Report of ICA Regional Workshop

WASTE RESOURCE RECYCLING BY COOPERATIVES

- the Chinese experience

International Cooperative Alliance
Regional Office for Asia and the Pacific

Report of ICA Regional Workshop
Shanghai (China) : 25 March - 4 April 1991

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Acronyms

ACFSMC	:	All-China Federation of Supply and Marketing Cooperatives.
GPUSMC	:	Gansu Provincial Union of Supply and Marketing Cooperatives.
ICA ROAP	:	International Cooperative Alliance Regional Office for Asia and the Pacific.
SFSMC	:	Shanghai Federation of Supply and Marketing Cooperatives.
SRRUC	:	Shanghai Resource Recovery and Utilization Company.
UNDP	:	United Nations Development Programme
UNIDO	:	United Nations Industrial Development Organisation.

Foreword

During the 35 years of its establishment, the Shanghai Resource Recovery and Utilization Company (SRRUC), a subsidiary of the Shanghai Federation of Supply and Marketing Cooperatives in China, reclaimed various kinds of recycled waste materials totalling 37.02 million tons with a value over 12.6 billion Yuan. The reclaimed raw materials and products have been supplied to various industries and innumerable households. Besides, to make use of these materials country can conserve a lot of natural resources and save energy comparable to 23.62 million tons of standard coal and 2.3 billion Kw/h. The SRRUC collected almost 4 million tons of waste paper from various sources, and had supplied about 3 million tons to the paper factories. Recycling of one ton of waste paper produces 800 kg of new paper. It conserves 3 cubic meters of wood, a great deal of water, electricity, coal, chemicals, etc. The smeltery of the SRRUC reclaims scrap ferrous metal, mainly involving swarfs, shavings and other kinds of scrap iron and steel generated in the course of production. With these industrial wastes, regenerated pig iron was produced and supplied to metallurgical industries as steelmaking furnace charge.

During the period 1966-86 by another subsidiary of the SRRUC a total of 211,417 tons of rubber scrap had been recycled and some 41,960 tons of scrap tyres and 87,845 tons of imported scrap types had regained their utility in different ways through processing.

Similarly another subsidiary of the SRRUC is engaged in the recovery of precious metals from the scrap.

These are some of the shining examples of success of the Chinese Cooperative Movement in the sector of waste material recycling and recovery. The Movement in China, as elsewhere, is concerned with the increase in pollution levels and disposal of garbage and waste material. The leadership of the Movement have gradually realized that the waste material could also be put to some use. The recycling and recovery efforts have eventually paid off and the country has been able to meet some of the critical needs of the industry from the "neglected resources". This is an achievement which deserves a careful and serious study. The International Cooperative Alliance, a world confederation of Cooperative Movement, has also launched a number of programmes to conserve natural resources, attack pollution, and make the planet pleasant and

worth living. Cooperatives and cooperators all over the world have been invited to participate in this venture. All programmes should eventually lead to a sustainable development since preserving nature is not a one-time affair. The ICA ROAP together with the All-China Federation of Supply and Marketing Cooperatives, therefore, agreed to undertake an exercise in sharing of experiences through a Regional Workshop on the subject of Waste Resource Recycling. The workshop was held in Shanghai during 25 March - 4 April 1991.

The experiences gained in China are of great relevance to other movements. A number of technical papers were produced for consideration. The present document contains a brief report of the Regional Workshop and some of the important papers which were used during the Workshop. We hope that the material would be of some interest to our cooperative leaders and policy makers.

I am indeed very happy that the leadership of the ACFSMC was able to cover all the local costs of the Workshop and provide the participants with an opportunity to gain first-hand experience in the country. In the organisation of this Workshop and preparation of this document a lot of hard work has been done by my colleague, Mr. Guo Yong Kang, ICA Advisor on Agricultural Cooperatives which I appreciate. The ICA is extremely thankful to Mr. Yang Deshou, Secretary-General of the ACFSMC for his generous support to the organisation of this very important activity.

G.K. Sharma
ICA Regional Director

Bonow House
New Delhi
31 December 1991

Introduction

Background

The deteriorating condition of environment and ecology is engaging the attention of all human beings. National governments, non-governmental organisations and international organisations are launching a number of projects thereby trying to protect environment. The matter was discussed at considerable length at the Central Committee of the International Cooperative Alliance (ICA) at its meeting held in Madrid in September 1990. The Committee adopted the following resolution in this context:

Deeply concerned by the critical state of the environment in which we live and the economic, social and political policies that perpetuate and further aggravate these conditions;

Noting that the major cause of the continuing deterioration of the global environment is the unsustainable pattern of production and consumption which has resulted in the depletion of the ozone layer, the greenhouse effect, the contamination of air and water, the degradation of land resources, etc.;

Recognizing the inter-related nature of development and environment necessitates that environmental protection be viewed as an integral part of the development process and that economic policies be reviewed on issues including debt;

Recognizing also that unless action is taken in the immediate future at the local, national, regional and international level, human survival may be endangered;

Stress the need for education campaigns, conservation measures and policy changes in all sectors of the economy and at all levels to be made; and

Urges ICA member-organisations to join in local, national, regional and international efforts to address the issues of environment and development and take measures to stop the degradation of the human and natural environment.

In its message issued in conjunction with the 68th International Cooperative Day (1990), the International Cooperative Alliance, a world confederation of Cooperative Movement, called on its 600 million individual members "to continue the battle to protect the environment, by supporting their societies' environmental campaigns and sustainable development programmes, lobbying local governments to adopt environment-friendly policies, boycotting products which are harmful to the environment, recycling reusable items and informing themselves and educating their children about nutrition and the environment."

Being aware of the harmful effects to mankind through pollution and in accordance with the general policies laid down by the ICA in this sector, the ICA Regional Office for Asia and the Pacific (ICA ROAP), New Delhi, undertook to develop and launch modest programmes for its member-organisations in the region, by way of developing awareness materials. A small brochure - A PLACE TO LIVE - written by Mr. Daman Prakash, issued by the ICA ROAP in November 1990, is a modest attempt in generating awareness among the cooperative populace and to create situations where all members of the cooperative world stand together to participate in this most important activity of our life-time, protecting the environment. 3,000 copies of this awareness material have been distributed extensively. ICA member-organisations have been requested to give widest possible publicity to the material by reproducing it or by undertaking its translations. The material has already been translated into various languages e.g., Japanese, Hindi, Sinhalese, Urdu, Bahasa Indonesia, etc., and has been serialized in a number of cooperative journals throughout the region.

Already in this region some positive steps have been taken by some Movements e.g., the Chinese Cooperative Organisations, the Japanese Consumers Cooperative Union, the Agricultural Cooperative Movement of Japan, various sectors of the Indian Cooperative Movement, etc. During the year 1991-92 the ICA ROAP has decided to undertake a comprehensive regional study leading to identification of causes of imbalances in eco-system. The study is also aimed at developing suitable recommendations and national plans for the benefit of cooperative organisations in the region.

Turning Waste Material into Treasures

Controlling pollution by taking steps in maintaining ecological balance, regeneration of resources, reafforstation programmes, gas emissions, handling farm chemicals properly, creating and protecting forests is an important activity. This should be done by all human beings, formal and non-formal organisations and at all levels. Also is important to conserve energy and to make the best possible use of waste material which is generated by household and industry. In this waste material or the garbage are hidden resources of immense value and utility which not only meet out day-to-day needs but also conserve energy and our much needed foreign currency.

The waste material rejected and discarded by production units no doubt generates pollution which is harmful to human being and all living beings. If there is a will there is a way, and it is of significance to note that some of the industrialised nations and even some of the developing countries have tried to reap a rich harvest from the waste material by installing recovery methods. Plastic material, glass items, rejected pieces of computers, telephone and electricity wires, old discarded newspapers, tin cans have been processed to produce items of household needs. In China processes have been installed to

recover gold, silver and copper from the waste material. This is an important activity and which presents happy solutions to some of our waste materials.

China Shows the Way

The Cooperative Movement of China under the leadership of the All-China Federation of Supply and Marketing Cooperatives and its various constituents have shown the way that cooperatives can play an important role in environmental protection and the Chinese cooperators are willing to share their expertise and experiences with other sister cooperative movements within the region. Maximized recovery and utilization of the waste material is, in effect, the amplication of mining industry, which contributes greatly to the conservation of natural resources and alleviation of environmental pollution, while boosting production, encouraging social frugality, and enlarging employment potentials. In China, the Shanghai Resource Recovery and Utilization Company (SRRUC), a subsidiary company of the Shanghai Federation of Supply and Marketing Cooperatives, founded in 1956, is now commanding in the trade throughout the country with regard to resource recovery amount, transaction volume, integrated utilization, and operational scale. It possesses a complete organisational structure, processing system and business network. The SRRUC at present undertakes activities of recovery, processing and recycling of as much as 16 categories of reclaimable waste materials. These include, for instance, scrap ferrous and non-ferrous metals, rubber, plastics, paper, cotton, hemp, rags, chemical residues, domestic animal bones, human hair, used glass bottles, old machine parts and accessories, acids, etc.

The ICA ROAP in collaboration with the ACFSMC, a member-organisation of the ICA, participated actively in dissemination of information and experience of the Chinese cooperatives to all other movements in the region by organising national and regional level workshops, consultative meetings, exchange of study visits and preparing documentation. The present regional workshop on "Waste Resource Recycling" was one such effort.

In accordance with the conclusion and recommendations of the workshop, the ACFSMC and SFSMC, with the coordination of ICA ROAP, will send one mission to Thailand and Philippines in 1992 to assist the Cooperative League of Thailand and the Cooperative Union of Philippines to conduct the feasibility study on Waste Resource Recycling Projects there.

Workshop Objectives

The Regional Workshop was organised with the following objectives:

i. To develop awareness among the member-countries on the relevance of waste resource recycling and utilization in the conservation of the natural resources including man and the society;

ii. To develop and strengthen the bonds of cooperation, understanding and unity among the member-countries/cooperative societies in the region;

iii. To share wisdom, experiences and technology among the member-countries;

iv. To avail the services and technology of SFSMC/SRRUC on waste resource recycling and utilization applicable and economically feasible in the participants respective countries; and

v. To avail of the financial support of other member-countries through ICA for the implementation of the project in each participating country whenever feasible.

Workshop Proceedings

The ICA Regional Workshop on Waste Resource Recycling was conducted in close collaboration with ACFSMC and SFSMC during 25 March to 4 April 1991 in Shanghai, China. It was the first regional training programme hosted by ACFSMC in China as well as the first training course on the above subject. Seven participants from India, Philippines, Sri Lanka, Thailand and China attended the workshop. Another three selected participants were unable to attend the workshop due to flight problems.

The workshop was inaugurated on 25 March at Gong Xiao Hotel, a cooperative hotel, in Shanghai. Mr. Yang Deshou, Secretary General of ACFSMC and Mr. Ye Zheng Sheng, Director of SFSMC attended the inaugural session and conveyed the greetings to all the participants. Mr. Guo Yong Kang, Agricultural Cooperative Development Advisor of ICA ROAP, briefed the participants on the objectives and programme of the workshop.

The method adopted for the workshop was first a briefing of all participants by ACFSMC, SFSMC and SRRUC on the cooperative structure and the activities of waste resource recycling in China which covered many types of waste resources, e.g. steel, plastic, paper, ferrous metal, precious metal and rubber. This was followed by field visits to all the processing plants and collection stations. For every plant and station visited, briefing and orientation supported with video presentation on plant operations, technology, staffing and other relevant information were conducted before the actual observation on installations and plant processing. After the observation, discussion which again followed, were participants' questions and queries on areas of their interest, were entertained. All the participants presented their country papers on situation of environmental protection. After the observation and discussions the workshop adopted the conclusion and recommendations for effective implementation of waste resource recycling project in the region.

On 3 April Mr. G.K. Sharma, ICA Regional Director, chaired the evaluation meeting. All the participants felt that the workshop was well-planned, well-

prepared, well-coordinated, very effective and highly successful.

The closing session of the workshop was held on 4 April at Gong Xiao Hotel. Mr. Wu Chuan Rui, Secretary General, Finance and Trade Office of Shanghai Municipal People's Government; Mr. Zhu Jing Hui, Deputy Director of SFSMC; Mr. G.K. Sharma, ICA Regional Director; and Mr. Guo Yong Kang, Agricultural Cooperative Development Advisor of ICA ROAP attended the session. Mr. Zhu Jing Hui opined that the workshop got great success with the joint efforts of all the participants and emphasised that the workshop was just the beginning of our cooperation and SFSMC would devote itself entirely to the cooperation with cooperative organisations in Asia and the Pacific region. Mr. Sharma expressed his great pleasure to see that the workshop had achieved its goal and hoped that all the participants should not only report to their cooperatives the experience gained from the workshop, but also report to their governments so as to get the support from governments in order to effectively and successfully implement the proposed projects and make the contribution to resource conservation and environmental protection.

On behalf of the participants Mr. Glicerio E. Lorejo conveyed the gratitude to all the sponsors and pointed out that all of us saw by ourselves in the workshop that Chinese cooperatives had contributed greatly to the environmental protection and resource conservation. He hoped Chinese cooperatives would provide assistance to cooperative organisations in the region in the field of waste resource recycling. Finally, Mr. Wu Chuan Rui, on behalf of the Finance and Trade Office of Shanghai Municipal People's Government congratulated the success of the workshop and wished the cooperation between Chinese cooperatives and participating cooperatives be successful.

Conclusion and Recommendations

Industrialization in developing countries has gained its momentum in the Asia-Pacific region. Although this may have served the purpose in the social and economic upliftment of these countries and the people, but this will ultimately develop an unbalanced ecological system in view of the exploitation of the organic and inorganic resources coupled with improper management of the waste products.

