APN
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Scientific Capacity Building & Enhancement for Sustainable Development in Developing Countries

Capacity building on climate change and locally-owned technology and systems

Final report for APN CAPaBLE Project: 2004-CB04CMY-Naito

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Final Report submitted to APN

Overview of project work and outcomes

Non-technical summary

Mitigation of greenhouse gas emissions to combat climate change continues to have high priority under the provisions of the UNFCCC and its Kyoto protocol, as climate change could endanger the future well-being of humans, ecosystems and economic progress in all regions. All countries, taking into account their common but differentiated responsibilities, should continue to advance the implementation of their commitments under the Convention to address climate change. Technology transfer should be strengthened as much as possible via means such as concrete projects and capacity-building in all relevant sectors. With this in mind, the present project focussed on capacity building in climate change mitigation with locally owned technology.

Information on locally owned technologies beneficial for climate change mitigation was collected from the Asia-Pacific Region. Two meetings were then held in 2003, in Tianjin, China and Kalyani, India, respectively, to exchange and share information, to select good examples of appropriate technology and to discuss effective ways to promote technical transfer. During the second year of the project, a symposium and a workshop were organized in Hyogo and Kyoto prefectures, Japan in November 2004 to exchange and share information among scholars and experts from local governments and NGOs. The technologies discussed were considered earth- and user-friendly technology matched to the scale of community life and also defined as intermediate technology by Dr Ernst Friedrich Schumacher.

Objectives

The present project aimed to:

- Foster local and regional collaboration within Asia and the Pacific;
- Enhance the understanding of locally-owned technology for climate change mitigation; and
- Promote the technical transfer of appropriate technology for climate change mitigation strategies.

Amount received and number years supported

The Grant awarded to this project was totally US$ 80,000 in two years.

- US$ 35,000 for Year1, 2003-2004
- US$ 45,000 for Year2, 2004-2005

Work undertaken

The work was undertaken by members of the Kyoto Institute for Eco-Sound Social Systems (KIESS), one of the Kyoto based non-profitable organizations headed by Professor Masaaki Naito, specifically focusing on Environmental Ethics, Environmentally Sound Technology, and Environmentally Sound Social Systems Formation, which link to Urban and Rural areas, Environmental Index, Environmental Planning, and Eco-Industrial Systems.

Year 1 activities

Two KIESS members visited India and Nepal for information gathering and meetings at the Institute for Studies in Population, Agriculture & Rural Change, University of Kalyani, India and Environment and Public Health Organization in Kathmandu, Nepal (From Feb. 11, 2004 to Feb. 27, 2004,). They also visited some local villages in West

Bengal, India and some locations in Kathmandu valley, Nepal to collect examples of appropriate technologies, which have been implemented in the areas of energy, water treatment, waste disposal, traffic and transport systems and residential construction.

Another member of KIESS visited China for information gathering and meetings in Tianjin, China. She visited and collected information from Hangzhou Regional Center for Small Hydro Power in Hangzhou, the Asia-Pacific Biogas Research and Training Center in Chengdu, and a number of local villages in Yunnan province. She also visited Qingdao to exchange information and collect examples of appropriate technologies used in urban China (From Feb. 13, 2004 to Feb. 27, 2004).

Year 2 activities

A half-day symposium (Nov. 14, 2004) and two-day workshop (Nov. 15-16, 2004) were held in Japan in November 2004 to exchange and share information among scholars and experts from local governments and NGOs on locally-owned technology for climate change mitigation, to identify appropriate technology and to discuss methods to promote technical transfer.

At the open symposium, the vision and concept of ecologically sound society was discussed to provide a common understanding on the framework of a society which is based on appropriate technology. At the workshop on day 1, examples of locally-owned technologies beneficial for climate change mitigation collected from the Asia-Pacific region were presented. These technologies were demonstrated as being eco- and user-friendly technology matched to the scale of community life and also defined as intermediate technology by Dr Ernst Friedrich Schumacher. Such technologies included an oxen-powered desalination system, a cooperative biomass power plant owned and managed by villagers, a lagoon-type waste water treatment system in India, an Arsenic Kanchan Filter (AKF), which is a modified bio-sand filter using iron nails to remove arsenic by adsorption, a Solar Disinfection System (SODIS) using PET bottles for safe drinking water, a Constructed Wetland-type Waste Water Treatment System in Nepal, an Ecological Sanitation System (ECOSAN), which separates urine and faeces, in Nepal and Bangladesh; and a household methane generation system and small-scale hydro generator in China. At the workshop on day 2, examples of ecologically sound societies, called eco-villages, were presented and methods to promote alternative ideas and other kinds of technology transfer were discussed.

Results

The present project gathered information on locally-owned technology and systems with a specific focus on China and India in year 1 followed by a public open symposium and workshop in year 2, which deepened the discussions among scholars and experts on locally-owned technology for climate change mitigation, to identify appropriate technology and to discuss methods to promote technology transfer. Concepts of ecologically-sound technology were summarized and some useful intermediate technologies in the context of developing country conditions in energy, water and sanitation were illustrated.

Relevance to the APN CAPaBLE Programme and its Objectives

The present project fulfilled the CAPaBLE objective in developing and enhancing scientific capacity in developing countries, by focusing on intermediate technologies suited to developing country conditions. Having involved dedicated researchers from China, India, Japan and the USA, the project also aimed to build the capacity of young and aspiring scientists.

Self evaluation

In spite of challenges anticipated in the beginning, this project successfully addressed locally-owned technology and systems particularly through the gathering of information in China and India in 2003. The symposia organized in Hyogo and Kyoto prefectures in 2004 were well accepted by the local public and international participants, and the workshop which followed the aforementioned symposia deepened the discussions among scholars and experts on locally owned technology for climate change mitigation, to identify appropriate technology and to discuss methods to promote technology transfer. In light of the Kyoto Protocol, which entered into force on 16 February 2005, this project was conducted in a very timely manner to promote due consideration of Asian countries in undertaking measures for climate change mitigation.

Potential for further work

In light of the growing strength of global environmental constraints in the decision-making process, the Project Leader will address further mid- and long-term development scenarios for local communities, through locally-owned technology and systems, with the aim of contributing to a sustainable society. It is also expected that the present project report will be disseminated to the global change communities, such as IHDP, for their attentions on sustainable measures for climate change mitigation particularly in developing countries.

Publications

A final report will be published in print and an electronic form (CD-ROM). Publication of a book (initially Japanese language only) based on the papers and discussion of the symposium/workshop is also in progress and will be published within a year.

Acknowledgments

The Project Leader and the researchers involved in this project express their appreciation to APN for its support of this challenging project.

Technical Report

Preface

Mitigation of greenhouse gas emissions to combat climate change continues to have high priority under the provisions of the UNFCCC and its Kyoto Protocol, as climate change could endanger the future well-being of humans, ecosystems and economic progress at the global level. All countries, taking into account their common but differentiated responsibilities, should continue to advance the implementation of their commitments under the Convention to address climate change. Technology transfer should be strengthened as much as possible via means such as concrete projects and capacity-building in all relevant sectors. With this in mind, the present project focused on capacity building in climate change mitigation with locally owned-technology.

Table of Contents

1. Introduction: Why Intermediate Technology (Masaaki Naito[1])

The problems we face and the direction to overcome them

Our century faces a wide range of problems as by-products of the prosperity of a highly developed industry that has resulted from the 20th-century-style "large-scale industrial technology" and the "global market mechanism." The adverse effect is significant in cities but more concentrated in rural communities in Japan. It is undeniable that in some respects, large cities and industrial society were realized at the expense of regional communities. Sustainable society begins to have a meaning when it is set towards eradicating such adverse effects. In this report, therefore, we define sustainable society as a "society that can co-exist with nature," as an antithesis to the 20th-century-style industrial society, and the technology that supports this sort of sustainable society as "locally appropriate technology."

An appropriate technology system for a sustainable society

What kind of technology promotes the well-being of regional communities under the constraints of preventing today's global environmental crises? The answer is that the technology must ameliorate, at the roots, the many by-products brought about by the 20th-century-style technology that has affected man and nature.

Technology benefits some people in the form of safety, comfort and convenience, but at the same time brings various "by-products" that negatively affects others, especially the weak. Reflecting on such nature of technology, Schumacher have first proposed concepts of intermediate technology that are different from the advanced large-scale technology of the 20th century. The "intermediate technology" can be managed with limited human and financial resources in developing countries and is useful for improving the well-being of the local community. The earth is currently going through environmental crises, and in that, the concept meaning is being re-examined as the type of technology for sustainable society which is suitable not only for developing countries but also for industrialized/developed countries.

