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NATIONAL COMMUNICATIONS FROM PARTIES NOT INCLUDED IN ANNEX I TO THE CONVENTION

PROVISION OF FINANCIAL AND TECHNICAL SUPPORT

List of projects submitted by Parties not included in Annex I to the Convention in accordance with Article 12.4 of the Convention

Note by the secretariat

I. MANDATE

1. By its decision 12/CP.4 (FCCC/CP/1998/16/Add.1) the Conference of the Parties requested the secretariat to compile and make available to Parties a list of projects submitted by non-Annex I Parties in accordance with Article 12.4 of the Convention.

II. APPROACH

2. In response to the above mandate, the secretariat reviewed the relevant sections of all the 10 initial national communications submitted by Argentina, Armenia, the Federated States of Micronesia, Jordan, Kazakhstan, Mexico, the Republic of Korea, Senegal, Uruguay and Zimbabwe with a view to compiling the list of projects.

3. Pursuant to decision 10/CP.2 (FCCC/CP/1996/15/Add.1) and Article 12.4 of the Convention, developing country Parties may, on a voluntary basis, propose projects for financing, including specific technologies, materials, equipment, techniques or practices that

would be needed to implement such projects, along with, if possible, an estimate of all incremental costs, of the reduction of emissions and increments of removals of greenhouse gases, as well as an estimate of the consequent benefits. Of the 10 initial national communications submitted so far, the communications from Jordan and Zimbabwe did have separate sections where projects proposed for funding in accordance with Article 12.4 were elaborated on.

4. Armenia submitted as an addendum to its initial national communication, a list of 17 projects for funding. Estimated costs were provided for 16 of the 17 projects. The proposed projects with their estimated costs and duration are given in the annex to this document.

5. Jordan provided a varying degree of detail on the background, location, implementation plan, estimated costs and duration of eight projects, as shown in the annex to this document. It further provided a list of 10 other project titles with estimated costs.

6. Zimbabwe provided concept notes on a list of eight enabling activity projects for funding. It additionally proposed four projects for funding under the heading of mitigation activities. The information provided is shown in the annex to this document. The incremental cost and emission reduction potential of the mitigation projects are documented in two studies which were only referenced in the communication. Zimbabwe further indicated that initial external support would be required for the development of the proposals.

7. In their initial national communications, the other seven developing country Parties referred to above provided information on various initiatives to implement the Convention but did not explicitly put forward projects for funding in accordance with Article 12.4 of the Convention.

Annex*

LIST OF PROJECTS SUBMITTED BY NON-ANNEX I PARTIES IN ACCORDANCE WITH ARTICLE 12.4 OF THE CONVENTION

ARMENIA

1. Education and training solar School Laboratories

2. Solar power Supply for Meteorological stations

3. Solar Hot Water Supply Demonstration System for the International Post-trauma Rehabilitation Center (IPTRC)

4. Pilot Production of Biohumus by Processing of Organic Part of Solid Urban Wastes and Manure

5. Rehabilitation of Heating and Cooling of Buildings by Environmentally Safe Systems for the Earthquake Zone of Armenia

6. Introduction of Solar Water-Heat Collectors (SWHC) into the Energy System of Armenia

7. Development of a Concept, Strategy and Action Plan to Reduce Emissions from Road Vehicles

8. Demonstration Heating and Cooling System Implementation on the Basis of Environmentally Safe Heat Pump Equipment in Armenia

9. High Efficiency PV Module and Station: Manufacturing and Testing

10. Study of a problem of Application of Methane Fermentation in the Conditions of Armenia

11. Conditions of Geothermal Resource Studies and Perspectives for the Practical Use of Geothermal Energy in the Republic of Armenia

12. Removing Barriers for Using of Fast Growing Tree Plants in Private Sector of RA as a Source of Renewable Energy

13. Developing of a Computer Interactive System for Evaluation of the Measures for Mitigation of Vulnerability of Ecological Systems under the Possible Scenarios of Global Climate Change

14. Vulnerability, Adaptation and Mitigation Open Interactive Automated System

15. Center for Studying Global Climate Change Impact

16. The Threat of Desertification under Possible Climate Change in Armenia

17. The Threat to Biodiversity under possible Climate Change in Armenia

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1. Education and Training Solar School Laboratories

The objective of this project is to increase awareness of the potential of renewable energy in the environment protection, to demonstrate its utilization and to disseminate environmental friendly renewable energy technologies beginning from a secondary school level by developing and implementation of solar energy curriculum.