This problem may not be felt by rich and advanced countries but this is true to the less fortunate ones. Along this line, the cooperative movement in the region through the ICA ROAP has endeavoured to explore a certain degree of mutual cooperation among the member-countries with the end view of environmental protection and human survival.

Towards this end, the participants in this workshop on Waste Resource Recycling have identified some areas of experience and observations in Shanghai, China, where the objectives of the workshop can be attained upon the support of the advanced member-countries through the ICA ROAP.

1. For effective and successful implementation of projects proposed, the following steps should be undertaken:

1.1 SFSMC/SRRUC should provide the participants with the requirements for the feasibility of the project (investigating form);

1.2 Participating organisations/countries should conduct the actual survey/ investigation and fill up the forms correctly and honestly;

1.3 Participating organisations should carry out consultations with and secure clearance from their governments as to the establishment of the project and the importation of the equipments and technology from Shanghai, China;

1.4 When clearance is secured, participating organisations shall send the result of their survey/investigation to SFSMC/SRRUC for the latter to conduct preliminary evaluation and investigation. A copy of the communication should be furnished to ICA ROAP as a guide on what action to be taken on their part;

1.5 SFSMC/SRRUC should send investigation team to the participating organisation/country with board and lodging to be borne by the latter. At this step, the experts of SFSMC/SRRUC can decide and advise the organisation/country about the feasibility of the project. If found feasible, SFSMC/SRRUC and the organisation can outright decide on the kind of cooperation they may adopt;

1.6 Plans will be finalised and the Memorandum of Cooperation (MOC) will be concluded with ICA collaboration for funding of the project; and

1.7 Installation of the plant.

2. To furnish the report of the workshop to participants' respective organisation/ government as basis for follow-up and later for implementation, if feasible.

3. ICA ROAP should assist participating countries in the attainment of the objectives of this action plan upon presentation of the project proposals on the following:

3.1 Waste rubber recycling,
3.2 Waste plastic recycling,
3.3 Waste ferrous/non-ferrous recycling,
3.4 Waste precious metal recycling,
3.5 Waste paper recycling.

4. ICA ROAP should take favourable action on this matter seriously to avoid environmental hazards and to preserve the eco-system of the region.

5. ICA ROAP should consider this project as one of the top priorities within three years period.

Waste Resource Recovery and Utilization in Shanghai*

Waste materials are often rejected as useless objects in the course of production and people's daily life. But in actuality most of these rejects have not yet lost their use value and can be regenerated as raw material for further utilization, i.e. turning the useless into the useful, and turning the waste into treasure.

Maximized recovery and utilization of the waste material is, in effect, the amplification of mining industries, which contributes greatly to the conservation of natural resources and alleviation of environmental pollution, while boosting production, encouraging social frugality and enlarging employment.

Following the rapid development of production and increase in the consumption of natural resources, the amount of waste materials is largely enhanced, resource recovery and utilization as a social engineering operation will envisage much wider prospects.

Our government has always attached much importance to resource recovery activities, and placed them under effective administration. In the meantime, special economic policies and legal provisions were adopted to ensure the social status, role and production targets for recycling industries. All these are incorporated in the State programme for developing national economy and social progress. For the expansion of recycling industries necessary funds, technologies and equipment are usually provided by local governments.

After the founding of the People's Republic, ACFSMC set up specialised organisations for resource recovery and utilization. Shanghai Resource Recovery and Utilization Company (SRRUC) is a subsidiary company of SFSMC and a municipal level recycling enterprise, which was founded in 1956 and is now commanding in the trade throughout the country with regard to resource recovery amount, transaction volume, integrated utilization and operational scale. In other words, SRRUC possesses a complete organisational structure, processing system and business network. At present 16 categories of reclaimable waste materials (encompassing more than a thousand varieties) are processed and recycled by our enterprise. They are scrap ferrous and non-ferrous metals, rubber, plastics, paper, cotton, hemp, rags, chemical residues, domestic animal bones, human hair, used glass bottles, old machine parts and accessories, acids, etc.

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* *by Mr. Wu Hongcheng, Manager, Shanghai Resource Recovery and Utilization Company of SFSMC.*

During the 35 years since the establishment of SRRUC in 1956 we reclaimed various kinds of recyclable waste materials totalling 37.02 million tons with a value over 12.6 billion Yuan. The reclaimed raw materials and products have been supplied to various industries and innumerable households. Besides, to make use of these materials can conserve a lot of natural resources and save energy comparable to 23.62 million tons of standard coal and 2.3 billion kw/h.

Classification of Main Resources Recovered from Scrap from 1956 to 1990 (Unit : 10,000 tons)

Items	Quantity	Percent
Iron and steel	1,461	39.5
Non-ferrous metals	20.5	0.6
Paper	345.5	9.3
Rags	50.5	1.4
Rubber	36.8	1.0
Plastics	19.8	0.5
Cullets	86.3	2.3
Used glass bottles	55.7	1.5
Waste acids	447.4	12.1
Others	1,178.5	32.8
Total	**3,702**	**100**

Recycling practices of SRRUC are detailed in the following passages.

Organisational Structure

SRRUC manipulates resource recovery within the range of Shanghai and undertakes professional dealings and management affairs. It is necessary to set up a complete organisational system to ensure different functional bodies running well, to make timely decision and work out plans, to give instructions, and carry out efficient monitoring and coordination. Our organisational structure consists of a municipal company and several district or county branches. Directly subordinating to the municipal company, SRRUC, there are four business departments, namely, metals, machinery and electric appliances business department; comprehensive waste reclamation business department; rubber, plastics and miscellaneous goods business department; and storage and transportation department. In addition to them there are three direct subsidiaries

which are Shanghai Precious Metals Refinery; Haiguang Ferrous Metal Smeltery; and SRRUC Vocational Training Centre. For administration purposes we set up 12 district branches and nine county branches. SRRUC and the branches exercise respective administration over all their subordinating waste purchasing, processing and sales units.

Now in the districts we have 287 waste materials purchasing stations, and 215 such stations sprawling over the suburban counties under the management of grass-roots supply and marketing cooperatives. In the city of Shanghai we have 26 comprehensive waste materials reclamation shops, chiefly undertaking the purchase of all recyclable industrial wastes, 66 reclaimed raw materials and products sales departments and 138 such retail shops. Based on the different characteristics of all reclaimable wastes a complicated but streamlined network has been formed for processing old machinery and electric appliances, plastics and rubber scrap, formed steel products and stainless steel, used glass bottles, ropes and threads, paper, hemp, etc. Besides, we have a number of big-size shops, renowned shops and shops of special features, all dealing in sales business in large quantities.

Since waste materials are usually mixed with great varieties and different specifications, they have to undergo processing, such as sorting, classification, removal of dust and impurities and refining, before they can gain reuse value. With this in view, under SRRUC and its branches is set up a group of commerce-based industrial enterprises specializing in scrap iron and steel and non-ferrous metals processing, briquetting and precious metals refining, chemical products fabrication, waste rubber and plastics regeneration, and scrap automobiles disintegration.

SRRUC employs over 21,000 staff and workers, possesses a fixed estate plus flowing capital totalling 430 million Yuan, more than 800 cargo vehicles, 600,000m2 of building space for waste recycling and materials depositing, and thousands of complete sets of processing equipments.

The above organisational structure has basically formed a resource recovery and utilization corporate featuring an overall professional undertaking within the range of Shanghai.

The organisational structure of SRRUC is explained as follows:

a. SRRUC Direct Subsidiaries

- Metals, machinery and electric appliances business department;
- Rubber, plastics and miscellaneous goods business department;
- Storage and transportation department;
- Comprehensive waste reclamation business department;

- Guangda stainless steel shop;
- Haiguang ferrous metal smeltery;
- Shanghai precious metals refinery;
- SRRUC vocational training center.

b. District Branch Subsidiaries
   - Comprehensive waste recycling workshops;
   - Professional waste purchasing and sales shop;
   - Central waste purchasing station;
   - Commerce-based industrial works;
   - Transportation team.

c. County Branch Subsidiaries
   - Township waste processing factories;
   - Grass-roots coops' waste purchasing stations;
   - Waste purchasing agencies.

Measures Adopted for Resource Recovery and Utilization

Procurement of recyclable waste materials is the preliminary stage for performing the entire business activities of our enterprise i.e., purchasing such materials rejected by different trades, industries, and inhabitants in the city and suburban areas, and widely scattered, inter-alia, in production sectors and merchandise trafficking centres.

As most of the reclaimable wastes are dispersive, of small quantity and low value, they are easy to be neglected and discarded, recycling enterprises have to make every effort possible to procure these wastes and utilise them in an effective way. To provide convenience for all the inhabitants to sell their rejects, a network of waste purchasing stations and agencies has been set up by SRRUC and its branches, while thousands of professional workers are assigned to stay periodically in relevant industries to help collect, classify and transport the waste at the source.

As most of the post-consumer wastes are paper, cotton, chemicals, fibers, etc. and sprinkled in separate households, fixed and itinerant, normal and occasional waste collections are usually organised.

Fixed waste purchasing : An overall reclaimable waste purchasing station is set up in an average of two thousand inhabitants' residential quarter. Each station has an open price list for purchasing waste materials of different

standards from inhabitants during fixed business hours. For rural inhabitants, all suburban county grass-roots coops set up waste purchasing stations, or consign some retail shops to undertake this job as an agency.

Itinerant waste purchasing : All waste purchasing stations have formed a system to send itinerant groups to gain access to every street, lane and village to carry out periodical waste collection. In the city monthly itinerant waste collections are carried out in collaboration with the inhabitants' neighbourhood committee. For the aged and disabled inhabitants special waste collection and purchasing services are periodically offered. In the villages, boats, shoulder-poles and wheel-barrows are employed by itinerant groups to carry out the job, and often in combination with daily commodities sales drive in countryside.

Launching waste purchasing campaign : In the new year, spring festival, labour day, national holiday and other traditional grand occasions, in coordination with the mass sanitation movement we usually organise force together with the district and county branches to launch waste purchasing campaign for a definite period.

Collection and purchasing of reclaimable industrial waste : Wastes generated in industrial sectors can be roughly divided into three categories. First, scrap, residues and packaging materials arising in the course of production. Second, equipment scrapped for alteration, scrap building components, and automobiles. Third, over-production and overstock materials. Based on the size of the industrial enterprise, its production capacity and the amount of reclaimable waste yielded, different waste purchasing services are offered, such as residentiary, periodical and itinerant collection.

Residentiary waste purchasing service : As for big-size industries with large quantity of waste and great varieties of products, the local comprehensive resource recovery shops usually send skilled workers to stay in the factories to help collect, sort, bale and transport the waste cargoes.

Periodical waste purchasing service : For medium-size industries with definite amount of waste material, the local comprehensive resource recovery shops used to hook up with the factories to appoint time for waste purchasing.

Itinerant waste purchasing service : For small factories, shops, hospitals, schools, government bodies, and officers, local comprehensive resource recovery shops or waste purchasing stations always offer itinerant waste purchasing service.

Purchasing of reclaimable waste has to be carried out in the interests of the sellers, purchasers and the consumers, with the appropriate handling of the close relations between commerce and industries, the business department and the great mass. With this in view, waste purchasing prices must cope with the

quality and real value of the materials sold, so as to develop the cooperative spirit among the waste sellers, recycling enterprises, and the industrial consumers.

Sources and the procured amount of reclaimable waste in 1990 (unit : tons)

Amount/ Sources	Total	Big and medium size industrial enterprises.	Small-scale factories & township enterprises.	Urban and suburban inhabitants.
Total	1.58	1.03	420,000	134,000
Urban districts	1.01	850,000	80,000	80,000
Suburban counties	570,000	180,000	340,000	50,000
Percentage	100	65	27	8

Processing Technologies

All kinds of reclaimable waste have to undergo either sorting and classification, or processing and product fabrication. In accordance with different varieties of the waste and different requirement of the consumers and market demands, different treatment is adopted to maximize the use value of the material. With the basic principles of recycling industries: "Utilization must go prior to melting down", "The fine comes out of the crude", and "Adaptation of market demand", different processing technologies are employed according to the state and characteristics of the reclaimable waste.

Routine Processing

Sorting and classification : This is the preliminary stage subjected chiefly to manual labour, which involves selecting reusable metals, tools and machine parts, and removing impurities, especially easy-burning, explosive, toxic and harmful elements so as to ensure operational safety.

Repairing and refabricating : The purpose of repairing and remanufacturing is to restore the waste objects to their original use. For instance, old cartons, barrels, machines, parts, tools, and hardwares can be used after a series of processing, such as reassembling, refabricating, and refurbishing. Rejected metals, metal trims and cuts can be made into useful products directly for sale.

Mechanical processing : Some materials are bulky but light in weight and great

in quantity, for these, mechanical densification, transformation, and size-reduction are necessary for gaining their respective utility. For illustration, the bulky but light iron and steel frameworks, construction components, boilers, automobile shells etc. have to go through shearing, oxyacetylene-cutting; for swarfs and light iron and steel shavings mechanical pressing, baling and briquetting are necessary. Scrap tyres are to be disintegrated before regeneration; waste paper and rags can be supplied to the paper mills as qualified raw material only after removal of dust and impurities.

In-depth Processing

Smelting and casting: Dusts and residues mixed with impurities are to undergo removal of impurities and classification, and go through smelting and refining, and finally to be cast into ingots for further processing into finished products. As for seriously oxidized and agglomerated swarf, which cannot be briquetted, as well as scrap iron sheets will be made into pig iron for casting. With improved technology and equipment, pig iron can be used to fabricate iron pots, drainage conduits and other castings.

