984-85	5,235	3,625	8,810	8,211	46.56
1985-86	5,753	3,314	9,067	8,722	50.61

Source : Fertiliser Statistics 1986-87, Indian Agriculture in Brief ; 1985.

Table-5

CONSUMPTION OF FERTILIZERS (n+p+k) AND FOODGRAINS PRODUCTION IN INDIA DURING THE PLANS

(Million Tonnes of Nutrient)

Year		Fertilizer Consumption	Foodgrain production
1	2	3	4
1955-56	I Plan End	.13	68.9
1960-61	II Plan End	.29	82.0

1	2	3	4
1965-66	III Plan End	.78	72.4
1973-74	IV Plan End	2.84	104.7
1974-75	V Plan End	2.57	99.8
1975-76	V Plan End	2.89	121.0
1976-77	V Plan End	3.41	111.2
1977-78	V Plan End	4.29	126.4
1978-79	V Plan End	5.12	131.9
1979-80	V Plan End	5.26	109.7
1980-81	VI Year Plan	5.52	129.6
1981-82	VI Year Plan	6.07	133.3
1982-83	VI Year Plan	6.39	129.5
1983-84	VI Year Plan	7.79	151.5

Source : From Fertilizer Statistics, 1983-84.
FAI P-I-173 and pp II- 27-28.

IMPROVED SEEDS

In order to feed continuously the increasing population of the country, there is a need to increase foodgrains production in general and agricultural production per unit of land in particular. This increase in production relative to land should be viewed against the background of the given resources. As India is labour-abundant, one should prefer to use labour-using technology. Thus, HYV seeds are capable of increasing production and are labour-using. Even planners also feel that, 'production of quality seeds will continue to be an important input for crop production strategy. Therefore, the programme for production of certified seeds will be pursued with added vigour'[14].

Among the new agricultural strategies responsible for increasing productivity, adoption of resource input of HYV seeds meets with ready response and adoption[15].

The HYV-seeds are a major input of agricultural production under the Green Revolution. Their main characteristic feature is increased responsiveness to chemical fertilizers. Their period of maturing is short, it helps double cropping ; they can easily carry a heavy fertilizer load, resist wind damage, their larger leaf surface helps the process of photosynthesis also[16].

The Government of India has now been fully geared up to deliver these seeds adequately on time and hence an efficient infrastructure has been set up for the purpose. In 1984-85, distribution of a record quantity of 35 lakh quintals of HYV- seeds was made, and there was record production of breeder, fundation and certified seeds in the same year. As seed (control) order to ensure quality and equitable distribution of seeds was rpomulgated and lastly an advance supply plan of seeds for each season was introduced form that year[17].

The HYV- seeds are land substituting, but land-using materials are neutral to scale because, they can be used by all regardless of farm-size. They require entriely new inputs and agronomic practices includiing use of irrigation, fertilisers and pesticides. They play the role of modernisers of agriculture, engines of chang,e capable of transforming a traditional farmer into a commercial producer. According to an observer, they act the part of a steam engine, to ignite an agrarian revolution in poor countries[18].

HYV-seeds are considered to be neutral to scale and can be adopted even by small farmers with meagre resources. Improved variety of seeds is an essential ingradient of the Green Revolution and rightly named as miracle seed. But the problem of HYV technology is that it has a limited coverage and scope for adoption. This technology can be successfully adopted where water and chemical fertilizer available. It is rightly called water-seed-fertilizer technology. Because of this fact, it was adopted in the IRDP area rather than in other areas in the initial stages. This technology also requires heavy investment. Therefore, small farmers lagged

behind large farmers in the adoption of new seed varieties. Hence, the benefits of HYV programme did not percolate evenly to all sections of the community. The use of HYV seeds is actually responsible for bringing about the so-called 'Green Revolution' in Indian agriculture. HYV-seeds along with some other inputs like irrigation, fertilizers, plant protection, etc., have boosted both productivity and output in agriculture. The area under HYV at All India level in shown in Table-6.

Table-6

AREA UNDER HIGH YIELDING VARIETIES (INDIA)

Crop	1966-67	1970-71	1975-76	1980-81	1984-85	1985-86	1986-87	1987-88 Target
Wheat	0.54	6.48	13.46	16.10	19.09	19.18	19.02	21.13
Paddy	0.89	5.59	12.44	18.23	22.78	23.37	23.48	26.53
Maize	0.21	0.46	1.13	1.58	2.03	1.80	1.92	2.40
Jowar	0.19	0.30	1.96	3.50	5.07	6.08	4.94	6.45
Bajra	0.06	2.05	2.90	3.64	5.17	4.99	4.68	5.91
TOTAL HYV :	1.89	15.38	31.89	43.05	54.04	55.42	54.04	66.30

Source : Indian Agriculture Brief List Edition 1986, Economic Survey, 1987-88.

PLANT PROTECTION

Plant protection is very importnat in order to reduce crop losses and improve crop yield. The nature of new agricultural strategy is such that it yields more production, although expensive. Therefore, a cultivator does not like to loose even a part of his crop. Crops as they grow in the field and outputs in storage are prone to damage through pests and diseases. Recent studies have revealed that in the year 1976- 77, around 20 percent of the cropped area suffered losses from pests and diseases, but the area treated with pesticides was only 7.2 percent[19]. Therefore, more effecitve measures shall have to be adopted to safeguard the plant (crop) to obtain its potential productivity.

The quick growth of plant with the use of fertilizers and irrigation has created tremendous pest and disease problems. Moreover, new seed varieties are more prone to pests and diseases. The control of pests enables a crop to yield its maximum, thereby increasing total production. Though plant protection chemicals are costly, they are profitable. The use of pesticides, unlike that of fertilizers, does not increase productivity of land. It merely arrests crop losses.

CONSUMPTION OF PESTICIDES

The average per hectare consumption of pesticides in India is very low.According to Mahan, in the year 1954-55 it was 3.2 gms per hectare which has considerably increased during the last three decades. During the year 1983-84 it was around 327 gms per hectare. But it is very insignificant as compared to certain developed countries like the USA (1,600 gms/hec), Europe (2,000 gms/hec) and Japan (10,790 gms/hect)[20]. It is understood that only seven percent of the farms are being treated with pesticides which shows that a very large area is still being untreated. All India outlay on plant protection was merely 2.3 percent compared to other sectors of agriculture and its allied sectors. As regards States, Uttar Pradesh with 0.79 percent compared to other sectors of agriculture and its allied sectors. As regards States, Uttar Pradesh with 0.79 percent was the lowest, Punjab with nine percent was the highest and Tamil Nadu being the second best with seven percent. If we take the figures of outlay on plant protection in the State, it was only 2.5 percent of the total outlay in agriculutre and allied sectors[21]. Another tragic factor is the utilisation of funds under plant protection was only 50 percent of the allocation. All these facts reveal that investment on plant protection and use of the allocated funds are too low. And, if we have to boost crop yield, pesticides consumption must be increased.

MECHANISATION

Introduction of high-yielding varieties of wheat, paddy, maize, bajra, etc., alongwith adequate water and chemical fertilizers has made possible a larger harvest and multiple cropping. These miracle seeds can show their production potential if all the operations of farming are conducted at the proper time and

harvesting and threshing too should be done in time so that the next crop is shown in time.

To get the optimum benefits from new farm technology, some sort of mechanisation of farm operations-pre and post harvest is necessary for the simple reason so that multiple cropping can be reaped, the farmer must fight against time and to be ready for the next sowing in time. The experience of Punjab shows that mechanisation does not displace labour ; instead, new jobs are created for repaid, maintainance and running of machinery itself. At the same time, more labour is required for intensive cultivation. Punjab, infact, is importing labour from States like Bihar, Rajasthan and Uttar Pradesh. This type of mechanisation replaces bullock power and not human labour.

In India, the growth in mechanical inputs in farming practices is of recent origin and at a low level. But, with the introduction of commercial agriculture, farmers are adopting it on an increasing scale specially in Punjab, Haryana, Uttar pradesh, Andhra pradesh and Tamil Nadu.

When multiple-cropping is resorted to, timeliness in tillage planting and harvesting becomes a critical factors. if the holding is sizeable a tractor, either self-owned or jointly/co-operatively owned becomes vary effective. A farmer owning six hectares of land can reduce cost by using tractor- power, provided his cultivation intensity in 50 percent.

There is a controversy among economists regarding the introduction of motor-operated mechanical implements. The controversy is centred around the mechanization of agriculture and its effect on employment. The optimists argue that, mechanized irrigation offers an opportunity for reducing risk by ensuring timely supply of water. It also makes it possible to practise multiple cropping. Moreover, many a time the duration of time between harvesting a crop and planting of the other is very short. Animal and human power are not suited to speed up the operations, particularly on large farms in peak time. 'Mechanization, therefore, contributes to meeting these peak time needs. With better land preparation and

higher cropping intensity would lead to bigger harvests, which in turn require more labour during the post-harvest period for a larger number of field operations.

The pessimists, on the other hand, argue that relatively less developed irrigation facilities in most parts of the country would not increase cropping intensity to a larger extent. Therefore, immediately mechanizing the farm operations will displace labour. Wolf Ladesinsky holds the view that, 'the widespread experiences of other countries show that as agricultural technology grows in sophistication, it leads to less employment of labour. Moreover, the scope of mechanization is limited in India because of the very small size of the holding (1 to 5 hectares), Table-7.

AGRICULTURAL CREDIT

Credit is the most crucial input in all agricultural developmental programmes, the other inputs, *viz.*, technology, HYV-seeds, fertilizers, pesticides, irrigation and mechanisation-all depend on the availability of adequate credit. For a large majority of farmers in India, credit is an important input as the small and marginal farmers do not have their own to arrange timely institutional credit for them, to ensure that they carry out their agricultural production programmes by adopting modern technology and improved farm practices. Since the operations under the programme are spreading, a massive expansion of agricultural credit, with a smooth and easy flow to the farmers, is a must. The need for simplifying lending procedures and making credit available at the doorsteps of the cultivators has also been now realized and an attempt is being made to reduce procedural formalities.

The credit institutions in general, and long term lending institutions in particular, have been advised to strengthen their technical supporting staff and to improve the quality of landing operations.

A new approach has been adopted in making credit available to the farmers. It includes co-operatives, commercial and regional rural banks. The co-operatives operate at three levels-such as agricultual credit societies at the village level ; central co-operative banks at he district level and the state co-operatives at the

state level, supplying short term crop loands and medium term investment credit to farmers. Long term credit is provided by land Mortgage Banks at the primary and state levels.

Table-7

FARM MECHANISATION-SOME BROAD INDICATORS (IN INDIA)

S. No. Item	1951	1961	1971	1981
1. Gross Cropped Area (Million hectares)	131.9	152.8	165.8	173.3
2. Tractors (Lakhs)	0.9	0.30	1.35	5.79
3. Tractors per one lakh gross cropped area	7	20	81	334
4. Electrical Pumpsets (Lakhs)	0.26	1.60	16.20	46.60
5. Electrical Pumpsets per one lakh gross cropped area	20	105	976	2688
6. Consumption of power (kwh) per hectare of gross cropped area	1.5	5.5	27.1	83.6

Source : Commerce 'Annual Number', 1977.

Public Electricity Supply Statistics, 1982.

Basic Statistics relating to Indian Economy, 1981-82.

At any rate, co-operative banking institutions are providing support to agricultural programmes by providing institutional credit in short, medium and long term loans. Co-operatives have also assumed the responsibility of processing and marketing of agricultural produce. Storage facilities are also being provided by them to some extent. The primary agricultural creidt societies have been organised with a strong professional and financial base. Farmer Service Societies (FSS) have

been set-up to start various activities to help the agricultural sector. Managerial cadres have been formed at various levels to ensure smooth functioning of the co-operative agencies. There exist a number of Apex organisations for guiding and co-ordinating the functions of grass root level societies. The progress of co-operative societies during the Plan period in India can be seen in Table-8.

Normally, credit per acre extended by the co-operatives is found to increase significantly with increases in the size of the farm. When concentration of land assets is higher, the concentration of co-operative credit is also higher. But in the Punjab, concentration of assets is the lowest among all States. In the southern and Eastern states, the concentration of assets as well as of co-operative credit is higher than the national average. Though the credit is higher through co-operatives in these States, it is not supplied on time. Therefore, an effective administration in these States is needed to fill up the gap so as to fulfil the wishes of the farmers.

SUMMING UP

The new agricultural strategy is consolidated by the adoption of HYV-seeds, fertilizers, pesticides, irrigation, machinery, improved implements, soil conservation, institutional credit and extension services. Apart from the above, inputs ancillary services like transport and marketing and remunerative prices are needed to motivate the farmers to adopt new technology.

Size of the farm is also one of the components and large holdings had come up in Punjab due to the consolidation of land holdings in 1948. The consolidation of the land holdings in Maharashtra, Rajasthan followed by Uttar Pradesh and Punjab had been satisfactory. The performance of other States is not so satisfactory. Implementation of land reforms is also one of the factors for the adoption of the new package in agriculture. Even the national commission on agriculture observed that, the laws for the abolition of intermediaries had been implemented fairly and efficiently. But in the field of tenancy reforms and ceilings on land holding legislation had fallen short of the desired objectives and the implementation of enacted laws has been inadequate. But the State where the Green Revolution had an impressive spread like Punjab,Haryana, Tamil Nadu and Uttar Pradesh are by

Table-8

PROCESS OF COOPERATIVE CREDIT SOCIETIES (ALL-INDIA)

Item	1950-51	1950-61	1970-71	1980-81	1983-84	1986*
I. Primary Agricultural Order Societies						
(a) No. of Societies (Lakhs)	1.05	2.12	1.61	0.95	0.94	0.92
(b) % of villages covered	NA	75	94	97	97	97
(c) Membership (Lakhs)	44.08	170.47	309.63	576.53	666.70	721.18
(d) % of rural population covered	9	30	36	56	62	NA
(e) Average membership per society	45	80	193	613	725	NA
(f) Paid-up share capital (Rs. Crores)	7.61	57.75	205.74	571.08	720.75	NA
(g) Deposits (Rs. crores)	4.28	14.59	69.46	290.58	463.93	572
(h) Working capital (Rs. Crores)	37.25	273.92	1153.40	4035.98	5416.79	NA
(i) Loans advanced during the year (Rs. Crores)	22.90	202.75	577.88	1763.59	2499.31	3.140
(j) % of loans overdue to outstanding	22	20	41	42	45	42
II. Land Development Banks						
(a) Number of Banks						
(i) Central	5	18	19	19	19	19
(ii) Primary	286	463	865	1066	1185	NA
(b) Loans advanced during the years (Rs. crores)	1.38	11.62	170.36	363.0	438.74	533
(c) Loans outstanding (Rs. crores)	6.59	37.74	636.16	1697.0	2236.41	2.625

Source : Indian Agriculture in Brief : 1986, Report on Currency and Finance, 1986-87.