To this end, solar laboratories consisting of various solar installations will be manufactured and established in 22 secondary schools of Armenia, the educational material including additional information on other renewable energy sources (wind, geothermal, biogas) and methodics will be prepared and training of teachers will be organized.

Implementation duration: 18 months
Estimated budget: 85,000 USD

2. Solar Power Supply for Meteorological Stations

The objective of the project is to improve and facilitate the climate data acquisition of the Armenian National Meteorological Service by using an autonomous solar photovoltaic power supply for reliable and uninterrupted operation of the measuring equipment and communication means.

Another objective is a new technology implementation as regards the using of controllers, inverters, measuring and monitoring devices for optimization of a solar system and a demonstration of the importance and effectiveness of photovoltaic systems for a diverse range of remote applications.

Solar modules will be manufactured and installed with other system's components on the most important and typical stations.

Implementation duration: 12 months
Estimated budget: 40,000 USD

3. Solar Hot Water Supply Demonstration System for the International Post-trauma Rehabilitation Center (IPTRC)

The main objective of this project is to demonstrate the environmental and economic effectiveness of using solar water heaters instead of fossil fuel for hot water supply. The project leads to reduction of CO_2 emission by using solar energy instead of diesel oil.
Being the first project in Armenia regarding the use of solar collectors field for hospital's hot water supply it will initiate the implementation of similar systems for other health

establishments, sport centers, hotels, farms, factories and for residential applications. The project will contribute to the transfer of new technology and to the organization of solar collectors production in private sector of Armenia, in particular by the proposer of this project.

Implementation duration: 18 months
Estimated budget: 200,000 USD

4. Pilot Production of Biohumus by Processing of Organic Part of Solid Urban Wastes and Manure

The objectives of the project are:

- Utilization of household solid wastes and manure
- Elimination of emissions of methane, nitrogen protoxide and hydrogen sulfide during aerobic composting
- Trapping ammonia during composting
- Production of biohumus
- Rehabilitation of the salted site as an example of biohumus usage
- Transition from chemical agriculture to the biological one

Implementation duration: 24 months
Estimated budget: 65,000 USD

5. Rehabilitation of Heating and Cooling of Buildings by Environmentally Safe Systems for the Earthquake Zone of Armenia

The objective is: development, design and implementation of technical measures for rehabilitation of heating and cooling of buildings in the Earthquake zone of Armenia on the basis of energy efficient and environmentally safe geothermal heat pump systems.

Implementation duration: 3 years
Estimated budget: 2,000,000 USD

6. Introduction of Solar Water-Heat Collectors (SWHC) into the Energy System of Armenia

To introduce and develop an alternative energy resource into the energy market, such that the SWHC will be within the reach of the general population/consumers and will be designed for local conditions.

Informational and organizational structure for the promotion of renewable energy resource market will be created.

Implementation duration: 2 years
Estimated budget: Depends on extent

7. Development of a Concept, Strategy and Action Plan to Reduce Emissions from Road Vehicles

Long term goals are the reduction of atmospheric pollution and decrease of emissions from road vehicles including greenhouse gas emissions.

