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ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA
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Energy Programme

PROJECT PROFILE

SOLAR AGRO-INDUSTRIAL DEMONSTRATION FARM



PREFACE

In this field of energy, developing countries throughout the world and the countries of Western Asia face a twofold challenge: achieving a satisfactory overall growth rate; while, at the same time, preparing a new self-sufficient energy era under conditions much more complex than present ones.

In order to meet this challenge, the Economic and Social Commission for Western Asia has been working in the areas of energy planning, research, development, implementation and evaluation with regard to new and renewable sources of energy, including activities aimed at promoting projects related to rural energy.

The United Nations Development Programme (UNDP)-funded regional Seminar on Small-scale Solar and Wind Technologies for Rural and Remote Areas in the ESCWA Region, held in Amman, Jordan, in December 1986, considered the outline of a number of regional projects that would lead to the elaboration of specific projects at a regional level. That Seminar was followed up by an Inter-governmental Meeting of energy experts from ESCWA countries who considered and approved various new and renewable sources of energy (NRSE) projects.

In this context of objectives and programmes, and in the face of the magnitude of the work required, ESCWA efforts are focused on technical co-operation among the region's countries; these efforts complement the manpower and technological capacities of technical co-operation among developing countries (TCDC) in the rest of the world. It is therefore important to seek the technological and financial co-operation of the regional and international community, as well as to exchange the experiences gained in the development of NRSE; this may prove a highly productive exercise to further regional and interregional co-operation.

Such co-operation with the region's countries and scientific institutions and those outside the ESCWA area will doubtlessly be highly useful in general, particularly so in so far as it complements the region's existing indigenous capacity and strengthens the possibilities of achieving a regional renewable energy breakthrough, with increasing technological autonomy.

The central goal of the project profile presented is to obtain support from regional and international financial agencies and from national institutions of industrialized countries in order to bolster the region's rural energy supply, while contributing to the world-wide process of energy/technology transition.

This document describes one of several projects that are to be carried out in the ESCWA region in the years to come. It must be emphasized that this project, which may in some cases be isolated from a regional context, constitutes only part of the regional NRSE projects identified by member countries for execution or implementation by ESCWA through the Energy Programme of the ESCWA Natural Resources, Science and Technology Division.

This project is part of a package of projects on solar and wind energy. These projects are integrated into ESCWA programmes and activities, and form part of a group of projects under regional programming with regional co-operation as the objective.



TITLE : SOLAR AGRO-INDUSTRIAL DEMONSTRATION FARM

DURATION: TWO YEARS

A. Background and justification

Many of the development projects pursued in rural areas of the ESCWA region lack clear policies on the limitation of harmful socio-economic and environmental consequences in rural/remote areas. Also, most of the development plans of rural and remote areas in ESCWA countries focus on land reclamation, the enhancement of water resources and the supply of power. However, the objectives of these plans could be better achieved if agro-industries were introduced as an integral part of the rural community. This approach will enhance the productivity, as well as social interaction between remote and urbanized areas. The most common agro-processes are milk processing and crop drying, which are both generally carried out using traditional techniques with lengthy processes that limit the rate of production considerably.

In view of the fact that these areas enjoy high solar radiation rates, solar thermal and PV systems could be used to develop agro-industrial activities in remote rural communities. Solar drying systems are currently being tested in the region (in Fayoum in Egypt), and the use of solar energy in milk processing plants is being demonstrated in Jordan.

This project aims at creating small-scale agro-industrial activities that can combat human and environmental depredation. Should this pilot project to use solar energy to produce reliable electrical energy for a farm in a selected village prove successful, priority will be given on a regional scale to similar projects in an effort to combat desertification and soil erosion.

In the light of the above, an assessment of the experiences of ESCWA countries, including socio-economic aspects, in the utilization and testing of solar energy systems for small-scale agro-industries should be undertaken.

This project will also consider the promotion of solar energy systems in the ESCWA region, taking local conditions into account.

The project will also deal with other aspects such as the local manufacture of a number of components, installation and the training of local manpower, all as a part of a long-term policy.

The project will also cover monitoring, aspects of performance, maintenance and repair, and its social acceptability.

The project proposal was discussed in the Regional Seminar on Small-Scale Solar and Wind Technologies for Rural and Remote Areas in the ESCWA Region, sponsored by UNDP and organized by ESCWA, which was in Amman, Jordan from 29 November to 3 December 1986.

