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# Utkarsh
# Details of Problem Statements

## Appropriate Green House Technology for Indian Region

**Introduction:** High-Tech agriculture, as we understand today, consists of cultivating high value crops in more or less controlled conditions. In technologically advanced countries, use is made of green house in which some of the major climatic factors are controlled, and a system, in which plants are provided with balanced nutrition and adequate water, is given. Several business houses and Indian farmers have installed this system recently.

**Features of Modern Conventional Green House**:

- Such green houses are generally supported by steel structures and cladding of UV stabilized plastic film
- The green house is provided with heating and cooling system or in more sophisticated manner with a thermostatic control, which is manually operated
- Crops are grown on raised beds of soil with proper pH and porosity or some other medium like coconut peat, sand, rice husk, etc
- Water is supplied by means of drip irrigation systems which often serve as carrier of inorganic nutrients soluble in water

**Economic Aspect of Conventional Green Houses:**

- Depending on the level of sophistication, the cost of green houses may vary from Rs. 10 million to Rs. 20 million per hectare
- The interest on capital is about 18% and the depreciation is 20%
- The interest in capital and depreciation, cost of fertilizers, pesticides, seeds, watering energy, labour, packing, transporting, watch and ward, marketing and management overheads add up to annual expenses ranging between Rs. 5 million to Rs. 10 Million per hectare

**Study on needs according to Indian Climate:** The studies show that the green houses in India were constructed according to European design. The green house in Europe is a hot house used to grow crops in winter. In India, under high intensity sunlight, such green houses got so much heated that artificial cooling had to be practiced. The fact is that at least in Indian peninsular region, most of the crops could be grown without artificial cooling or heating throughout the year. Hence, the primary purpose in this region is those of cross winds and $CO_2$ content in atmosphere around the crops. Thus, what one needs under peninsular region is a structure that would prevent dissipation of CO2 produced by plants during night and which would also serve as a windbreak. However, other methods of construction of raised beds, drip irrigation needs to be still tackled too.

**Aim/Problem:** High-Tech agriculture practiced in technologically advanced countries is exorbitantly costly. Need is to urgently develop a cheaper technique more suited for Indian conditions by means of locally available materials to its maximum. [Like bamboo, bricks, sand, etc].

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## Household Paddy Dehusking

**Introduction:** As of today, in rural households throughout the country people use the pounding method or dehusking paddy to obtain dehusked rice. In this method, a wooden mortar having one or more shallow pockets is utilised for keeping the paddy and one or two rural women folk pound the paddy by means of long wooden log of 5ft to 6ft called pestle. In this traditional method, at times the mortar is made up of stone. However, for both the mortar and the pestle, people cut down the trees thereby depleting the natural wealth and upsetting the ecological balance. Another drawback is that pounding method takes a long time. The product is not uniform and rice grains are often broken. Power operated rice hullers are also available as an alternative. Though the output capacity of the power operated hullers are several times more than that of pounding method, this is not suited for rural conditions because of high cost of machine and power requirements. Additionally, where such power-operated hullers are installed at community centres, the individual rural household people will have to track the distance both ways wasting time.

**Aim:** The aim here is to bring out an overall improvement, replacing the traditional method of paddy dehusking, that is acceptable to the rural households so that it can be carried out at house hold level.

## Small Capacity Power Generation Unit

**Introduction:** Today electricity has become an integral part of everyone's life. Many operations come to a stand-still in absence of electricity. Rural India is also not very much far from this problem. In most parts of rural India, electricity supply is quite sporadic and there is heavy load shedding in many areas.

**Problem:** Due to sporadic supply of electricity and irregular load shedding, many problems are faced. In addition to this, the electric lines generally get damaged during rainy seasons and storms. It takes numerous days to restore normal supply of electricity hence leaves the locals are devoid of electricity during this period.

**Aim:** Design and develop a small capacity power generation alternative for household usage of more than **100 W**. The prototype should be such that it can be operated and maintained locally. This should be affordable for rural households.

## Efficient Chulha for Rural India

Introduction The primary motivation for a cleaner cooking stoves initiative is reduction in health impacts from indoor air pollution. A national stove contest in China recently highlighted a number of such stoves being sold around the country. Other important co-benefits include improved efficiency of resource use, reduction in time and effort to collect biomass with concomitant social benefits, and climate mitigation from reductions in emissions of Green House Gases (GHGs) and black carbon, a climate warming agent.

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Therefore we need to develop the cleanest possible cooking stoves. In fact, our broad aspiration should be to deliver a clean cooking experience with biomass as good as with other common options such as LPG.

**Technology status:** Promising *advanced biomass stoves* (ABS) for household cooking include:

a. *gasifier stoves*
b. *direct combustion or "rocket" stoves.*

*Gasifier stoves* using wood-chips as fuel and an electric blower were developed for cooking during 1990s. This has been followed up by development of several designs of gasifier stoves based on forced draught as well as natural. A national stove contest in China recently highlighted a number of such stoves being sold around the country. Direct combustion stoves with design innovations like a post-combustion *"rocket"* section, or others, have been developed and used for example in rural settings and in some international programs for displaced people.