Project builds basis in Armenia to reduce harmful emissions from road vehicles. The project scope is:

- to develop a concept, strategy and priority action plan to reduce emissions from road vehicles;
- to develop a number of projects aiming at implementation of priority actions;
- to strengthen the institutional legislative and administrative capacity to support to the reduction of emissions from road vehicles;
- to develop institutional mechanisms to strengthen dialogue, information exchange, and cooperation between governmental and non-governmental organisations, academic, private and grassroots sectors, increase public awareness on this issue;

Implementation duration: 2 years
Estimated budget: 400,000 USD (340,000 + 60,000 in-kind)

8. Demonstration Heating and Cooling System Implementation on the Basis of Environmentally Safe Heat Pump Equipment in Armenia

Development, design and implementation of a geothermal heat pump installation and training of personnel for energy efficient and environmentally safe heating and air conditioning of a building in Armenia.

Implementation duration: 10-12 months
Estimated budget: 20,000 USD

9. High Efficiency PV Module and Station: Manufacturing and Testing

The aim of the project is the manufacturing and studying of experimental photovoltaic station on the base of proprietary design for enhancing the solar cell efficiency developed by the specialists of "Amrots" Scientific Industrial Company.

Implementation duration: 9 months
Estimated budget: 25,000 USD

10. Study of a problem of Application of Methane Fermentation in the Conditions of Armenia

Study of a problem of methane fermentation application in the conditions of Armenia for de-contamination of wastes, biogas, production as an alternative source of energy, production of organic fertilizers, and reduction of methane emission to atmosphere.

Identification of the constraints interfering development of methane fermentation technology-based bioenergetics and removal of these constraints.

Implementation duration: 12 months
Estimated budget: 35,000 USD

11. Conditions of Geothermal Resource Studies and Perspectives for the Practical Use of Geothermal Energy in the Republic of Armenia

Initiate actions to reveal new geothermal areas and estimate the geothermal resources. Setting up the first pilot plant producing geothermal energy on the base of the "dry" rock heats in the bounds of the Djermakhbjur Lot (Sisian).

Implementation duration: 24 months
Estimated budget: Depends on extent

12. Removing Barriers for Using of Fast Growing Tree Plants in Private Sector of RA as a Source of Renewable Energy

Project objective is to remove barriers for using of fast growing trees in private sector of RA as a source of renewable energy as well as demonstration of its profit for private owners and for the state, as well as its dissemination on a mass order.

Implementation duration: 24 months
Estimated budget: 50,000 USD

13. Developing of a Computer Interactive System for Evaluation of the Measures for Mitigation of Vulnerability of Ecological Systems under the Possible Scenarios of Global Climate Change

Developing of a tool for the evaluation of the measures for mitigation of vulnerability and strengthening of the adaptation capacities of ecological systems under the predicted Global Climate change

Implementation duration: 12 months
Estimated budget: 68,500 USD

14. <u>Vulnerability, Adaptation and Mitigation Open Interactive Automated System</u>

To create an Open Interactive Automated System, on the basis of the potential created in the country under "Armenia - Country Study on Climate Change". The System will have possibility to enlarge the computer models for the problems of Climate Change. The System will develop optimal recommendations for inclusion in the Government planning for various sectors.

Implementation duration: 24 months
Estimated budget: 230,000 USD

15. <u>Center for Studying Global Climate Change Impact</u>

To create a Center, on the basis of the potential created in the country The Center will have the capacity to develop strategies and action plans for reducing the adverse effects of Climate change. The center, in close cooperation with the Ministry of Nature Protection, will develop recommendations for inclusion in the Government planning for various sectors.

Implementation duration: 12 months
Estimated budget: 350,000 USD

16. <u>The Threat of Desertification under Possible Climate Change in Armenia</u>

To conduct a detailed study on desertification process in Armenia for evaluating the threat to Armenia's ecosystems and biodiversity, as well as the soil in intensive agricultural land in pre-mountain and lower mountain zones of Armenia.

Implementation period: 12 months
Estimated budget: 30,000 USD

17. <u>The Threat to Biodiversity under possible Climate Change in Armenia</u>

To conduct a detailed study on the condition of plant and animal species under threat of extinction, for evaluating their adaptation capabilities and developing methods for their conservation.