(a) Relates to the year 1980-81

* Relates to the year June, 1986.

NA=Not available.

no means known for successful land reform legislation compared with the snail progress of green revolution in Gujrat and Maharashtra known for their better implementation of land reforms.

Irrigation is one of the important pre-conditions for the application of new agricultural strategy. It saves agriculture from the gamble of rainfall and averts famine and semi-famine conditions. In the recent past, tube-well irrigation is one of the significant changes associated with the adoption of new agricultural technology.

Fertilizer use is another important component of new agricultural strategy. As in relation to this, IADP and LAAP programmes increased the importance of fertilizers phenomenally. Hence, in some States like Andhra Pradesh, Tamil Nadu and Kerala the consumption of fertilizers per hectare has been significantly higher in pre and post-green revolution periods than the all-India average consumption. But, Punjab is relatively using the highest doses of fertilizers per hectare.

The HYV seeds are another major input to the new strategy as it helps not only double cropping, but the short stems of the HYV plants can easily carry a heavy fertilizer load and their larger leaf surface helps the process of photosynthesis. The total ares under HYV seeds had gone up from 1.89 million hectares in 1966-67 to 54.04 million hectares in 1986-87 which is an indication of the spread of green revolution.

Measures like plant protection and the application of pescticides play a vital role in reducing crop losses and simultaneously to improve crop yield. Even though these measures are expensive in nature, they yield more production which improves the living standards of the farmers.

During the period of Green Revolution, farm mechanisation had took rapid strides. To get the optimum benefits from new farm technology, some sort of mechanisation of farm operations-pre and post-harvest is necessary for the simple reason that multiple cropping can be reaped easily. But the experience of Punjab shows, the mechanisation does not replace human labour. And, simultaneously more human labour is required for the intensive cultivation. Therefore, Punjab is

attracting labour from States like Bihar, Rajasthan and Uttar Pradesh. Thus, mechanisation replaces only bullock power but not human labour.

Agricultural credit is another important input for the adoption of water, seed, fertilizer and technology, specially by small and marginal farmers. The institutional structure for providing the credit had been strengthened by the extension of commercial banking in the rural areas on the hand and by opening Regional Rural Banks on the other. These institutional agencies are supplying credit alongwith the co-operatives including primary agricultural co-operative credit societies and farmers co-operative service societies. Credit extended by co-operatives made a remarkable progress in the post-green revolution period which certainly had an impact on agriculture growth.

NOTES AND REFERENCES

1. *R.N. Chopra, Green Revolution in India, Intellectual Publishing House, 23 Ansari Raod, New Delhi, 1985, p. 47.*

2. *It has repeatedly been emphasised that, one of the most serious causes of debt is the small size of the average holding which is greatly aggravated by way in which it is split into innumerable fields scattered round the village. It is obviously too late to increase the size of the holding and with an increasing population, they are bound to become even smaller, but there is no reason, except human prejudice why they should not be consolidated. For ten or fifteen years economists and officials debated how it could be done but it was left to Mr. Calvert to hit upon the discovery that co-operation provides the best solution to most of the problems. The first society was formed in 1921 and ten years later there are about 800 with 4,800 numbers and in the interval about 3,36,000 acres have been consolidated at the cost of Rs. 2.50 per acre, the whole of which has been borne by the Government. It must be expected 'that whole tracts will be adjusted without great labour and much time but a real revolution of incalculable benefit to the cultivators of the central districts has been definitely started'. For details see, M.L. Darling and M.S.*

Randhawa, The Punjab Peasant in Prosperity and Debt, OUP, 1932, p. 252.

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TOBACCO : THE "EQUAL OPPORTUNITY" KILLER

Tobacco is a unique consumer product because of the number of deaths and diseases to which it is directly linked as a causal factor. the effects of tobacco consumption have been extensively documented for developed countries and to a lesser extent for developing countries. It is now clear that smoking-related diseases have become "equal opportunity" diseases, affecting women and men in similar ways, if they have similar exposure to tobacco and smoking behaviour. Further more, women have additional specific risk related to reproduction. Smoking also contributes to poverty and malnutrition.

- World Health Organization

DEVELOPMENT OF BIOMASS STOVE FOR SMALL SCALE HAND MADE PAPER MAKING INDUSTRIES IN NEPAL

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Hand made paper making, a popular small scale industry of Nepal, has an unique production procedure. Expansion and diversification of hand made paper production through mobilizing Lokta Cutters, in cooperation with traditional paper makers of Nepal has been discussed in the present paper, emphasising multipurpose use of fuel wood. Development and test demonstration of improved biomass stove for paper making has also been discussed simultaniously with suggested action plan.

NEPALESE HAND MADE PAPER

Hand made paper making is an age old traditional enterprise in Nepal. The traditional paper making process was imported from Tibet to Nepal in the 12th century A.D. Paper making areas are scattered in both the Western and eastern hills along Mahabharat Range of Nepal where Lokta (daphne sbholua and daphne papyracea), a slender shrub, is found as raw material for paper is foldable without being creased and torn. With lapse of time, it is capable of lasting long, even to hundreds of years. The paper is widely known for its attractive texture and durability. It had been very much popular for its uses on various purposes. Legal documents are mandatorily made on it for its long lasting nature.

The Nepalese Hand Made Paper (NHMP) has been developed as one of the important small scale enterprise in rural Nepal. The socioeconomic importance

of NHMP enterprise to the rural people particularly to those families who are involved in this occupation is thus obvious. These enterprises have now been well established and successful to protected the Nepalese traditional technology and skill on one hand and promote the local materials and provide income opportunities to the rural people on the other. However, for most of the paper makers, farming still is the main activity.

In the earlier days, there were lots of Lokta trees as well as fuelwood trees to cook Lokta. Now-a-days, both Lokta and fuelwood trees are scare and hence Lokta cutters as well as paper makers have to travel long distances to collect these items. Because of heavy harvesting of these items, adverse impact due to degradation of forest and local environment in the surrounding localities can easily be visualized. This has been threatening even the existence of paper making enterprises from Lokta.

INVOLVEMENT OF BHAKTAPUR CRAFTS PRINTERS IN PROMOTION OF NHMP

Bhaktapur Crafts Printer (BCP), a project initiated in Bhaktapur district for community development through hand made paper production and market was started in 1981 with UNICEF assistance.

Since then, it has been playing an important role in the expansion and diversification of hand made paper production through mobilizing Lokta Cutters and traditional paper makers in Baguling, Parbat and Myagdi districts in Western Nepal. The project was initiated as community based income generating options for low income level enterpreneurs.

Around 350 community members of the project area are actively engaged in hand made paper making enterprises. The project has been helping rural people in increasing their income as well as in providing financial assistance in community development works in these areas.

After the establishment of BCP, hand made paper is increasingly used for wrappings, calendars and block Prints sold locally and for making the colourful

PROCESSING FLOW CHART OF HAND MADE PAPER FROM LOKTA

greeting cards distributed/marketed world-wide by UNICEF for raising fund in support of UNICEF sponsored projects. It demand, particularly in the form of stationeries, decorating product and printed Hand Made Paper is ever increasing. Nepal and Tibetan arts printed on NHMP are highly liked by the foreigners and tourist making it an important souvenir in the tourist shops. NHMP is gaining its popularity and demands abroad as well.

FUELWOOD FOR PAPER PRODUCTION

The bark of Lokta is soaked in water, cooked and beaten to make pulp before paper is produced from it in a mold frame. In general to produce the paper, the lignin from the wood has to be removed and the remaining cellulose fibers are arranged into a sheet. The Lokta is first cooked in a digester (half sized used oil drum) in presence of water and alkali (coustic soda) for several hours to remove the water soluble parts. After this, the Lokta has to be beaten to separate the fibers. The separated fibers are mixed with water and the paper-seets are formed by pouring the solution over a cloth- frame. After drying the paper sheets are ready for further processing.

The quality of this important indigenous paper mainly depends on skill of the paper makers in beating the Lokta fiber and in molding. Finer the pulp and uniformity in pasting the pulp, the better is the paper quality, that is, uniformity in thickness, spread, color, fineness, luster and the look.

With the ever widening scope for hand made paper production the problems of raw material and energy requirements and its availability become serious. The main raw material, Lokta, is very limited in supply. The availability of adequate quantity of Lokta is one of the bottleneck in increasing the production. On the other hand, the demand of fuelwood required to process Lokta has also increased. The tendency of harvesting both Lokta and fuelwood is threatening the already deteriorating environmental situation in the project areas.

As in the case of other parts of the country, deforestation is taking place in a more alarming rate in the paper making districts as well because of heavy requirements of fuelwood for paper making enterprises. Fuelwood has been one of the scarce and costly input in the hand made paper manufacturing process. to process a kg. of Lokta, about 3.5 kg of fuelwood is required. Mainly traditional types of cooking stove such as three stones type, open chamber type, chimneyless type, etc. are used to process the Lokta. This process consumes substantial quantity of fuelwood on one hand and produces lot of smoke for users on the other.

The local market price of 1 bundle (40 kg.) of fuelwood is around Rs. 120. This prevailing condition is substantially hampering the hand made paper production by reducing the profit and income margin to the producers as well as deteriorating the health and sanitation conditions of the paper producing areas. On the top of it, depletion of forest for excessive cutting of fuelwood is also damaging local environment significantly. It is estimated that during 1992 and 1993, 322 metric ton and 308 metric ton of fuelwood respectively was used by the paper makers in the paper production areas of BCP.

DEVELOPMENT AND TEST DEMONSTRATION OF IMPROVED BIOMASS STOVE FOR PAPER MAKING

Realizing the severeness of the problem related to fuelwood supply in the above mentioned Hand Made Paper production areas, at the request of BCP, the Center for Rural Technology (CRT) in collaboration with Research Center for Applied Science and Technology (RECAST), a research organization within the umbrella of Tribuwan University, conducted a test demonstration of Improved Biomass Stove (IBS) in June, 1991 at the complex of BCP in order to demonstrate the usefulness of IBS to initiate fuelwood saving options. The stove design was developed by the RECAST based on the discussion with CRT and BCP.

As the paper makers generally cook Lokta in half-sized used oil drum (100 litter), the IBS was designed to suit the oil drum for cooking Lokta. The stove consists of a combustion chamber made of mud and brick with a grate at the bottom, baffle and chimney. An iron ring was at the top of the pot- hole so as to fit-in the bottom of half-sized oil drum. The chimney was made of bricks and the grate from iron strips. In order to compare the findings, traditional type cooking stove was also brought under operation during the testing. The general observation and the findings of the test operation was as follows :

About 35% of fuelwood was saved as compared to the traditional type

- Time take to cook Lokta in both the types were found to be equal
- The efficiency measure through Water Boiling Test in IBS was 15.2% as

compared to 10.1% in the case of traditional type indicating that the greater utilization of heat in IBS.

- The smoke freely went out of the room

The above test rusults motivated the officials of BCP about the potentials of IBS in conserving the fuelwood in the paper production area and as such, they entrusted CRT to launch UNICEF assisted "Pilot Wood Saving Project for the Hand Made paper Enterprises" at Prabat and Baglung districts in Western Nepal where the hand made paper project is being implemented.

IMPLEMENTATION OF IBS PROJECT

With the objective to assist paper makers in the use of IBS to process Lokta for making paper so as to save fuelwood and improve local sanitation and environmental conditions, the "Pilot Wood Saving Project for the Hand Made Paper Enterprises" was launched in December 1991. The pilot project was undertaken for a period of 4 months. The implementation of IBS project was divided into three stages : Introduction of IBS, Economic Assessment and Dissemination.

1. Introduction of IBS

Introduction of IBS was undertaken during the pilot demonstration phase through orientation activities to create awareness among the paper makers about the importance of using IBS in fuelwood conservation. Then, in order to improve their skills and to strengthen local capability for promotion and dissemination, a training program has been conducted for 10 local promoters.

2. Economic Assessment of IBS

After the orientation and on the completion of training, an economic assessment of IBS was carried out. The economic analysis of using different types of stoves showed that an average paper maker could increase his annual profit by about Rs. 1208 by using IBS and Rs. 944 by using semi IBS. Each family with IBS and semi- IBS could save about 649 kg and 440 kg of fuelwood respectively as compared to traditional one considering that an average Paper Maker make hand made paper from 40 batches, each batch consisting of 12 kg. Lokta.

It is estimated that around 100 (30% of the total) paper makers in the paper making areas are using semi-IBS with an estimated fuelwood saving of about 44 metric ton Lokta could be motivated to install, at least the semi-IBS type. For this, further promotional activities, local capabilities building and mechanism for IBS installation and its follow-up/monitoring have to be build-up and strengthened.

As a matter of fact because of the awareness creation as well as adoption of at least semi-IBS in the project area contributing to fuelwood saving demand for such stoves are increasing not only in Patbat, Myagdi and Buglung district but also in adjoining Lamjung and Gorkha districts where BCP has been expanding the paper production activities quite recently. As such, CRT has trained 4 more Local Promoters, 2 in each district in order to carry out promotion and dissemination of IBS in these new district.