Refining and disintegrating : For waste solutions and residues containing different metal elements, chemical dissolution is applied to extract precious metals and produce various chemical products. A precious metal refinery has been established under our company, which boasts a strong technical force specializing in science research, exploitation of new technology, and creating new processing facilities, with which precious metals like gold, silver, platinum, rhodium, palladium, iridium, ruthenium, and osmium are successfully extracted through chemical dissolution and refining. Meanwhile, plastics and rubber scraps are to be treated with high temperature dissolution and decuncanisation to recover monomers, or produce plastics granules, and making regenerated rubber.

Up to now SRRUC has established a number of specialised waste recycling enterprises which involve scrap ferrous and non-ferrous metals processing and smelting, precious metals refining and chemical products manufacturing, regeneration of plastics and rubber scrap, scrapped automobile disintegrating etc. Reclaimed resources account for some 50% of all the waste collected.

Items and output amount of reproduced raw materials
(Unit : 10,000 tons)

Items	Quantity
Paper stock after sorting and classification	23
Reassembled cartons	1
Regenerated rubber	1,300

Scrap iron and steel after classification and mechanical processing.	30
Swarf briquettes and iron and steel bales	18
Pig iron for casting	5
Iron castings	0.5
Disintegrated automobiles (vehicles)	2,300
Refined gold (kilograms)	181
Refined silver (tons)	25
Refined PGM (kilograms)	292

Selling of Reproduced Raw Materials and Products

Selling of reproduced raw materials and products is the final stage in the general flow of secondary resources. All reclaimable waste has to go through diversified purchasing, concentrated processing, and selling in great batches. The significance of selling secondary raw materials and reproduced products could be summarized in the following:

1. To enable the widely scattered rejects to regain utility : The actual use value of all reclaimed raw materials and products can only be obtained through marketing and consumption by different industries and households.
2. To help promote production : Selling of reclaimed materials aims at providing more raw materials for production, supplying more qualified products for different consumers so as to make up the material shortage for the market, while lowering production cost, and exerting industrial development.
3. To procure economic benefit for the recycling enterprises : The great sales volume of reclaimed materials and products will lead to more active business operations, more rapid flow of capitals, and more economic gains for the enterprises. The selling of reclaimed materials and products should adhere to the following professional principles :
   (a) "Utilization must go prior to melting down": A greater part of the waste we purchased can be directly reused only after preliminary processing, such as reassembling, repairing, disintegrating and transforming. Adhering to direct utilization will maximize the enterprise's profit.
   (b) Purchasing waste according to market demand: The function of recycling is to enable all reclaimable wastes to realise their reuse value. With this in view, we have to make efforts to collect such wastes as are short in supply on the market. As for those materials which have bigger supply

than market demand, we should carefully purchase for the sake of reserve but avoid overstock to free ourselves from economic loss. In the meantime, however, endeavour should be made to open more sales channels.

(c) Consideration of the benefits for all the concerned parties: Most of the reclaimed materials are fit for industrial utilization, especially metals and paper stock, which are subject to State planned administration. To ensure the selling of reclaimed materials for the benefit of both commerce and industry, and in close adherence to the State policies, we have to supply all types of qualified and rationally priced materials for consumers.

4. To sell reclaimed materials in a professional way: Since reclaimable waste comes from different trades, industries, and millions of households with great varieties, complicated specifications, and small quantities, they have to undergo concentrated processing after careful sorting and classification. As such, professional sales organisations have to be set up to cope with the great varieties and different specifications of the reproduced raw material and objects. Our enterprise has established a number of professional sales shops, such as 22 shops specializes in selling iron and steel, 9 shops in selling paper stock, 8 shops in selling cullets, and numerous others for selling metals, machines and electric appliances, packing materials and containers, rubber, plastics and hardwares, thus forming an overall business network in the city.

5. Establishment of retail shops : Retail shops should be set up separately for selling industrial production raw materials and people's daily use necessities, thus facilitating the provision of cheap and applied commodities for inhabitants, and qualified raw materials for industries. Retail shops should embrace great varieties of material, with samples well-arranged on store shelves for choice and open price list for fair bargains. At present, in Shanghai we have lined up specialised retail shops in Beijing Road, Changzhi Road, Dongchang Road, and the famous secondhand merchandise market on Jiujiang Road, all of which have gained their firm standing in Shanghai, while radiating business opportunities throughout the country.

6. Importance of giving publicity to enlarge our market: Efficient propaganda can largely expand our sales market. It enables the mass to realise our business scope and the big varieties of reproduced raw materials and products our enterprise is able to supply, thus raising the prestige of our trade. Meticulously arranged windows, expositions, news briefings, advertisements, and other mass media are to be employed to invite public interests.

Chief Consumers and the Supply Amount of our Reproduced Materials in 1990 (Unit : 10,000 tons)

Items/ Supply amount	Heavy Industries	Light Industries	Township Industries	Other Industries
Iron and steel	48	2	10	9
Non-ferrous metals	1.3	0.2	0.3	0.1
Reusable formed steel	-	4.5	12	2.8
Processed rubber	-	0.3	0.3	0.06
Paper stock	-	20	4	-
Cullets	-	2	1	-
Plastics	-	-	0.5	-
Used acids	-	-	-	19

International Cooperation and Technical Exchanges

The world trend is developing secondary resources exploitation. Waste recycling has contributed greatly to the protection of social environment and saving energy. In view of different organisational systems and processing technologies adopted by different countries, worldwide cooperation, technical exchanges, and trading activities are considered indispensable to the promotion of this special industry. Since the implementation of economic reform and open policy in our country, SRRUC has spared no efforts to develop international trade and technical exchanges.

As early as the late 70s, we started exchange of study visits by experts, and established business relations with other countries and regions. In 1978 representatives of our company participated in the second world recycling convention held in Manila. In 1986 we obtained effective membership in the Bureau International De la Recuperation in Brussels. In 1984, under the joint auspices of UNDP/World Bank, Germany and Shanghai Municipality, an International Resource Recovery and Utilization Seminar was held in Shanghai with the participation of experts and representatives from Europe, Asia, Africa and Latin America and guest lecturers from various industrial countries. In 1989 a UNIDO-SRRUC sponsored workshop on Waste Plastics Recycling Technologies was held in Shanghai with the participation of experts in this special field from most Asia-Pacific countries and regions. Together with the SFSMC and ACFSMC we are undertaking the organisation of the present ICA Regional Workshop on Waste Resource Recycling in Shanghai. A closely follow-up

UNIDO-MOFERT sponsored international conference on waste plastics recycling practice in Shanghai is set to be held in the coming April. All these have and will enhance our active participation in international recycling operations.

Foreign trade involving processing of supplied materials and export of reproduced products have witnessed remarkable increase over recent years. Pure cotton cloth ends and trims, precious metals alloys, pig iron castings are the main export-oriented products, in addition to various traditional items like plume, gelatine, cotton wastes, plastics pellets etc. From 1987 to 1990 we had earned foreign exchange over 6 million US dollars.

We introduced advanced recycling technologies and equipment to upgrade our processing capacity. For instance, with Belgian government's special funds contributed to UNIDO we introduced advanced technology and equipment for reclaiming plastics scrap to yield pellets; demonstrative operations will be held in the coming international conference in Shanghai.

Another UNDP-funded project for PGM recovery technology and equipment will soon be executed sometime later in this year. Over the past few years we have introduced dozens of iron and steel dust briquetting machines and bulky but light scrap ferrous sheets and shavings baling facilities from Japan. Efficient straw and perspex button fabricating machines have long been introduced from Italy. Just months before contracts were signed with Japan for supplying us with vacuum molding equipment to fabricate formed castings.

Development of Applied Science Research

Integrated resource recovery and utilization are closely linked with applied science researches. In order to comply with the daily increase of waste varieties, new processing technologies and equipment are earnestly required to solve much more complicated technical problems in the course of processing. In view of this, we hold that applied research should have close ties with exploitation of waste reuse. Stress must be placed on integrated utilization of the secondary raw materials, and concentrated efforts are to be made to eliminate environmental pollution generated in the course of waste processing.

For the realization of the above objectives we emphasise :

1. Combination of scientific research with practice : This is the only way to make it possible to upgrade the function of resource recovery and utilization. To attach science research to production can ensure quick transformation of research fruits into production capacity. For example, the improved precious metals refining technology has realized the extraction of pure gold, silver and platinum group metals from scrap containing such metal traces, and developed high value products. Through diligent study, new tech has been developed to employ high temperature and high pressure to produce

regenerated rubber from synthetic rubber scrap, which has been granted patent right by the State Science Commission for nationwide application.

2. Initiation and renovation of processing equipment: Technical force should be organised to raise production efficiency and reduce manual labour. Materials loading and unloading for transportation, briquetting and baling of ferrous scrap, removing impurities and dust in the process of sorting, which were originally done by man force, are now replaced by simple mechanical devices.

3. Elimination of regenerated waste pollution : Concentrated treatment of waste materials, mostly containing harmful and poisonous elements, will inevitably give rise to secondary pollution. Protection of workers' health and social environment is an urgent task for applied research. In order to reduce dust contamination, oscillating screen and pulse dust arresting system have been worked out. Biochemical treatment of waste water, metal displacement, and noise-reducing facilities are all that contribute greatly to the alleviation of secondary pollution.

4. Establishment of an efficient technical contingent : Timely professional training, collaboration with social science research institutes, setting up experimental labs, and exchange of information with other recycling enterprises at home and abroad have all proved successful in cultivating a strong technical force rich in theory as well as practice in waste recycling, thus creating a favourable condition for developing our industry.

Conclusion

To wind up, we would like to reiterate that recovery and utilization of secondary raw materials plays a particularly important role in pushing forward national economy and social development. Following the consecutive increase in production capacity and technical level, the volume and varieties of reclaimable waste will inevitably be enhanced. To accelerate waste recycling and multipurpose utilization should be placed on our agenda. Here we wish to take advantage of the ICA Regional Workshop on Waste Resource Recycling to exchange expertise and experiences in this regard with all the delegates and experts of the participating countries for the purpose of promoting recycling activities in the entire region.

Shanghai Resource Recovery and Utilization Company, Pudong Branch

General Picture

Structure

Shanghai Resource Recovery and Utilization Company, Pudong Branch, was established in 1966. It has 800 staff and several subordinates such as Pudong Metal Station, Pudong Paper Station, Pudong Materials Market, Pudong Rope Store, Pudong Cloth Recycling Station, Pudong Resource Reclaiming Center, Yuansheng Iron Works, the Truck Team, etc. These subordinates are located along the Huangpu river in the Pudong Development Zone. The Pudong Branch has 4 million Yuan worth of fixed assets including 30 trucks, 10 cranes, 8 shearers and briquetting presses. It also has established exclusive business relations with 5 enterprises in Shanghai and other cities.

Business Scope and Operation

The major business of the Pudong Branch is to undertake the collection of reclaimable garbage and scraps generated in Pudong and part of Puxi (the west bank of the river) as well. Its business scope includes not only reclaimable second resource such as steel scrap, used steel products, ferrous and non-ferrous metal scraps, raw materials for paper industry like used paper; but also finished products like new paper, stainless steel products, various fasteners and fittings, mechanical accessories new paper and plastic packaging material, yarn, rope, thread, etc. Its business partners can be found in many other industries, for instance, metallurgy, textile, chemistry, handcraft, and communications.

The Qichangzhan Purchasing Station and the Donggou Scrap Yard

The Qichangzhan Purchasing Station

The Qichangzhan Collection Station is one of the 14 purchasing stations belonging to the business section of the Pudong Branch. Its eight employees are all women. Their work is to collect domestic discards in the area nearby. Besides doing their regular job in the station, they often go from door to door to collect reclaimable household throwouts, especially on sundays and on the eve of national holidays. The average annual value of used paper, cloth, steel householdwares and glass bottles collected by the station amounts to Yuan 300,000.

Because of the creative efforts and good service of its employees, the station enjoys a good reputation among the residents in the area, especially among those aged and handicapped who are visited by the station regularly. For many years, the station keeps the title of model station awarded by SRRUC.

The Donggou Scrapyard

The Donggou Scrapyard has 60 employees and an area of 20,000 square meters. The metal scraps stored, processed and recovered here every year amounts to 20,000 tons. The iron filings and shavings collected from iron works are not processed here. They are briquetted in another scrapyard and then sent back to the smeltery. What Donggou does is to sort out reclaimable scrap steel which are then sheared and cut. Some of the reclaimed iron and steel are sold to small steel rolling mills or hardware manufacturers to make tools like spades, hoes, etc. The leftovers are returned to smelteries.

The Pudong Branch of SRRUC is planning to set up a new resource recycling enterprise and open more business stations in the Pudong area so as to widen its business scope and gear up to the development of Pudong. It hopes to begin cooperation with foreign partners in the near future.

Xing Guang Plastics Factory of SRRUC

Xing Guang Plastics Factory, set up in 1956 with 120 staff and workers in a total area of 7,300 square meters, is a small-size factory specialised in processing waste plastics consisting of PE, PVC and PA, of which 80 to 90 per cent is in the form of film used for packing, agricultural purposes, with a small quantity of cuttings and trims coming from other plastics factories.

The original technology for transforming waste films into pellets was sorting and washing manually, tearing and pressing in an open-type double roller, plasticizing in an extruder and then cutting into pellets. The technology is simple, but the production efficiency is low with, moreover, an unsanitary working condition. Thanks to the assistance of United Nations, we have implemented two UN projects and imported two sets of advanced processing line - short-screw extruder and dencificator which upgrade productivity greatly. The following is a brief introduction about the two lines.