Three categories of technologies

The figure categorizes technologies into three types according to their specific characteristics.

	Home Tecnology	Social Technology	Industrial Technology
Resource, Scale	Small	Intermediate T. Appropriate T.	Large
Technology	Primitive (Human-powered, non-professional) <Individual>	Alternative T. Machine control <Participatory>	High Computer control, experts <Monoply>
Target (For whom)	Survival of Family (Family)	Welfare of Community (Stake holder)	Profit of Stock Holder (Stock holder)
Evaluation	Non-marketable	Marketable/Non-Marketable	Marketable

Large, advanced technology called industrial technology is what the advanced nations have today. Businesses wield it via market principles. In contrast to this, home technology takes the form of family labour in developing nations. The reason why we raise both of these here is that we see a new harmonic society with technology that is in-between these two technological realms. This in-between technology could be similar to "intermediate technology" proposed by Schumacher. It is referred to in this study as

[1] Chairman, Kyoto Institute for Eco-sound Social Systems (KIESS)

"locally appropriate technology". Such type of technology does not exist alone but usually with a tight relationship to the local society. This is the reason why we termed it "locally appropriate", in contrast to the advanced technology which generally has universal qualities.

Therefore, the symposium/workshop aimed to exchange opinions and ideas to seek concepts of ecologically-sound technologies that can realize sustainable society under the constraint especially of fossil fuel consumption, to examine quantitatively its effectiveness, and to explore how it could be implemented in developing countries. Moreover, it aimed to disseminate the significance of such alternative ideas in Japan, one of the most industrialized countries, and to explore methods to disseminating them in the society.

2. Methodology

2.1 Information Gathering

A group consisted of two KIESS members visited India and Nepal for information gathering and meetings at the Institute for Studies in Population, Agriculture & Rural Change (INSPARC), University of Kalyani, India and Environment and Public Health Organization (ENPHO) in Kathmandu, Nepal (from Feb. 11, 2004 to Feb. 27, 2004). They also visited West Bengal Renewable Energy Development Agency in Kolkata, some local villages in West Bengal, India and some locations in Kathmandu valley, Nepal with Professor Mukhopadhyay of INSPARC to collect examples of intermediate technologies, which have been implemented in the area of energy, water treatment and waste disposal.

Another member of the KIESS visited China for information gathering and meetings in Tianjin. She visited and collected information from Hangzhou Regional Center for Small Hydro Power in Hangzhou, the Asia-Pacific Biogas Research and Training Center in Chengdu, and some local villages in Yunnan province. She also visited Qingdao with Dr. Zhao of Tianjin Environmental Protection Bureau to exchange information and collect examples of appropriate technologies used in urban China (from Feb. 13, 2004 to Feb. 27, 2004).

2.2 Exchanging Opinions and Ideas

A half-day symposium (Nov. 14, 2004) and two-day workshop (Nov. 15-16, 2004) were held in Hyogo and Kyoto prefectures, Japan on November 2004 to exchange and share information among scholars and experts from local governments and NGOs on locally owned technology for climate change mitigation, to identify appropriate technology and to discuss the way to promote technical transfer.

(1) International symposium on "Technology to overcome the pressure of a changing earth: In search for a new intermediate technology for the local community"

- Date and Time: Sunday, 14 November 2004, 13:30 pm - 17:00 pm
- Venue: JICA Hyogo International Centre (Briefing/Orientation Room)
- Number of Participants: 100 people (Open for Public)
- Language: English and Japanese (with simultaneous interpretation)
- Guest Speakers and Panellists:

Ernest Callenbach, Author of ECOTOPIA (U.S.A.)
Ekhart Hahn, Institute of Spatial Planning, Dortmund University (Germany)

Peter Harper, Centre for Alternative Technology (CAT) (U.K.)
Masaaki Naito, Kyoto Institute for Eco-sound Social Systems (Japan)
Sudhin K. Mukhopadhyay, Institute for Studies in Population, Agriculture and Rural Change (INSPARC), University of Kalyani (India)
Yufang Yang, TFRC Water Treatment Research Laboratories (China)
Takaaki Niren, School of Environment Science, University of Shiga Prefecture (Japan)

- Program:

13:30 Opening address (Masaaki Naito)
14:00-14:00 Presentation (1): 30 years of Ecotopia (Ernest Callenbach)
14:40-15:20 Presentation (2): Concept and Method of Ecological Regional Planning –The New Science of Urban and Regional Ecology- (Ekhart Hahn)
15:20-15:30 Break
15:30-16:10 Presentation (3): Urban Intermediate Technology (Peter Harper)
16:10-17:00 Panel Discussion
Coordinator: Masaaki Naito
Panellists: Ernest Callenbach (USA), Ekhart Hahn (Germany), Peter Harper (UK), Yufang Yang (China), Sudhin K. Mukhopadhyay (India), Takaaki Niren (Japan)
17:00 Closing Address (Sombo Yamamura, APN Director)

(2) Capacity Building Workshop on Climate Change Mitigation with Locally Owned Technology and Systems

- Date: 15 (Mon)-16 (Tue), November 2004
- Venue: Community Hall, 3rd Floor, IHD Centre Building (November 15)
  Kyoto City International Community House (November 16)
- Number of Participants: 30 people (Closed doors)
- Language: English and Japanese (Consecutive interpretation)
- Program:

November 15, 2004: Workshop for Professionals (Day 1)

Session 1: Introduction
10:00-10:20 Why Intermediate Technology? (Masaaki Naito, KIESS, Japan)
10:20-10:40 Prerequisite for Intermediate Technologies (Reina Kawase, Kyoto University, Japan)
10:40-11:00 Cost-Effective Climate Change Mitigation –The Intermediate Technology of Energy Efficiency for China- (Jingjing Qian, Natural Resources Defence Council, USA)
11:00-11:20 Intermediate Technology for Rural Development in India –A Study in the Context of Global Climate Change- (Sudhin K. Mukhopadhyay, University of Kalyani, India)
11:20-12:00 Discussion

12:00-13:15 Lunch

Session 2: Assessment of technology
13:15-13:45 Technology Evaluation Indicators and Evaluation Method (Takashi Iwakawa and Masaaki Naito, KIESS, Japan)
13:45-14:45 Discussion

14:45-15:00 Coffee Break

Session 3: Case Studies

15:00-15:20 Self-Supported Energy Production and Environment Protection in China (Yufang Yang, TFRC Water Treatment Research Laboratories, China)
15:20-15:40 Intermediate Technology in India (Tetsuji Arata, KIESS, Japan)
15:40-16:00 Arsenic Kanchan Filter (AKF) –Research and Implementation of an Appropreate Drinking Water Solution for Rural Nepal (Tommy Ngai, MIT, USA)
16:00-16:20 Rural Development and Intermediate Technology for Imprivement of Sanitary Condition in Bangladesh (Akira Sakai, University of Marketing and Distribution Science, Japan)

Session 4
16:20-17:20 Summary discussion for the first day

November 16, 2004: Workshop for Professionals (Day 2)
Session 5: Local community by intermediate technology
10:00-10:30 "Ecovillages" in Europe and the United States (Miki Yoshizumi, Kyoto University, Japan)
10:30-11:00 Ecovillage in Japan (1) –The Case of Shiga- (Takaaki Niren, University of Shiga prefecture, Japan)
11:00-11:30 Ecovillage in Japan (2) - Construction of an Ecologically Sound Park in the Tango Region, Kyoto, and NPO's Efforts for Ecologically Sound Villages (Toshihiko Sakurai, Earth Design School, Japan)
11:30-12:00 Discussion

12:00-13:15 Lunch

Session 6
13:15-15:00 Concluding session

3. Results & Discussion

3.1 Problems and Perspective of Eco-sound Society

3.1.1 30 Years of Ecotopia (Ernest Callenbach[2])

The novel ECOTOPIA (1975) was the first attempt to envision a sustainable modern society. It reflected vast new scientific research into ecological processes and the human role in them. Available in Japanese translation, it has proved popular and influential. It has stimulated discussion of alternatives to expansionist, consumerist industrialism. It offers hope for a stable and comfortable alternative future, especially for young people.