Financially, the users do not see any benefit in using IBS or semi-IBS. However, in terms of fuelwood saving each paper maker could save additional 200 kg of fuelwood per season/year by using IBS instead of semi-IBS. It will not only financially help the users but also help in saving of time required to collect additional fuelwood. Beside, saving of fuelwood help also in the conservation of local forest/environment.

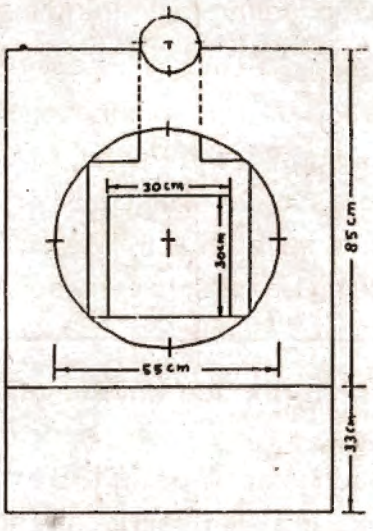
3. Dissemination and Monitoring of IBS

After the introduction of IBS in the paper making areas, most of the paper makers committed that they would install IBS for processing the Lokta as well as Improved Cooking Stoves for household cooking with the help of trained Local Promoters. As a result following activities were undertaken.

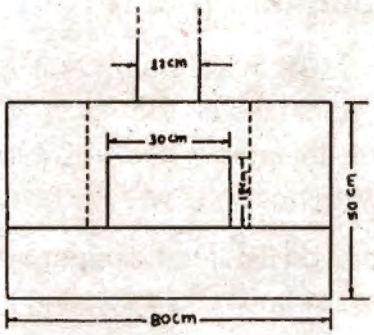
- Installation of 19 demonstration IBS for the paper makers and 22 demonstration Improved Cooking Stoves for household cooking.
- Follow-up/monitoring and performance test of the installed IBS.

The dissemination of improved Cooking Stoves for household cooking took place quite well as it did not involve much investment cost. However, the dissemination of IBS for paper making was not that fast as was envisaged. The main

reason behind slow dissemination of IBS was that the paper makers were expecting some subsidy specially for the metallic part costing about Rs. 600/Unit from BCP. On the other hand, BCP was of the view that since the demonstration IBS have shown positive result, the dissemination should have been automatic.



PLAN



ELEVATION

Dimensions of Improved Biomass Stove (IBS)

Once the subsidy was not coming from BCP the users adopted a mid- way approach installing modified local "U" shaped IBS, semi- improved type, where they did not use metallic parts that mainly involve the capital cost. These semi-IBS are also almost closed chamber with baffle and chimney. The fire-gate was a bit bigger to adjust their bigger sized fuelwood. These semi-IBS were also performing equally efficiently, around 13.8%. Some of the users installed IBS at least with iron grate however without iron ring and fire-gate. Some users installed IBS in the open space with little shade without any chimney. They intentionally did not have iron fire-gate so that they could use bigger sized fuelwood. The efficiency of semi-IBS was found to be comparatively less.

Follow up/mointoring of the installed IBS have shown that the performance of IBS have made most of the paper makers quite satisfied. The saving of fuelwood was quite significant. The smokelessness was another benefit. The average efficiency has increased from 9.1% to 15.3%. The incremental efficiency was a bit low because of dampness of the new IBS installed.

However, some users had made complaint on the high cost of investment as well as size of firewood which need to be fairly small because of size of fire-gate. The height of IBS was also not favorable to them for easy handling. The added investment for the installation of IBS was around Rs. 800.

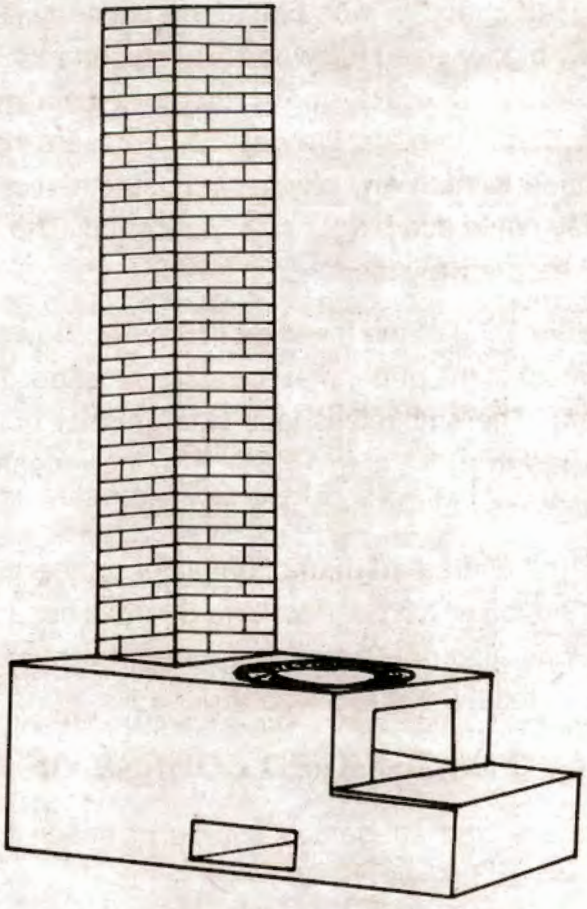
MAIN ISSUES AND SUGGESTED COURSE OF ACTION

The main issues and suggested course of action for promotion and dissemination of IBS are as follows :

1. Although IBS has more efficiency as compared to semi-IBS, paper makers are not installing them mainly because of lack of fund. In order to encourage for using IBS, they need either to be tied up with financing institutions to fulfil their investment requirement or BCP can create a revolving fund through which the paper makers can be financially helped on credit basis expecting the credit to be paid back in instalments.

2. In order to meet the fuelwood requirement partially to carry the paper

making enterprise, the local residents including the Paper Makers and Lokta Cutters need to be motivated to undertake household fuelwood plantation activities and also install household ICS.



3. Besides men, also women need to be motivated to actively take part in all process of paper making as they are very much accustomed to use fuelwood efficiently.

4. Training cum-demonstration on the use of IBS and ICS has to be carried out in new paper production areas of BCP in order to create awareness among the local community members as well as transfer the technology to local promoters with emphasis on building local technical capability.

5. Follow-up and monitoring of the stove dissemination activity and its performance was lacking. So follow-up and monitoring of dissemination activities in both old and new paper production areas has to be carried out regularly to further promote the dissemination activity on one hand and take corrective measures in time for increasing efficiency on the other hand.

6. Action research for improvement/modification of also the present IBS design, specially with regards to fuelwood feeding gate, height of cookstove etc can be initiated in order to suit the need of the Paper Makers.

7. The paper makers have to be motivated for the use of semi-IBS at least with grate so as to increase fuelwood efficiently.

8. Since small sized fuelwood increase stove efficiency, the papers need to be further motivated for its use instead of using bigger sized logs.

9. The paper making process is to be reviewed for increased efficiency of fuelwood use, such as use of lid to cover the lokta boiling container, overnight pre-soaking Lokta before boiling and fully deeping Lokta while boiling.

10. The trained local promoters are not being utilized for promotion and dissemination of IBS because there is no fixed programme as such to encourage and tie them up with IBS installation activities. So, the already trained local promoters need to be further supported technically and the IBS installation and its use must be periodically monitored for strengthening the extension of IBS dissemination activities.

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ECONOMICAL "COLD STORAGE" FOR FARMERS

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INTRODUCTION

Most of the fruits and vegitables produced in nature are seasonal, these must be stored and preserved if they are to be made available year around. In annual survey, it is found that nearly 60-65 million tonns of fruits & vegitables are produced in India, out of which 20-35% are lost due to lack of storage facilities. In this article, economical cold storage is suggested which is easy to construct, operate and no electrical or any other energy is rquired to work it. The farmer can construct it on their own farm and it is possible to maintain 10 to 14 degree celcius temperature difference between inside and environment. The construction cost is approx. Rs. 50 per cubic meter.

Today large urban population, require tremendous quantities of food which is mostally produced and processed in rural area or outlying area. Large quantity of fruits and vegitable are seasonal, cultivated during certain period of the year. To make it available through out the year, they must be stored and preserved at low temperature. The standard of living of people has gone up, demanding always better and fresh quality foods.

In annual survey, it is found that nearly 60 to 65 millions tonnes of fruits and vegitables are produced in India. Out of which 20 to 35% is lost due to lack of proper storage facilities. The knowledge and advantages of storage are not popularise in rural area, and hence most of fruits & vegitables growed bulkly has to be sold at very cheep rates. If it can be stored & preserved, two main advantages are—

—Fruits & vegitables are available through out the year .

—The farmer can earn more money from farm products.

Refrigerated cold storage is the only way to store and preserve the food. But it is not commonly & publically used in rural area because :

—Higher initial construction & operation cost.

—Plant and machinery is required.

—Skilled person is required.

—Economically can not offered by poor farmer.

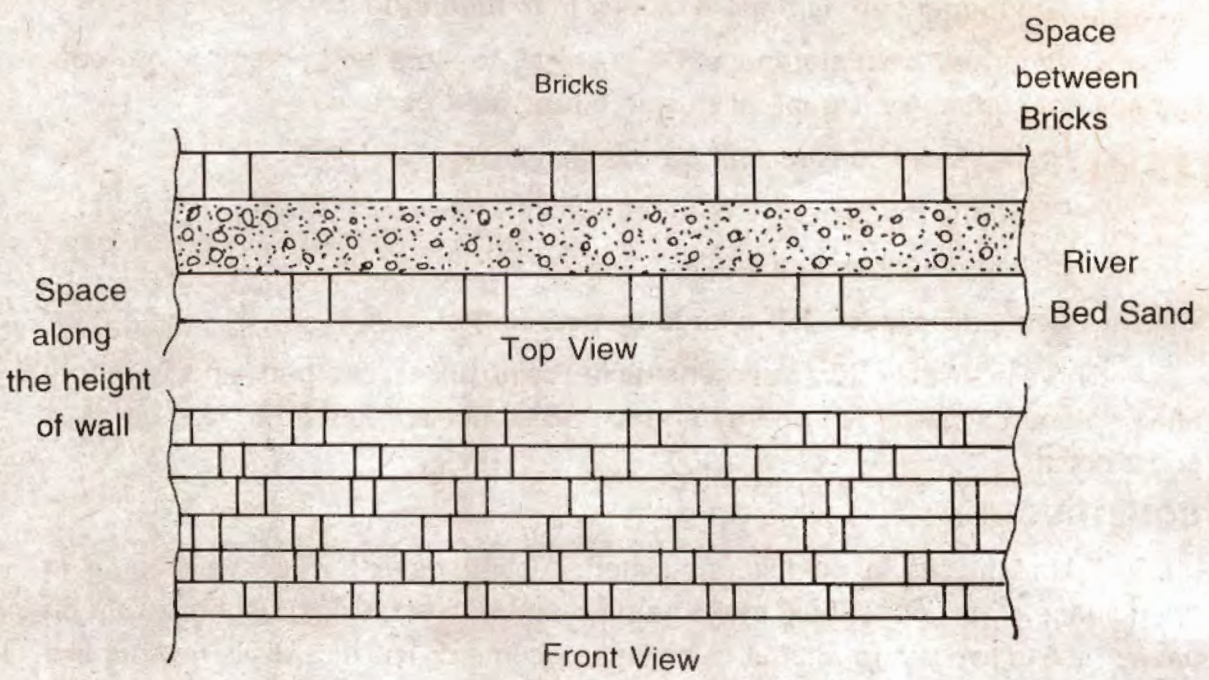
This simple cold storage is constructed using bricks, riverbed sand, bamboo, khas, gunny bags etc. No energy and skilled labour is required to operate it or construct it.

CONSTRUCTION

Select the site for cold storage where continuous air flow is available *i.e.* in open space. First floor should make hard with murum etc. Construct brickwork on flat surface in two layers without using lime or cement. The insecticite powder like B.S.C. or any other may be used below the bricks to avoid formation of fungy & insects.

The side walls are constructed with bricks placed as shown in figure. Clean unbroken and uniform bricks are used for walls.

One to two inch space should maintain between two adjacent bricks. Construct two rows of bricks providing 4-5 inch cavity. Precautions is to be taken that wall should be sufficiently rigid. Pillers can be constructed after every 10 feet with bricks and morter to strengthening the walls. All four walls are constructed similarly. Fill the cavity between wall with riverbed sand. Care is to be taken that, sand should not push the bricks and spoiles the construction. Also see sand is not coming out from space between bricks. Put the rubber tube along the sand, having holes at every two feets approximatly. The rubber tube is connected to elevated water tank. Water is allowed to dribbled from holes at the rate of 2 to 2.5 Lit. per hours.



The roof is constructed from bamboo strips, khas & gunny bags. Khas is placed in between gunny bags and tight to bamboo strips with m.s. binding wire. Place above prepared roof on four walls of the storage. The roof must be rigid so that it should not lean down in the centre. Provide additional support if required. Avoid direct sunlight on the roof.

OPERATION

Allow water through tubes till all bricks should getting wet. Arrange to spray water on roof, which ultimately absorbed in khas & gunny bags. Do not spray excess water so that it will drops on fruits & vegitable placed inside the storage.

Air flow passes from walls & roof, heat from cold storage is absorbed by water and inside temperature reduced and humidity increased.

The fruits & vegitables are placed in plastic trays or such a way that their should not be direct contact between wet bricks and fruits.

CONCLUSION

It is a very simple cold storage in construction, operation and maintenance. Any poor & uneducated farmer can use this on his own farm to keep fruits, fresh for 10 to 15 days without any energy input. The inside & outside temperature difference depends on environmental conditions.

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Indoor Air Pollution : Myth or Reality?