In order to cleanse films mechanically, diversified films should be shredded into even pieces. The Weiss Densification System made in Germany is fully competent for this operation. The system features a welded steel vessel which is fitted with dual direction drive rotors co-rotating at 1,500 RPH. Each rotor has two reversible knives. Scrap is chopped by the turning knives smoothly. If the film chips are not clean enough, they would be discharged from the outlet and undergo washing.

However, even clean plastic chips are not suitable for feeding directly to the extruder since its low bulk density. For example, if bulk density of PE is only 0.1 kg/1, the products or pellets extruded by it are inferior in quality because of the bulbs inside them.

While chips keep on rotating in the vessel, heat generates from friction and makes chips softened and melted. When the material reaches its agglomerating temperature, it is quenched with water mist which vaporizes immediately after contact. At once the material shinks into densified particles which are dry, free flowing and uniform. The bulk density of the renewed material is 0.40 to 0.65 kg/1. In the meantime, the auxiliary devices of the system can separate out metals magnetically, stir, dry and match colour in a silo harmoniously. The pellets can be fed to extruder and injection mold directly to produce domestic consumer goods. If pellets require nicer appearance and more densification, they have to be put into the extruder to be granulated again. But plastics are characterized by more heating, and more degradation. Taking this into consideration, PRH 120 extruder, invented by Belgian Professor, G.A. Patfoort, adopted the design principle different from the traditional one. The screw of the

extruder with a length-diameter ratio of 8:1 is shorter than normal ones, the rotating rate of it is up to 300 revs. per min. This design makes the plastics subject to a short dwelling time in the extruder. Furthermore, cold water is introduced to feeding and pressing parts so that the material is compressed in the state of heat insulation. The material is heated and plasticised quickly until it is pressed forward to the head of the screw where the maximum density is acquired.

During the operation, plastics do not decompose. It is specially fitted for PVC that is sensitive to heat and easy of degradation. Further than that, the head of the PRH 120 extruder has special structure which can granulate mixed plastics of PE and PVC, thereupon the most difficult problems on plastics recycling can be solved.

For the sake of upgrading the quality of regenerated pellets, the factory is making an investigation on plastics washing technology and equipment which will be replenished to complete the system. For getting greater benefits from plastics recycling, the factory has set a goal of producing finished products which are planned to have two types, one is made from verging plastics mainly for domestic consumer goods, the other is made by reclaimed plastics particularly for lower grade products such as construction material, garden fence and so forth. As a result, metal, wood and other natural material can be conserved.

Nanshi Paper Stock Supplying Station of SRRUC

Shanghai Nanshi Paper Stock Supplying Station is a professional unit taking charge of trading, processing and utilizing of various kinds of waste paper. With a staff and workers over 280, a building area of 8,000 square meters, it is the largest among the 20 enterprises of the same trade in Shanghai. Established in 1956, the station has developed rapidly through 34-year practices.

At present the annual profit turn-over attains 2 million Yuan, with the highest record of 4 million Yuan, instead of only 100,000 Yuan previously; the processing capacity of waste paper reached more than 1,500 tons per month, with an increase of three times the original, and the operating capacity is over 20,000 tons per annum. Most part of processed paper is provided to paper mills in Shanghai, Jiangsu and Zhejiang provinces, thus saving a great deal of water, electricity and energy while effluent is reduced remarkably for the benefit of environment protection.

Source of Waste Paper

As a specialised agency, the principal task of the Station is to collect all the waste paper scattered about within the range of the city. What is of first priority is to make a survey on the sources of waste paper as well as its operating channels. Through investigation, we have made it clear that there are two major original sources, one is from factories involving printing houses, paper product manufacturers and so on which bring about paper trims and cuttings, substandard paper, etc. arising in the course of production. The other source is from people's daily life, for example, diversified used books, magazines, newspapers, files, accounting books, documents, boxes, cases and other trashes. These two categories of waste paper are purchased, gathered, retreated and packed by our purchasing stations or those professional workers sent to the factories and shops, then transported to the Station to be further processed.

Processing Methods and Equipment

The waste paper gathered in the Station is seriously mixed with different specifications, qualities, types. It is necessary for waste paper to be sorted and classified at first. Two processing methods are adopted as follows:

One is the manual sorting at source. Selecting our pernicious substance, classifying waste paper in different items, baling and delivering them directly to paper mills.

Actually the paper scrap processing line employed was designed and made by technicians and workers in the Station many years ago, and during the past decades, the home-made processing line has undergone several times of renovation and adaptation. And now it runs with good efficiency and stability. The working procedure of this line is detailed below.

The paper scrap is fed into the input entrance, and sent to the paper dispersing device by a belt conveyor. The dispersing device is actually a conical rotating drum with wire clutches to disperse the paper clusters, while dust and impurities are removed. The dispersed paper is conveyed to the cylindrical rotary strainer for further removal of impurities and sent to a vacuum paper-dust arrestor. Then the cleaned paper is delivered to hand sorting tables to separate metals, plastics and other foreign substances. Finally in a two-side hydraulic-presser the paper is compressed into bales, each with a weight at 100 kgs. The dust collector will arrest the residue through the ventilator and let it sink into the dust bin.

Driven by electric power of 40 kw, operated by 15 workers, the daily processing capacity reaches 20 tons. Since the adoption of the line the labour intensity has been reduced and the pulp yielding raised up due to low impurities. Therefore, the processed paper is greatly welcomed by most paper mills. Considering its low cost, simple operation, stable quality of products as well as its contribution to the environmental protection and energy saving, it is really applicable to all the developing countries.

Varieties of Waste Paper

In accordance with the quality and usage, all kinds of waste paper are categorized principally into three grades and 14 varieties. The first grade paper scrap consists of four varieties, involving those white paper with no colour or only a little printing marks mainly coming from printing houses and paper products manufacturers. Generally speaking, the first grade paper scrap can be put into pulp chest directly replacing a part of wood pulp. With this kind of pulp, offset paper, writing paper, relief paper, machine glazed paper, etc. can be produced with lower cost.

Paper scrap of the second grade also contains four varieties, chiefly collected from factories, shops, officers and institutes, including books, news, kraft paper for wrapping etc. Most of them can be reused as wrapper, the bottom layer of kraft paper, while carton paper and the surface of box board.

The third grade is the lowest grade of the three, with six to seven types, mainly coming from inhabitants' daily life, including mixed paper, yellow paperboard, mixed coated paper, flint paper, paper scrap with heavy ink printing, and so on which are widely spreaded and seriously mixed with impurities, dust and some chemicals, with which only low quality of reclaimed paper such as yellow paperboard, felt paper can be produced.

Social and Economic Benefits

The recovered waste paper is classified and processed in terms of the requirements of paper mills. Waste paper, from collecting to marketing, brings in certain economic benefits to the Station. Moreover, waste paper recycling contributes significantly to environment. From the foundation of SRRUC, four million tons of paper scrap has been collected, among which three million tons have been supplied to paper mills. It is estimated that recycling one ton of waste paper can not only produce 800 kgs of new paper, but also conserve three cubic meters of wood, a great deal of water, electricity, coal and chemicals as well. Now a days in Shanghai there are more than 40 paper mills to produce various kinds of paper with an annual output over 400,000 tons of which 40% is made from paper scrap.

Hai Guang Ferrous Metal Smeltery of SRRUC

As one of the large recycling factories in Shanghai, Hai Guang Ferrous Metal Smeltery enjoys high reputation among the enterprises in the fields of metallurgy, foundry, municipal engineering, foreign trade and material administration.

General Situation

In October 1958 the Smeltery, as a subordinate unit of SRRUC, was founded for the purpose of reclaiming scrap ferrous metal, mainly involving swarfs, shavings and other kinds of scrap iron and steel generated in the course of production. With these industrial wastes, regenerated pig iron was produced and supplied to metallurgical industries as steel making furnace charge.

In the initial stage the scale of the Smeltery was small with 120 workers and staff members, 200,000 Yuan of fixed assets and a total area of 0.3 hectares. Its annual processing capacity was 5,500 tons of regenerated pig iron reclaimed from more than 7,000 tons of scrap ferrous metal. At that time, there were only two sets of cold blast cupolas. Feeding and discharging depended totally on manual work which resulted in high labour intensity and low productivity.

Thirty years later, the factory has expanded its production. The present annual recycling capacity of multifarious scraps is 72,000 tons and its annual output reaches 65,000 tons. Reclaimed cast iron of different state standards, sewer conduits together with their fittings of various specifications and castings of various types are main products. Within the last two years, its total output value has reached 36 million Yuan profiting 4.2 million Yuan per year.

At present there are 940 workers and staff members working in the three main workshops - smelting, casting and overhauling sections as well as quality control, product adaptation, sales, external cooperation, accounting, capital construction and general affairs, etc.

Production and Infrastructure

The basic equipments employed by the Smeltery are five hot-blast cupolas, three of which are 3 ton/hour cupolas located in the smelting shop. While the other 2 are two ton/hour cupolas placed in the casting workshop mated with another 1.5 ton/hour cuploatte for precious casting. Besides, three iron casting machines, 9 bridge cranes, 4 feeders and other accessories are in operation. Besides, there is a maintenance shop equipped with several dozens of lates for metal processing and cold forming. Therefore, routine maintenance and overhaul even processing spare parts can be taken care of within the factory itself.

The Smeltery has 32 vehicles for production purposes as well as 9 cars and buses for other routine activities. Since the factory is located along the river, it enjoys superiority in water transportation having a 2 km long bank and three ports for loading and unloading 70,000 tons of goods each year.

Five storage houses are established specially for storing raw material and auxiliaries, maintenance material, facilities, finished-products, consumer goods and labour protecting articles. Six computers have been put into use for the management of the whole factory.

Raw Material, Finished Product and Their Markets

Waste metals originated in Shanghai are recovered by the district and county branches of SRRUC. Through them, the scraps are distributed to each processing factory. It is through the above major channel the factory obtains its raw material and sometimes channels in other cities are also used.

The chief products are: reclaimed cast iron type Z26, Z22, Z18 and Z14. Cast sewage conduits of 75 mm, 100 mm, 150 mm, 200 mm in diameter and 182 cm, 150 cm, 100 cm in length as well as their fittings with more than 100 types and specifications. Besides, it also manufactures other castings such as sewer manhole covers, telephone system manhole covers, garden benches, elevator counterbalance, furniture fittings and the like.

Most of the regenerated iron and casting pipes are supplied to over 320 enterprises in Shanghai, the rest goes to other cities. As for the castings, most of them are exported to Japan, Australia, America and Singapore while the rest are supplied to the domestic market.

Personnel

At present the factory has 38 engineers and technicians and 212 skilled workers, 37.4% of whom are senior high school, technical school and college graduates. Of the 940 employees, 654 are workers, 71 are engaged in jobs such as machine maintenance and transportation, while the rest are for management and administration purposes.

Development Objectives

Since its foundation, the factory has succeeded in the field of waste recycling and has gained ripe experience in scrap recycling and great economic benefits. Especially in recent years, under the guidance of economic reform and open policy of our government, it has gained many opportunities to learn from others. The Smeltery is aware of the importance of adapting scientific management and advanced technique. Therefore, the present goal is to upgrade production with

advanced technique and improve quality. Besides, guaranteeing the market with its present products, the smeltery has recently installed and debugged two 1.5 ton power frequency electric furnace and is ready to provide the market nodular and special cast iron and casting.

The year the Smeltery will implement the mounting and debugging of the vacuo-forming foundry machine imported from abroad, thus high quality castings could be expected to provide for markets at home and abroad next year.

Rubber, Plastic and Miscellaneous Goods Business Department of SRRUC

Introduction

Rubber is a kind of high polymeric material of strong elasticity, resistant to wear, cold and erosion, and air-locked and waterproof, is indispensable to numerous industries. Rubber resource is, however, scarce in China due to climate effect. Before the founding of the People's Republic, rubber supply depended almost totally on import. And only after 1949 China started rubber plantation. Upto 1988 cultivation of an expanse over 600,000 hectares of rubber plants with an annual growth of 200,000 tons of gum along with the rapid development of synthetic rubber industry with an average yearly output of 257,000 tons, contributed to a certain degree to the ease of rubber shortage.

But, in fact, due to ever wider application of rubber in various industries and people's daily life the gap between the supply and demand of it is still wide. With this in view, recycling of rubber scrap i.e., tapping the potential of the "secondary raw material" to narrow the gap while alleviating environmental pollution is considered a matter of great significance.

Acquisition of Rubber Scrap

Source of the Waste

Generation of rubber scrap : Rubber scrap is usually generated in the course of production in the form of trims and cuts and disqualified products. Besides, transportation, agricultural machinery and mining industries provide large quantity of waste tyres and various other scrapped products like rubber plates, tubes and strips. Post-consumer rubber scrap is still another potential source.

Rubber scrap collection : (a) Local collection; (b) Collection from other provinces and municipalities; and (c) Import of scrap tyres from abroad. From 1966 to 1986 a total of 211,417 tons of rubber scrap had been recycled and some 41,960 tons of scrap tyres and 87,845 tons of imported scrap tyres had regained their utility in different ways through processing.

Management of rubber scrap collection : The district waste treatment centres and county agricultural byproducts Purchasing and Management Sections turn over their aggregated scrap rubber to the Rubber, Plastics and Miscellaneous Goods Business Department, a subsidiary of SRRUC, specializing in rubber scrap recycling. First, we have to check before accepting the scrap as raw material, and clear the account with the delivery parties, and then classify the

material into different categories according to different product items and properties. After sorting to remove impurities, we make stockpiles in the scrap yard and warehouses ready for processing, and supplying the local market and rubber industries as raw material. In case local collection of rubber scrap fails to meet the planned demand, we are obligated to procure more material from other provinces and municipalities to ensure industrial production.