Implementation period: 18 months
Estimated budget: 40,000 USD

JORDAN

1. Crude distillation unit preheater for the charge heater 301 H1

2. Co-boiler for the fluid catalytic cracking unit

3. Heat recovery from sulfur acid plant / Jordan Phosphate Mining Company

4. Power supply by photovoltaic system to remote villages

5. Exploration for geothermal energy in Jordan

6. Salt-gradient solar pond pilot plant

7. Reverse osmosis water desalination

8. Regional Training Centre in the field of Renewable Energy

9. Other projects

1. Project Title: Crude Distillation Unit Preheater for the Charge Heater 301 H1

(a) Background

The objective of this project is to recover heat from the heater's effluent gases by means of an air preheater, thus conserving energy and, consequently, reducing flue gas emission. The charge heater 301 H1 is the largest fired heater at the refinery and serves Topping-3 which is a crude distillation unit of 10,000 T/D throughput. The absorbed heat duty of this furnace is 40.7 million KCal/hr and it has a 77% efficiency. Cooling of the stack gases to 200°C in an air preheater for the air of combustion will increase the furnace efficiency to 88%, thus contributing to energy conservation and reduction in flue gases emission.

The main design parameters for the air preheating installation are based on data collected with the Crude Distillation Unit operating at full capacity.

(b) Environmental Impact

Present fuel consumption	130 T/D
Expected fuel consumption	113.8 T/D
Fuel oil saving in tonnes	16.3 T/D
	5380 T/Y
Reduction in CO_2 emission	16730 T/Y

(c) Economic Aspects

Fuel oil saving in dollars	538000 $/Y
Increase in power consumption	96000 $/Y
Increase in maintenance cost	100,000 $/Y
Net savings	342,000 $/Y
Estimated required investment	2,500,000 $
I.R.R	5%

(d) Conclusions

Installing the air preheater will reduce carbon dioxide emission by 16,730 tonnes/year. If the project is subsidized by $1 million, the IRR will increase to 19%.

2. Project Title: Co-Boiler for the Fluid Catalytic Cracking Unit

(a) Background

The Fluid Catalytic Cracking Unit incorporates a generator where coke is combusted and heat generated. However, there is significant loss of heat, through the regenerator stack, by the flue gases which are discharged in the atmosphere at a temperature of 670°C and contain substantial amounts of carbon monoxide. In this project, and in order to maintain the CO combustion, the regenerator gases must be heated to 800°C by firing supplementary fuel gas before heat is recovered in the CO-boiler. At the unit's designed feed rate of 640 T/D, the quantity of fuel gas required is 140 kg/h and the estimated rate of steam generation is 14 T/h.

(b) Environmental Impact

Based on the assumption that one tonne of fuel oil produces about 15 T of steam.

Reduction in fuel oil consumption	7391 T/Y
Reduction in CO_2 emission	22989 T/Y
CO_2 generated by combusting 140 kg/h fuel gas	1108 Tonnes
CO_2 generated by combusting CO	185000 Tonne
Overall reduction in CO_2 emission	3380 Tonne/Year

(c) Economic Aspects

Value of steam generated	638872 $/Y
Cost of supplementary fuel	126000 $/Y
Maintenance cost	110000 $/Y
Net annual saving	402872 $/Y
Required investment	2,740,000 $
IRR	7%

(d) Conclusions

The project will reduce the CO_2 emissions by 3,380 Tonnes/Year.

3. Project Title: Heat Recovery from Sulfuric Acid Plant/ Jordan Phosphate Mining Company

The main aim of this project is to utilize the waste heat from the sulphuric acid unit at the fertilizer compound in Aqaba to desalinate sea water. Desalinated water would be used as a process water and for domestic purposes. It is expected that the proposed desalination unit would produce 5 MCM/year at a cost of $26 million.