Most of us would dismiss it as MYTH but would be shocked to know that it is the truth. Airconditioned spaces are generally designed to keep "indoor" air "in" and "outdoor" air "out". This is done to keep energy costs low because more fresh air means more ventilation which means more tonnage and thus, more energy cost. The lack of ventilation/fresh air causes build up of contaminants or pollutants like CO_2, bacteria, viruses, VOCs, tobacco smoke, odour etc. which getsrecirculated in the 'closed' space resulting in the indoor space becoming more polluted.

An 'Environment Protection Agency' study has shown that organic contaminants can occur indoors at upto 10 times the outdoor levels found in either industrial or rural area.

So the next time you walk into any conditioned space, office, restaurant, nursing home, club give "Indoor Air Quality" a thought !!

MEDICINAL PLANTS & ITS DOMESTIC USES

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Often we notice that people of all ages, irrespective of their gender visit doctors for small ailments, little do they know that besides incurring wasteful expenditure on strong allopathic medicines they have to suffer from their after effects also which is unnecessary, since in the house or nearby we can find many herbs and shrubs & trees which can cure small ailments without leaving any side effect. Sometimes people do not recognise these herbs and are thus unaware of their qualities and utilities, therefore there is a crying need to recognise and be aware of some easily available plants and to know their uses so that they can be used judiciously in time and according the diseases.

TULSI

How to Recognise

In India Tulsi is a very common plant, because of its religious importance too, it is planted in most of the houses. Tulsi has tremendous amount of medicinal qualities, besides it drives away insects and mosquittos and keeps the atmosphere clean resulting pollution free environment. This plant is about 60 to 75 cm. long and has many branches. Leaves are about 5 cm. long, with pinking edges and hairy surface. It has light pink aromatic flowers which contain yellow tiny seeds.

Use

Tulsi leaves, roots and seeds are used as medicines. This plant is mainly useful in cough, cold, indigestion and skin diseases.

Method

1. Take 8 tulsi leaves, 3 black pepper, one small piece of ginger- raw or dried, small ball of goggery (Gur) and boil together with a glass of water for sometime. When the water reduces to half, sieve and drink this decoction for relief with cough cold and fever. This decoction is very useful if taken early morning and/or at bed time.

2. One Tsp tulsi leaves juice, 1 Tsp ginger juice, 1 Tsp honey, mix together and lick it frequently. This syrup is very effective for curing cough.

3. Boil Tulsi roots in water, and sieve it. Take one cup of this doction twice or thrice a day, it is beneficial in Malaria fever.

4. In earache or watery discharge from the ear, drop tulsi juice in ear once or twice in a day. It cures the discharge and reduces the pain.

5. Bleeding nose of children can be cured if Tulsi juice is droped into the nose.

6. Tulsi paste is very effective in skin diseases like eczema.

7. Bad odour of mouth can be reduced by chewing tulsi leaves.

8. Boil, Tulsi seeds in a glass of water, when quantity reduces to half, drink luke warm, useful for urinary infection.

9. According to latest research Tulsi is a very effective tonic. Regular intake of this herb keeps vitality and energy in the body. This can be consumed directly by chewing or boil it in a glass of water before can suming. It is good for stomach also as it kills the worms. Specially very useful for children.

NEEM

How to Recognise :

Neem is a well recognised tree in India. it is huge in size and diameter. Constructin of leaves are pointed in front and broad at rear portion. Flowers are white and aromatic. Raw Neem fruits are green and ripe fruits are yellow in colour. Inside this is a white seed which has very strong odour.

Use :

Neem is a well established antiseptic plant, besides this it has other medicinal qualities and entire tree is useful, especially for skin diseases.

Method

1. Extract Juice of 8-10 fresh and, washed neem leaves, mix pinch of salt and drink every morning. It is good for stomach and kills the worms.

2. Neem leaves juice mixed with honey is very useful in Jaundice and it should be taken one table spoon in morning and evening.

3. Because of its antibiotic nature it helps curing and giving relief in small pox and chicken pox. Boil leaves in water and take bath with luke warm water. This gives relief to skin itchiness due to small/chicken pox.

4. (a) Neem fruits which are called Nimbori or Nimkauli has a peculiar oily substance. It cures dryness of the skin caused by Jaundice or ailments of liver. Leave overnight 8-10 crushed Neem fruits in 1/2 katori of coconut oil. Heat it up in the morning and message it on dry skin.

(b) Boil few leaves and 20-25 fruits in water and take bath with this water (luke warm) after two hours of message.

5. Grind to paste 8-10 leaves and heat it up. Spread it on a guaze and bandage it on blisters. This remedy removes the puss formation and dries the wounds.

6. 2-3 inch piece of neem bark, boiled in water makes a god mouth wash. It reduces swelling of gums and tonsils, if gargle has been done with this water.

7. On stem of an old neem tree if a cut is made, it produces gum like substance-this sticky syrup like substance is ideal to remove pimples and scars.

8. Neem oil is beneficial for skin diseases like leprosy, eczema, etc. It heals up the wounds also.

AMLA

How to Recognise

It is a medicinal plant. The tree is of an average height. Leaves are very thin and formation is very close that they look like feathers. Flowers are light greenish yellow and grow beneath the leaves and they grow in bunches. Fruits are round and like marble. They are green in colour. It has a round stone like seed in it.

Use

Mainly Amla fruits are used for medicinal purpose, raw or dried. It has

tremendous amount of vitamin C. It is mainly beneficial in heart disorders, asthama, jaundice, indigestion & other disorders of stomach, eye diseases, chronic headache etc. People who suffer form heat stroke, should take Amla regularly as medicine.

Method

1. Stomach disorders as gastric trouble, constipation, pepticulcer, acidity, dycentry can be cured by eating raw or dry Amla. It is very useful for anemic patients. Raw Amla should be eaten empty stomach in the morning with salt and drink a glass of water, is very useful. Many people can not eat it because of its acetic taste, for them it is advisable to grate it in stainless steel grates, mix pinch of salt and little honey and eat. But remember in that, do not throw away the water which comes out after grating otherwise its medicinal value will reduce.

2. Dry Amla in season, pound and make powder of fruit and seeds separately. Before going to bed, eat one spoon each and drink water. It helps remaining indigestion and constipation.

3. Powder made out of seeds, taken one-two spoon, 2-3 times daily helps asthma patients. When fresh fruit is available use fresh seeds, crush and boil them

in water. Let it boil till water reduces to half, drink one-cup of this luke warm water as medicine.

4. For people who suffer from headache and burning sensation in eyes should take Amla murabba early in the morning. If fresh fruit is available then use one spoon of fresh Amla Juice and one Spoon Honey. This has more medicinal qualities than Murabba.

5. People prone to catch heat stroke should eat murabba and drink water before going out in day time in summer season.

6. Diseases like T.B., Skarvi and Jaundice require extra vitamin C to heal patients suffering from these diseases can take Amla in any form, e.g. raw amla, amla powder, amla ketchup (Chatni) or Murabba.

7. Because of stones in Kidney if any urinary problem is occuring, instantly Amla sharbat should be taken. For this sharbat prick and dip 1 k.g. Amla in water for 2-3 days. Boil it in fresh water and after remaining seeds grind to paste. Mix with 1/2 ltr. water and 2.5 Kg. sugar. Cook till it forms a smooth syrup. Make Sharbat with this Syrup and drink at the interval of 2 hours. It checks frequency of urine.

8. If Amla powder is rubbed on the teeth, its helps in curing pioria.

9. Amla powder 1 spoon & Jasmine oil 2 spoon mix well and rub on body, it cures itching on body.

10. On bleeding nose-fry dry Amla in pure Ghee and cool it then make paste. Apply paste on nose.

ARJUN

How to Recognise

It is about 80 feet tall tree. Its leaves are broad and about 15- 25 c.m. long. They grow on top. Light yellow flowers grow on the top of the tree in bunches. Fruits are brown and hairy.

Use :

Fruit and bark are used for heart ailments, liver disorders and wounds etc. Leaves are useful for earches and headche.

Method :

1. Take 3″–4″ piece of bark from trunk of Arjun tree. Boil it in a glass of milk and drink it early in the morning in empty stomach. This is beneficial in heart ailments.

2. If fresh bark is not available easily then alternate is to collect and dry the bark in sun and made powder. Mix on tea spoonful of powder in milk with sugar or Gaggery (Gur) and drink.

3. After getting hit if bruses (blue spot on skin) apper, or in fracture, one spoonfull of bark power and 1/2 tea spoon full honey should be taken orally, twice or thrice in a day. It helps preventing wound, bruses pain etc.

4. Bark powder and honey if mixed together and applied on pimple as a pack, prevents and dries pimples.

5. Boil bark & leaves in water, use this water for washing wounds, this water acts as disinfectant.

6. For earache drop 3-4 drops of leaves extract (Juice) in ears twice or thrice daily.

BEL

How to Recognise

It is a big tree. It has cluster of 3 to 5 leaves. Thorns are grow in between leaves. Flowers are white aromatic and grow in bunches. Fruits are big and round like ball. Fruits skin is hard like wood. Raw fruit is green in colour but it turns yellowish brown when it is ripe. Fruit pulp is dark yellow in colour and has very strong aroma. Seeds are small and have coating of gum like substance.

Use

Bel fruit is used to check irregularities of the stomatch as constipation and chronic dysentry etc. Decoction of the leaves is useful for diabities patients.

Method

1. Eat fruit pulp after removing seeds. This can be taken any time but more effective after meals. It is useful to control the constipation.

2. Pulp of half ripe fruit taken twice in a day increases apetite and cures indigestion.

3. Take 15-20 leaves and boil it with two glass of water, when it remains half sieve it. This docoction is very much useful for diabities patients. Take one glass, once a day.

4. Decoction made out a bark of Bel trunk, taken thrice a day cures diarrhoea.

5. After curing dysentry, squash made out of pulp of Bel fruit, helps to regularise the stomach. For this purpose take full ripe bel pulp after remaining seeds, soak it in water for 1 hour. Now mash properly and seive. Mix sugar in this Bel puree and cook. After cooling keep it in a bottle and drink twice in a day, with mixing water like other squash.

AMALTAS

How to Recognise

It is a small tree. Leaves are dark green and 5-10 c.m. long & grow in a bunch. Tiny yellow flowers are also grow in very big bunches to give appearance of a big flower. Fruit are 50-60 c.m. long, green in colour and in appearance like flute. They turn black of brown in colour after ripe. Fruits skin are very hard.

Use

Fruit pulp is good to cure constipation, especially for children. Leaves are useful for facial paralysis and ring-worm.

Method

1. Take one spoon grinded fruit pulp, mix it in one glass of water. One spoon can be given to children once or twice in a day as required. To clear bowel specially for children it is a very good medicine.

2. Apply leaves juice on affected area of ring-worm.

3. In facial paralysis rub heated leaves on affected area.

4. Ground fruit pulp in applied on navel for taught stomach and pain to children.

MAHUA

How to Recognise

Mahua tree is very big in size. Main trunk of the tree is not too big but its branches are widely spread in diameter. Leaves are thick and tough and about 15-25 c.m. long which have prominent veins. Flowers are highly aromatic, light yellow in colour, pulpy and grown in bunches. They grow at the tip of the branches. Fruits are small and of light yellowish colour, and full of liquid pulp with strong odour.

Use

Whole Mahua tree has tremendous medicinal value. Bark, leaves, fruits and seeds are used as medicine. Normally it is used to cure skin diseases, bleeding gums and diabities. Flowers are useful to prevent cough and skin diseases.

Method

1. Ground bark is used for bleeding gums, swallen gums, boils, and itching on skin.

2. Burn dry leaves and make ash. Mix pure ghee in it and apply it on wounds for fast healing.

3. Make floral docoction by boiling flowers in a glass of water. Drink this decoction 2 hours before meals, it is a good tonic as well as it increases hunger also.

4. Boil fresh or dry Mahua fruits in water. Give hot formentation on stomach with this water.

5. In diabities eat 5-6 fresh Mahua fruits in the morning. In absence of fresh fruit dry fruit can be taken. It helps to control the diabities.

6. Its seeds contain very rich oil which is beneficial for gout and joint-pains. Grind seeds to paste, heat up and give message on affected parts. In headache apply this paste on forehead without heating. Pain disappears very fast.

SAHIJAN

How to Recognise

This is very commonly available and well known tree in India. In size it is very big, but it's branches are not very storng. They are so weak that in fruit season, because of weight of fruits they start breaking themselves. Leaves are very tiny. Flowers are greenish white. They grow on top of the stems. Its green fruits are thin round in diameter and about 1" long like sticks that is why they are called drumsticks.

Use

Leaves, fruits, flowers are extensively used as home remedies. It works as a tonic on sprain, weakness of bones, especially in children, piles, berry berry and general weakness of children.

Method

1. One tsp juice of Sahijan leaves, one glass coconut water and 1 spoon

honey mixed together and given to the patient suffering from dysentary, twice a day helps tremendously.

2. In gastric troubles take one spoon juice of leaves with salt. It gives relief instantly. If required can be taken in the interval of 15 minutes, for three to four times.

3. In urinary infection half cup juice of leaves mix with a cup of carrot or cucumber juice helps a lot. If carrot or cucumber is not available then any other vegetable juice can be added.

4 Mix together juice of leaves and tie oil together, cook this mixture till water evaporate. Use this oil on gout or sprain. Patients gets relief.

5. Soup of fresh tender drum sticks is given to the patient of stones of urinary track and gout as medicine. For this soup boil together 8-10 drum sticks, 1 piece of garlic, 1/2 onion, 4-5 black pepper and salt. Sieve and season it with pure Ghee. Drink it hot. It is quite tasteful and benefecial.

6. People who suffer from heat storke should take decoction of flowers. For this use fresh or dry flowers, cook it with small raw mango, add salt, mash and eat it as ketchup. If fulfils deficiency of Iron and vitamin C. It is ideal for feeding mothers.

7. Make Powder after drying seeds. Take powder thrice a day to get rid of thread worm and round worms in stomach. It should be taken for 15 days to eradicate worms completely.