Varieties of Rubber Scrap

There is a big varieties of rubber scrap with different types and inner structures, which require skilful sorting to assure high value utility and fruitful reclamation. Normally rubber scrap falls into two big categories, namely, rubber scrap and waste tyres. Rubber scrap is sub-divided into : (i) Rubber scrap from waste tyres; (ii) Scrap rubber shoes; and (iii) Miscellaneous rubber scrap.

Utilization of Rubber Scrap

Adhering to our professional practice, we usually let utilization go first and melting down at last. For this reason careful sorting and examination of the physical property of all reclaimable waste must run prior to other processing stages. The same is true to rubber scrap recycling. After sorting and proper examination different utilizations are briefly stated in the following:

Utilization of rubber scrap in its original form : The scrap rubber plates, tubes, strips and tyres procured from industrial, mining and transportation enterprises, after undergoing simple processing, can serve for handicraft, civil and agricultural purposes.

Utilization of waste tyres and inner tubes after retreading and repairing : Complete tyres and inner tubes rejected by trucks and pedicabs with slight cuts can be reused after retreading and repairing with durability upto 60% or 70% of the new ones with only 10% of raw rubber as additive.

Utilization of waste tyres after disintegrating : Worn-out tyres are first disintegrated and then used to fabricate other rubber products such as labour-protection rubber-soled boots resistant to high temperature, ordinary rubber-soled shoes, and gaskets for rails.

Utilization of worn-out tyres as substitutes : Worn-out steel cord tyres from heavy-duty trucks can be used to substitute shock-attenuation balls to protect the bank piers when ships are pulled close for anchorage.

Utilization of rubber scrap after melting down : This is the chief process for utilizing most part of the rubber scrap. It is generally estimated that 10 tons of rubber scrap can yield 8 tons of regenerated rubber, and that 4 tons of regenerated rubber stand for 1 ton of raw rubber in terms of utility.

Processing of Rubber Scrap

Processing of Waste Tyres

As mentioned above, waste tyres after being disintegrated can be used to make other rubber products. Equipment to serve this purpose is often varied and mostly fabricated by the processing unit itself. In our reclaiming workshop main processing equipment includes horizontal double-knife debeader, double-roll peeler, rubber cutter, tread remover, punching device, dryer, buffing wheels, etc. A waste tyre processing flow is briefly illustrated as follows:

Sorting -> debeading -> cutting out -> tread peeling -> blanking -> removing cord layers -> surface levelling -> blending -> patching -> jacketing with iron plates -> high temperatures flattening -> punching -> inspecting and trimming -> packing for storage.

Making Regenerated Rubber

Of all the rubber scrap we collect there is always a considerable portion with very low rubber content and of great varieties, which we cannot deal with in any other ways than melting down and reproducing different types of regenerated rubber, so as to explore the "secondary raw material" for better economic benefit while reducing social environmental pollution.

Since we started trial production of regenerated rubber in 1964 and developed it in commercial scale operation in 1966 with a yearly output of regenerated rubber 444 tons, the output volume had seen a rapid increase to 3,186 tons in 1985. And now a medium-scale rubber regeneration workshop has been set up, with a processing area of 1,500 m2, a finished product storage of 500 m2, and a scrap yard of 200 m2. It has 150 employees and a complete production line. The regenerated rubber production flow can be summarized as follows :

From 1966 to 1986 our department had produced regenerated rubber 33,945 tons with an after tax profit of 5.26 million Yuan.

Reclamation of Scrap Synthetic Rubber

An ever increase in the demand for rubber supply to prop up industrial development has accelerated the depletion of gum rubber in the world. To make up the shortage, measures have been taken by most countries to develop synthetic rubber. Upto 1987 the output of synthetic rubber had totalled 10,380 tons.

To keep up with this trend, we started intensive research on recycling of scrap synthetic rubber in 1985. Through repeated experiments we successfully developed the dynamic heater method and jaketing devulcanising autoclave,

which were awarded in March and November 1987 the State patent rights as "practical and brand new" and "creative" inventions (patent No.86101191 and 86200950). And the reclaimed synthetic rubber also won the third grade prize from Shanghai Municipality as "outstanding new product" in 1987.

The dynamic heater method we adopted, which features the functioning of heat-carrier to conduct circulation of heat, thus controlling the reaction process of physical and chemical depolymerization of the scrap rubber powder, and making it possible to selectively break the S-S and S-C cross-links in the vulcanized rubber while retaining the radical bond which constitutes to form reclaimed rubber. Meanwhile, the jacketing devulcanising autoclave with the advantage of high temperature, high pressure and accurate control system is able to depolymerize and regenerate synthetic rubber of particular structure and utility in a single variety. Rubber thus regenerated possesses a property upto 60% of the gum rubber, and can be used to fabricate products highly stable quality, meeting all technical indexes and even surpassing the professional standard. As high as 70% of such reclaimed rubber can be added to the gum rubber for making quality products. As the jacketing devulcanising autoclave is electric heating and giving rise to no serious pollution, the huge high-pressure steam boiler is no more required, thus saving a lot of space, minimizing the operation scale, and alleviating pollution in the course of reaction.

Dynamic heater method can not only reclaim gum rubber scrap but synthetic rubber as well, with devulcanisation time as short as 2-3 hours for the gum rubber scrap instead of 16-30 hours with traditional technologies and 42 hours for the synthetic rubber scrap.

The Scrap Iron and Steel Recycling Centre of Yang Pu District, SRRUC

Shanghai is an industrial city which consumes a vast amount of ferrous metal in production, in the course of which large quantities of scrap iron and steel are generated. Every year a lot of equipment and facilities are renovated and abandoned which add up the quantities of scrap ferrous metals. A small portion of these scraps is directly reused by the consumer factories themselves while the large part of it is collected and processed by specialised operating enterprises for further utilization.

The Scrap Iron and Steel Recycling Centre of Yang Pu District collects and reclaims ferrous from more than 500 factories and 1.06 million inhabitants within the proper district. Specific measures adopted include collecting at source, expanding purchasing stations for the convenience of the residents to sell such scraps and setting a national price in the interests of the scrap sellers and purchasers. The Centre also collects and processes scraps from factories and in the end return certain quantity of new steel sections back to the factories. In processing both manual work and small medium-sized machines are employed by the Centre to maximize the utility of ferrous scrap.

In 1989 it marketed 60,672 tons of processed iron and steel with a profit of 2.4 million Yuan, saving 10,000 tons of new steel as well as a great deal of energy.

Collection

The scrap iron and steel recycling procedure primarily involves collecting, processing and utilizing. With collecting as an initial step, processing an effective means and utilizing the ultimate end, the Centre adopts several measures to assure a thorough collection. To ensure an effective collection of widely scattered scrap, manpower and transportation must be guaranteed. For this purpose, the Centre has built up a professional group over 100 people with a dozen vehicles specially engaged in handling, sorting and baling, etc. The professional workers of the Centre usually make contacts with factories to emphasise the significance of scrap iron and steel communication. The collecting methods vary according to the size of the factory and the amount of scrap it originates. As to large-scale factories, the Centre sends people there to gather scraps at source, while regular services are offered to those medium and small ones. In the meantime, the ramification of 45 purchasing stations over the district provides convenience for the inhabitants to sell their post-consumer wastes. Every year before festivals, some 10 itinerant groups are sent out collecting wastes from street to street.

In 1989, 60,744 tons of scrap iron and steel were collected. The sources and classification of the scrap are shown below:

Scrap Iron and Steel Source

Mechanical industry	:	15.72%
Light industry	:	36.33%
Other industries	:	39.38%
Households	:	8.57%

Scrap Iron and Steel Classification

Scrap steel	:	42.41%
Scrap iron	:	5.22%
Usable formed steel	:	12.15%
Sheets and shavings	:	7.56%
Iron & steel filings	:	32.66%

Processing

Iron and steel scrap stems from a variety of sources and are of mixed specifications, various shapes and different weights. They require treatment before being reused. At present, the Centre is equipped with 13 sets of different kinds of processing machines, 9 sets of elevators, with annual processing capacity of around 40,000 tons of scraps. The processing means are described as follows:

1. Manual Sorting

Manual sorting is the initial process in routine operation. By sensory identification, skilled workers pick out usable steel sections, machine components, hardware tools and so on. At the same time pernicious impurities such as combustibles, explosives, toxic elements, non-ferrous metals and non-metallic residues, which are detrimental to the quality of furnace charge are being sorted out.

2. Oxyacetylene Cutting

Oxyacetylene cutting is mainly used to dismantle those over-sized frameworks, for instance, can bodies, old boilers and heavy castings, etc. just for furnace charge. It can also disintegrate framework in order to obtain usable parts.

The advantage of easy operation and portability make oxyacetylene cutting relatively popular in scrap processing. But it has the disadvantages of causing more burning loss, high cost and comparatively lower efficiency. Explosion may sometimes occur if it is not properly operated.

3. Mechanical Shearing

After manual sorting and cutting, over-lengthy steel sections, plates, sheets, shavings and some bulky scraps are sheared mechanically. Particularly, the scrap cut by a small shearer is preferable for small electrical furnace.

Mechanical shearing is universally adopted for its superiority in yielding little wastage, high efficiency, relatively lower cost and little energy consumption.

4. Baling and Briquetting

Through hydraulic or friction pressing, iron and steel filings, shavings and light sheets are compacted to small and highly densified bales and briquettes which can be used as qualified furnace feed.

Economic Benefits

Removing and utilizing scrap iron and steel can achieve not only social benefits but also economical gains. The costs include purchasing payment, packing, transportation, processing and some administration expenditures, then a reasonable selling price of the regenerated iron and steel is established to yield a certain operational profit. The purchasing price of the scrap from factories is specially set by a calculating method. In 1989, 60,672 tons of ferrous metal were recycled with a profit of 2.387 million Yuan.

Besides the above mentioned economical gains, the recovery and utilization of ferrous metals produces significant social benefits. First, it can cut down the State's investment in mining industry as well as conserve natural resources. Second, it saves energy and reduces production cost. For example, the filings and light scraps will not undergo iron-making before steel-making which consumes a lot of energy. Third, recycling waste iron and steel can preserve metals. Around 11,000 tons of sorted out and reshaped usable steel, if counted roughly, at the utility rate of 60 per cent, are comparable to 6,600 tons of new steel. Furthermore, the recovery and utilization of scrap iron and steel has other positive effects, such as protecting the environment and providing more employment.

Precious Metals Refinery of SRRUC

When we say precious metals, we really mean gold, silver, platinum, rhodium, palladium, ruthenium, iridium, osmium, etc. Platinum, rhodium, palladium, ruthenium, iridium and osmium belong to the platinum group metals (PGM for short). The mineral resources of precious metals are rare, unevenly distributed, and difficult to explore. Gold and PGM are concentrated in a few areas over the world. Although the output volume of precious metals from mining has increased over the past few years, the increase is still far from being able to catch up with the rapid uprising demand of relevant industries. To meet the industrial demand of PGM, most countries in the world resort to recycling waste materials containing PGM besides necessary imports and mining.

But in our country, except gold which can basically satisfy industrial needs, silver and PGM are too scarce to fill the gap between supply and demand for industries. As such, it is very important to speed up recycling PGM-bearing scrap for exploitation of the "secondary resources". This is also an urgent task for all countries to further developing precious metals scrap recycling and reutilization technologies.

Classification and Collection of Scrap Bearing Precious Metals

Scrap bearing precious metals usually exist in the form of liquid, solid and gas. Our enterprise only recover and utilise solid scrap.

Procurement of Scrap Bearing Precious Metals

Scrap bearing precious metals are scarce and widely distributed. In order to procure such scrap efficiently, a few points are stressed below for reference:

i. Approach industries where different precious metals are employed. Contact banks and material supply department to obtain information about the application and distribution of precious metals before starting collection and purchasing.

ii. Analyse the production situation of different local enterprises and gain full knowledge of the varieties of precious metals employed in certain production areas. List the names of the enterprises where relevant scrap may arise, and conduct surveys through constant contact before organising collection activities.

iii. Wide publicity is required for approaching the source of scrap bearing precious metals.

Storage of Scrap Bearing Metals

Careful depositing of waste materials containing precious metals must be emphasised due to their high value. First of all, big varieties of the said materials require spacious storage areas, and meticulous classification and numbering of them must go before depositing. Those which can be treated with the same technology are to be put together. Materials with low content should be distinguished from the same with high content. It is necessary to avoid possible mixing during processing in order to streamline the entire recovery procedures.

Since these materials as secondary resources are mostly generated in the course of industrial production, their compositions are complicated and contaminated, and some of them will give out stink or spread harmful and even toxic substance. For the later, proper sealing is a must when depositing. Direct contact should be avoided and immediate treatment is required.

Materials of strong acidity are seriously corrosive. To hold them, anti-corrosive containers are to be used at storage. For those inflammable and easily explosive such as ruthenium-bearing acetone solution, fire-proof devices must always be kept handy. And the waste silver-zinc batteries are easy to spark and burn when impacted, so they have to be isolated from other scrap.

Reclamation of Precious Metals from Scrap in China and Abroad

Recovery of precious metals from scrap to make up the shortage of the virgin precious metals resources have been highly stressed in many countries, especially industrialised countries, because of low cost and the advantage of protecting environment. It is generally estimated that the worldwide recovery amount of gold and silver from scrap accounts for 30% and 70% of the total consumption. Large-scale, modernized and specialised recycling enterprises have been set up to extract precious metals from scrap. In recent years, the industry of recycling scrap bearing precious metals has also seen a fast growth in our country, as many professional works have sprouted up among which, however, the Shanghai Precious Metals Refinery is the biggest. Its processing and refining technologies have held a safe lead in the trade since it was incorporated with the Kunming Precious Metals Institute several years ago. In 1986, SPMR recovered 4,210 Ozs, silver 27,460 kgs, and PGM 54 kgs.