4. Project Title: Power Supply by Photovoltaic Systems to Remote Villages

(a) Background

The proposed project is intended to supply electricity produced by photovoltaic (PV) systems to public facilities and residents in selected villages in remote regions, where no electricity is currently available. PV systems are designed to generate electricity by converting light energy directly to electric energy by using PV devices.

Basically, small-scale PV systems will be installed on the premises of each customer, with ownership retained by the utility. The electricity is provided on a fee-for-service basis. (Grid-connected applications are also possible, although, in this case, construction of a local distribution grid will be required).

(b) Objectives of the project

The project has short, medium and long-term objectives; they are briefly described below.

1. Short-term objectives

Short-term objectives of the project include the following:

- i. To provide electricity, as one of the basic needs for a decent life, to inhabitants of the villages concerned. Bedouins who may settle down in or around the villages can also benefit from the electricity installed.
- ii. To provide electricity to public facilities that serve various domains, like education, medical care, communication, to the benefit of the village inhabitants and of the bedouin population living around the villages.

2. Medium and long-term objectives

Medium and long-term objectives of the project include the following:

To facilitate the general welfare of bedouins by helping them meet their basic social needs.

- i. To promote economic development in and around the villages.
- ii. To reduce disparities in the social and economic development of urban and rural regions.
- iii. To promote environment friendly power systems.
- iv. To save foreign currencies for other vital needs, by reducing imported fuel bills.
- v. To attain sustainable development.

(c) Project Sites

Thirty eight priority sites (villages) for the implementation of the project have already been selected. Basic data on the priority sites is presented in Table 1. The sites are located in remote areas and the cost of transporting diesel to these villages would be considerably high. In most of the villages there are presently one elementary school and a small clinic.

(d) Project components

PV systems will consist of:

1. PV panels
2. Storage batteries
3. Charge controllers
4. Inverters
5. Wiring, fuses and switches

The total power and energy demands are estimated respectively at 300 W and 1,520 Wh/day for each household (see Table 2).

(e) Implementation plan

The project includes the following steps:

1. Final selection of the candidate villages.
2. Specifying and designing the PV power systems and their components, according to the energy needs and the potential solar radiation.
3. Bidding for tenders and evaluation of offers.
4. Supply of PV systems and transportation to the selected villages. Installation of the equipment, including civil and electrical work, functional test, final inspection and instructions to users.
5. Documentation and final report.

The expected duration of the above steps is two years (see Table 3).

(f) Estimated costs

The total project cost is estimated at $3.5 million (in 1996 prices).

1.	PV system equipment and transportation costs	$1.600.000
2.	Installation/electrical work	$1.200.000
3.	Indirect costs and training	$ 700.000
	Total	$3.500.000

Table 1
Priority sites (village)

SN	Village Name	District	No. of Houses	L.V. PDES	Distance from Grid (km)
1	El - Eina	Karak	60	120	2
2	R. Al Shargia	Mafrak	18	120	29
3	G. Al- Gharbia	Mafrak	24	200	32
4	Rawdet Al- Bendan	Mafrak	12	50	21
5	Salhyet Al- Naim	Mafrak	33	50	21
6	Qatar	Aqaba	36	60	2
7	Ez- Heiqa	Tafileh	10	45	3.5
8	Ras Al- Naqab	Ma'an	4	15	10
9	Al Mafrak / Shehabia	Karak	12	80	2
10	Al Mwaqar	Amman	20	100	3
11	Hammam Al Shamot	Amman	10	70	4
12	Ghadeir Al - Naqa	Ajloun	8	35	3.5
13	Samra Marba Wahsh	Zarqa	12	72	3
14	Al Tafeh Al Janouby	Zarqa	8	48	4
15	Al- Tayar (3)	Zarqa	6	40	3
16	Fagou Ajhay Shamai	Karak	8	60	5
17	Hujaira	Karak	25	150	6
18	Afra Village	Tafileh	16	80	8
19	Al Burbatia	Tafileh	16	60	6
20	Al La Aban	Tafileh	8	100	9
21	Al Hareer	Tafileh	5	100	3
22	Zebaideh	Tafileh	6	30	3
23	Attwaneh	Tafileh	4	30	3
24	Emlaih	Madaba	4	50	4
25	Maghayer Enhanna	Amman	19	130	4.5
26	Arainbeh Gharbeyeh	Amman	14	100	4
27	Al Eqnatera	Amman	6	50	2.5
28	Al Ktaifeh	Amman	16	60	7
29	Al Ktaifeh/ Al Khbab	Amman	12	60	22
30	Ezmailat / Garagier	Amman	10	70	5
31	Al Emshagar	Amman	15	65	4
32	Al Mashta	Amman	13	35	3
33	Maysara (7)	Balqaa	4	40	3
34	Hamrethusen	Balqaa	8	60	5

