VILLAGE INTEGRATED ENERGY SYSTEMS

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Developed countries, with negligible small fishermen communities, long ago adopted aggressive and over-efficient technologies in fishing and reaped a rapid depletion of fishery resources causing, to say the least, considerable concern. This has led to controls being enforced and a preference for small-scale operations. In the less developed countries the traditional, small-sector fishermen dominated the fisheries economy in terms of populace and volume of catch. Armchair policy-makers in India and other lesser-developed countries diagnosed the poverty of the small fishermen as an indication of the low productivity of "primitive" technology. The answer was technology. Plans were drawn up and implemented, loans extended, experts created and considerable euphoria emanated at the upper levels of government. Rapid mechanization and building up of infrastructure was undertaken and the results were: no dramatic increase in productivity or production; no real improvement of the lot of the small fishermen; further marginalization of the traditional small-scale sector; depletion of fisheries stocks and often irreparable damage to shore eco-systems.

The primary factors that have caused the predicament of small-scale fishermen are: (1) an unequal distribution in assets (of craft and gear), and (2) exploitation in the market process.

Thus, should appropriate and alternate technologies be able to solve the problems of small fishermen they would primarily be "societal" technologies and not artefactal technologies as discussed at this meeting.

However, one cannot deny the fact that should small fishermen have at their disposal appropriate and alternate technologies and energy systems they would be able to better exploit ocean and inland water potentials, with less effort, using less hard energy. And further, increased catches would entail increased incomes, assuming a non-exploitative market and credit systems. And in this special case technology and energy systems do have a role.

Most of the existing technologies seem to follow a standard pattern. They depend considerably on human and animal labor; they use local resources and are usually low efficiency process that produce high entropy. The advantages are that the people are used to them and the efficiencies involved are sufficient for survival but rarely do they produce surplus to participate fruitfully in the economy. In nature we also come across similar processes with one big difference: Integration. The processes interconnect and use each other's waste products thus causing a feed back synergy that in an overall analysis overcomes the problems of low efficiency processes. Thus technologically, and thermodynamically, speaking it makes immense sense to integrate technologies. Not only do wastes get optimally utilized they also prevent or improve conditions. For example, in several small fishing communities the people use the beach for defecation and urination thus wasting potential fertilizer. It also contaminates the beach where the fish are sorted, cleaned, auctioned and dried. If it should be possible to get the people to use latrines to feed into biogas systems not only would waste become useful and payback with fuel gas and fertilizer but the process would prevent contamination of fish and in general improve the hygiene in the community. However there are several reasons why this rationale may not be accepted by the community, like the investment in the system, the need to cooperate and the need to change lifetyles.

The type of scenario that can be imagined as a possibility in fishing villages in most of the areas represented at this workshop is shown in the figure.

Integrated energy systems are economical, ecological and appropriate but only when the community is prepared to accept it as such and provide the care and effort to make it function. And this is the real catch, which has caused innumerable programs to fail round the world. *Technology and alternate energy are necessary but not sufficient conditions.* The sufficient conditions that enable people to use tools (rather than become tools themselves) are socio-political-economic in nature and involve aspects like education, technological attitude, cooperation, mobilization and self reliance.

Technology transfer and the communication of technology are large problems. I have focused on four specific issues often encountered at the field level, which have not received the attention they deserve from practitioners of development.

1. The Role of the Intervener in the Target Group's Worldview

In rural communities in India social role plays a very important part in the building of fruitful relationships. Some categories of people already have a clear role for intervention in peoples lives. An intervention by a "religious" person is respected, understood and even appreciated. An intervention by a person who either belongs to a political party or is political in nature, in the sense that he helps out the community in various roles, is also respected, appreciated and sought after.

There are very few others who have a legitimate role of the intervener. The government, development agencies, research organizations, educational institutions are all suspect. For it is difficult for a person to understand why

the person or organization is intervening and what he or it gets out of the effort. Until this social aspect of development is solved technology transfer by these organizations will suffer from indifference, and may even be received with hostility.