Experts who participated in the Seminar emphasized the importance of this project. The representatives of Egypt, Democratic Yemen, Iraq, Jordan, Oman, the Syrian Arab Republic and Yemen Arab Republic, all expressed the interest of their countries in participating in this project.

The Intergovernmental Technical Meeting held in Amman, Jordan on 4 December 1986 unanimously approved this project proposal.

The project is intended to be implemented in two phases namely, a feasibility study and demonstration activity phase, with possible replications in other ESCWA countries afterwards.

B. Development objectives

1. To assist selected ESCWA member States to accelerate the use of solar energy resources through the application of mature technologies to improve the quality of life and increase the productivity of rural and remote areas through the introduction of agro-industrial activities.

2. To assist the Governments of the region in their assessment of techno-economic viability and social acceptability of the application of solar energy for small-scale activities in remote and rural areas of selected ESCWA countries, through the demonstration of solar energy schemes for energy conservation and pollution control.

3. To develop local capabilities in the manufacture of solar equipment.

4. To assist the Governments of the region in the development of long-term policy for the diffusion of solar energy in rural areas.

C. Immediate objectives

1. To develop alternative designs for solar agro-industrial systems that are appropriate to local conditions in rural areas of selected ESCWA countries.

2. To develop local capabilities in the construction, repair, operation and maintenance of solar energy systems.

3. To monitor the performance of solar systems under local conditions.

4. To assess the economic viability of these systems, taking into consideration their social benefits.

D. Special consideration

This project pays special attention to the needs of ESCWA countries and to the improvement of the social and environmental conditions of villagers. The project will provide energy for a farm in a village that will relieve farmers of strenuous tasks and improve their quality of life. The introduction of solar agro-industries to the village will help to create a number of small or handicrafts industries that will increase farmers' incomes. The introduction of electricity to village houses will also have a great impact on the education of villagers, thus improving their health conditions.

This and other evidence of the impact of solar energy on village life would be measured and analysed in order to give a better understanding of possible replications elsewhere.

The project also provides for the promotion of technical co-operation among developing countries in the utilization of solar energy for agro-industrial applications in remote areas of the ESCWA region.

E. Output

1. A series of country-by-country feasibility assessments of socio-economic and environmental threat to the most favourable rural/remote areas of the ESCWA region, where the project could contribute to improving economic development through the use of solar energy technologies.

2. Development of a set of alternative designs for solar systems that are appropriate to local conditions in ESCWA countries.

3. Training programme for local rural manpower on the installing, operation and maintenance of solar energy systems.

4. Report on the monitoring and evaluation of the technical performance of solar energy system under local conditions.

5. Report on the social impact and acceptability of introducing solar systems and on the role of the community in the promotion of these technologies.

6. Report on the co-operation efforts of ESCWA countries and other regional international agencies as part of a long-term policy to ensure that energy and socio-environmental awareness are integrated into any rural economic development activities that are pursued.

7. Recommendations for further applications, including a technical guide to provide information for policy makers, energy engineers and rural development planners.

F. Activities

1. Establishment of feasibility studies on selected sites on the utilization of solar agro-industrial technologies to develop rural and remote areas in the ESCWA region.

2. Review of recent technology developments in the utilization of small-scale solar agro-industrial systems in milk processing and crop drying.

3. Identification of a farm in a nearby village suitable for the installation and testing of systems under local conditions and their feasibility for wider applications.

4. Design procurement and installation of a small-scale solar agro-industrial plant for milk processing and crop drying.

5. Monitoring, collection and analysis of data for technical performance.

6. Evaluation of the socio-economic impact, benefits and costs of the establishment of the plant.

7. Organization of the training of local manpower on selected systems including their installation, operation, repair and maintenance. This activity will be conducted in collaboration with the research and development agencies.

8. Holding of workshops on solar agro-industrial systems by local agencies. The recommendations of these workshops would be used to improve and widen applications and explore the possibility of manufacturing some or all of the components of the systems locally.

9. Preparation of a technical guide to provide information for policy makers and rural development planners on the performance of solar systems, including the criteria for selecting these systems in ESCWA countries. The guide will also include unified test standards and procedures for the monitoring and performance evaluation of these technologies.

G. Input

1. Government participation

The contribution of each Government would include but, not be limited to the following:

(a) Identify and designate a competent official to act as a focal point for the project in the selected country, who would be fully aware of the project development and ensure the fulfillment of all government obligations towards the project in due time.

(b) Make available to the experts and consultants all the necessary documents and information relevant to the implementation of the project.