35	Alkanesa	Ajloun	6	60	2.5
36	Shtttoura	Ajloun	10	45	5
37	Al Shra A/GAA	Mafrak	9	60	2
38	Ga Akhanna	Zarqa	11	70	6

Table 2
Power and Energy Demand

Households

Appliance	Unit	Power (W)	Hour of use (h)	Energy (Wh)
a. Lights	2	80	6	480
b. Fan	1	60	10	600
c. TV	1	80	4	320
d. Radio/cassette player	1	10	5	50
e. Other		70	1	70
Total		300 W		1520 Wh

Public facilities (e.g., elementary school and a clinic)

Appliance	Unit	Power (W)	Hour of use (h)	Energy (Wh)
a. Lights	3	20	6	360
b. Fan	2	50	6	600
c. Refrigerator	1	60	10	600
d. Radio/cassette player	1	10	5	50
e. TV	1	80	2	160
f. Other (e.g., tele-communications system)	1	500	0.2	100
Total		720 W		1,870 Wh

Table 3
Project Time schedule

	Time (Month)											
Activity	2	4	6	8	10	12	14	16	18	20	22	24
- Selection of villages												
- System specification & design												
- Tender preparation & evaluation of offers												
- System supply & transportation												
- System installation, civil and electrical works												
- System operation & testing												
- Monitoring and final documentation												

5. Project Title: Exploration Regarding Geothermal Energy in Jordan

(a) Background

Most of the electrical power now being produced in Jordan is generated by imported fuel oil. If sources of geothermal energy could be identified and brought into production, the resulting benefits would contribute substantially to the following objectives:

1. Reduced electric energy cost.
2. Establishment of an indigenous source of base load energy.
3. Diversification of energy resources.
4. Reduced impact on the environment.

However, the immediate objective of the project is to identify geothermal drilling targets by advising the Natural Resources Authority (NRA) on the execution of appropriate geological, geophysical and geochemical studies in areas to be selected after evaluation of all previous activities and documents.

The project would also assist the NRA in interpreting the data resulted from the above-mentioned studies by providing the necessary equipment. A follow-up stage will be required to assist the NRA in drilling exploration holes and in evaluating the results of drilling.

(b) Work Plan

Proposed area of the project

1. The area located east of the Dead Sea.
2. Northeast part of Jordan.

Phase I

1. Review and evaluation of available geological, geophysical, geochemical and hydrogeological data. Based on the results of the evaluation, an exploration programme has to be prepared for the proposed areas or any promising additional areas.
2. Expected duration of this phase: 2-3 months.

Phase II

1. Execution of the prepared exploration programme which, most probably, will include geological, geophysical, geochemical and hydrogeological studies. The results of the studies will be integrated to define the target areas for deep drilling.
2. Expected duration of this phase is one year.

Phase III

1. Drilling of projected deep wells to a depth not less than 2,000m.
2. Carrying out different geophysical logging, including temperature measurements.
3. Carrying out the necessary tests in case of positive results.
4. Submitting a final report with all the results of the above-mentioned studies and recommendations for further phases.
5. Duration of this phase is at least one year, depending on the proposed drilling programme.