Sustainable technology and industry, however, depend on matching social attitudes, and the fact that the world has not yet moved significantly toward sustainability encourages us to rethink our perspectives. Here are some tentative conclusions:

Sustainability is understandable to everybody, and is a workable goal, just as its opposite, "growth," has been. What we need is sustainable stability. Growth in quality is permissible and desirable; growth in material throughputs is not. Some Western European countries have succeeded in this.

Impact criteria beyond greenhouse gases and pollution must always be remembered: for instance, changes to the earth's albedo, effects on percolation of rain into the soil, impacts on ecosystems and nutrient recycling.

Decentralization is efficient (or "beautiful"); this is especially clear in energy distribution.

Material growth easily overwhelms technical improvements. For example, more cars or more kilometres driven improve the efficiency of fuel.

Prevention is always better than treatment or restoration. It is easier to preserve natural areas than to attempt fixing them after they have been disrupted.

Appropriate technology must not be merely technical; it must "match" the needs of people of different ages and genders, and it must have a strong emotional appeal.

"Carrots" (lures) and "sticks" (threats) are both necessary to change human behaviour.

Social change happens fundamentally through social or communal or group processes, not just from individual actions; reaching Ecotopia will be a political process.

The ecological effects of our built environment (cities, streets, highways, etc.) are dominant in determining our impacts on the natural world. Compact, pedestrian-oriented cities are not only ecologically and economically efficient; they are more congenial as human habitat than car-dominated cities.

The expansion of the economically globalised economy poses grave threats to our future. Transition from fossil fuels to solar, wind, biomass, and other renewable energy sources will be difficult, especially in an era of oil imperialism. However, long-term necessities will ultimately require our adjustment to ecological reality.

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[2] Author of ECOTOPIA, a description of a future sustainable society, and of ECOLOGY: A POCKET GUIDE.

3.1.2 Vision and Concept of Ecological Urban Planning (Ekhart Hahn[3])

Industrial Revolution and modern age mark a paradigmatic shift in man and nature, one that has been observed on such a comprehensive scale only in the context of the Neolithic revolution. It entails scientific-technological progress but also faulty developments whose dimensions are historically new. Both can be studied nowhere better than in the built environment which can be seen as the materialized map of man-nature relationship. There is no other field in which the regard or disregard of a society towards nature gets manifest in a more comprehensive way and with such far reaching ecological, social and economic consequences than its urban and spatial structures.

Modern urbanisation is developing rapidly and is currently the highest contributor to unsustainable development. Urbanisation, particularly in cities in which the mainly efficient and cyclic organized human/nature relationships of pre-industrial times changed to linear transformation of valuable resources, are producing hazardous wastes, climate-endangering gases, and environmental contaminants. The access to globally scarce resources made possible by scientific-technological progress has only proven too seductive. The laws of scarcity, the dependence on the regenerative cycles of nature and small-scale recycling systems seemed outdated to have been invalidated, and were increasingly ignored. In addition scientific-technological progress also proved able to externalize negative environmental impacts, removing them from the places where they occurred. Local and regional "domestic economies" were abandoned in favour of a global import and exchange economy. This new independence from nature was for a long time celebrated as one of the main advantages of modernity. The daily experience of man's dependence on nature and on traditional urban and architectural structures was displaced by anonymous large-scale techniques.

It is obvious that this type of urbanism is an ecologically dead alley which can only last for a limited time and as long as it is reserved only for a small group of privileged countries. Without fundamental changes not only in the technical and physical structure of cities, its matter flows as supply and disposal systems; but a new and sustainable man-nature relationship in a much wider and holistic sense; i.e. a sustainable catharsis of modernity will not be possible. In such a comprehensive way we have to rethink post-modern urbanism and the theory and praxis of urban development.

Viewed in substantive and conceptual terms, the aim is a reversion to cycle-oriented urban and regional structures based mainly on a domestic economy and rendered accessible again to people as far as their effective ecological interdependencies are concerned. The basic principles of sustainable development, age-old and still in effect, must be redefined at the scientific-technological level in the beginning of post-modern - post-industrial age and adapted to the conditions of modern cities and mega cities.

A lot of research and many pilot projects have been carried out on this topic in the last 20 years. The knowledge and the technologies needed are basically already available, at least in the phase of scientific development and testing or discernable as a perspective. Modern information and communication technologies offer the necessary technical potentials; which are also accessible to the rapidly urbanizing underdeveloped countries. They will help promote appropriate solutions that are adapted to local/regional levels and different cultural backgrounds extending down to the local and project levels and conducive to new regional diversity.

[3] Professor, Institute of Spatial Planning, Dortmund University (Germany)

Nevertheless a rupture on a wider scale is still missing. One of the main reasons is that many people, politicians and businessmen continue to see environmental issues as anti-modern and backward-looking, restrictive and holier-than-thou in tone, narrow and controlling, requiring sacrifice and disavow of beloved consumption patterns, and to do without the achievements and rewards of our consumer society. This kind of thinking on a high extent still overlaps the enormous potentials and chances of sustainable catharsis of modernity that will mark the 21st century. Very often, this has something to do with the highly intellectual and technocratic nature of the topic.

According to philosopher Florenskij, strategies that only communicate with reason will be insufficient. Much more important is the idea of a new post-industrial "existential community of humans and nature" being expressed at the level of attractive symbols and visions. These must stimulate interest and pleasure, be easy to communicate, and above all, awaken desire.

With reference to the nature philosopher K-M. Meyer-Abich, the author has introduced the metaphor of the tanker as a symbol of an outdated epoch of the human/nature relationship and added to that a vision of a new post-industrial sailboat society and urbanism. The tanker symbolizes the characteristic features of our past industrial system, neither sustainable nor particularly attractive; instead revealing itself to be more ponderous and awkward than intelligent.

Completely different is the ultramodern sailing boat. Equipped with the most advanced technology, it illustrates the principles of a new post-industrial and sustainable era of civilization. With its computers, highly efficient materials, graceful but powerful structures, with satellite navigation, and nature-influenced and well-optimised designs, it demonstrates that we are moving to a totally new level of man-nature relationship technology and design. Most importantly, humans occupy the central role again. It is the humans who set the sail, determine the course, observe nature, learn to deal honestly with it – by experiencing daily how reliant we are on it – humans who again learn to respect nature's splendour, beauty, endless secrets, but also its dangers and unpredictability – using nature and testing our abilities.

Compared with the tanker, the sailboat principles illustrate a jump to a totally new configuration of man, nature and technology--a configuration that is not only sustainable but can also be attractive and desirable. To rethink urbanism and restructure the cities and mega-cities of today according to such post-industrial sailboat principles is one of the big tasks of Agenda 21 and the 21st century.

3.1.3 Potential of the Intermediate Technology Approach (Peter Harper[4])

We can identify two important kinds of processes for delivering physical sustainability. These processes interact, so both are important. Here we are focusing on the cultural, lifestyle elements.

- Top-down, large-scale measures involving technology, legal changes, regulations, financial instruments, and international agreements.
- Bottom-up, local and personal measures involving changes of habit, aspirations, willingness to change and adapt: ‘life-styles’

Two interesting kinds of green communities are seeking to reduce their

[4] Head of Research and Innovation, Centre for Alternative Technology (CAT) (U.K.)

personal/household environmental impact.

- Techno-greens relying principally on technological means of reducing their impact
  - Well-resourced, proactive adopters of advanced environmental technologies
  - Potentially 5-10% of the general population, locally more
  - Their preferred solutions have a high take-up rate
- Life-style-greens relying principally on cultural and behavioural means of reducing their impact
  - Favour intermediate technology
  - Highly committed, often collaborating to achieve greater effects
  - About 1% of the general population, locally more
  - Their preferred solutions have high impact-reduction

How can these active communities influence their society's progress toward sustainability?

- Techno-greens:
  - Techno-greens are recognisable and respected members of the community.
  - They are not perceived as threatening.
  - They act as role-models and creators of markets.
  - They can accelerate wider adoption of environmental technologies.
- Life-style-greens:
  - Adopting the most feasible measures, lifestyle greens quickly achieve a much lower environmental impact.
  - Further progress towards sustainability is often slow – there is little more that can be done culturally.
  - They pioneer new attitudes, institutions and social arrangements.
  - There is little direct influence on the mainstream population, but a stronger influence on the techno-greens.