8. Decoction of roots and bark with honey is very much useful to control the irregular fever. Gargle with this decoction without mixing honey is good for throat infection.

9. Sahijan is an inexpensive natural tonic. If fulfils the defeciency of Iron, Calcuim and Vitamins is prenatal and postnatal days. For new born babies also, it is ideal as it gives strength to the bones and general health. For this cook the juice of leaves on double boiler (cook on steam). When it starts thickening remove and sieve, mix it in milk and drink once a day.

ASHVA GANDHA (ASGANDH)

How to Recognise

This plant has wild growth. This is about 1.5 meter tall and always remains green. Its roots are fleshy, thick and brownish white in colour. Fresh root smells like urine of horse because of this it is called "Ashvagandha". Leaves are 5-100 c.m. long 2-5 c.m. broad and oval in shape. It's fruits are like peas or Makoi. They are green in colour, after ripe they turn in orangish red. Its seeds are yellow in colour and like beans in shape.

Use

Ashvagandha is used as medicine on diseases like T.B., gout and general weakness. It is used as preventive medicine also. Ground root heals wounds, boils and swelling. In low blood pressure because of tension this plant provides energy. This increases mental ability, sound sleep and decreases blood pressure. For children who are suffering form requetts its a very effective healer.

Method

1. Its leaves and roots have antibiotic and anti bactirial qualities because

of this quality it heals up and dries up wounds fast. Take fresh roots and leaves and grind them to paste. Apply this paste on wound and tie it with cloth. Wound heals very fast.

2. For swelling (due to injury or any other cause) heat up this paste and apply.

3. For Gout, mix any oil in the paste of roots, heat up the mixture and apply on affected parts.

4. For high fever take fresh juice of leaves thrice daily.

5. Its an ideal medicine for low blood pressure. It is beneficial in all the ailment related to low blood pressure. Grind seeds and leaves in equal proportion, make pea like balls and dry it. Take 3-4 balls at bed time with milk. This will bitter in taste but its an ideal medicine for low blood pressure.

* * *

Technological changes affecting man's environment are being introduced at such a rapid rate and with so little control that it is a wonder man has thus far escaped the type of cancer epidmic occuring this year among the trout

–California State Dept. of Public Health

LOW COST WATER PURIFICATION

A team from the engineering department at Leicester University in U.K. has developed a practical alternative to the use of chemicals to roduce clean water in developing countries. Contaminated water supplies, particularly in rural areas where people drink river water, remain a major threat to health.

Chemicals such as aluminium sulphate (alum) will effectively coagulate minute particles of pollution such as sewage, allowing easy cleaning at water treatment works. But chemicals are expensive.

The Leicester University team have used as an alternative, crushed seed powder from the tropical and sub-troipcal tree known as "Moninga oleifera". When mixed in water, the seed material produces postively charged proteins in solution, which interact with the negative charge in suspended organic and inorganic matter, resulting in coagulation. The coagulated particles (floc) enmesh bacteria and viruses and are easily removed by settlement and filtration. It is claimed that results with "Moninga" show the technology to be simple and sustainable.

The "Moninga seed" pods contain 40 percent vegetable oil which has a fatty acid content similar to that of olive oil. Once the oil has been extracted, the remaining press cake can still be used for water coagulation.

The project has led to pilot studies for setting up small-scale rural enterprises for extracting oil from "Moninga seed".

DESTROYING ORGANIC WASTES FROM SOLAR ENERGY

Organic chemicals have been known to infiltrate water supply over the year. Chlorinated alkenes such as trychloroethylene (TCE) and perchloroethylene (PCE) which are excellent solvents commonly found at sites ranging from military bases to dry cleaners, aromatics like benzene, toluene and xylene are found where petroleum fuels are prevalent. Pesticides, herbicides, fyes from textile and food industries along with polychlorinated biphenols (PCBs) are a few of the regulated compounds.

Reducing the concentration level of these contaminants has been the focus of many research and development projects. Solox, a Texas based company has developed a photo-oxidation process for this purpose.

Water cascading over a waterfall of travelling as vapour through the atmosphere absorbs oxygen. This initiates the oxidation process of organic compounds. The process is enhanced when the water is irradiated with sunlinght. Energy from the solar ultraviolet spectrum is absorbed by the exposed molecules, weakening the bonds and hastening oxidation. Accelerating water remediation with technology anchored in a naturally proven premise is the basis of solar UV/oxidation.

Increased environmental concerns, tighter regulations and higher costs of waste disposal give impetus and cost viability to the use of solar energy for destroying contaminants in water. A recent project demonstrated the feasibility of treating these collectors with the solar photocatalytic process.

Photocatalytic processes have been investigated by many researchers over past decades. In this system, sunlight is focused on a photoreactor tube through which the contaminated water flows. Ultraviolet energy from the concentrated light activates a catalyst (titanium dioxide) in the photoreactor tube. The catalyst reacts with an oxidant (Hydrogen perodide, ozone, or both) to convert the organics in the water to carbon dioxide and water.

The project demonstrates the feasibility of using concentrated solar energy to destroy organic wastes. Sunlight naturally destroys many organic compounds, including methylethyl ketone (MEK), perchloroethylene (PCE), phenol, toluene, and trichloroethylene (TCE). The destruction times varies with the targeted chemical. Most chlorinated alkens (sum as TCE and PCE)react rapidly relative to alcohols and ketones.

Aromatics, such as BTEX compounds also have a rapid reaction rate.

WATER PUMP FOR RURAL AREAS

Rural communities which rely on hand-operated water pumps for their daily needs may find life a little easier and the pumps more reliable through research

undertaken at Silsoe Research Institute in southern England by post graduate students. In the picture are Andrew Macdonell (right) and paul Button, measuring the water output of a rotary, action hand pump—a Volanta.

The two students are seeking imporvements in the design of seal- less pistons which would made pumps such as the Volanta more reliable, more efficient and easier to maintain, as sealless pistons ensure that essential parts never come into contact, reducing wear to a minimum.

Their commercial link is with Richard Cansdale, the owner of a small business in Northumberland, north east England, who designs and manufactures low-tech seal-less hand pumps and is currently testing and improving the designs.

Silsoe Research Institue is the UK's national centre for research in engineering and the physical sciences for the agricultural, food and biology-based production and processing industries.

OZONE FRIENDLY TECHNOLOGIES NEEDED FUNDS

Even as Ministry of Environment and Forests (MoEF) officials leave for a working group meet at Geneva to thrash out proposals for saving the ozone layer, the MoEF's ozone cell is having difficulty in funding indigenous clean technology which can help save the protective ozone layer. A month ago, Aquarian overseas, a green technology innovator, wrote to the cell for fund support. The Company infromed that it had developed a prototype for a home geyser and an air-conditioner which did not use polyurethene foam, double-metal sheet, pressurised chamber or CFCs to keep the heated water hot and the room cold. The product was simple and led to net savings in materials and energy used. But it failed to get the cell's nod. The cell daploys the Montreal Protocol Multilateral Fund, which was created four years ago, to assist developing nations in meeting their phase-out obligations. The fund supports only incremental costs in company-level investments which are to reduce or eleminate ozone deplecting substances (ODSs) in Article 5 countries—those developing countries that use less than 300 grams of ODSs a person a year—under the Montreal Protocol.

RENEWABLE ENERGY DEVELOPMENT PROGRAMME OF CHINA

China's State Planning Commission, the State Science and Technology Commission and the State Economy and Trade Commission have jointly brought out a progrmme with goals, tasks of strategies and measuees for new energy and renewable energy development from the period of the 9th Five Year Plan to 2010.

The programme suggests that in the next 15 years, China's new and renewable energy development programme aim at increasing energy consumption structure great break through be made in new technology and process development; the mature technology developed at home or overseas be applied in mass production ; relatively complete production and service system be formed, and the actual usage of new and renewable energy be over 390 million tons of standard coal.

To realise these aims, the programme proposes certain tasks like developing a batch of critical technologies of great value to the national economy and ecological environment, from the end of this century to 2010.

These technologies relate to : high-yielding and multifunctional tree varieties and cultivating fast-growing trees ; high efficient direct burning, compact solidified forming and gasification and liquefaction; application of energy saving solar buildings, solar energy water heaters ; photovoltaic power generation ; construction of geo-thermal power stations in the areas of high temperature thermal reserves developmet of tidal power in coastal area ; generation, storage and utilisation of hydrogen energy ; regeneration of organic waste from daily lifes and all kinds of production activities.

SPACE SAVER STORAGE SYSTEM

More the foodgrain, less the space to store them. Finding itself in such a piquant situation, the Food Corporation of India (FCI), has embarked on an ambitious Rs 10 billion project to suitably store the large quantity of foodgrain production is likely to soar in the coming years leading to acute storage problems.

'Vaccum Process Storage' (VPS) is the modern storage system aimed at by the FCI and this involves the storage of as much as six mt of foodgrain in a single PVC container. Once the containers are filled with grain, air is instantly sucked out of them, leaving them vacuumised.

According to FCI, the containers can be stacked in open spaces without the fear of the grain getting spoiled or infected with fungus in the absence of air. Also they will not discolour and stay thus even when stored for more than three to four years.

The VPS is now undergoing a feasibility study by the National Industiral Development Corporation to check its suitability in Indian conditions.

CHROME SLUDGE DISPOSAL IN TANNERIES

This disposal of chorme sludge from tanneries poses an envrionmental challenge to Indian tanners. A collaborative developmental work of the Central Leather Research Institute (CLRI), Madras (India), the Regional Research Laboratory (RRL), Thiruvananthapuram (India) and the TNO Institute of Applied Physics, Eindhoven, the Netherlands has led to a breakthrough in chrome sludge use for coloured wire-cut brick manufacture. The technology for manufacturing the bricks from clay and chrome sludge mixture was developed and tested at Raja Tiles, Triuchur, Kerala (India). The bricks were burnt using a novel technique to prevent the formation of chromium. These have successfully undergone chrome leachability studies.

In-process enhancement of chrome uptake is one of the best alternatives for a long range chrome management. Two commercially attractive closed loop processes based on ethanolamin pretreatment and alutan-BSC combination have been developed by the LCRI-TNO-BLC (UK) joint investigation and field tested. This technology is expected to emerge as the logical choice for chrome management in the years to come.

HIGH AND LOW

The Indian Council of Agriculural Research (ICAR) is promoting a Rs 3.3 crore project to develop new hybrids of vegetables, for increased production by

small farmers. Initially, nine vegetables—tomato, brinjal, chilly, capsicum, ladies-finger, onion, cucumber, bitter-goured and cabbage have been selected to be researched on. Studies will be carried out in four ICAR institutes and 10 agricultural universities throughout India.

Inspite of being the world's second largest producer of vegetables, India is below the requisite per capita availability level. Efforts to produce indigenous hybrid seeds have been going on since 1971. Many varieties have hit commercial markets after local improvement.

Imported hybrid seeds are available through the private sector. Recent trade liberalisation and seed policies have increased the quality and quantity of seed import.

But seeds which ICAR is going to develop will also be of superior quality. They will cost less as well, enabling farmers to afford high grade seeds. Further, they will be easily transportable, disease resistant and uniform in production and adaptability.

PEDAL PUMP—KRISHAK BANDHU

International Development Enterprises an international non- profit organization, has developed a small-scale irrigation sytem for small and marginal farmers in developing countries, where irrigation facilities are not assured. The pedal pump, christened *Krishak Bandhu,* can be used to earn higher incomes. Being low-cost, efficient, and environmentally sustainable, it is appropriate for small farmers. At resent, the pedal pump is marketed to farmers in Indian districts where farmers hold less than one hectare of land. The salient features of the pump are as follows : (i) the discharge of water is approximately 6000 litres per hours ; (ii) the pump is easy to install, requires little maintenance, and can be easily repaired by the farmer ; (iii) minimum operating costs ; (iv) the Krishak Bandhu pump effectively irrigates land holding which are one hectare or less in size ; (v) this manual pump is best suited for water levels less than 15 feet below ground level, and is recommended for lifting water from 1.5 inch bore wells or from surface water, rivers, ponds, streams, canals, wells, etc. ; (vi) the pump costs Rs. 350-1000 (US

$10-100); and (vii) the pump is available in two models : three-and-a-half inch and five inch in diameter, in sheet metal and cast iron. A concrete model suitable for areas of high water salinity is being perfected.

EXOTIC PLANT DEGRADATION

The bid to reafforest the Himalayas could actually backfire on its ecology. Exotic plants which have the ability to grow rapidly and used for the afforestation programme are having an adverse effect on the soil, water and air in the region. Vir Singh, a noted ecologist from the G.B. Pant University of Agriculture and Technology, Grahwal in Uttar Pradesh, in a published study says that the Himalayan mountains have come under "a great threat" because of large-scale intorduction of commercial extoic plants replacing the indigenous vegetation.

The study explains that exotics like eucalyptus, poplars, silver oak, subabool and chir pines are, by nature, invaders ; and cause disruptions in the environment. Such is their efficacy in turning vast areas of fertile land into 'green deserts' that natural regeneration of indigenous species is given the go by. The report concludes that the unique Himalayan ecosystem can be restored only by indigenous vegetation and warns against an 'environmental coup' by the exotics which could totally wipe out the indigenous species.

But the Uttar Pradesh forest department and some government institutoins have turned deaf ears to the criticism and are continuing the process with the sole air of greening the denuded hills,though by methods which are envionmentally-unfriendly.

BIODEGRADABLE PLASTIC

The Battele Memorial Institute, Ohio, US has applied for an Indian patent (number 174575) for its process to produce a biodegradable plastic.

The process starts with the polymerisation of L and/or D lactide monomers in the presence of a known catalyst. The unreacted monomers, if present in the reaction mixture, and finely dispersed using polyactic acid as plasticiser. Other plasticisers such as L/D lactide, lactic acid and or their oligomers, are added if needed to the polylactic acid to aid mixing.