2. The Concept of Possession of a Technology or Idea

When a person or a community "owns" a technology or at least develops a feeling of responsibility towards it he or she cares for it, looks after it, maintains it, prevents it from being misused by others, and actually uses it to its fullest capability. When the feeling of possession does not exist it fails due to a lack of care and concern.

Most development models assume intervention and assistance as necessary. And even as the intervention role needs legitimization the assistance aspect needs looking into to assure a feeling of possession and responsibility. This requires us to seriously look at the methodology of assistance whether it be an outright grant, subsidy, low cost credit or charity. Outright grants and charity except as emergency relief rarely creates feelings of possession and responsibility. Large subsidies also do not seem to help. Which leaves us with low cost credit systems and hire-purchase systems that can be better utilized.

3. Appropriateness of Technology

Any technology that fits the demand for it accurately is appropriate. The problem seems to be that people, like us, who are involved in developing aptech and attach are rarely the ones using them.

Thus the first task of the designer is to help and enable the end user articulate his real needs and problems. If problems are properly defined keeping in mind the worldview of the user and with an understanding of his socio-economic situation then rational science and technology can and should be able to develop environmentally sound technologies suited to the users goals of economic development and self reliance.

Another aspect in technology transfer is the level at which the fabrication is undertaken. There is a tendency, based on costs, to produce technologies at central locations and then transfer them as artefacts. In the long run this spells economic disaster as the value is added elsewhere. Not only that but the fact remains that in addition to generating employment locally people who locally manufacture a technology will definitely be able to maintain it and evolve it better because of the understanding gained in fabrication.

Resources and "Wastes" Available

Source	Resources
1. Sun	Solar energy—heat and electricity
2. Wind	Motive power, drying
3. Humans	Muscle power, intelligence, innovation, cooperation; night soil, urine and domestic waste
4. Cattle, poultry, pigs, rabbits	Animal and poultry meat; animal power; dung and droppings, animal and poultry meat wastes; bone; skin; feathers; wool; recycling ability (pigs)
5. Aquaculture	Fish as food; waste reuse ability (biogas effluent and organic wastes); fish waste for ensilage for poultry feed
6. Marine culture	Fish as food; shell fish culture; prawn culture; sea weeds; calcium from shells; fish waste for ensilage
7. Agriculture	Grains, pulses, vegetables, oils; medicinal plants; fruits; biomass based industry like alcohol etc.; soil enrichment; waste reuse ability
8. Forestry	Fire wood; fodder; food; biomass waste based industry like paper, alcohol, chemicals, gums; soil enrichment; environmental spinoffs; erosion prevention

4. Communication of Technology

Our experience is that developing "appropriate" technology is jut a part of the effort and often a small part that *is* vulnerable to management in most case. The major aspects, of which little is known, seem to be the methodologies of transfer of technology which includes communicating the technology and developing the socio-economic infrastructure to enable people to assimilate the technologies into their lifestyles in a convivial manner.