Interaction between the two communities could be mutually beneficial. Lifestyle greens will be persuaded to adopt new technologies where appropriate because the creation of markets has made them cheap and reliable. This will accelerate their impact reductions. Techno-greens will be persuaded to adopt some institutional and lifestyle patterns because these have been 'de-bugged' and shown to be beneficial. This will accelerate their impact reductions. Techno-greens can 'launder' changes in social software and make them accessible to the mainstream population.

The 'intermediate technology' approach is not a panacea for the present situation. But it is an important catalytic ingredient. In the long term, it could hold the key to a sustainable and humane future.

3.2 Conditions for the Creation of Eco-sound Society

3.2.1 Background of Eco-sound Society (Tetsuji Arata[5])

There are three elements in the eco-sound society. The first one is "recycling", the second is "decentralization", and the third is "coexistence". "Recycling" and "decentralization" come from the thermodynamic condition of human society, and "coexistence" comes from the need for organizing a recycling system.

[5] Researcher, Kyoto Institute for Eco-sound Social Systems (KIESS)

Figure 3.2.1.1 shows the thermodynamic condition of human society. It shows human society as the "subject," the eco-system as the "environment," and space as the "environment of environment." One should note here that the earth is a materially closed system without any physical interaction with the outer space, with the exception of input in the form of low-entropy sun's rays and output in the form of high-entropy infrared emission. The inevitable conclusion we can draw from this is that we must fill energy needs for production, consumption, recycling and all other activities inside the human society with solar energy. Using terrestrial-stored energy, such as fossil fuels, would inevitably be accompanied by an expansion of physical entropy, as exhibited by the emission of carbon dioxide. Because the earth is a closed system, physically expanded entropy, however, cannot be discharged outside the system (space), leading to a gradual accumulation of high-entropy wastes. This also applies to nuclear power. In terms of emission, considering the characteristics of the eco-system--the environment for human society--and thermodynamic conditions of the earth, all that is fine for human society to discharge into the environment would be biodegradable rubbish, carbon dioxide derived from biomass, water and waste heat. Everything else must be recycled in human society, and the energy needs for recycling must be met by solar-based renewable energy.

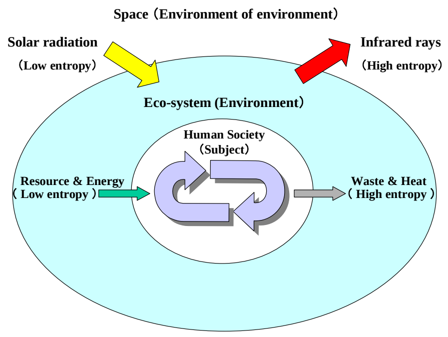


Figure 3.2.1.1 Thermodynamic view of the human society

Why recycling? The answer is simple. Because it is evident that human cannot forever go on extracting resources from, and discharging waste into limited global environment. The only path to sustainability lies in recycling non-renewable resources and non-biodegradable waste.

Now we are living in a society of huge centralized systems for our energy supply, water supply, wastewater treatment, waste disposal, etc. The energy needs for the operation of these huge systems are met by non-renewable sources such as fossil fuels and nuclear. But in order to be sustainable, according to the thermodynamic condition of human society, we have to eliminate the use of non-renewable intra-terrestrial energy sources and replace them with renewable energy sources derived from solar radiation from outer space. Fossil fuel and nuclear power are high-density energy that enabled the concentration of power for the huge centralized systems. On the other hand, it is difficult to concentrate power from renewable energy because the solar energy, the ultimate source of all renewable energy, is of low-density. When power cannot be concentrated, then huge centralized systems are simply not possible. We have to change our technology and regional structure to a more decentralized one that is compatible with dispersed renewable energy source.

Along with material flow of today's industrial society, six sectors can be identified as follows: 1) resource mining; 2) material production; 3) assembly and manufacturing; 4) distribution and sales; 5) consumption; and 6) waste disposal. Except for "consumption", the other five sectors are mostly carried out by corporations and they are competing with one another in the market. The remarkable thing here is that the corporations are competing with other corporations in the same sector. For example, motor companies are competing with other motor companies. In other words, it is an intra-sectoral competition. It is said that market competition brings better economic efficiency. Maybe it is true for the economic efficiency inside one sector, but it is questionable for that of the society as a whole. In the present linear throwaway society, corporations are trying to externalize their costs as much as possible for their survival in the intra-sectoral competitions. These externalized costs accumulate in the environment on both ends of material flow as shown in Figure 3.2.1.2.

Although market competition today brings about environmental degradation through the externalization of costs, what is needed is to change the dimension of competition rather than elimination it. The idea of extended producer responsibility (EPR) has been introduced recently for the creation of recycle-based society. Under the EPR regime, the companies that produce the final products are responsible for the whole lifecycle of the products. Among the six sectors written above, "assembly and manufacturing" sector companies have to take responsibility. When the EPR regime is introduced, production-recycling circle shown in Figure 3.2.1.3 will be created under the leadership of assembly and manufacturing sector companies. In this case, it seemed that the competitions would be performed not within each sector, but among production-recycling circles. A group of corporations which could create the most efficient circle will win, and then the economic/environmental efficiency of the society as a whole will be improved through this type of competition. Under this system, externalization of cost to neighbouring sector companies has no meaning because the circle is closed. If one sector company in a circle crushed because of accumulation of externalized cost from other sector companies, the whole circle will be crushed; hence the companies in the same circle are expected to help each other. In other words, the idea of coexistence with other sector companies becomes important for all companies in the same production-recycling circle.

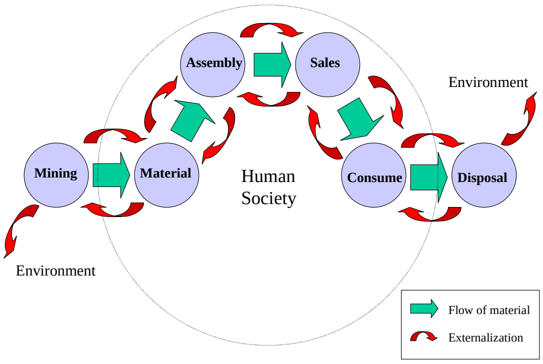


Figure 3.2.1.2 Linear throwaway society

It can be expected that, if such production-recycling circles are localized due to the necessity of decentralization as written above, competition among the circles will be reduced and that will change our social attitude from competition-oriented to a more coexistence-oriented one. And if we can reduce human impact within the carrying capacity of the environment through the creation of decentralized low-impact recycle-based society, the coexistence between human and nature will be also achieved.

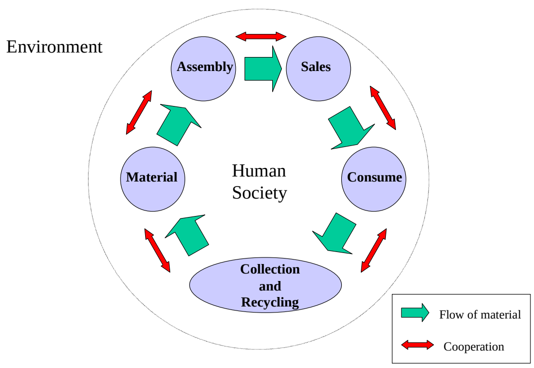


Figure 3.2.1.3 Recycle-based Society

3.2.2 Environmental constraints for sustainable society (Reina Kawase[6], Yuzuru Matsuoka[7])

Some emerging phenomena which were suspected to be the results of global warming

[6] Research Associate, Graduate school of Global Environmental Studies, Kyoto University
[7] Professor, Graduate school of Global Environmental Studies, Kyoto University

were observed. IPCC reported that 1) the global warming observed in the past fifty years is due to anthropogenic greenhouse gases, and 2) regional climate changes in the recent years, especially temperature increases, have already had an impact on many physical and biological systems.

The ultimate target of climate change countermeasures is to stabilize climate. In this report, firstly, estimations of annual mean temperature and precipitation toward the end of 21st century in Asian countries are simulated. Next, an acceptable range of temperature increase is suggested from the viewpoint of relationship between temperature increase and its impacts on ecosystems. A required stabilization level of CO_2 concentration is introduced based on 2ºC increase relative to the 1990 level. In this study, 450 ppm is adopted as the stabilization level of CO_2 concentration and the global CO_2 emission path to achieve the concentration is calculated. The Contraction & Convergence (C&C) approach is adopted as a method to allocate the global CO_2 emissions to individual countries and regions. With this approach, per-capita emissions after all countries and regions are equal after convergence year. The result based on this allocation method shows that developed countries are required to reduce CO_2 emissions by more than half of today's emissions by 2050. China needs to start reducing its emissions just after 2010. In India, however, the per capita emission of BaU does not exceed the world average per capita by 2050. This paper also analyzes estimations of greenhouse gas emission reductions and cost per tonne of carbon equivalent which avoided the anticipated socio-economic potential uptake by 2010 and 2020 of selected energy efficiency and supply technologies, either globally or by region and with varying degrees of uncertainty. When comparing the total reduction potential with the baseline CO_2 emission level, the world reduction potential will be about 20% in 2010 and about 30% in 2020.