Equipment

1. Heat conductivity meter for rock samples and any additional equipment needed.
2. Drilling of at least two deep boreholes.

(c) Estimated costs

Jordanian Contribution	US $
Personnel	100,000
Equipment	30,000
Office & field facilities	20,000
Transportation	50,000
TOTAL	200,000

Foreign Contribution	US $
Experts	150,000
Air tickets	25,000
Equipment	25,000
Drilling	1,200,000
Total	1,400,000

(d) Environmental Aspects

The analysis of the various environmental problems connected with the utilization of geothermal sources will be limited to the operational period of the plants, during which the fluid evolves in the various components and systems.

(e) Conclusions

The project proposal offers some interesting economic possibilities. It will make it possible to produce geothermal heating power for different purposes.

The proposed programme of drilling and testing will produce data enabling water resources to be exploited rationally and reliably over the long term.

With this in mind, the initial project could form the beginning of a long collaboration, with the goal of managing water resources, be they destined for geothermal heating or for human consumption.

6. Project Title: SALT-Gradient Solar Pond Pilot Plant

(a) Background

The long-term objective of the proposed project is to develop a national capability to design and build solar ponds for various energy purposes, while the immediate objectives are:

1. To learn as much and as quickly as possible about the technical, practical and economical aspects of the solar ponds by actually constructing demonstration pilot solar ponds.
2. To monitor the operation of the pond over a period of one year to determine the operating characteristics, including water and salt make-up requirements.
3. To improve, develop and modify components in order to obtain an optimal system.
4. To prepare designs and plans for larger pilot plant.
5. To train personnel on the design and operation of solar ponds.

(b) Implementation Plan (See Table 4)

PHASE I

Preparation:

This phase should result in the assessment, testing and evaluation of the Dead Sea brine and of the soil at the proposed site, in dissemination specific information on the site, training study team members and designing pilot ponds.

This phase consists of the following work package (WP):

WP100: Study of the thermal and physical properties of the Dead Sea brine. Most of the existing solar ponds utilize sodium chloride in creating storage and gradient zones where the properties are well known. However, in the proposed project, the Dead Sea brine is projected to be utilized as a medium to create such zones where little data and information are available.

WP 101: Light transparency in the Dead Sea brine and clarification techniques and materials. It is important to improve the light transparency to permit maximum solar rays to penetrate the gradient zone and reach the storage zone.

WP 102: Soil physical and chemical properties. Several types of tests will be performed on selected soil samples to determine the standard structural properties. There is the potential for interacting with Dead Sea brines to generate unwanted gaseous products and soil permeability upon exposure to heated brines. Gas evolution testing will consist of soil samples immersed in heated brine for periods of up to two months, with continuous monitoring for possible gaseous output.

WP 103: Training members of a study team. The need for training stems from the fact that in Jordan, the technology of salt gradient solar ponds is not developed yet and many questions still exist. However, Jordanian researchers can benefit from their foreign counterparts' experience in this field. Training programmes will be outlined during the detailed work packages planning.

WP 104: Design of solar ponds. It will include design of the base for lined and unlined ponds, plumbing, heat dissipation draining system, test programme, instrumentation, support facilities and utilities, filling techniques, selection of equipment, etc. The preliminary designs and blue prints can be performed in Jordan, but it would be helpful if experts assist in review, modification and approval. An exact list of the necessary equipment and instruments should be also worked out during this phase.

WP105: Site selection and preparation. It will include selection of site, excavation, levelling, roads, water pipes, electric lines, etc.

PHASE II

Construction & Operating Phase

WP 200: Field construction of solar ponds and support facilities. It will include the physical construction of pond facilities, placing the instruments and equipment in position, plumbing, lining the line ponds, compacting the unlined ones, constructing brine and fresh water tanks, pumps, and having the ponds ready for filling.