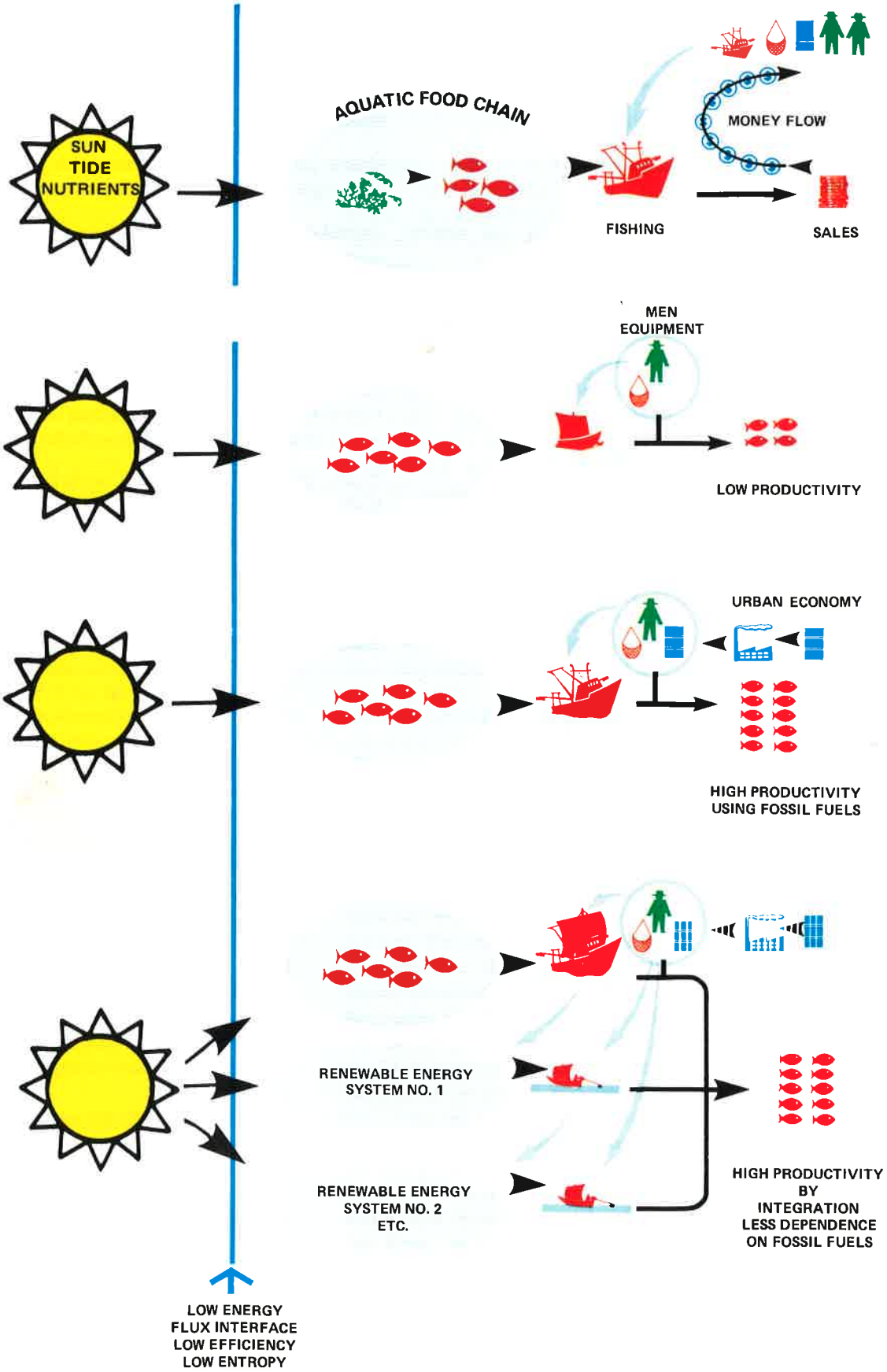
Our analysis has helped us to delineate the process into distinct communication areas based on the type of information to be transferred and the complex interplay of variables involved. The first area is one of making people aware of facts and inter-relationships and motivating them towards specific decisions.

The second area of communications is to enable people to design and fabricate technology.