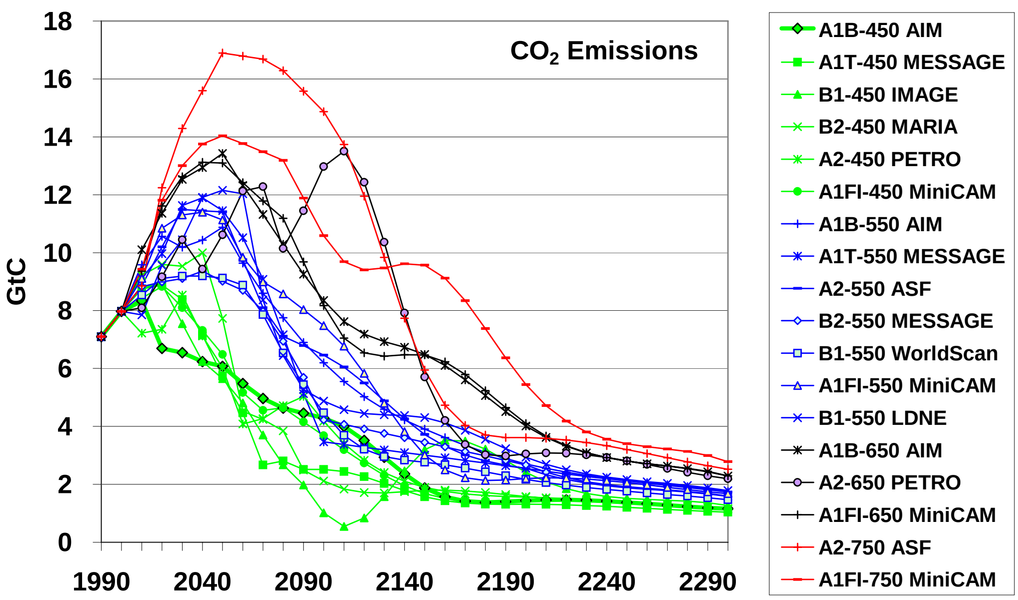


Figure 3.2.2.1: CO_2 emission path of each stabilization level

3.2.3 Evaluation frame in Eco-sound Society (Takashi Iwakawa[8], Masaaki Naito)
As the raison d'être of locally-owned technologies differs significantly from that of today's advanced technologies, their evaluation should be made from a different point of view as well. In this section, we first point out the differences between locally-owned

[8] Researcher, Kyoto Institute for Eco-sound Social Systems (KIESS)

and advanced technologies on matters outside the scope of environmental impact assessment and particularly with respect to the meaning of “social benefits,” and then identify the issues related to locally-owned technology evaluation.

As an example of locally-owned technology evaluation, we look at biomass resource recycling and gauge its $LCCO_2$ as well as examine its social and economic impacts. Economic assessment is made by looking at the project's intraregional money flow and social assessment by obtaining the hours worked by the local people as an indicator of opportunities created for their participation. The results show that a recycling system is meaningful in decreasing environmental burden and in increasing the working hours of the local participants, but it also significantly increases the costs totally paid by local entities. However, results also show that the greater part of those costs will be paid to intraregional entities. Therefore, it can be argued that a recycling system with the participation of the local citizens is effective in stimulating intraregional economic activities. To promote local citizens' acceptance of locally-owned technologies, we need a paradigm shift from an orientation centring on "material affluence" towards that of "spiritual wealth", of being satisfied economically and materially with only the things we need and finding joy in interpersonal exchanges in our daily lives and work.

In recent years, there are noticeable moves to develop environmentally harmonious regions at the local government level. These moves necessitate guidelines on introducing locally-owned technologies into the regions and planning such introduction. In this light, we also indicate in this section how technology assessment can help in the planning of environmentally harmonious regions that incorporates locally-owned technologies and how the planning can proceed based on technology assessment. As social benefits are an important consideration with respect to locally-owned technology selection, the policy for locally-owned technology selection should be aimed at reducing environmental burden as well as stimulating the local economy, creating jobs, and promoting communication in the local community.

Environmental load reduction as well as regional development must be taken into consideration when preparing a plan for introducing locally-owned technologies. This requires creating a system for quantitatively understanding and maximizing social benefits generated by individual locally-owned technologies. In addition, proposals made at the time of planning should be evaluated by identifying the participating entities, background, available resources, methodology, scope and time.

3.3 Eco-sound Society and Intermediate Technology

3.3.1 Cases from India, Nepal and Bangladesh

1) Intermediate Technology for Rural Development in India (Sudhin K. Mukhopadhyay[9])

The dangers of greenhouse gas emission, global warming and climate change are posing serious threats to security and stability of life on earth. The primary causes of per capita emission in a country may be categorized as carbon-intensity of energy systems, energy-intensity of GDP, and GDP per capita. Use of high carbon-intensive energy-based technology for rapid industrial and economic growth is automatically associated with high carbon dioxide emission per capita. Thus per capita income level and emission are positively correlated implying that the contribution of poorer and traditional technology-based countries to global emission is much less than that of rich and industrialized

[9] Professor, Institute for Studies in Population, Agriculture and Rural Change (INSPARC), University of Kalyani (India)

countries. For instance, compared to India, per capita emission of carbon dioxide in the USA is twenty times more, about nine times more in Japan, and three times more in China. India is responsible for only about 4 per cent of global carbon-dioxide emission, while USA's contribution is 25 per cent. However, no country on earth, irrespective of its level of emission, can escape the disastrous consequences of climate change. Despite its relatively small contribution to global warming, India has been concerned about the problem and has adopted policy measures to control its emission. It should be mentioned that with a low income per capita and large proportion of people near economic subsistence level, India's options are severely limited in the choice of emission-reducing technology because most of these technologies involve high costs of foregone income and welfare of the poor. Nonetheless, India has been trying to pursue, as far as feasible, policies for economic growth and human development with efficient, equitable, and eco-sound technologies. Major focus has been on policies for (i) energy conservation; (ii) promotion of renewable energy resources; (iii) controlling air pollution; and (iv) afforestation, watershed planning and wasteland development. Over the past decades choice of technology in India has largely succeeded in maintaining energy intensity and emission levels stable. Being a predominantly rural country, rural technology plays an important role in determining the trade-off between development and climate quality in India. A brief review of selected rural technologies for the most critical needs of rural life, e.g., housing, sanitation, water, energy, and livelihood, shows that India has an impressive record in developing innovative appropriate eco-sound technologies for sustainable rural development. Continuous programs of designing, upgrading and disseminating streams of such appropriate rural technologies could ensure development without aggravating the problem of global climate change. The problem in India is not so much with the availability of appropriate technologies on the shelf, but with its rapid and effective diffusion. Policy should focus on a comprehensive system of incentives, compensations, training-cum-demonstration, sensitization, delivery, and back-up programs for appropriate intermediate technologies and products. Internal and international collaboration in designing and disseminating such technologies can be of great significance for India and other developing countries.

2) Intermediate Technology in India and Nepal (Tetsuji Arata)
This section is based on observations conducted in southern West Bengal, India, and in the peri-urban area of Kathmandu, Nepal, from February 11-27, 2004. The observation had three objectives: 1) to record cases of intermediate technology contributing to improvement of rural living conditions and prevention of global warming; 2) to gain an understanding of conditions in rural India, where there is scope for using intermediate technology; and 3) to exchange information with Indian and Nepali experts regarding rural development and intermediate technology. The survey initially planned to cover five areas – energy, water treatment, waste disposal, transport, and housing. However, only the first three areas were covered.