Technologies for Reclamation of Precious Metals from Scrap

Reclamation of Gold

Generally, basic displacement, acid dissolution and ion-exchange processes are employed according to different kinds of gold-bearing scrap.

Basic displacement for degolding is applied to gold-plated elements to extract

gold. First, the gold-plated scrap is depleted by dipping it into a depleting solution containing 10 - 20% potassium cyanide with some subsidiary agents at about 30 degree centigrade and under normal pressure. Second, the acidity of the saturated depleting solution is regulated to about PH2, and zinc plate is put into it for displacement. After filtering and rinsing raw gold is obtained, and pure gold with a content over 99.95% is further produced by refining process, meanwhile, the degolded nickel-cobalt bearing scrap can be used as raw materials for making nickel-cobalt chemicals.

Acid dissolving process is adopted to produce gold from scrap gold-base alloys (or gold-bearing refuse). The scrap gold-base alloys are completely dissolved in aqua regia three times the weight of the scrap gold-base alloys. After evaporation, concentration, dilution, statical placement and filtration, gold dust can be obtained by displacement and reduction with sodium sulphite, and cast into bullion after baking out.

Displacement and ion-exchange are employed to process gold-bearing waste solution. After the waste solution is acidified with hydrochloric acid, diluted with water, and displaced by zinc gold can be produced by acid dissolving process as applied to gold-base alloys.

Reclamation of Silver

Since silver-bearing scrap generally comprises residues, waste solutions, silver-base alloys, and silver-plated elements, different processing methods are adopted to meet their different characteristics.

For silver-bearing residues, dry enrichment and electrolysis are employed for extracting silver; for scrap silver-base alloys nitric acid dissolving process is used; for scrap silver-plated elements chemical depleting is carried out by using concentrated sulfuric acid combined with diluted nitric acid; for waste fixing solution electrolysis, iron-powder displacement and acid direct precipitation are applied.

After metallic silver is obtained, quality silver can be yielded through a series of conventional treatment such as rinsing, baking out and smelting with follow-up bullion casting. Meanwhile, the clooer-bearing solution obtained after the dissolution of the scrap silver-bearing alloy as well as the copper waste stock after depleting of silver-placed elements can serve as raw material for yielding copper salt products.

Reclamation of PGM from PGM-Bearing Scrap

Technology for producing sponge platinum : Raw material : Scrap Pt-Ir alloys. Process : Hydraulic precipitation and ammonium chloride precipitation.

Technology for extracting palladium powder and palladium chloride : Palladium is mainly extracted from palladium charcoal, palladium asbestos and scrap of palladium-silver alloy.

The improved technology for reclamation of precious metals from scrap : New technologies for regeneration of precious metals from scrap mainly comprise solvent extraction and ion-exchange. C12/HCE through dappling has been adopted to replace partly dipping aqua regia technology at some advanced refineries abroad.

Resource Recovery and Comprehensive Utilization in the Regeneration of Precious Metals

In the course of reclaiming precious metals from scrap, there are some other non-ferrous metals can be recovered.

At the same time when precious metals are regenerated, some other valuable non-ferrous can be obtained, such as copper, cickel and cobalt, which are usually made into important industrial products after purification.

Resource recovery and utilization is an important means for saving energy and increasing economic benefits. For instance, non-ferrous metals acquired from recycling scrap bearing precious metals can be used as chemical products which yield profits directly for the enterprise.

Comprehensive utilization of secondary resources contribute greatly to environmental protection and prevention of harmful contaminants from wide disseminating. Of course, it is inevitable to generate secondary pollution during recycling process, such as residue, effluences and waste gas which containing certain quality of valuable metals, must not be directly discharged without proper pre-treatment.

Prevention of Secondary Pollution Generated from Reclamation of Precious Metals from Scrap

Generation of the Secondary Pollution

The secondary pollution actually arising from the treatment of primary contaminated scrap involves solid, liquid and gaseous waste. Pollution in solid state comprises used fuel containing radio active elements produced in the course of processing, residues and lead-bearing slime, etc.; waste liquid includes cyanogen-bearing solution, copper-bearing lead-bearing and chromate-bearing waste water; gaseous waste mainly denotes nitricoxide, for example, nitrogen monoxide, nitrogen dioxide and sulfide, sulphur dioxide, etc. In our factory, the main environmental problem to deal with is the poisonous gas and harmful waste water.

Treatment of the Secondary Pollution

Condensation, burning, catalytic transforming, absorption and adsorption are the basic process we adopt to treat poisonous gas. Condensation is mainly applied to pretesting highly concentrated and easily condensed harmful gas as an effective pre-treatment followed by absorption or catalytic transformation. Direct burning, thermodynamic burning and catalytic burning are fit for treating the harmful gas with inflammable composites.

Catalytic transformation is such a process that transfers harmful gas into harmless substance which can be easily recovered and utilised through chemical reaction by means of catalysts. For example, nitric oxide is catalyticly reduced to nitrogen gas and water with ammonia. Absorption is an important measure to separate harmful substance from waste gas, and remove the substance by means of solution or solvents. According to different characteristics of harmful substances different absorbents and solutions are selected. Water and oil are ordinary absorbents. Various kindly of acid, alkali and salt solutions also can serve as absorbing solvent fluids.

Absorption is an effective measure to remove poisonous elements from waste gas which is purified by the surface attractive force of multipurpose solid absorbent. This method is chiefly applied to low concentrated harmful gas.

Waste solutions produced in the course of recycling can be treated by physical, chemical or physicochemical process. Physical process includes precipitation and floating, filtering and centrifugal separation; chemical process includes neutralization, chemical precipitation, mixed condensation, and oxidation reduction; the physicochemical process comprises absorption, extraction, steam evaporation, air-blow-doffing, electrolysis, ion-exchange, electrodialysis and inverse penetration.

In our factory, waste solution are generally treated by neutralization, chemical precipitation, and oxidation reduction. For instance, copper bearing waste water is usually treated by chemical precipitation to form molybdenum hydroxide, and the remnant solution is finally discharged. As for cyanogen-bearing waste solution, chlorite alkali neutralizing method is employed.

Country Background Papers

INDIA*

India, a union of 32 States, is a Sovereign Socialist Secular Democratic Republic with a parliamentary system of government. It is the seventh largest country in the world and the 10th industrialised nation. Its total area is 3,287,263 sq.km - 3,214 km from north to south and 2,933 from east to west. It has common borders with Afghanistan, Pakistan, China, Bhutan, Nepal, Burma, Bangladesh and Sri Lanka. In the north is the Great Himalayas and it tapers off into the Indian Ocean between the Bay of Bengal and the Arabian Sea. Rajasthan is one of the states of the Indian Union.

The State of Rajasthan

The total land area of Rajasthan is about 342,274 sq. km, out of which about 196,100 sq. km is arid and the rest is semi-arid. Forests cover only about 37,638 sq. km., i.e. 11% of the total area. The Aravalli hills running over a length of 680 kms divide the State into two parts, north-western and south-eastern. The productivity of land in Rajasthan is low.

A major portion of western Rajasthan has desert soils and sandy plain; sand dunes occupy a greater part of the desert. Occurrence of saline-sodic soils in Rajasthan is a common feature. The soils of the desert plains are loamy sand to loam in texture, and lime concentration ambulation generally occurs within 150 cm. of soil profile. Eastern Rajasthan has alluvial soils, which support good forests and agricultural crops. Certain patches in south-eastern and eastern Rajasthan have red sandy soils.

The average annual rainfall in the State is 525-675 mm in the eastern region and 275 mm in the western region. About 90% of the annual rainfall occurs during the south-west monsoon from June to September. The annual precipitation in different tracts of Rajasthan varies from 13 mm to 1,766 mm.

The climate of the desert region also shows extremes with temperatures ranging from below freezing point in winter to as high as 52°C in summer. The average humidity varies from 85% to 50%. Frosts are generally severe during winter, particularly in the sandy areas.

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* *Paper presented by Mr. N.S. Mahiyaria, Regional Manager, Rajasthan Tribal Areas Development Cooperative Federation Limited.*

Energy Demand in the State

The growing demand for fuelwood as a result of rapid population growth has made it increasingly difficult for many people in this region to meet their basic energy needs. Most of the users of fuelwood lack access to alternative fuels. But by the year 2000, a situation of acute scarcity and fuelwood deficits could affect 2,400 million people in the world, over 1,400 million of them in the Asia and Pacific region, unless adequate corrective action is undertaken.

Deforestation, particularly when accompanied by fuelwood shortages, affects many aspects of rural life. Deforestation of watersheds and areas with fragile soils can lead to soil erosion and loss of soil fertility, increased flood damage and downstream sedimentation of dams. Some 3,100 million hectares of land in the developing countries is estimated to be threatened with soil erosion as a result of rising population and livestock pressure, leading to land clearing for agriculture, overgrazing of upland range and forest areas and overcutting for fuelwood.

Economic development of a country is dependent on adequate supply of energy at a reasonable cost, in time and at the right place. Almost 70% of India's population lives in rural areas and the domestic energy needs are met mostly as biomass fuel. Nearly 85% energy consumed by the rural population is obtained from indigenous biomass resources, firewood, shrubs, twigs, animal waste and crop residues. A vast majority of rural population uses firewood for cooking. Families of agricultural labourers waste about 20% of their mandays in collecting firewood, twigs, etc. in the countryside.

Self-reliance in energy supply is a vital factor in the development of any nation. It has been estimated that if the economic growth rates were to be in the range 5.5 - 6 per cent, the energy requirements would register a 4-fold increase within the next 20 years. Wood can be a self-reliant fuel that requires little foreign exchange and it does not demand a sophisticated distribution network; indeed, it is the most accessible form of energy for most rural populations in developing countries.

For the rural poor, particularly in remote villages, sources of fuel other than biomass are hard to come by. They are mainly dependent on fuelwood felled from the forests as the source of energy. Indiscriminate felling of trees and putting marginal lands under cultivation have led to degradation of the environment, shortage of wood for use as fuel and for other uses, decertification of fertile lands and ultimately a grave threat to human survival. Another factor responsible for the decline in the availability of forest produce is the deteriorating fertility of soil due to lack of input-output balance ever since man started tilling the land.

In the rural sector, 84% lighting is done through the use of kerosene, while 94.5% cooking is done using biomass-based fuel. The corresponding figures for

lighting in urban areas are 53% through electricity and 45.2% through kerosene; and for cooking, 58.1% through biomass-based energy and 26.5% from kerosene. According to the report of the Working Group of Energy Policy, Planning Commission, Government of India, New Delhi (1979), in rural India, wood is the principal sources of fuel (68.5%) followed by oil products (16.9%), animal dung (8.3%), coal 2.3%) and others 3.4%). The present per capita fuelwood consumption is 9.6 tons. With a population of 684 million (1981) census, the present requirement of fuelwood would be of the order of 410 million tons per annum. According to the National Commission on Agriculture, fuelwood production in the country in 1990 is expected to fall short of the requirement by 100 million cubic meters.

A large gap between demand and supply of fuelwood is resulting in reduction of the forest cover, adversely affecting the environment as well as quality of life of the rural population. to bridge the gap between demand and supply of fuelwood, the quickest solution is development of fuelwood plantations, which, when properly managed are renewable. Fuelwood plantation development will, therefore, have to be taken up on a mass scale to stop cutting of forest trees.

The preceding situational analysis clearly depicts the impending energy crises in India particularly in Rajasthan. The plight of tribals is even worse. The tribal's relationship with the forests was that of mother and child.

Eco-System and Waste Recycling

The eco-system has been completely destroyed due to deforestation, decertification is following. All these things are leading to serve stresses and strains on the lives of tribals. Along with the fast disappearing forest in its fold the vital resources of soil water, vegetation system are also a variety of valuable forest steeples which the tribals are accustomed to have in lean season are also disappearing. Landlessness is leading the tribals to extreme poverty. In the absence of earning sources their lives are becoming difficult.

To face this situation effectively, two-fold action could be and is being done by recycling the energy waste effectively by educating the people on energy waste recycling.

The present paper is an attempt of reviewing the work already done on energy waste recycling in India particularly in Rajasthan. These efforts could pave way for the betterment of tribals lives.

Weeds have always existed and are often considered problematic. Identification and utilization of their potentials as prospective sources of biomass is a rather recent phenomenon. With the growing menace of weeds in alarming proportions, especially in humid tropics, their eradication has proved impossible. Yet, in a way, these untested members of the plant kingdom constitute a free crop that

requires no agro-technological package or inputs. They grow luxuriantly on all kinds of soils, including disturbed or wastelands and often encroach new areas, competing with conventional crops and vegetations. They owe their better adaptability under various agroclimatic regions to their wider genetic base. Exploiting their prolific growth potentials, working out the cropping patterns and exploring the feasibility of using these non-conventional bio-masses for fulfilling energy and other needs would be desirable.

Effective exploitation of the biomass potentials of jhubby weeds is essential and each opportunity to rescue the waste materials needs to be examined thoroughly. Loss of material or energy must be avoided and a wide variety of biological chemical and physical processes can be made tools for minimizing losses during biomass utilization. The paper further suggests an integrated approach to the use of different components of biomass substrater for meeting various demands would reduce the formation of underside waste products, while the woody biomass can serve the fuel requirements.