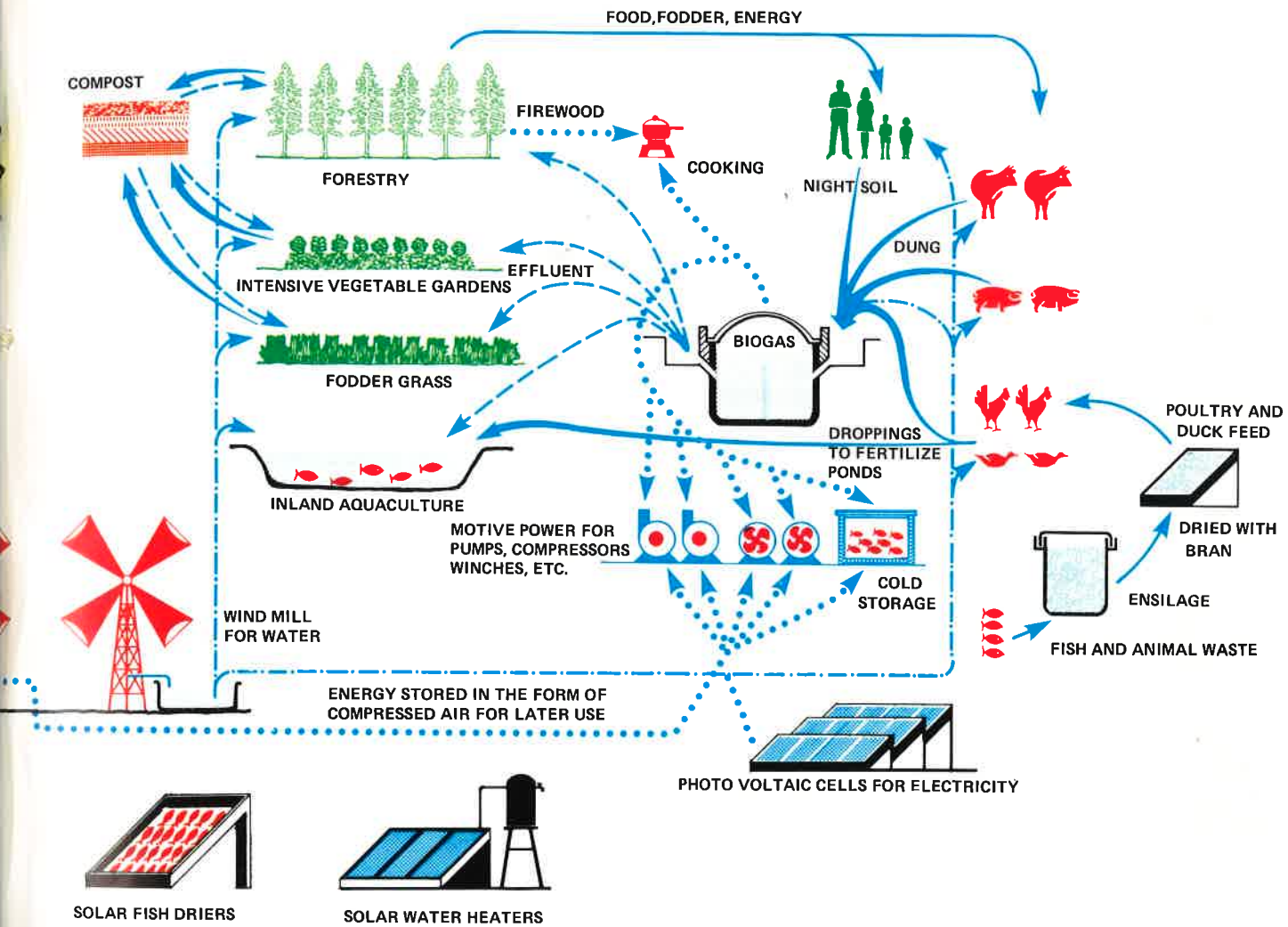
The third area is the most difficult of all—to help people to trouble-shoot and repair equipment.

The three areas specified are further made difficult by the fact that the end users we have in mind are usually illiterate and often have a completely 'different visual framework' which makes the use of symbols and visuals a tricky job.

Systemic Justification for Integration of Renewable Energy Systems



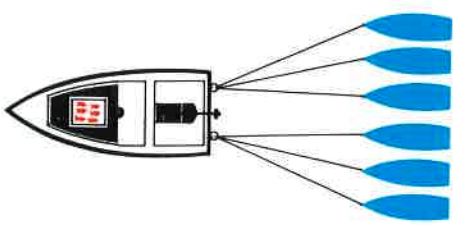
Renewable Energy Scenario



SOLAR FISH DRIERS

SOLAR WATER HEATERS

Sailboat with supplementary power in the form of a pivoted engine with long propeller shaft (power stick)



Mother boat concept

Motorized large boat tows out small fishing boats to fishing zone and then brings them back.
Mother boat has insulated holds with ice from biogas/windmill cooler on shore.
Mother boat can be cooperatively owned or hired from government.