Seven examples of intermediate technologies were collected from the observation: i) Energy: biomass power plant in Gosaba island and PV power plant in Sagar island; ii) Water treatment: oxen-powered desalination plant in Machranga island, fish lagoon in Kalyani, Waste Water Treatment Plant (WWTP) and Solar Disinfection (SODIS) in Kathmandu; iii) Waste disposal: Ecological Sanitation (ECOSAN) in Khokhana. The paper presents a three-type classification of technology – "household technology", "community technology", and "industrial technology." Five of the seven cases are examples of community technology, and two are examples of household technology.

While the present survey was unable to gather data for quantitative evaluation, it is clear that the technologies surveyed are improving local people's living environments. Meanwhile, with the exception of Kalyani wastewater treatment plant, the cases presented do not use fossil fuels at all, avoiding negative impact on global warming. As for the lagoons section of the Kalyani wastewater treatment plant, it uses fossil fuels only for pumping to carry the wastewater to the primary pond, and subsequently uses gravity to channel water through the series of ponds. While this system requires a large land area, it appears to consume very little energy.

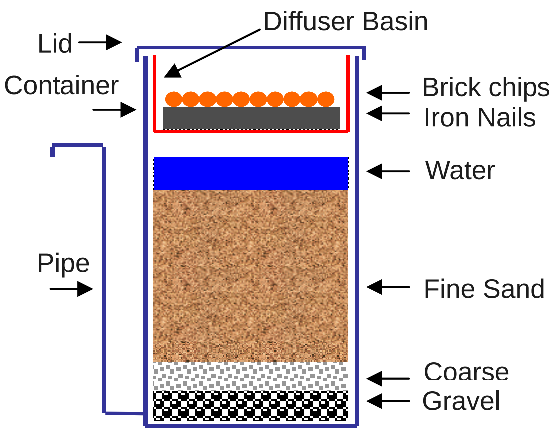
Autonomous decentralized small-scale societies offer the best prospects for sustainability. With the exception of SODIS, six of the present surveyed cases were technologically supporting such societies. As for SODIS, it is more an emergency preventive measure than technologically supporting a sustainable society. In the future, SODIS should be replaced by an appropriate management of water and sewage.

Classification of Cases

	Household Technology	Community Technology	Industrial Technology	Need for Fossil Fuel
Gosaba Island Biomass power plant		○		NO
Sagar Island PV power plant		○		NO
Oxen powered desalination plant		○		NO
WWTP using fish lagoon		○		YES
SODIS	○			NO
Constructed wetland		○		NO
ECOSAN	○			NO

3) An Appropriate Drinking Water Solution for Rural Nepal (Tommy ka Kit Ngai[10])

Nepal is one of the least developed countries in the world. Impoverished villagers in the rural Terai region lack access to safe drinking water. It is estimated that up to 5 million people are affected by arsenic and/or microbial contamination in their daily groundwater drinking water sources. Despite growing recognition of the immediacy of this crisis, many previous aid projects have failed, largely because of the use of inappropriate technologies and ineffective implementation scheme that disregarded long-term sustainability.



Components of KAF

As a result, many villagers have no choice but to drink contaminated water, and to suffer severe health consequences including diarrhoea, cholera, stunting, skin lesions, and cancer.

[10] Research Affiliate/ Lecturer, Massachusetts Institute of Technology (MIT), Department of Civil and Environmental Engineering

A team comprised of researchers from Massachusetts Institute of Technology and two Nepali NGO partners (ENPHO and RWSSSP) developed a low-cost (US$20), innovative household water filter, the KanchanTM Arsenic Filter (KAF), constructed using locally available labour and materials. The design of this intermediate technology is based on five years of multi-disciplinary research and is optimized taking into account the socio-economic conditions in rural Terai.

The KAF design and implementation won a US$10,000 award at the MIT IDEAS Competition 2002 and a US$115,000 award at the World Bank DM Competition 2003. In 2004, the team established an in-country technology implementation center and built local capacity in affected villages towards self-reliant, long-term, user-participatory safe water provision, involving training of local women, technicians, teachers, and authorities. Ten local entrepreneurs have been trained in filter construction and business skills. Education workshops have been conducted in 150 villages. About 2,000 KAFs have been distributed by various organizations, serving over 15,000 people. January 2005 project evaluation showed excellent filter technical performance and strong user acceptance and satisfaction. Prominent NGOs and the Nepali government consider the KAF as the best among all household filters available.


KAF in operation

The KAF is a sustainable intermediate technology and the implementation scheme is appropriate in the context of rural Terai region of Nepal. However, no single solution can be applicable to the entire country. Multiple options are required. Building on the success of this project, the team is actively pursuing additional funds to expand this project.

4) Rural Development Approaches and Intermediate Technology for Improvement of Sanitary Conditions in Bangladesh (Akira Sakai[11])

Bangladesh, a developing country in South Asia, is one of the most densely populated countries in the world. Although it is a typical agricultural nation, it has various difficulties for rural development. In this country, a unique approach for rural development has started from the East Pakistan era originally This has been designed to address problems associated with high population density, small size of farmland per household, natural disasters including flooding during the rainy season and drought during the dry season, low wages, high unemployment rate, farmers' health and nutrition, low literacy rate, and status of women, in addition to improvements in their economic conditions. The author introduced the approach for rural development called “the Comilla Approach” implemented by Bangladesh Academy for Rural Development (BARD).

Among the problems in Bangladesh rural areas, the low ratio of population with access to sanitary toilets is of major concern. Insufficient sanitation adversely affects the living environment particularly during frequent flooding and the resources in rural areas, and also contributes to arsenic contamination of tube-wells. Therefore, it is not only necessary to increase the ratio of population with access to improved sanitations systems, but also to utilize human excreta as resources and to reduce impacts on environment. The author suggested some intermediate technology alternatives that will meet local requirements and discussed process to introduce intermediate technologies

[11] Professor, University of Marketing and Distribution Sciences

into local communities at the grassroots level.

In these discussions, it was confirmed that the principles and methodology for the grass-roots penetration of intermediate technology in Bangladesh had much in common with what the author had been considering with several study groups engaged in the improvement of sanitation in developing countries. Also, the problems associated with sanitation and toilet in Bangladesh was sorted out to apply it to multi-purpose intermediate technology.

A Japanese non-profit organization, to which the author belongs, is currently working to introduce multi-purpose toilets in the rural areas in Bangladesh aiming to sustain beautiful environment of Bangladeshi villages as ecotopia.

3.3.2 Case from China

1) Environmental Challenges in China and the Role of Energy Efficiency (Jingjing Qian[12])

The Natural Resources Defense Council (NRDC) is a U.S. non-profit environmental organization. Since 1996 the China Clean Energy Program has focused on promoting energy efficiency and low-carbon energy options through projects in three areas: green buildings, clean power, and sustainable transportation. This presentation describes China's environmental challenges pertaining to energy use and illustrates the role of energy efficiency in mitigating the environmental impact with NRDC project examples.

China's extraordinary economic growth since 1980 has lifted almost 400 million people out of absolute poverty. While this is a huge accomplishment, it has also taken a heavy toll on public health and the environment. Official Chinese data reveal that 92 cities out of 340 had severe air pollution in 2003 and most large cities were in this group. China is the world's largest emitter of sulphur dioxide and has acid precipitation on over 30 percent of its land. According to the World Bank, air pollution in China contributes to over 200,000 premature deaths and by 2030 the health cost of air pollution could amount to 390 billion U.S. dollars.

The biggest culprit of China's air pollution is coal. Already the world's largest producer and consumer of coal, China aims to quadruple its GDP by 2020 that will increase coal use. Oil and electricity demands have also been soaring in recent years. Meanwhile, China's per capita energy consumption remains unacceptably low. The heavy reliance on fossil fuels causes serious local and regional pollution and international concern over carbon dioxide emissions.

Among the various available technology options for addressing the environmental challenges, energy efficiency should be the first choice as it is the cleanest and usually the cheapest. It involves no high technology and is a resource. Chinese industries are 25 to 90 percent less efficient in energy consumption than their developed country counterparts. Overall, up to 30 percent of current energy consumption could be saved through efficiency, conservation and structural adjustment.