(c) Provide the technical staff, labour and administrative support necessary to initiate the project locally, and to monitor and supervise consultants in the implementation of the project.

(d) Secure suitable areas in the farm for the system and monitoring equipment.

(e) Provide the experts and consultants on mission with local transport, offices and adequate secretarial services.

(f) Provide all the facilities necessary for the production of data sheets and reports.

(g) Supervise and follow up the operation and monitoring of the solar systems after the completion of the project.

Total government contribution would account for about \$US 100,000 in both cash and kind.

2. Funding agencies' contributions

The funding agencies are expected to provide funds for the following:

Phase I: Feasibility studies

	<u>Work-months</u>	<u>\$US</u>
Expert in small-scale solar agro-industrial technologies	6	30,000
Expert in agricultural development	3	15,000
Expert in socio-economic studies	3	15,000
Training costs ^{a/}		10,000
Travel costs		10,000
Reporting costs		5,000
Subtotal		<u>85,000</u>

Phase II: Demonstration project

Expert in small-scale solar agro-systems	6	30,000
Expert in agricultural development	2	10,000
Expert in socio-economic assessment	3	15,000
Equipment		10,000

The demonstration equipment to be supplied by the project will include the following:

Two small milk processing plants, each for 100 milking cows		50,000
Two solar thermal systems to provide hot water and low pressure steam for the milk processing plant, each system will consist of approximately 40-50m ² of collectors		35,000
Set of solar drying facilities, each for drying 100 kg/day of agricultural crops and medical plants		20,000
Photovoltaic pumping station for agricultural and cow watering		40,000
Canning and packaging facility for the products		10,000
Photovoltaic clinical refrigerator, insect sprayers, TV set for the cultural centre, etc.		20,000
Monitoring equipment for the different systems		25,000
Subtotal		<u>255,000</u>

^{a/} As specified in annex I.

	<u>Work-months</u> <u>\$US</u>
Training costs ^{a/}	10,000
Travel costs	10,000
Report costs	5,000
Subtotal	<u>25,000</u>
Total	<u>365,000</u> =====

H. Preparation of work plan

A detailed work plan for the implementation of the project will be prepared by the project co-ordinator in consultation with the designated focal points. This will be done at the beginning of the project and brought forward periodically. A draft for the work plan is shown in table 1.

The agreed work plan will be attached to the project document as annex 1, and will form part of that document.

I. Preparation of a framework for the effective participation of national and international staff in the Project

The activities necessary to produce the indicated output and to achieve the immediate objectives of the project will be carried out jointly by the national and international staff assigned to it. The respective roles of national and international staff will be determined by their leaders at the beginning of the project through mutual discussion and agreement, and will be set out in a framework for the effective participation of national and international staff in the project. This framework will be attached to the project document as an annex, and will be reviewed if necessary. The respective roles of national and international staff shall be in accordance with the established concept and specific purpose of technical co-operation.

J. Development support communication

ESCWA and other participating agencies and organizations will communicate reports and data and exchange information collected on solar and wind water pumping.

K. Institutional framework

1. As the executing agency, ESCWA will be the primary institution concerned with the implementation of project activities. The project co-ordinator and any project personnel or consultants recruited to implement the project will be based at ESCWA headquarters in Baghdad.

^{a/} As specified in annex I.

2. The project will be executed under the supervision of and in accordance with the regular administrative procedures of ESCWA, the executing agency. It is suggested that the project be hosted by Democratic Yemen, Oman, Saudi Arabia, the Syrian Arab Republic, United Arab Emirates and Yemen Arab Republic.

3. All activities to be carried out within the framework of the project will be reviewed by ESCWA participating countries, the principle donor countries, financial institutions, consultants' advisory group and, where appropriate, suggestions and advice will be forwarded by them directly to ESCWA, the executing agency for the project.

4. Participating non-ESCWA countries are requested to support the project either through a direct contribution or through the services of experts who will study specific problems, provide equipment, and by special arrangement obtain access to the technical information needed for the implementation of the project.

L. Project review, reporting and evaluation

1. Tripartite monitoring reviews

The project will be subject to periodic reviews by ESCWA, in accordance with ESCWA policies and procedures for monitoring projects and programmes.

2. Progress and terminal reports

The project co-ordinator, in consultation with the experts, consultants and focal points of the project, will submit periodic reports during the implementation of the project, as well as a terminal report.