Land for Energy Plantations

The basic idea behind putting firewood plantations is that the requirement of firewood as far as possible should not be met from the natural forest cover, as it would drastically reduce the existing forest area, which is already very low in India. The effective plant cover at present is only about 12%. There is thus an additional 10% i.e. about 32 million hectares of land which could be brought under forest and would be exclusively for fuelwood plantation. Based on the statistics provided by the National Commission on Agriculture, 2.7 million hectares of land are available on the boundaries of farms. The area under shifting cultivation is around 3 million hectares in the north-eastern region, Orissa and Andhra Pradesh. The total land available along roadsides, canal banks and railway lines has been estimated to be about 0.6 million hectares. Over 13% of the total area (43.6 million hectares) has been classified as wasteland, which is neither under forestry nor under agriculture. Assuming 50% of this wasteland to be of no value, about 20 million hectares could be brought under fuelwood plantations. Thus, a total of 25 millon hectares land could be brought under fuelwood plantations, which would raise the forest area of the country to about 30% of the total.

There is wide variation in the nature and properties of wastelands and cultivation planting practices differ for each of them. Several standard techniques to overcome the productivity problems related to these wastelands have been developed at various institutes. For the application of these techniques, it is essential to identify the characteristics of wastelands, their problems and potential to support different tree crops.

The need for research work on recycling of organic wastes for replenishment of plant nutrients and maintenance of soil health has been realized since long, but

it is only recently that serious attention has been paid to the use of organic wastes of agricultural production. Low nutrient status and poor rate of mineralization are the major limitations to maximization of efficient use of organic wastes. Among the possible alternatives to improvement of the nutrient status of organic wastes, vermicomposting offers a promising scope to increase agricultural bioproductivity.

Pot experiments were carried out to study the effect of various organic wastes, with and without earthworms, on dry matter yield and uptake of nutrients by maize using soil collected from the Micro-Model Complex, IIT, Delhi. The commonly available wastes used in the experiment were: garbage, turning matter, screening matter, compost, poultry waste, sawdust, biogas slurry, cattle during and sewage sludge. Earth-worms were collected from pasture soils of IIT, Delhi, cultured in earthen pots and got identified from the Zoological Survey of India, Calcutta. The earthworms used belonged to the species Metaphire posthuma (Vaillaint). Maize (variety Ganga Safed-2) was grown as the test crop. Ten treatment combinations were replicated three times each in four experiments. Pots were irrigated regularly throughout the experimental period. The total dry matter yield and uptake of nutrients from all the pots were determined at the harvest of crop.

Why Bioenergy Education?

The concept of bioenergy education, though of recent origin, has assumed great significance due to the crucial role "energy" plays in the domestic, agricultural, industrial, transport and public utility sectors. The need to search for alternative, renewable, non-polluting sources of energy assumed top priority when the oil producing countries resorted to price hikes. Among all the options available, bioenergy offers the most promising scope under Indian conditions, because this form of energy encourages self-reliance through efficient utilization of indigenous resources and employment of technologies suiting varying conditions of target communities.

The following two considerations show bioenergy education not only to be suitable for our environmental, infrastructural and socio-economic peculiarities, but also as a specialised field which has to be institutionalized, researched and developed.

There are a few aspects of renewable sources of energy which make them stand out with special consideration for their development. Firstly, these sources are by and large best utilizable in a decentralized manner and the capacity per unit is generally small. Hence, they can make an adequate national impact when used on a wide scale by the population and, in a country like India, where millions of individual users can benefit from them. The individual users in many cases have to pay the initial cost of the devices themselves. Reduction in initial costs, without sacrificing quality, should thus be an important objective. This can

come about only with increased and continuing attention through appropriate education and training.

Another feature characterizing renewable sources is their close interaction with the lives and economies of masses, particularly in the rural areas. This is particularly relevant to the area of fuelwood and biomass as also the areas of agriculture and rural development. In the first case, renewable sources have to meet the needs of the poorest sections of the people in such a manner that wood and biomass resources are in fact, renewable in nature and the alarming trend for deforestation is not only halted but reversed. In respect of agriculture it has to be recognised that the present estimates for cereal production project a requirement of 300 million tons of cereals by the turn of the century to feed the increasing population and provide adequate feed for the livestock to meet the milk production requirements. All this will require a much higher productivity from the cultivable land, which will require increasing fertiliser and water inputs, both of which mean increasing energy inputs. Locally produced energy and fertilizers for the various critical needs from renewable sources of energy would greatly help in meeting this goal and may in fact be crucial or a prerequisite. It follows that an important element in public policy has to be a close interaction among the environment, forestry, rural development and the agriculture sector. It thus requires a special attention in an organised way and not mere awareness.

Bioenergy can be given the distinction of one such non-conventional energy source that can be the key to the desired social change apart from, of course, being a renewable and additional energy source. It can bridge the gap between man and nature; can weave the withering threads of the bonds between science and society; it is a solution to most of the every-day problems. Bioenergy education will lead to a social revolution, as it is life centered activity.

Several bioenergy technologies suited to developing countries have been perfected. The second edition of BOSTID brought out recently by the National Research Council, Washington DC, covers these technologies. Among the renewable energy technologies biogas, revegetation, cooking devices, such as solar cooker for saving fuel, and smokeless stoves for providing clean environment, are worth considering.

Thus, in the present paper an attempt was made to present the different researches bring conducted on energy waste recycling. An effort was made to highlight the bioenergy education part which is of equal importance.

PHILIPPINES

The Replication of Shanghai Experience in Davao City*

Background

Davao city, being the biggest city in the world in area, since 1953, is still underdeveloped as compared to the city of Manila. Known to be the "Land of Promise" it offers a lot of opportunities to tourists, investors, manufacturers, miners, loggers and most of all to farmers. It has several comparative advantages in terms of natural resources, climate, location, people, peace and order, among others.

It is situated in Region XI (southern Mindanao) Philippines. This Region is ideal for agricultural and industrial development because its climate is characterized by having a rainfall which is more or less evenly distributed throughout the year. It is essentially outside the "typhoon belt". This type of climate, therefore, has definite advantages especially in the cultivation of tree crops, fruits, aquaculture and fishing.

With the government's economic plans and the increase in population, commercial spaces for educational centres, offices, show windows, shops and stores will have a greater demand in the near future.

The Cooperative Union of the Davao City Inc. (CUDC) has more or less 200 cooperatives and Samahang Nayongs and a Cooperative Rural Bank of Davao City Inc., the largest and most outstanding Cooperative Rural Bank (CRB) out of the 29 CRBs throughout the Philippines.

Davao city is 2,443.61 square kilometers in area. It has 171 barangays, 7 districts and 3 congressional districts. It has a land area of 961.83 sq. km.; forest reserve of 212.21 sq.km.; timber and forest land of 1,153.90 sq. km.; non-disposable 114.83 sq. km.; fishpond of 0.83 in sq.km.

Davao city's population

1989	819,525	with a density of 335
1988	795,566	with a density of 326
1987	771,778	with a density of 316
1980	614,125	with a density of 251

* *Paper presented by Glicerio E. Lorejo, President, Cooperative Union of the Philippines.*

Garbage Disposal System

With the background of Davao city, the tremendous volume of wastes coming from the industrial, commercial and residential compounded by its growing population is huge. Garbage disposal and collection system is still a big problem.

Scavengers are still plying in the streets for their usual livelihood and even at the dumpsites. Scavengers' health is exposed to the hazards due to the pollution of the wastes and dirty smokes of the dumpsite along a diversion highway just less than 3 kms. from the residence of the undersigned.

The participant has in mind the factors in putting up a Waste Resource Recycling Plant depending on its uses:

- Just to clean up the wastes.
- To use the by-products of bio-gas to run electric plant might be very costly.
- Governments' perception and support.
- Form scavengers into a cooperative for a business endeavour to have economy of scales in :
  a) Conversion of wastes into organic fertilizers,
  b) Systematic garbage collection,
  c) Recycling process whenever possible.
- Davao city has 200 cooperatives which can assist and be tapped.

Conclusion

On the second thought, this participant would like first to see. view the installations, technical processing of waste resources recycling in China; assess potential and mutual strategy for the possible transfer of technology of waste resource recycling within the Philippine settings and finally will formulate follow-up action plans for participants' organisation.

This participant is wishing and hoping that the Shanghai experiences can be replicable in Davao city, southern Philippines and other cities after pilot-testing such an endeavour beneficial to the Philippines Cooperative Movement.

Garbage and Waste Disposal System in Iligan City*

Background

Iligan city, the industrial city of southern Philippines, is located along the coastal part of Lanao del Norte, a province of Central Mindanao, otherwise known as Region XII. It is also the commercial centre of the two provinces of Lanao del Norte and Lanao del Sur and part of Misamis Oriental, a province of northern Mindanao or Region X. The city has a population of around 300,000, some of whom are employed with the big industries.

Garbage and Waste Disposal System of the City

Being an industrial and commercial centre, garbage and waste disposal becomes an imminent problem much more that the agency concerned lacks the necessary and proper equipments and facilities.

In July 1987 the city government was offered by a certain company for the establishment of a waste processing system that will solve the problem of waste disposal in addition to the following advantages:

- Financial assistance - The company shall extend US$ 2 million per month financial assistance to the Philippines Government;
- Employment opportunities - around 2,000 to 3,000 direct employees are needed to operate the plant. Indirect employment can also be generated.
- Electricity generation - The plant can generate electricity that can be supplied to existing electric power franchise holder;
- Foreign exchange - The project is a dollar earning industry that will help increase the dollar reserves of the country;
- Technology transfer - The project will introduce a new technology in waste disposal that can be adopted in other areas of the country using local garbage and imported waste materials (solid and liquid); and
- Increase in the income of the city in terms of taxes.

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* *Paper presented by Mr. Renato B. Yanez, Chairman, Region XII Cooperative Union Inc. Philippines.*

Brief Description of the Proposed Plant

Plant capacity	:	2,000 tons per day
Number of incinerator units	:	5
Ave. calorie value of refuse	:	6,000 kj/kg
Steam generated per boiler	:	42 tons/hour
Live steam pressure	:	35 bar
Live steam temperature	:	375 degrees centigrade
Power generation capacity	:	30 MW
Generator voltage	:	6.6 kv

Weighed refuse are discharged to the refuse bunker then fed into the pre-heated furnaces with temperatures at 1,000 degrees centigrade. Diesel burners are used in heating the furnaces. Since refuse combustion is an exothermic process, diesel burners are no longer needed when combustion has started. Each incinerator furnace has four incineration grates which spread and transfer the burning refuse slowly through the furnace. Air drawn from the refuse bunker is pre-heated by superheated steam and introduced into the furnace through the underside of the incineration grates.

In the process of combustion, flue gas is produced which is used to generate steam. Superheated steam from the boiler is expanded through two condensing turbines, each of which drives a generator to produce electricity. Part of the electricity generated is used to operate the plant while the surplus can be sold to Public Utility Franchisers.

The incinerator and the turbogenerator units together with their auxiliary equipment are operated and monitored via circuits from the Central Control Room. The essential equipment and closed circuit TV monitors the combustion status of each incinerator unit. Combustion conditions in the furnace are controlled automatically by a digital control system which regulates the air distribution in the furnace and adjusts the feeding rate of refuse according to its heating value.

The ash residue from the furnace is transported to the ash pit via vibrating conveyors that pass through an overhead electromagnetic separators where ferrous scrap metals are recovered.

The flue gas leaving the boiler flows through an electrostatics precipitator which is designed to remove up to 99.5% of the dust content in the flue gas. The clean flue gas is emitted through a 150 meter tall chimney.

Despite the aforementioned advantages of the proposed project, Filipino scientists and other technical and knowledgeable people are strongly opposed to its implementation.

The oppositors explained that it is terribly dangerous to establish such kind of a waste disposal plant in Iligan city or in any part of the Philippines, as proposed, in view of the unidentified waste materials from highly industrialised countries which might include toxic or hazardous wastes in solid or liquid forms. It is an elementary principle in science that matter cannot be created nor destroyed. Therefore, incineration cannot destroy hazardous wastes. These wastes can only be transformed into solid of greatly reduced volume which we call ash or slag. Simultaneous with such reduction of solid/liquid volume, however, there is production of a very large volume of gaseous matter with great variety of constituents.

Studies have shown that due to the extremely high temperature in the combustion process Polynuclear Aromatic Hydrocarbons (PAH) and other organic compounds are produced. Some of these PAH are released to the atmosphere but most are found in the solid residues. Likewise, produced as part of the exhaust gases are oxides and sulfur and nitrogen and organometallic compounds. When it rains, the PAH emitted to the atmosphere will fall with the rainwater, while the oxides of nitric are sulfuric will be converted into nitric and sulfuric acids which will fall to the earth as acid rain.

PAH are carcinogenic-compounds that cause cancer and at the same time mutagenic-compounds which are capable of determining human genetic structure leading to the birth of retarded or deformed children.

In view of these hazardous effects to ecology, the proposed project was not pushed through, thus, the waste disposal in the area remains a problem.

Conclusion

Hopefully, after this workshop, this participant would be able to bring home a message from Shanghai in particular and China in general on non-hazardous and economically feasible system of waste recycling with the utilization of the cooperatives capabilities within the region. Furthermore, the implementation of the participant's experimental learning carries a heartfelt gratitude to the sponsor's altruision to our country.

SRI LANKA

Cooperative Movement of Sri Lanka*

Present Status of Cooperative Movement

There are over 50 different types of cooperative societies functioning in the country. Besides the multipurpose societies others are single purpose societies engaged in specific activities. Except for the Thrift and Credit Cooperative Societies which are constituted with three tiers, other types of societies for business purposes are vertically integrated into national level organisations.

The National Cooperative Council of Sri Lanka which is constituted with the Cooperative District Unions is the apex organisation of the Cooperative Movement in the country.