NRDC has taken lead in promoting two major ways of energy efficiency in China: electricity demand-side management (DSM) and green buildings. In Jiangsu and Shanghai, our technical team is helping decision makers understand the costs and benefits of DSM programs, which if widely implemented could avoid 260 million tons

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[12] Senior Research Associate, Natural Resources Defense Council

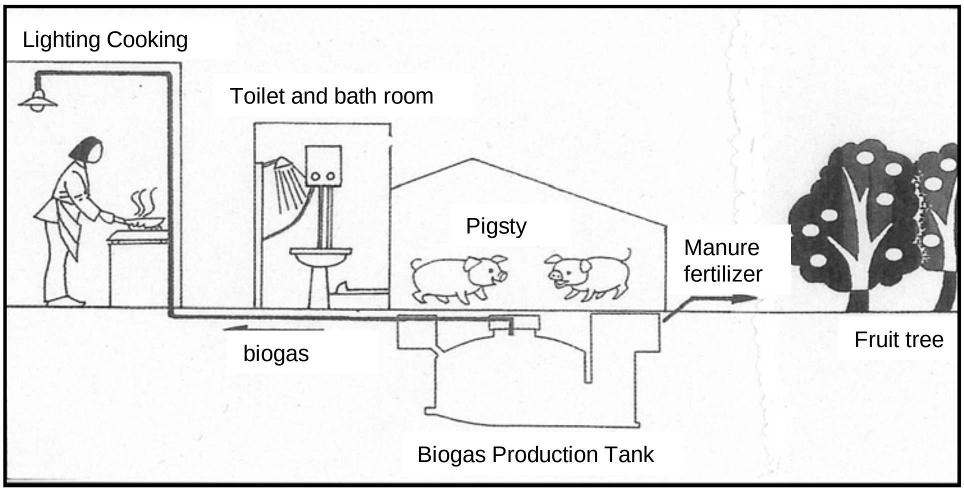
of CO_2 emissions each year. Buildings represent 20-25 percent of China's total energy consumption, thus making a significant environmental impact. NRDC promotes more efficient building energy standards that can save 10,000 MW by 2020. As the world's largest producer of solar water heaters and compact fluorescent lamps, the potential for energy saving through wide application of these products is also huge in China.

2) Self-supported Energy Production and Intermediate Technology in China (Yang Yufang[13], Masaaki Naito)

This paper describes the present situation of energy supplement and utilization in rural area of China and predicts the increasing energy requirements in resource protection and utilization of renewable energy in the future. The research was conducted at Simao City in southwest area and Liumingying village in Beijing area. Methane or biogas has been widely used as a traditional energy, and it enabled the reduction of environmental load and the supply of energy in rural areas. It is clarified that such bio-energy utilization is very effective to CO_2 and deforestation reduction for protecting the eco-environment and establishing a renewable energy supplement system.

The primary achievements of environment protection and agricultural economy in China countryside area are:

1. Reducing the use of natural wood, and saving the natural forest
2. Relieving lung and eye diseases because of smoke, with the substitution of wood by methane gas
3. Promoting a hygienic environment with the introduction of the "toilet" and pig raising method
4. Making good use of the manure of pigs and men, turning it into organic fertilizer which reduced the use of chemical fertilizer
5. Life improvement through organic agricultural economy
6. Reduction of labour for wood collection and forest protection
7. Protection of ecological environment



In this research, we re-evaluated the significance of traditional biogas production and utilization system in China's farming villages where a rapid increase in energy consumption has become a major concern. At the same time, we examined the potential of an energy supply system for farming villages that is friendly to both the local and global environment that can also serve as an economically efficient energy source. If self-supported bio-energy production and biomass recycling systems are to be implemented, it could serve as a mechanism that would greatly help China's rural areas,

[13] Director, TFRC Water Treatment Research Laboratories (China)

where rapid economic development is expected, in their transition into a resource-recycling society. Moreover, it would provide suggestive hints to Japan and many other industrialized countries highly depended on large-scale advanced technology and struggling to cut their carbon dioxide emissions.

3.3.3 Conditions for Acceptance of Intermediate Technology and Its Implications

(Tetsuji Arata)

When we think of conditions for acceptance of intermediate technology, at least four aspects should be taken into account. Three general conditions could be summarized as follows:

- Technological aspect
  - Good (enough) performance
  - Material availability in local area
  - Easy construction
  - Easy operation and maintenance
- Economical aspect
  - Low initial cost
  - Low running cost
- Social aspect
  - Cultural acceptance
- Environmental aspect
  - Long-term sustainability

Among the conditions written above, the importance of each item varies with specific cases. It also differs between technologies used at the household level (household technology) and technologies used at the community level (community technology). In case of household technology, “easy operation and maintenance” is very important. Household technologies, like drinking water treatment technologies, are usually maintained by housewives, and they are very busy, especially those who are living in poor families in the rural areas of developing countries, like India and Nepal. So, if new technology adds extra hard work to their daily tasks, it is not acceptable. But in the case of community technology, even though its operation and maintenance is not easy, there could be high degree of acceptance if it creates new job in the community, like a biomass power plant in West Bengal, India.

The importance on environmental aspect seems very much different in developing countries and developed countries. In developing countries, intermediate technologies are introduced so that people in the rural areas can improve their living conditions on technologically, economically and socially acceptable bases. In this case, environmental aspect is not so important, at least from the user’s point of view. In contrast, in developed countries, the condition of “long-term sustainability” seems to be a major concern for the users. Moreover, the use of intermediate technology in developed countries where modern technology is available is in many cases accompanied by some expense in other aspects like inconvenience, extra cost, etc.

It seems more difficult in developed countries to persuade people to use intermediate technology because of competition with high-tech solutions. As far as energy consuming high-tech solutions remain cheaper and people are trapped in a double bind between economy and environment, intermediate technologies will never be widely accepted in developed countries, even though some environment conscious people welcome such idea.

3.4 Challenges of Eco-villages Toward Eco-sound Society

3.4.1 Eco-villages in Japan

1) Experience in Shiga Prefecture (Takaaki Niren[14])

Sustainable society should not be identified by specific characteristics like environmental, industrial, economic, political, societal, and cultural attributes. Although they may shed light on the state of the society, these do not explain its dynamics. Society is a complex dynamic system composed of living entities having strategies for survival that is not for the present but for the future. Thus, if we intend to attain a sustainable society, we have to design the system of dynamic society, or linkage of entities composing it. Our approach to sustainable society is to create a system of dynamic sustainability first at the community level then spread the dynamics to the rest of society. The first experimental sustainable community is planned at Kobunaki, Ohmi-hachiman City, Shiga Prefecture, located in the centre of Japan and the coastal area of Lake Biwa, the largest lake in Japan. The place is called Kobunaki Eco-Village.

The design concept of the eco-village is to change the engine of the society from economy to life. We generally put priority on economy for improving our life in the modern society. As the national government has placed priority on improving the nation's economic performance; the business society is targeting economic achievement and usually works to earn money. If the economic target performance of the society is good and guarantees societal and environmental health, every entity can have good conditions, but no evidence exists that would assure economic growth will not damage societal and environmental health. On the contrary, economy can grow at the expense of society and environment. We can show a plenty of examples. If we can change the engine of the society to life, we reorganize society to a sustainable one. Because improving the quality of life will not sacrifice the economy, the society or the environment.

Table 3.4.1.1 Project of Kobunaki Ecovillage

	water	energy	material	societal health
Community action	Biotope	Microclimate control by landscape	Eco-efficient lifestyle	Participatory community development
	Rainwater & Gray water utilization	Biomass use	Community organics cycle system	Participatory commons management
Business action		Pedestrian community	Community supported agriculture	Ecoliteracy education
		PV assisted EV	Agriculture & Manufacturing complex	Capacity building of people
				Assistance of community business
Futures design	Ecological housing			
	Research of sustainable society			
	Eco-business development consortium			
	Monitoring & Evaluation of environment elements / Community Growth Management			
	Experimental sewage treatment	Experimental energy system	Chemicals free habitation	Everyday health care

2) Experience in Tango, Kyoto Prefecture (Toshihiko Sakurai[15])

The Kyoto Prefectural Government once attempted to reinvigorate the local economy by converting the Tango region into a resort area. However, in a burst of a bubble, the

[14] Professor, School of Environmental Science, University of Shiga Prefecture
[15] Director, The Earth Design School

government made dramatic shifts in this plan. Such shifts included the plans associated with the 144-hectare-land reserved for building a public park that would be a central facility of the resort area. Originally, the park was planned to be a place for retreat with a lot of hotels and villas. It changed to be an ecologically sound park that incorporated regional cultural characteristics. Further, the government decided to work with the citizens for building the park, inviting citizens' participation to discuss what should be done to live harmoniously with nature and study this theme. Such a democratic approach was unprecedented in Japan. In 1997, the prefectural government announced that it had changed the construction plans of the public park and that it would launch a project called "Earth Design School (EDS)."