**Performance criteria:** Basic performance criteria of stoves include thermal and emissions performance are typically measured using a water boiling test (details of which will be provided). Thermal performance is typically expressed as a thermal efficiency (ratio of the amount of useful heat derived to the heat released by burning the fuel), needs additional data for its calculation including calorific value of the fuel, the thermal capacity of the water-pot assembly and the calorific content of the remaining char. Emissions performance includes the emissions of pollutants per kg of fuel burned, typically for CO and particulate matter. A measure of combustion efficiency is the $CO/CO_2$ ratio. It must be noted that particle matter (PM) and CO emissions do not bear a simple relationship and need to be individually addressed. In addition emissions of black carbon (BC), a climate warming pollutant, must also be curtailed. Other criteria include, easy turn-down of power (i.e. high power and simmer), safety criteria (external surfaces should remain cool), durability (material lifetime which withstands 1000-2000 thermal cycles or 5-10 y) and cost (recommended cost Rs. 1000-2000). In the table below, we suggest two sets of standards labelled Generation I and Generation II. Stove power should be 2-3 kW. It may be noted that the market demand in India alone is about 150 million units, each 5-10 y, depending on technology life.

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**Table:** Proposed performance bands of thermal efficiency and pollutant emissions factors in g of pollutant emitted per kg fuel used for next generation advanced biomass stoves.

| S No | Fuel | | Thermal efficiency (%) | CO ($gkg^{-1}$) | PM ($gkg^{-1}$) | CO/ CO2 ratio | BC ($gkg^{-1}$) |
|---|---|---|---|---|---|---|---|
| 1 | Wood, crop residues*, light chopping / splitting (sticks of 25-30 cm length and 1-4 cm diameter). | Gen I | 40 | 30 | 1.5 | 0.07 | 0.3 |
| | | Gen II | 45 | 25 | 1 | 0.05 | 0.2 |
| 2 | Wood, crop residues. Processed biomass chips, briquettes, pellets (flat chips, cubes, cylinders of 3-4 cm length). | Gen I | 50 | 7 | 0.7 | 0.003 | 0.1 |
| | | Gen II | 55 | 5 | 0.5 | 0.002 | 0.05 |

**Aim:** Develop a Cooking Stove taking into consideration available local fuel, cooking practice and above performance levels.

## Water Purification Technique for Rural India

**Introduction:** Water is an essential resource for existence of life. Water scarcity is a common problem in all areas. In rural India, water scarcity not only brings the problem of unavailability of water but also other health related problems due to impurity in it. This has been a serious issue in past few years.

**Problem:** In Konkan region, during summer season in water scarce rural areas, as water scarcity grows, the problems of impure water substantially increase. At many places, women dig a small ditch in the dry basin of a river/stream and collect water from it. These impurities may involve mud, water contamination, algae growth, heavy water due to reduced recharge etc. It is responsible for many health hazards.

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**What do we expect**: A solution that does not cost more than Rs.1500 and mostly uses the locally available materials to maximum extent is desired. It should serve the drinking water requirement of at least 5 houses or 30 people. The mechanism should be easy to maintain by the locals. The standards for drinking water quality are typically set by governments or by international standards. These standards typically set minimum and maximum concentrations of contaminants in usable water.

**Aim:** The aim here is to develop an affordable and effective water purification technique for households in rural India. This system should purify a given quantity of water to basic standards of portable water in a short period of time.

## Innovate and Create

The fields suggested above are just few examples to initiate the thought process and should only be taken as a starting point in the innovation process. The participants are free to choose any field in which they feel the need to innovate and come up with solutions in that field.A pool of ideas, which tries to encompass a few aspects of the rural problems, is listed below.The list given below is not exhaustive and should only be taken as reference.

1. To increase the cultivation, we need to develop an efficient and cheaper irrigation system. The existing irrigation systems, which fulfill our motive, like "Drip irrigation", requite costly for marginal farmers. The aim here is to design an efficient, durable and cheaper irrigation system for marginal farmer in India that can be built up from locally available materials and can be maintained from locally available skills.

2. In case of a Medical urgency, due to undulated roads and terrain with inadequate transport service, it is quite difficult to take a person to nearby hospital. The aim here is to design and develop a quicker, comfortable and cheaper (manual or motorized) ambulance that would improve existing but inefficient practice.

3. In Konkan region of Maharashtra, water scarcity during late winter and summer is one of the major issues of concern. Women, particularly in the rural Konkan, have to travel a long distance to fetch water to fulfill daily domestic water need. They usually carry a load of 25-35 kilograms over a long distance. This activity is associated with heavy drudgery and is responsible for many health related problems viz. neck-ache, backache, mental stress etc. The terrain in the region is mostly undulated. The aim here is to design and develop a manual water fetching system that would reduce manual water fetching load for rural Konkan region, which should be technologically simple and easy to understand with low maintenance cost.

4. One of the districts in Konkan region is Raigad district. Thakur, a tribe in this district is busy with farming growing mostly vegetables, and fruits that grow on vines. They build some wooden structure struts, for the vines to grow and spread, which is obtained by the local forest. Each such vegetable-producer cuts nearly 1000 sticks. Considering the number of such growers, it can be easily visualized how fast the jungles are cut down. The number of these growers will increase as

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the time passes and so will the number of many faceted problems. There is an immediate need of a step to be taken so that the problem can be checked at the right time.

5. One of the districts in Konkan region is Raigad district. 75% of villagers in this area work on brick-kilns. They work for 6 months in a year, such that a couple (husband & wife) makes about 1.5 lakh bricks during this period. The brick making process is difficult and involves physical labor. On having a look at the logistics of the process, one can find that a brick mould is such that only two bricks can be molded at a time. It is a woman that carries the dry bricks from one place to the kiln. She carries 14 bricks on her head at a time; thus she transfers about 1500 bricks in a day; and so she makes nearly100 trips. On analyzing the problem, we found that the present mechanism is an imperfect use of time and energy. The aim here is to developing a new technique which can reduce to and fro movement and improve the neck breaking job of carrying bricks to a considerable level.