Multipurpose Societies

The multipurpose cooperative societies are the most widespread type of societies which can be considered as the backbone of the cooperative movement in the country. The 285 MPCS with a network of nearly 7,500 branches cover the entire country. The membership of the MPCS stood at 2.3 million at the end of 1989.

The main activities of the MPCS are the distribution of consumer goods, supply of agricultural produce, provision of agricultural credit and rural banking facilities while wholesale and retail trade in consumer goods remain as principal business activities. However, in some of the main paddy producing areas, agricultural activities have become more important.

Cooperative Rural Banking Activities

The MPCS have been able to develop a banking system over the past years as a successful venture through a network of rural bank branches.

The rural banking scheme was started in 1964 with the initiative of the People's Bank with a view to develop an agricultural credit system and to introduce basic banking facilities to the rural sector. Under the rural bank system financial assistance was available to members for purposes of production, housing, debt redemption, trade, consumption, electrification and other purposes including emergencies.

**Paper presented by Mr. G.D. Thilaka Kusum, President, Panadura MPCS Limited. Sri Lanka.*

Credit Cooperative Societies

The credit cooperative movement has a scheme of opening cooperative banks attached to district unions. The primary societies deposit their surplus funds with the district bank and the district bank utilizes these funds for lending to needy societies. The Federation of Thrift and Credit Cooperative Societies operates an inter-lending scheme to district banks. The excess funds of the district banks can be deposited with the Federation of Thrift and Credit Societies and it uses these funds to lend to the needy district unions.

Milk Producers' Cooperative Societies

Milk producers cooperatives were in existence in the country for the last 50 years and today these societies are widely spreaded throughout the country. These societies serve the village level small milk producers mainly in marketing their milk and provide various services for dairy development in the rural areas. There are 226 milk producers' societies with a member strength of 45,360 producers.

Milk producers cooperatives are primarily village level organisations which assist the small producers to market their milk at a highest possible price. The price of milk is determined by the government from time to time. The milk cooperative societies in the country collect 36 million litres of milk per year.

Coconut Producers' Cooperative Societies

The coconut producers cooperative societies are the main agricultural processing societies in the country. There are 11 coconut producers cooperative societies of which six are engaged in processing and the rest are village level small societies. These small societies collect nuts from the members and sell to processing societies.

The main products of the coconut producers cooperatives are desiccated coconut, copra, coconut oil and coir yarns. Poonac and charcoal are the by-products.

The coconut societies engaged in processing own eight desiccated mills and 8 oil mills. The annual production capacity of the desiccated coconut mills is about 9,000 mts. However, the coconut cooperatives produce 15% of the total desiccated coconut produced in the country. There is a possibility of increasing the production of the societies by 20% with the existing machines.

Rubber Producers' Cooperative Societies

Rubber has been the second important export crop in Sri Lanka since colonial days. It contributes 18% to the export earnings and accommodate 8% of the agricultural labour force in the country. The total land area under the rubber

plantation is about 226,600 hectares of which 65% belongs to individual cultivators, while the balance is owned by the state. One important phenomenon in the rubber plantation is that holding size is small and average size of a holding less than one hectare. Holdings less than one hectare accounts for 88% of the total holdings. Thus the rubber industry of Sri Lanka is dominated by small holder producers. Today there are 56 rubber producers cooperative societies with a membership of 2,000 small-holders.

The establishment of the rubber producers cooperative societies has helped the small-holder to increase their income. Before this process the sheet rubber produced by individual small-holders were of inferior quality and fetched low prices.

Sri Lanka Consumer Coop Federation (COOPFED)

The cooperative consumer activities are handled by 289 multipurpose cooperatives with a network of 9,000 retail branches spreaded through out the country. The multipurpose cooperative sector is the strongest sector in the movement, with a membership of 2.4 million and their annual business turnover in around Rs.14,000 millions.

Sri Lanka Consumer Cooperative Federation was established during this year. The objectives of the Federation are :

- to promote the growth of consumer cooperative movement in Sri Lanka;
- to provide necessary skills and advice to member societies in their effort to expand develop and strengthen the consumer cooperative societies; and
- to function as the apex organisation and to represent as the national and international spokesman of the consumer movement in Sri Lanka.

THAILAND

Draft Handbook for Biogas Programme*

Introduction

Biogas plants have a long working life, provided they are properly maintained and checked. It is hoped that this project will enable poorer farmers to obtain maximum gas production and plant-life from their equipment.

Addition of slurry to the system and routine work

1. Add fresh slurry only, and not dry material.
2. For the initial addition to a new plant use 50% fresh cattle slurry and 50% digested slurry from another plant. Do not use pig slurry at first.

i. The ratio of slurry to water should be as follows :

	Cow slurry	Buffalo slurry	Pig slurry
Slurry	1	1	1
Water ratio	1	1	1-2

Slurry must not be added to the biogas plant in greater volumes.

ii. When mixing the slurry and water together contamination with rice husks, stones, soil, said and undigested materials must be avoided.

iii. Bamboo poles can be used to stir the slurry, each time as amount is added.

iv. The cover must always be closed after stirring to avoid contamination, for example by flies laying eggs.

v. The cover should also be closed immediately after every addition of slurry.

Two-weekly Operations

i. Every two weeks the substrate must be stirred with a bamboo pole, as after fermentation the slurry increases n size due to the gas given off, and the digested slurry must be removed as fertiliser.

ii. Clean water should be added.

iii. The value should be used to discharge excess water.

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* *As discussed by Amnat Rojanapaibul, Board Member, Cooperative League of Thailand & The Federation of Savings & Credit Coops of Thailand.*

iv. An instrument (e.g. pole) should be used to spread out the slurry evenly inside the plant.

Monthly Operations

i. Open the valve to discharge excess water and carry out a general cleaning of the valve and pipes.

ii. Check for leaks in the gas pipes.

iii. Clean all the gas appliances (e.g. lamp, stoves).

iv. Check the gas pressure to see whether the slurry should be renewed.

An important factor for the integration of biogas technology into the production systems of small or medium size farms is the use of the fermentation residues, the digested slurry. Biogas projects are faced with an increasing demand for more detailed information and advice about the use of digested slurry as fertiliser.

For small farms in developing countries farmyard manure or compost is the most common organic fertiliser and is therefore the alternative to fertilizing with digested slurry. Digested slurry also substitutes for chemical fertilizer which often has to be imported. Most field trials compare the differing effects between using the effluent with chemical fertiliser, farmyard manure and compost.

Digested slurry is regarded as an effective fertiliser which gives better yields in comparison to fresh manure because of the better availability of nutrients. Some short term experiments and observations seem to prove this statement.

The results from different field trials show that the application of digested slurry is a good or even better alternative to traditional farmyard manures or compost manure. To make the best use of the slurry, any nutrient losses during the collection of dung and handling of digested slurry after fermentation have to be minimised.

Workshop Programme

24 March, Sunday	Arrival of participants
25 March, Monday	
0930-1000	*Opening ceremony* Opening remarks by Mr. Yang Deshou, Secretary-General, ACFSMC; and Mr. Ye Zheng Sheng, Director, SFSMC.
1000-1030	Briefing about the objectives and programme of the workshop by Mr. Guo Yong Kang, Agricultural Coop Development Advisor, ICA ROAP.
1030-1200	Report on Resource Recovery and Utilization in Shanghai by Mr. Wu Hong Cheng, Manager, SRRUC.
1200-1330	Lunch
1330-1500	Video presentation on the general situation of SFSMC.
1500-1700	Discussion
26 March, Tuesday	
0830-1200	Visit to native products shop at a primary cooperative of SFSMC.
1200-1300	Lunch
1300-1700	Sightseeing at Yu Yuan Garden.
27 March, Wednesday	
0900-1200	Visit to Pu Dong Branch of SRRUC.
1200-1300	Lunch
1330-1700	Discussion : Topic - Organisational System of Waste Recycling, Waste Collection and Processing.
28th March, Thursday	
0900-1200	Visit to Xing Guang Plastics Factory of SRRUC.
1200-1400	Lunch

1400-1700	Visit to Nanshi Paper Stock Supplying Station.
29 March, Friday	
0900-1200	Visit to Hai Guang Ferrous Metal Smeltery of SRRUC.
1200-1330	Lunch
1330-1700	Discussion : Topic - Processing and Utilization of Scrap Iron and Steel.
30 March, Saturday	
0900-1200	Visit to Shanghai County Supply and Marketing Cooperative of SFSMC.
1200-1300	Lunch
1330-1700	Discussion : Topic - Exchanging Experience among Cooperative Movements on Waste Resource Recycling.
31 March, Sunday	
0900-1600	Sightseeing : Grand View Garden in Qing Pu County.
1 April, Monday	
0900-1200	Visit to Rubber, Plastics and Miscellaneous Goods Business Department of SRRUC.
1200-1330	Lunch
1330-1700	Visit to the Scrap Iron and Steel Recycling Centre of Yang Pu District, SRRUC.
1730-1900	Dinner
1900-2100	Presentation of country reports.
2 April, Tuesday	
0900-1200	Visit to Shanghai Precious Metals Refinery of SRRUC.
1200-1330	Lunch
1330-1700	Discussion : Topic - Recycling of Scrap-bearing Precious Metals.

3 April, Wednesday

0900-1200	Review of the study visits and presentation of action plans by the participants.
1200-1330	Lunch
1330-1700	Evaluation Meeting chaired by Mr. G.K. Sharma, Regional Director, ICA ROAP.

4 April, Thursday

0900-1500	Free
1500-1600	Closing ceremony
1800-2100	Farewell banquet hosted by SFSMC.

5 April, Friday Departure of participants

Workshop Participants

1. Mr. N.S. Mahiyaria
   Regional Manager
   Rajasthan Tribal Areas Development Coop Federation Limited.
   11, Fatehpura, Bedla Road
   Udaipur-313001, India.

2. Mr. Glicerio E. Lorejo
   President
   Cooperative Union of the Philippines Inc.
   CUP Building, Roces Avenue Corner
   Mother Ignacia Street,
   Quezon City, Philippines.

3. Mr. Renato B. Yanez
   Chairman
   Region XII Cooperative Union Inc.
   3rd Floor, CM Building, Aguinaldo Street
   Iligan City, Philippines.

4. Mr. G.D. Thilaka Kusum
   President, Panadura MPCS Limited
   C/o National Cooperative Council of Sri Lanka
   455 Galle Road, Colombo-3, Sri Lanka.

5. Mr. Amnat Rojanapaibul
   Board Member, Cooperative League of Thailand &
   The Federation of Savings & Credit Coops of Thailand Ltd.
   4, Pichai Road, Dusit
   Bangkok-10300, Thailand.

6. Mr. Liu Qiang
   Section Chief, Operation Division
   Resource Recovery Administrative Office
   Ministry of Commerce, China.

7. Mr. Jiang Lu Ping
   Deputy Director
   Waste Material Processing Factory
   Gansu Resource Recovery and Utilization Company
   GPUSMC, Gansu Province, China.

Resource Persons

1. Mr. Wu Hong Cheng
   Manager
   Shanghai Resource Recovery and Utilization Company
   SFSMC, Shanghai, China.

2. Mr. Zhang Guo Jian
   Deputy Manager
   Shanghai Resource Recovery and Utilization Company
   SFSMC, Shanghai, China.

3. Mr. Yang Xiao Ping
   Division Chief, Operation Division
   Resource Recovery Administrative Office
   Ministry of Commerce, China.

4. Mr. Wang Jia Sheng
   Deputy Chief
   Foreign Economic Relation and Trade Division
   SFSMC, China.

ICA ROAP, New Delhi

1. Mr. G.K. Sharma
   Regional Director
   ICA Regional Office for Asia and the Pacific
   43 Friends Colony (East), New Delhi-110065, India.

2. Mr. Guo Yong Kang
   Agricultural Coop Development Advisor
   ICA Regional Office for Asia and the Pacific
   New Delhi.

A Place to Live

Roles Cooperatives can play in Protecting the Environment

Daman Prakash

– an environment related awareness material

INTERNATIONAL COOPERATIVE ALLIANCE
Regional Office for Asia & the Pacific, "Bonow House"
43 Friends Colony East, New Delhi-110 065, India

The **International Cooperative Alliance** is one of the oldest non-governmental international organisations. It is a worldwide confederation of cooperative organisations of all types. Founded in London on 18th August 1895, the ICA has affiliates in 77 countries with 195 national and ten international level cooperative organisations as members serving over 648 million individual members at the primary level. The ICA is the only international organisation entirely and exclusively dedicated to the promotion of Cooperation in all parts of the world. The ICA holds Consultative Status of Category-I in the United Nations Economic and Social Council (UN/ECOSOC).

Besides the head office in Geneva, Switzerland, there are four regional offices viz. the Regional Office for Asia and the Pacific in New Delhi, India (established in 1960); the Regional Office for East, Central and Southern Africa at Moshi, Tanzania (established in 1968); the Regional Office for West Africa at Abidjan, Ivory Coast (established in 1979) and the Regional Office for Central America and the Caribbeans at San Jose, Costa Rica (established in 1989).

The ICA Regional Office for Asia and the Pacific (ICA ROAP) serves 54 national level organisations from 19 countries, representing nearly 440 million individual cooperators. These countries are : Afghanistan, Australia, Bangladesh, China, Fiji, India, Indonesia, Iran, Japan, Democratic Republic of Korea, Republic of Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, USSR and Vietnam.

Main activities of the ROAP include coordination of cooperative development efforts within the region and promotion of exchanges and experiences; project identification, formulation and evaluation; promotion of establishment and development of national cooperative apex organisations; and organisation of seminars and conferences on specific subjects including support for programmes aiming at the involvement of women and youth in cooperative activities.

Finances are derived from member subscriptions, own f
from donors for various activities carried out by the ICA.