NEW RICE VARIETY

Rice plant breeders at the International Centre, of Tropical Agriculture, based in Cali, Coloumbia, have developed a new breed of 'super rice' which is expected to produce 25 percent more grain on the same land area ; it can help feed additional 450 million as it can be cultivated on vast, ecologically fragile, tropical Savannas. These varieties make it possible to grow rice like wheat, using similar machinery and enrich the soil, reduce erosion and control pests. The centre has also developed 135 bean varieties that are now growing in more than 40 countries or more than 700,000 hectares, with yield increases worth over $86 millions annually.

ECO-FRIENDLY COMPRESSOR

The Kirloskar Copeland Limited has introduced India's first eco- friendly refrigeration compressor that uses R-134a, a non- chlorofluorocarbon refrigerant. The Company has plans to introduce such compressors in the near future. The launch assumes significance as India has formulated a country programme for phasing out R-12, which is a chlorofluorocarbon (CFC), by the year 2006. When CEF gases are released into the atmosphere, they ascend to reach the thin ozone layer in upper atmosphere. Some years ago, a hole was discovered in ozone layer and the main reason was found to be the CFC component. The Montreal protocol was signed by many countries, including India, which seeks to phase out CFCs and substitute it with harmless eco-friendly substances.

SOUND WAVES TO SAVE FOOD INDUSTRY WASTE

Prof. Barry Hull of the Mechanical Engineering Department at Nottingham Trent University in U.K. has developed a technique that could save the food industry millions of pounds sterling a year. The technique uses sound waves way above the range of human hearing to check the level to which a food container is being filled during manufacture. Prof. Hull opines that the food industry waste arises either in the form of "give-aways" when containers are overfilled or via water filled containers which end up in rubbish bins or are sold at throw-away prices. It is

estimated that overfilling of milk bottles for instance currently costs the UK dairy industry at least 12 million a year

The problem is also bad in the fizzy drinks industry where changing production output from one flavour to another can mean a 30 minute delay before the level mointoring systems currently in use are backed-up and running. All the fizz produced in that time is dumped.

Prof. Hull claims that with ultrasonics has can do it in four seconds. His prototype system, it is claimed, can check liquid levels to an accuracy of half a millimeter. The system is cheap, robust and very safe.

ECO-FRIENDLY CIRCUIT BOARDS

Printed circuit boards need on longer be perceived as environmental headaches. NEC, the Japanese electronocs giant, has developed a technology that increases the proportion of recyclable material on printed circuit boards from 20 percent to 70 percent. The new know-how would enable the recycling of solder glass fibre and epoxy resins. This is how the process works : the circuit board is heated using infra-red radiation and the components are then dismantled. It is then pulverised and separated into a copper-rich powder and a glass fibre resin powder.

BIO-INTENSIVE GARDENING FOR CASH CROP

From waste water treatment technology to commercial horticulture—that's the path chosen by Iron Exchange (India) Ltd. A new company, Ion Exchange Enviro Farms Ltd., will spearhead this diversification by developing 40,500 ha of fallow land into orchards using bio-intensive farming methods. The company will undertake farming of proven cash crops like mango and cashew. The initial trust areas will be Maharashtra and Tamil Nadu with the first project being set up in Mangaon *taluka* of Raigad district in Maharashtra.

STEP TO SAVE RAINWATER

Top priority is being accorded to the adoption of drip and sprinkler irrigation systems since this is vital for extension of irrigation in water-scarce areas and would ensure efficiency in water use. Government assistance for sprinkler irrigation

systems would be available for all the field crops under a scheme. The use of these systems enables the farmer to contributes to the extension of irrigation and results in efficient use of water, thus saving investments in minor and major irrigation projects.

CHINA CLAY WASTE FOR PRODUCING CERAMIC PRODUCT

The Central Glass & Ceramic Research Institute, Noida Centre (India) has developed a technology to produce tower packing materials and low tension insulation using China clay waste. The Ceramic raw materials available in India are of superior grade. Using these high grade materials for low grade products and low tension insulations is considered a waste of this valuable resource. Hence, alternative low grade ceramic materials are to be found. During beneficiation of China clay from crude ores, a huge quanitty (about 70-80 percent) of waste is obtained from the washeries which creates problems of disposal.

FROM WASTE TO WEALTH

During the cutting of marble slabs water is sprayed to keep the temperature low and prevent dust formation. The mixing of water and marble dust results in the formation of marble slurry. The slurry, which is a major pollutant , is now being recycled for the manufacture of bricks. Pilot studies indicate that these bricks are of good quality and can cater to urban construction requirements. This technology has been developed by the Indian Environmental Society (IES) in its bid to negate the detrimental effects of marble slurry.

IES has set up a demonstration and training unit at Udaipur in India which has nearly 200 marble cutting and processing units. The project, if successful, will serve two purposes : it will reduce environmental pollution as a result of marble cutting on the one hand, and one the other it will provide raw material for bricks.

This waste material has been used up to 50 percent in weight in the production of tower packing materials along with plastic clays such as Bikaner ball clay, fire clay and potash, feldspar. Similarly the mateial developed for low tension insulators also contained 40 to 50 percent by weight of China clay waste.

The tower packing materials in various shapes and sizes-saddles, raschigrings, partition rings and honey combs are impervious and resistant to acids, alkalies and other chemicals and so will find wide application in the petrochemical and fertiliser industries. Similarly, the low tension insulators in shapes like kitkat fuses, fuse bases, and in other products will find wide use in household electrification, state electricity boards, railway and telephone industry.

As reported in CSIR news, the technology is economically viable as it uses an industrial waste (up to 50 weight percent of the total batch) in the production of such products which is said to have tremendous market potential.

OIL FROM PLASTICS WASTES

An innovative chemical recycling process that turns used soft drink bottles and polyester fibre wastes into oil and other useful hydrocarbons is among several new techniques being explored by experts to manage the growing menace of plastic wastes world over.

With millions of tonnes of different plastic materials being produced every year globally, burying or recycling these nondegradable objects has been a headache for scientists.

The new chemical procedure, developed by French inventor Jacques-Raphael Banzaria, is tipped to be a futuristic method to convert used plastics into raw mateials in petroleum and other industries.

Working on a project sponsored by the French Institute of Petroleum (IFP), Benzaria has found this technique is effective in treating polyethylene terephthalate (PET), the most commonly- used plastic in the world.

The institute is also investigating the possibility of using pyrolysis as a means of recycling plastic wastes. This involves the cracking of used plastics into monomers at a temperature of between 400 and 800 degrees Celsius in a controlled atmosphere containing variable quantity of oxygen.

The carbonaceous compounds thus produced can be used as efficient fuels as well as a synthetic raw material in petroleum refineries.

IFP scientists have also joined hands with researchers at the University of Compiegne to recycle used tyres. The proposed project is expected to transform the tyres into either liquid fuel or carbon black by heating them in heavy fuel oil at 380 degrees Celsius.

Though the conversion of tyres into liquid fuel is feasible, it has not yet reached an industrial stage, because of the high cost involved in collecting tyres, according to the scientists. Besides, the low cost of oil does not make it an economically viable operation.

However, they feel that the process can break ground in producing carbon black, a costly raw material which has wide industrial applications including manufacture of tyres, inks and bitumen.

Though there have been many techniques to treat certain plastic materials individually, it was for the first time a process which can recycle mixed polymers in single operation.

The 5000-tonnes-per-year plant being set up by the company with the help of two German and Austrian firms will produce a new homogeneous thermoplastic powder. The process uses pre-sorted waste containing up to 30 percent non-plastic matter.

ENERGY FROM OCEAN WAVES

The production of energy from ocean waves has come within the realm of reality, courtesy the hydropiezoelectric generator developed by Ocean Power Technologies, New Jersey, USA. The generator comprises a thin panel made from polarised polyvinylidene flouride, attached to a float and a battery unit. When ocean waves move the float and stretch the panel, some molecules get displaced, releasing positive and negative charges. Electrodes capture these charges and store them in batteries located at the bases.

BIOMASS BRIQUETTING TECHNOLOGY

Scientists from Biomass Conversion Laboratories, Indian Institute of Technology (IIT), Delhi, India in collaboration with Technology and Development Group,

University of Twente, The Netherlands have developed a technology to convert agricultural residues like rice husk and groundnut shell into briqueites for use as an efficient, economical and non-polluting fuel. The screw press technology for briquetting biomass compacts low-density agricultural residues into cylinders with a hole in the centre.

A major problem in using agricultural residues as fuel is their low density, which makes their handling, transport and storage both difficult and expensive. A Senior Scientific Officer with the Indo-Dutch project says "These problems can be overcome by compacting the loose biomass into briquettes". Although there are several briquetting technologies that are commercially available, they are expensive and produce briquettes that burn badly or generate lot of smoke. The new technology is less problematic. It works as follows : dried biomass is crushed and preheated to a temperature of 100-120°C. Pre-heating softens the biomass and also reduces the load on the screw. This material is then fed into a screw extruder press where a revolving screw compacts the mateial, which is then forced through a heated die to harden the briquettes.

PURIFICATION OF STORM WATER DRAINS

pollutec Opeprations, Australia, has come up with a technology to extract litter and other solid debries from urban storm water drains. The process, known as Continuous Deflective Separation, is likely to prove a boon for cities, since it removes virtually all water-borne polluting solids such as packaging mateirals, bottles, cans, plastic containers etc. The process works quite simply : a stainless steel perforated screen is fitted in a hydraulically balanced chamber set in the main pipe. Water passes through the deflection pipe, but solid items are diverted into a central catchment chamber.

CENTRE OF EXCELLENCE IN THE STUDY OF PHOTOVOLTAICS (PV)

An expertise has been developed in New Castle upon Tynes (North- East England) Centre of Excellence in the study of photovoltaics (PV) which uses solar

cells to turn sunlight directly into eletricity. This expertise has led to a 1.5 million project involving the incorporation of 456 PV panels with a total capacity of 40 kW on the four storey Northumbria University building in the city. The PV cladding has been incorporated into an extensive refurbishment programme.

According to Prof. Robert HIll of the UK Photovoltaics Applications Centre, in summer, the electricity produced by the panels is likely to meet the building's entire need for electricity for lighting, heating, computers and other appliances, which amounts to 30-40 kW. Any surplus power will be fed into the University's other buildings on campus. During the winter season, the near vertical mounting of the panels will make the most of the low angle sun.

The New Castle PV project is the first of its kind in Britain, as till now, most PV research has featured small-scale, stand-alone systems. Cost calculations have shown that electricity from PV- Clad office blocks could be cheaper than present electirdity prices within the next 15 years. The present project could, therefore, lead to more such installations, including the airport and an existing tower block in New Castle.

SELLING THE SUN

After covering ground from Leh to Tamil Nadu, the Central Electronics Ltd. (CEL), has entered the West Asian solar energy market with a big bang. It is going to set up a complete factory in Syria to manufacture solar photovoltaic panels and solar power generation accessories. CEL would provide training to Syrian engineers and offer complete documentation on the system design, engineers and offer complete documentation on the system design, engineering, operation and field maintenance.

CARE CLUB FOR GLOBAL ENVIRONMENTAL PROBLEMS

Japan would now go for an increase in green areas and environment-friendly transportation by 20 percent within five years."We do not have any magical way which can solve global environmental problems at once. We must do our best step by setp in local communities here we live" Tadamori Oshima, minister of environ-

ment agency of Japan, emphasized at the world Conference on Local Initiative for Sustainable Cities (LISC) in Yokohama.

For this purpose, the conference proposed setting up a "20 per cent Club for Sustainable Cities" which aims at reduction of domestic and industrial waste by 20 percent. The LISC was organised by the Environmental Agency of Japan and Kanagawa Prefecture, supported by the International Council for Local Environmental Initiatives. Authorities from 62 countries including 70 mayors and governors, national governments, international organisations and NGOs participated in the conference. Among the topics discussed were industrial pollution, consumption pattern, city scale and energy/transportation.

Klaus Topfer, minister for regional planning and urban development, Germany, emphasized that the future of mankind will decisively depend on the extent to which worldwide urbanisation could incorporate sustainable development as, at the beginning of the new millennium, one half of the world's population will live in cities. Heitor Gurgulino de Souza, Rector, United Nations University, stated that policy choice in developing countries would balance the trade-off between short-term strategy and long- term goals.

Local governments have important responsibilities towards sustainable development. As local authorities are close to local people, they are able to formulate their policies according to the characteristic of the social and economic activities of the latter.

The conference reported several serious attempts. The Lancashire County Council, UK, has been working for the past two years with local communities. The Institute for Sustainable Communities, USA, assists the Central European countries to make sustainable city planning by using risk concept and cost-benefit analysis. The Manus Provintional Government in Papua New Guinea identifies 12 development indicators. Cape Town City in South Africa is busy bridging wide social gaps caused by apartheid.

An important factor identified for sustainable development was local government autonomy. For instance, in Japan in the 70s, prefectures government, cities,

towns and even village offices imposed stricter emission regulations on industry than did the central government. Although at times this led to conflicts, the central government began to adopt measures at the local level. In fact, Japan owes most of its environmental achievements to the local bodies.

And as Japan's new basic environmental policy plan lacks a soild numerical target, it is opposed by business circles and ministries like the ministry of industry and trade. So, the Environmental Agency initially began establishing local numerical environmental targets together with foreign cities thereby setting up a *de facto* national target.

DISK QUEST

The Asian Health, Environmental and Allied Databases (AHEAD)—A New Delhi based international consortium has planned the commerical release of three CD-ROM database series on Asian evironment, health and natural resources, to be updated every six months.

The first batch of CD-ROM disks would contain 600 megabytes of bibliographic data, full text documents, biblographic directories and factual information, numerical data and graphics, A powerful in-built search software comes with every AHEAD compact disk.

Disk D1. titled "Environment Asia", and containing information on environmental and resource management, has already bagged 20 orders in India and is ready for despatch. It comprises full text databases on collection, treatment and recycling of waste water and solid wastes ; water supply management ; water resources planning ; and hygiene education and community participation. It also provides bibliographic databases on water supply and sanitation.