In December of 2002, 50 citizens who participated in the experiments by Earth Design School (EDS) gathered to establish a non-profit organization (NPO) Earth Design School. Prior to this establishment, the school was managed as a project of the Kyoto Prefectural Government. It secured its annual budgets from the government, and its administrative work was under the charge of the public servants. The establishment of the NPO cast new lights into the perspectives of the project.

It will take a long time for the non-profit organization Earth Design School to realize its goal. that is to transform the whole region to be ecologically sound. With this long-term goal in mind, the NPO's interim objective is to develop ideas for the aforementioned public park that will open in the next few years. The ideas highlight how to display a unique ecologically sound village as a prototype that shows potential measures for the long-term goal and how to make the park an educational place. The objective is exemplified by the NPO's motto, "a hand-made ecotopia, an ecological utopia built by the hands of citizens." The uniqueness is shown in the original environmental technologies developed for rebuilding a community. In reality, such development is challenging. Nonetheless, we are working on it through several projects listed below.

(1) Management of mixed forests and the plan of developing a biomass system
(2) Use of ecological materials - soil and trees - and reestablishment of its use
(3) Organic farming and landscape design

The main theme of this project is to maintain and/or rebuild regional communities. Such rebuilding requires winning supports not only from the people who live within the region but also from the people who live outside of it. This is another important theme. The NPO Earth Design School has been dealing with the above agenda. It began an experimental project called "Making Plans with Story-telling Methods." This project is assumed to have three processes. These are: 1) holding workshops as introduction or a basis of appreciating values of nature; 2) understanding stories that tell the meanings of previous events; and 3) creating stories that incorporate our creative ideas and transferring the stories to the next story-tellers or the next scene. The skills necessary for these processes are how to conceptualize the meanings and how to pass down the stories from generation to generation. As a starter, in 2003, the NPO produced simple brochures. Currently, it is exploring various story-telling techniques, including the ones used in novels, in picture books, and patterned language.

3.4.2 Global Eco-village Movement and Its Meanings (Miki Yoshizumi[16], Masaaki Naito)

Since the late 1960s, we have recognised environmental issues on global, national,

[16] Doctoral Student, Graduate School of Global Environmental Studies, Kyoto University

regional and local scales, such as climate change, air/water pollution and exhaustion of natural resources that have arisen as a result of prioritising economic development. In response to the situation, various people such as academic researchers, environment activists and students have addressed those environmental issues. As one of the activities for bringing solutions to environmental issues, “eco-villages” has gotten a lot of attention recently. Various “eco-villages” all over the world, particularly in Europe and the United States came to be built, and the Global Eco-village Network (GEN) was established in 1990. According to GEN, eco-villages are “urban or rural communities of people, who strive to integrate a supportive social environment with a low-impact way of life, and typically build on various combinations of three dimensions: social/community, ecological and cultural/spiritual.” To achieve this, people in eco-villages integrate various aspects of ecological design, permaculture, ecological building, green production, alternative energy, community building practices, and much more. Each eco-village aims to deal with not only environmental issues but also social and economic issues, although commonly they share the goal of sustainable development and the pursuit of the true meaning of wealth. There are mainly four kinds of aims to establish eco-villages: ecology, community, welfare for the handicapped, and philosophical and spiritual. In particular, eco-villages aiming philosophical and spiritual benefits are the second largest in number after ecology. Moreover, the existing eco-villages could be categorized into the following four types:

- **Residential**
  - **Independent**: Self-sustaining Working-Living System:
    Suvorholm（Denmark, Findhorn (England), etc.
  - **Dependent**: Ecological architecture and living environment:
    BedZed（England, Eco-Mura（Shiga, Japan）, etc.
- **Non-residential**
  - **Industrial**: Recycling wastewater, emission and solid waste in industrial areas, zero-emission:
    Ecoindustrial Park (Kalundborg, Denmark), Ecotown industries (Japan), etc.
  - **Education / Tourist Facilitie**s: Environmental education, ecovillage tourism:
    CAT (England), Earth Design School (Tanba, Japan), etc.

In conclusion, eco-villages have various potentials not only for tackling environmental issues, but also for boosting the economy of villages, fostering spiritual wealth, lifelong learning for the unemployed, the retirees, the disabled as well as children, revitalizing rural areas, and so on. Furthermore, there is complementary relationship between eco-villages and urban areas, and one of the important roles of eco-villages is tackling not only environmental issues but also mental issues such as the stress of urban living.

4. Conclusions

4.1 Concepts of Ecologically-sound Technology

First condition: Technology must not bring about burden greater than the assimilating capacity of natural environment

① Technology must not increase the concentration of substances derived from subterranean resources in the natural world.

② Technology must not increase the concentration of substances produced artificially.
③ Technology must not lead to development and extraction that impairs the foundation of the natural ecosystem.

Second condition: Technology must give happiness equally to all people in a region

① Technology must "maximize the happiness" which is defined on the agreement of all citizens of a bioregion and bound by the constraints of regional and global environment.
② Technology must bring happiness equally to all people in a bioregion.

Regionally appropriate ecologically-sound technology, moreover, may have the following characteristics:

* It is local and its scope is appropriate to the size of the local community: Local citizens working as volunteers manage the technology, which is not large-scale or mass-production technology.
* It is free from market competition: It offers the only feasible mechanism for "natural energy," "recycling," and "agricultural production," which, despite their importance, have been left undeveloped because they do not have a place in the present market mechanism. The recent popularity of local money or eco-money is not unrelated to this.
* It is independent: Materials and energy must be self-dependent within a region in order to internalize the technology and prevent it from increasing the burden on the environment. "Local production, local consumption" is an often used phrase today that implies this point.
* It mainly uses living organisms and the ecosystem: The technology mainly utilizes the power of natural life instead of advanced principles of physics or chemistry. Because the technology depends on energy derived from the sun, it is consistent with the law of entropy.

4.2 Implementation in Developing Countries

Group Process

Social change happens fundamentally through social or communal group processes, not just from individual actions. This is no doubt true in the implementation of intermediate technology in developing countries. When people are organized into groups, they can share their experiences and help each other. So a main priority in the implementation of intermediate technology in developing countries must be to mobilize groups.

(1) Solutions are almost always improved when many minds focus on a shared problem.
(2) The energy generated by a coherent group is more powerful than that of an equal number of individuals operating by themselves.
(3) Group size must be appropriate (not too big and not too small) to facilitate the face-to-face contact that is always important in decision-making.

Involvement

Involvement of people from planning stage is essentially important for the effective implementation of intermediate technology in developing countries. If people are involved from the beginning, not only can they adopt the new technology from outside, but they can also add their own idea and modify it to be more suitable for their locality. In such a case, it can be expected that the technology can receive better operation and maintenance, and its performance lasts longer.

Education

For the effective implementation, the most important thing is education. Information about the issue, solution options, cost and benefit of the options should be provided to the people (potential users) through community meetings and/or workshops to enable them to select the best suitable solution for the locality and for themselves.

4.3 Dissemination of Alternative Ideas

Developed countries

Eco-villages can be catalytic agents in developed countries to disseminate alternative ideas to the society. Day by day, more and more people are becoming aware that we cannot continue our present wasteful way of life forever. Some alternative ideas are already provided for them. But many people have not yet changed their way of life, because they are not aware of what is really workable in the real world. How can we convince people that another way of life is possible? The best way is showing them examples of long lasting eco-villages where alternative ideas are actually working. To make eco-villages more accessible to the society, the following is needed.

(1) Strengthen the network of existing eco-villages and compile the information about them.
(2) Provide information about eco-villages to the individuals who are concerned about alternative life and tell them they are not few.

Developing countries

The problem about technologies for rural development in developing countries is not so much in the dearth of appropriate technologies as in their rapid and wide adoption. The gap lies in the absence of an efficient and dedicated system of extension. Policy has to focus on improving and putting in place for potential users a comprehensive system of training-cum-demonstration, sensitizing and familiarizing, convenient delivery and dependable back-up programs for new technologies and products. Sustainable diffusion of many of these technologies could be implemented by collaborative enterprises involving government and non-government agencies, research and academic institutions, as well as other voluntary organizations through formation of self help groups and village cooperatives consisting of potential participants and beneficiaries. For sustainable development without the danger of climate change, transfer of technologies is as much important as their generation.