3. Evaluation

The project will be subject to evaluation in accordance with the policies and procedures established for this purpose by the financing agencies. The organization, terms of reference and timing of the evaluation will be decided upon after consultation between the Governments, financing agencies and ESCWA, as the executing agency.

Table 2. Project budget

Project personnel	Work- months	Total \$US	1988		1989	
			Work- months	\$US	Work- months	\$US
<u>Phase I: Feasibility studies</u>						
1. Expert in small-scale solar agro- industrial technologies	6	30,000	6	30,000		
2. Expert in agricultural development	3	15,000	3	15,000		
3. Expert in socio-economic studies	3	15,000	3	15,000		
4. Training costs		10,000		10,000		
5. Travel costs		10,000		10,000		
6. Reporting costs		5,000		5,000		
Subtotal	12	85,000	12	85,000		
<u>Phase II: Demonstration</u>						
7. Expert in small-scale solar agro-technologies	6	30,000			6	30,000
8. Expert in socio-economic assessment	3	15,000			3	15,000
9. Expert in agricultural development	2	10,000			2	10,000
10. Equipment costs		200,000				200,000
11. Training costs		10,000				10,000
12. Travel costs		10,000				10,000
13. Reporting costs		5,000				5,000
Subtotal	11	280,000			11	280,000
Total donor input	23	365,000	12	85,000	11	280,000
Overhead expenses (13% of donor contribution)		47,500	11,000			36,500
Grand total		412,500	96,000			316,500

Annex I

PHASE I: FEASIBILITY STUDIES

The training in phase I of the project will be mainly devoted to upgrading local capabilities of analysing and evaluating agro-industrial solar systems. It would include the following:

(a) Course on the identification of appropriate solar technologies for agro-industry (cost \$US 3,000);

(b) Training on the sizing, costing and analysis of the above mentioned system (cost \$US 3,000);

(c) Training on the evaluation of the socio-economic feasibility of the project (cost \$US 4,000).

Total training costs: \$US 10,000.

Annex

REGIONAL RENEWABLE ENERGY PROJECTS

Regional NRSE priority projects	Participating countries	Suggested host country for the project in priority scale	Estimated budget in thousands of US dollars
1. Establishment of Solar and Wind Energy Measuring Network	Bahrain, Democratic Yemen, Egypt, Iraq, Jordan, Lebanon Oman, Qatar, Saudi Arabia, Syria, Yemen	(1) Egypt, (2) Jordan, (3) Syria	895
2. Solar and Wind Energy Water Pumping in Remote Areas	Democratic Yemen, Egypt, Oman, Saudi Arabia, Syria, UAE, Yemen	(1) Syria, (2) Yemen, (3) Democratic Yemen	920
3. Solar and Wind Energy for Water Desalination of Brackish Sea Water in Remote Areas	Bahrain, Democratic Yemen, Egypt, Oman, Saudi Arabia, UAE	(1) Saudi Arabia, (2) Oman, (3) UAE	920
4. Demonstration of Wind and Solar Ice Making in a Fishing Community	Democratic Yemen, Egypt, Oman, Saudi Arabia, Yemen	(1) Democratic Yemen, (2) Oman, (3) Saudi Arabia	485
5. Training Programme on Biogas, Solar and Wind Technologies	All ESCWA countries	(1) Jordan, (2) Egypt, (3) Syria	175
6. Solar Energy Based Herders Settlement	Egypt, Democratic Yemen, Iraq, Jordan, Oman, Qatar, Saudi Arabia, Syria, Yemen	(1) Oman, (2) Syria, (3) Iraq	1,630
7. Solar Agro-industrial Demonstration Farm	Egypt, Democratic Yemen, Iraq, Jordan, Oman, Syria, Yemen	(1) Iraq, (2) Syria, (3) Jordan	365

Annex (Cont'd)

Regional NRSE priority projects	Participating countries	Suggested host country for the project in priority scale	Estimated budget in thousands of US dollars
8. Dissemination Programme for "Do-It-Your-Self" Small-scale Solar Equipment in Remote Areas.	Egypt, Jordan, Syria, Iraq, Yemen	(1) Iraq, (2) Jordan (3) Yemen	130
9. Solar Pond Technology for Electricity Generation in Remote Areas of the ESCWA Region	Bahrain, Egypt, Iraq, Jordan	(1) Qatar, (2) Jordan, (3) Egypt	1,240
10. Development of Demonstration of Mini-hydro Plants	Yemen, Syria, Iraq, Egypt	(1) Syria, (2) Iraq, (3) Egypt	6,176