Disk D2 which is titled "Wealth Asia", contains information on traditional Asian medicines and natural products, and has bagged more orders. It has a full text database on Indian raw material resources. It also covers bibliographic database on world literature on medicinal and aromatic plants.

The third disk D3, titled "Health Asia", will cover tropical diseases, natural

toxins like venoms and toxins and occupational safety and health. It contains information on water-borne diseases. Full text information incluidng photographs are detailed, besides bibliographic databases.

FARMING SYSTEM AND WOMEN LABOUR PARTICIPATION : THE CASE OF RURAL CHINA IN ECONOMIC TRANSITION

Rural reform has heralded China's transition from a centrally planned to market oriented economy. One of the key elements of rural reform in institutional change, which eliminated the base of collective farmng, *i.e.* the commune system, while restoring household production in its place. This reform has long been completed. Households almost everywhere in rural China have become the units of production, in charge of cultivating the contracting land with family labour, and receiving an income after fulfilling a few obligations to the state and villages. Although village committees, the farmer collectives, continue to hold the legal ownership title to land, the function of household production in rural China today does not differ substantially from that of the owner cultivator household farming in many developing countries. In addition, household based agriculture in China has become increasing subject to the functioning of market forces. The shift from commune system to household farming system has profound impact on every aspect of rural life. Production relations, which centred around the commune system before, are being reshaped. As soon as rural households reclaimed their central role in the prduction organisation, changes in the nature and pattern of work have taken place. As a result, new forms and new characteristics of the gender division of labour begun to emerge.

FUEL CELL TECHNOLOGY

Fuel Cells are one of the alternative sources of energy like solar, wind tidal, hot rock and biomass sources and are seen as viable suppliers of power in the future. Fuel cells are an efficient, low-pollution and flexible way of producing electircity. They have been used for instance as a clean means of producing power

on board spaceships. But at present they are too expensive to manufacture and not durable enough to compete with conventional methods of generating electircity.

Monash University in Aristotle is one of several institutions where research is in progress to perfect fuel cell technology for generating electircity in the 21st century. Monash University has established a reserach complex dedicated to this at its Gippsland campus outside Melbourne. The 1000 squaremetre laboratory has been designed so that the reserach and development organisation Ceramic Fuel Cells (CEF) can make and test prototypes of the technology. CFC has its main laboratories and head office in the university's Science & Technology park in Malbourne.

While fuel cell technology may seem complex compared with boiling water to operate a steam turbine, there are several advantages in producing electricity in fuel cells. One is that they convert the energy of a chemical reaction directly into electricity without relying on heat as an intermediary. This makes them about twice as efficient as thermal generation that burns fuel to heat water.

WOMEN'S LAND CONSERVATION PROGRAMME

A women's organization in Tanzania's semi arid Ruvuma region has won UNEP support for its efforts to halt land degradation caused by overgrazing, over-cultivation and de-forestation. The Ruvuma branch of the Union of Tanzanian Women (UWT) recognized the threat posed by land degradation several years ago-a UWT fact-finding mission reported that large areas were being cleared for agriculture and wood products and that fuelwood was becoming increasingly scarce. In 1987, the women of Ruvuma started, with no extemal support, programmes for tree planting, including agroforestry and afforestation activities on both common and private plots of land. Now, under a 15-month project launched in October 1994 UNEP will fund further afforestation activities aimed at reducing shortages of fuelwood and construction timber and promoting soil and water conservation. The project is helping set up village tree nurseries and conducting

practical hands-on training in tree-planting techniques. It will also install water supply points for tree nurseries and communal vegetable gardens in 18 villages.

ENVIRONMENTALLY SOUND ORGANIC SOLVENTS

A research student, Mr. Ren Kebao of Victoria University of Technology, Melbourne, Australia has developed organic solvents which are both worker-friendly and environmentally sound. The current range of products used to waterproof masonry buildings is based on alcohol and hydrocarbons which are now seen as a threat to workers' health and to the environment. Such solvents which are usually flammable are increasingly expensive to produce and are hazardous to store and transport. Many countries have enacted legislation which limits their use.

The organic solvents developed are water-based emulsions and solutions which are versatile and can be used as substitutes for mineral turpentine, white spirit, toluene and xylene.

GREEN AIR CONDITIONER

One can look forward to cool summers with fewer power cuts, thanks to an eco-friendly and energy conserving technology called 'vapour absorption', which makes it possible to enjoy comfort cooling by using one-twentieth of the power normally used in airconditioning. It has been developed by a Pune- based company, Thermax Ltd. The indigenously developed 'direct fired chillers' are essentially meant for comfort airconditioning market which includes hotels, shopping complexes, hospitals, office buildings and software parks.

AYURVEDIC MEDICINES

Bio Ved Inc, a US-based company, is all set to popularise Ayurveda world-wide. With an investment of more than US $1 million in India, it has launched large-scale research and development work to produce and market ayurvedic medicines worldwide. Its arthritis drug will be on the shelves within the next six months. A surgical anti-bacterial solution which can remain sterile for upto two hours, has also been developed by the company. Chronic diseases like hepatitis

'A' and 'B' and skin diseases like eczema, which have not responded favourably to allopathic drugs, are the main targets of these drugs.

SOLAR POWER STATION IN SPACE

Indian scientists are working on the setting up of the first- ever Solar Power Station (SPS) in space to rid the nation of the never ending power shortage. The dream project can mitigate the perennial shortage of energy because sunlight will be available to the stations for almost 24 hours with the shadow period being less than 12 minutes near midnight when power demand is the least. A ground based system will get direct sunlight at the most for 12 hours. The intensity of sunlight in space will be much more where it does not have to pass through the earth's biosphere. India and the U.S.A. are to be the primary parteners in this venture, with other world industries helping with collaborative technology development.

The initial objective would be to design and construct high efficiency, heavy lifer aerospace planes and construct large space/ground based photovoltaic power stations.

Experts say that for establishing the SPS, they would need heavy lift space launchers, with a performance better than the space launch vehicles available now. The mission is an affordable megaproject for a borderless world.

The satellite solar power station was first conceived in the U.S.A. but was not commercialised then, essentially because of non-availabitity of heavy lift space cargo launch vehicles capable of low-cost launch operations.

In 1988, at the 38th Conference of International Astronomical Federation, India presented a new aerospace vehicle design concept for a heavy lift space launcher called 'hyperplane'.

This design in the last few years had been closely reviewed by India and Russia and also several leading aerospace companies in the U.S.A. Today, the hy-perplane design has become a practical reality.

'Hyperplane' design introduced an 'aerobic' principle by which the space-plane takes off horizontally from any airport like a conventional aircraft launch

vehicle with payload fractions of 15-20 per cent-a feat not imaginable in the 1970s. India's aerobic design space launch vehicle 'hyperplane' has been internationally declared as feasible and described as a 'true aerospace plane'.

A solar power station in space would have a lot of advantage over a ground solar power station.

POLLUTANT TO FIGHT POLLUTION

A team of chemical engineers at the University of Calcutta has discovered that flyash is an excellent catalyst for treating toxic and non-biodegradable chemicals in effluents from the pesticide industry. The discovery holds promise of yet another safe and profitable way of disposing the large amounts of flyash being produced in the world. The discovery is based on the fact that the fine dust-like pollutant is nothing but a mixture of oxides. Almost half of its contents is silica or silicon oxide-which is an excellent catalyst. A quarter of its contents is aluminium oxide, yet another time- tested catalyst. These, and the fine dusty nature of flyash, have led the team to explore its catalytic properties. The effluents from the pesticide industry are loaded with organic chemicals which, if left as such, pollute the environment. These are routinely removed during effluent treatment by chemical oxidation as they are non-biodegradable. The choice of the oxidizing agent, used for this purpose world-over, is hydrogen peroxide.

INTERNATIONAL NETWORK FOR SUSTAINABLE ENERGY (INFORSE), COPENHAGEN, DENMARK

INFORSE is a world-wide network of independent organisations united by a common goal long-term sustainable energy development and a gradual phasing out of nuclear and fossil fuel energy consumption.

In addition to the preparation of specific programmes and projects, INFORSE is active in the exchange of information and awareness campaigns. It provides a meeting place for organisations working at all levels and is in regular contact with UN agencies, multilateral banks and other international bodies active in the energy field.

The network publishes the quarterly newstetter "Sustainable Energy News" and the annual "Sustainable Energy Contact List", containing valuable addresses.

In each of the INFORSE regions, regional coordinators and the member organisations determine regional action plans and other initiatives. The views and initiatives of each region are pre-sented by the coordinators at an annual meeting where INFORSE's global activities are planned.

Independent organisations interested in sustainable energy development are eligible to become an INFORSE members, subject to the regional coordinators' approval. Although membership is free of charge, voluntary contributions are welcome.

ENVIRONMENTALLY FRIENDLY CANS

The EU Packaging Waste Legislation, which was recently adopted, has made it necessary to adopt an environmentally friendly packaging system. Redicon Corporation, Canton, OH, USA has developed a system that makes environment friendly cans. The Redi-Can is a full height two piece draw/redraw can with side wall reduction that requires no cleaning, no spraying and no spray curing.

There are many environmental concerns surrounding current can making technologies-the solvents and lubricants in these processes can escape to cause growing air and ground water quality problems. The Redi-Can is an alternate approach that addresses the problem at the very beginning through improved materials engineering.

The material used for these cans is a precoated steel sheet, coil with high solid coatings or steel coil with laminate material indexed into the cupping press. The high solid coatings consist of epoxies, polyester and vinyls where the solvent portion of the coating offers better surface integrity and more uniform coating weight. Lower coating permeability allows the can to be filled with more aggressive products: and a more uniform coating means less coating weight in the can.

Laminate materials can be adhered to the steel with a thicker film weight as compared to conventional high solid coatings. This increased thickness improves

the barrier of the product to the metal enabling packs of high aggressive products on reduced sidewall containers.

GLOBAL WARMING FALLOUT

A dramatic change in the world's climate brought about by increased levels of carbon dioxide (CO_2) in the atmosphere could cost global industry up to $480 million a year in the coming century. A working group for the Inter-governmental Panel on Climate Change made its forecast in a draft report. It suggests that global warming will bring about dramatic changes in the climate if the levels of CO_2 in the atmosphere next century reach twice that of the pre-industrial world. This would hurt the world's annual industrial output of $24 trillion by 1.5 to 2%. As possible counter measure, it suggested a shift towards fuels with less carbon and a tax on carbon.

CLEANER TECHNOLOGIES TO POLLUTING INDUSTRIES

The Government of India is establishing a "Cleaner Technology Promotion Network" for providing cleaner technologies to pollution industries in India. The network envisages screening, evaluation and prioritisation of cleaner technologies available in and outside the country for procurement and large scale adoption through effective demonstration.

The network will be located at the National Environmental Engineering Institute (NEERI), Nagpur, India. As a part of the network, a host centre would be located at the Ministry of Environment and Forests, New Delhi. The network would process policy matters and facilitate technology transfer from other countries with funding under the global environment facility and other international institutions like World Bank, ADB, UNIDO and UNDP.

The priority areas to be covered include energy, transport, chemical industry, pharmaceuticals, petrochemicals, pulp and paper, sugar, leather, dyes and paints, cement steel and pesticides. The beginning is being made with two sectors- energy and chemicals. Expert task forces are being constituted for the sectors.

The network centre would be an autonomous body with a board of governors

coordinating the activities of all the participating institutions. The coordinating agency for energy would be the Tata Energy Research Institute (TERI) and the network would include several top private and public sector bodies and other concerns.

The World Bank has granted $2 million for soft and hardware procurement. The Environment and Forests Ministry is to make a counterpart funding of Rs. 150 million.

LOAN FOR PLANTATION

The Sri Lankan forestry industry is in for a massive improvement with the Asian Development Bank approving a $60 million loan and $400,000 technical assistance grant recently. The grants will help the government to initiate reforms in the management of 23 regional plantation companies to increase productivity and global competitiveness. The interest-free loan is to be repaid in 40 years with a 10 year grace period.

HARNESSING WIND POWER

The Bombay-based Keshavlal Talakchand (KT) group has harnessed wind power to run its textile mills at Morbi, Gujarat. The Morbi-based Vishaldeep spinning mill and the Arundoya mill, have each set up two wind mills at Lamba, in Jamnagar district, generating about one lakh units per month. According to K K Sheth, director, KT group, a more relaxed tax-benefits policy for wind farms could be an incentive for big investments. As of now, the accruals of tax-benefits for wind farms amount to only 20 or 25 per cent. The group also has a wasteland development project up its sleeve.

* * *

RENEWABLE ENERGY-SMALL HYDRO

The International Association for Small Hydro is orgnising a conference on "Renewable Energy-Small Hydro" from 3 to 7 February 1997 in Hyderbad, India. The conference is sponsored by the Central Board of Irrigation and Power, New Delhi. Related themes of the Conference are :

1. Present scenario and future porspects.
2. Environmental and legal aspects.
3. Flanning, design, construction of small dams etc.
4. Civil Works.
5. Standarisation of equipment.
6. Contract Practices.
7. Power Evacuation arrangements.
8. Operation and maintenance.
9. Techno Economic Viability
10. Manpower Training.
11. Assisance from world funding agencies, modalities etc.
12. Private participation, incentives, economic return, sale of power.
13. Case Studies

For further details contact :
C.V.J. Varma
Secretary General
International Association for Small Hydro
CBIP Building, Malcha Marg
Chanakyapuri
New Delhi-110021.

CONSTRUCTION MANAGEMENT

Lund Centre for Habitat Studies, Sweden, is going to organize an advanced "International Training on Construction Management", at Sweden from March 18-May 10, 1996.

Following main issues will be discussed in training programme :

—Design of buildings

—Construction Management

—Technology as an, instrument for reaching objectives

—Low Income Housing

—Energy Conservation

—Economy and Financing

ARCHITECTURE & DEVELOPMENT

Lund Centre for Habitat Studies, Sweden is going to organize another Advanced International Training on "Architecture & Development" at Lund, Sweden from March 18 to May 10, 1996.

The aim of this training programme is not to provide "expert education" but to provice a general frame work to support future professional activities. The four main themes to be covered in training programme are :

—Strategies for housing

—The role of factors : beneficiaries, professionals and decision makers.

—Design with consideration for culture, climate, economy and materials

—Issues in environment and appropriate technology

For further information on above two training contact :
Lund Centre for Habitat Studies
Box 118, S-221—Lund
Sweden

WATERPROOFING OF BUILDING

Central Building Reserch Institute, Roorkee will be organise a National Workshop on "Water Proofing of Buildings" from March 12-13, 1996, at Roorkee.

The workshop will cover the following themes :

—Causes and effects of seepage and dampness in building

—Waterproofing materials, their characteristics and performance

—Techniques of application

—Waterproofing of historical buildings

—Case studies.

The workshop would comprise of invited talks form technical experts, lectures by professional waterproofing organisions and case studies by delegates.

For further information contact :
Organising Secretary
Central building Research Institute
Roorkee-247667

HEALTH ENVIRONMENT & DEVELOPMENT

High Institute of Public Health (HIPH) Alexandria University in collaboration with World Health Organisation will be organised an "International Conference on Health, Environment and Development" on October 14-19, 1996 at Alexandria.

Main topics to be cover in the conference are :

—Management of Health Care System

—Environmental Health and Sustainable Development

—Population issues and Human Health

—Social and behiavioural issues

—Occupational health and industrial safety

—Nutrition, Food Hygiene and Analysis

—Epideminology and Tropical Health

—Global partnership for promoting health and conserning the environment.

For further information contact :
Executive Director
ICHED' 96
High Institute of Public Health
165 EL-Horria Avenue Alexandria
Egypt

TECHNOLOGY TRANSFER AND RURAL REALITY

Bioved Reserch Society, Allahabad will be organise a National Symposium on "Prospects and Problems of Technology Transfer and Rural Reality" on 19-20 Feb, 1996 at Allahabad. The symposium will be organise with the objective to highlight the recent advances in technology, to identify the factor responsible for low diffusion of technology and to suggest remedial measures to bridge the gap.

Central theme of the symposium will be :

—Technology for crop production and protection

—Technology of allied activities such as Animal Husbandry, Fishery, Forestry, Poultry, Sericulture, Be-keeping etc.

—Technology for rural education, health and sanitation

—Remote sensing technology for identification and solution of the problems related to natural resources and environment

—Technology for non-traiditional sources of energy

For further information contact :
General Secretary
Bioved Reserch Society
252a/4A Om Gayatri Nagar
Allahabad.

WORLD RENEWABLE ENERGY CONGRESS

World Renewable Energy Network, a voluntary organisation of UK will be organise "World Renewable Energy Congress IV" at Colorado, USA from 15-21 June 96. Main theme to be cover in the congress will be : Renewable Energy, Global Warming and the Environment.

For further information contact :
Prof. A.A.M. Sarifingh
World Renewable Energy Network
147, Hilmanton
Lower Early Reading RG6 4 HN
UK

GEOGRAPHIC INFORMATION SYSTEMS

Asian Institute of Technology, Bangkok, Thailand will be orgnaise a Three Week Training Programme on PC Based "Geographic Information System (GIS)" at Bangkok from 8-26 April 96.

The Training Programme aims to introduce professionals the concepts and skills required to use GIS for systematic analysis of environmental and national resource problems. The training will be mainly on AGIS's technology and its application in the areas of natural environment such as agriculture water resurces, forestry, soil conversation, water shed management, land development, bio-diversity etc. The emphasis is on the concepts and methods, rather than on comprehensive software training, enabling trainees to apply the approach to the specific conditions of their own office environment.

The course is directed towards professionabls from all sectros involved in the preparation and planning of spatial and non spatial information within their organisations. Mainly it will benefit the Natural Resources Planners, and managers, land use planners, foresters, agriculturists, watershed managers, soil scientists, environmentalists, civil engineers involved in water supply, irrigatin, and development, Rural Planners and Geographers etc.

For further information contact :
The Manager & Programme Specialist
GIS Application Center (GAC)
Space Technology Applications & Research (STAR) Program,
School of Environment, Resources & Development (SERD),
Asian Institute of Technology (AIT)
G.P.O. Bok 2754
Bankkok-10501
Thailand

PROBLEMATIQUE OF TECHNOLOGICAL TRANSFORMATION

Indian Academy of Social Sciences in collaboration with Institute of Engineering & Rural Technology, Allahabad will be organize a National Seminar on "Problematique of Technological Transformation of Rural India" at Allahabad from March 13-15, 1996.

The seminar aims to create a closer and friendly bond between the rural people and rural technology. Some main issues analyse in the seminar will be :

—Resources, assests, traditional skills, & technologies of Village India.

—People's needs and rural technology

—Nature of linkages between agriculture and industry and between rural and market economy.

—Technical education and education in village India

—Bio-diversity in rural India

—Interconnections between rural technology, social conflicts and social movements in village India.

—Political, economic, social and cultural constraints of technological transformation of rural India.

For further information contact ;
Convenor PTTRI
Centre for Development of Rural Technology
Institute of Engineering & Rural Technology
Allahabad.

MANUAL ON PUMPS USED AS TURBINES

In the present energy situation in development countries especially in rural areas, it is generally recognized that small hydropower may play a significant role. However, high initial investment costs of small hyropower plants have restricted rapid development of this energy potential in many countries. the use of standard pumps as turbines (PAT) may often be an alternative with a considerable economic advantage and might therefore contrbute to a broader application of micro-hydropower.

Present manual provides a practical method enabling engineering and technicians to select a PAT for a specific purpose. the manual is a practical handbook covering design and installation of microhydro schemes in isolated areas, using standard pump units as a low-cost alternative to conventional turbines. The selection charts presented are based on test results of over 80 PATs. The methods and types of equipment described are for isolated schemes generating between 200 W and 30 KW. The book is based on practical experience of pump-as turbine schemes in the UK, India, Nepal and Pakistan.

The book will be of considerable value for all those faced with the problem of energy production or recovery. The formal theory used in the handbook has been simplified in order that the non- specialized mechanical electrical, civil rural engineer should be able to follow all aspects covered by the book and to select a PAT for his particular application.

Mnaual is devided into Seven Chapters and Eleven Appendices. Seven Chaptrs are : Introduction & Summary, Concept of Pump Operated as Turbines, System Design, Operation and Control, Economic Consideration, Inquiry Operation and last chapter is Worked Example. Appendices on basic engineering hydraulic and hydraulic machines provide a concise introduction into the subject for engineers with little knowledge of hydropower.

"Manual on Pump Used as Turbines" by J.M. Chapallaz, P. Eichenberger, G. Fischer, published by GATE, West Germany, Pp 221, English.

STUDIES IN HUMAN RESOURCE DEVELOPMENT (in 3 Vol.)

Human resources hold a key position in the economic development of any country because the real strength of the country and its institutions depend upon the capabilities of their people. Development of persons to their maximum potential and the conservation of talents is the gist of the Human Resource Development (HRD) concept. The theme of development of human resoruces has occurred during different periods at different places.

The emerging literature of HRD has made it a multi disciplinary and multi-dimensional concept. A number of references that have appeared on the subject recentaly contain diverse ideas on conceptualisation, dimensions and strategies for HRD. The study of HRD has really become fascinating but of the same time confusing and complex. It is fascinating because there are several dimensions of HRD which have to be considered.

It is confusing and complex because it enters more into the field of behavioural sciences or put it precisely into the field of psychology rather than keeping it confined to management.

Volume One : "Understanding HRD-Basic Concepts" compiles all divergent views on the concept of HRD at one place and thus facilitates better understanding of the concept as used at the micro and macro-levels.

Volume One has been devided into three parts containing thrity two papers in all. Part-I containing thirteen papers deals with the emerging concept of HRD. The need and challenges of HRD are examined in the next fifteen papers in Part-II. Last four papers in Part-III relate to the issue of measuring human resource in organisations.

Volume Two : "Dimensions of HRD-Role and Orientation", discuss that HRD is a multi-dimensional and non-standardised process. This process affects

and is affected by the environmental forces that are internal and external to an organisation. HRD Programme cannot be structured in advance for all the situations. He is a continuous process and additions and substractions of dimensions continue regular to keep the effectiveness of any programme intact. That is why there is no unanimity among experts on the components of HRD Programmes. Present volumes deals comprehensively with the issue of dimensions of HRD and their role in developing human potentialities.

This volume contains twenty six papers grouped into four parts. Part-I contains six papers discussing emerging dimensions of HRD at organisational and national levels. The role of education and training demensions in human development have been examined in seven papers in Part-II. Some of the dimensions have been discussed separately in another seven papers of Part-III. Last part highlights the role of organisational dimensions in HRD.

Volume Three "HRD Practices-Assimilation and Implications" reveals that at the micro or organisational level, HRD represents the improvement in the quality of workers so as to achieve higher levels of productivity. In India, quite a number of organisations have created separate HRD departments during the last two decades. Present volume contains papers on HRD practices in India at micro and macro levels discussing the extent of assimilation and implication of HRD ideology. But all the papers conclude that HRD is a key factor in the process of growth and development.

This volume also contains thirty two papers in all. First eleven papers discuss the HRD practices of the national level. The next twenty one papers in part two of this volume throw light on HRD practices in different sectors and organisations. Some case studies gives the actual HRD experiences in Indian Organisations.

All the three volumes are very useful for students, research scholars, HRD department's personnels, and other interested in the field.

"Studies in Human Resource Development" (three Volumes)-Volume One

: Understanding HRD-Basic Concept, Pp 320, Volume Two : Emerging Dimensions of HRD-Role and Orientation, Pp 318, Volume Three : HRD Practices-Assimilation and Implications, Pp 425, by B.S. Bhatia, H.L. Verma & M.C. Garg (Ed.) Published by Deep & Deep Publications, New Delhi, 1996, English, Rs. 1350/- (Set of Three Volumes).

* * *

Solar Box Cooker

Millions of Swiss people carry in their pocket a valuable portrait of the inventor of a solar box cooker. Horace Saussure, who lived in the 1700s is also pictured on the 20-franc Swiss bank note.

SUBSCRIPTION FORM

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Institute of Engineering and Rural Technology
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3. Information repackaging and consolidation.
4. How to publish your news letter and news items.
5. Information presentation with Desktop publication.
6. Resource generation through information marketing.
7. Basic uses of computer for information management.

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The interested organisations / individuals may receive our regular and uptodate publication by paying a nominal subscrption. Organisations/ individuals subcrption for all RTIS publication will be offered a special discount price. Our main regular publication are.

1. Rural Technology Journal (quarterly in English).
2. Grameen Prodyogiki (quarterly in Hindi)
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4. Do-it yourself series Leaflets on various rural technology and income/employment generating techniques (both in English and Hindi).
5. Proceedings of workshops and seminars.
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7. Information folders on Appropriate Technology.
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These special training programmes are designed for the personnel of GOs and NGOs working in the field. Our in job training programmes enable them to study our working methodology both in headquarter and in the rural projects. These may be of great help for them for generating resources well as for proper implementaion of their projects and programmes. In Job Training courses are organised on special request of the interest organisations.

Special Training Courses for Voluntary Agencies

Most of the Voluntary Organisation of our country are facing serious financial problems to get funds for their projects and programmes. The Staffs working in those organisations are neither well equipped with the required information resources, nor they are trained enough to implement their programmes in a scientific and systematic manner.

In view of the above points. the Information Division has now designed special courses for the voluntary organisations. These training courses will focus in:

1. Formulation of project proposal.
2. Documentation and writing of reports.
3. Resource Generation.
4. Project Planning
5. Project Monitoring and
6. Project Evaluation

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Technical Quiry Service on Rural Technology and Renewable Sources of Energy, Environment and Rural Technology Network, Consultancy Service on RT & RSE.

For futher information contact :

Head Information Service Division
Institute of Engineering & Rural Technology,
Allahabad - 211002

RURAL TECHNOLOGY JOURNAL

AIMS AND SCOPE :

Rural Technology Journal is published by Information Service Division, Centre for Development of Rural Technology, Institute of Engineering and Rural Technology, Allahabad (India). The purpose of Journal is to provide a forum for exchange of views, information and create awareness in the field of Rural Technology, its development and transfer to the rural areas, technological products and processes, methodologies and approaches etc. Effort is being made to ensure that this Journal become relevant to only for this country but to all those nations, groups and individuals, in any part of the Globe who have concern to contribute towards the welfare of the under privileged rural communities. The Journal is divided into following main sectors :-

1. Portfolio	—	(Articles/Papers)
2. Tool Box	—	(Information on Rural Technology/Processes)
3. Spot Light	—	(News and Views)
4. Futurama	—	(Forthcoming Events : Training Programmes, Seminars, Symposium, Workshop etc.)
5. Book Bag	—	(News on Books and Publications)

NOTE FOR THE GUIDANCE OF AUTHORS :

Papers/articles information packages, technical queries and related materials are cordially solicited. Manuscripts should be sent to :-

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There is no limit to the length of contribution, but it is suggested that a maximum of 6,000 words or equivalent be used as a guide (approximately 6 to 7 pages).

1. The complete manuscript should be written in English and the desired order contents of Title, Abstract, List of Symbols, Main Text, Acknowledgement, Reference and Appendices. The Standard International System of Units (SI) should be used.
2. The manuscript should be typed on one side of the paper only (preferably 8"x11" bond paper) with double spacing between lines and 1.1/2, margin on the left.
3. Two copies of the manuscript and illustrations (one set original) should be sent to the Editor.
4. The title should be brief (maximum of 150 characters including blank in between words or other non-alphabetical characters) and followed by the author's name, affiliation and address.
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