WP 201: Initial operation. The ponds will be filled according to the preplanning filling techniques, observing brine and salinity quality. In addition, a shake down test, establishing gradient zones and maintaining them, is part of this work package.

WP 202: Test of components. Data-collection equipment, weather data, salinity and other components have to be fully tested prior to regular monitoring and data collection.

WP 203: Material compatibility. The Dead Sea brine is very corrosive. A survey of APC brine compatibility data will be made and material will be selected. The selected material will be subjected to bent and straight coupon exposure tests. The test will be conducted using Dead Sea brine and diluted brine at various temperatures (20-110°C)

WP 204: Data collection and analysis. This is devoted to research and development. It consists of data collection, monitoring of variable measuring parameters and observing the gradient zone depth for potential leakage.

WP 205: Maintenance. This is to adjust the ponds according to the local environment conditions, optimize the pond operation and achieve a better efficiency.

PHASE III

Large Pond Design, Construction and Potential Application Study

WP 300: Design of a large unlined pond. The execution of this work package depends mainly on the second phase and on the successful operation of the unlined ponds.

WP 301: Construction of a large, unlined pond. The construction will be similar to that of the small, unlined pond and the site will be in the vicinity of the prototype pond.

WP 302: Initial operation; it will include the filling operation of the pond under static condition.

WP 303: Heat extraction. Will include several types of heat exchangers for studying the energy extracted corrosion, fouling, etc.

WP 304: Potential application study. Will identify possible areas of application of such technology and type of application.

WP 305: Manufacturing cost. The cost of energy delivered by such technology will be studied and compared to systems using conventional energy.

WP 306: Plant manual. A manual has to be written to include all parameters, operation material selection, maintenance, recommendations, etc.

(c) Estimated costs

The total cost associated with this project, according to the work plan and duration, is estimated at $ 633,000 (JD=0.7$) distributed as follows:

First year

Construction	$200,000
Materials	$100,000
Salaries	$ 36,000
Subtotal	$336,000

Second year

Instruments	$150,000
Salaries	$ 36,000
Computer	$ 60,000
Subtotal	$246,000

Third year

Salaries	$ 36,000
Publication cost	$ 15,000
Subtotal	$ 51,.000
TOTAL	$ 633,000

Table 4
Project Time Schedule
Time (Month)

Description of activities	4	8	12	16	20	24	28	32	36
Thermal and physical properties of brine									
Light transparency									
Soil characteristics									
Meteorological									
Design of solar ponds and support facilities									
Site preparation									
Construction of ponds and facilities									
Initial operation									
Test of components									
Material compatibility									
Data collection & analysis & maintenance									
Design of a large unlined pond									
Construction of a large pond									
Initial operation of a large pond									
Heat extraction									
Market study & manufacturing cost									
Plant manual									

7. Project Title: Reverse Osmosis Water Desalination (ROWD) with Renewable Energy Hybrid Systems in Remote Areas

(a) Background

Providing the technical reliability and economic feasibility of small-scale ROWD systems powered by renewable energy (solar + wind) systems.

1. Transferring technical know-how on ROWD.
2. Contributing to solving the brackish water problems for the inhabitants of remote areas.
3. Securing environmental protection and sustainable management of natural resources.

(b) Work Plan

The scientific focus of the project is the use of RE (solar + wind) to power small- and medium-scale RO systems for desalination and treatment of brackish water to produce up to $100m^3$ /day drinking water.

The process of RO is used to separate two homogeneous fluids with the help of a membrane. The propelling force of hydrostatic pressure is applied to enable different components to permeate the membrane, while others are retained. When the pressure required to reverse the flow of fluid with osmosis can no longer be ignored, compared with the working pressure, it is known as Reverse Osmosis (RO). This is usually the case when removing or concentrating low-molecular components such as salts, lyes, etc., which can already develop significant osmotic pressure levels at low concentration.

The whole system will be powered by RE system. The RE power can be a hybrid solar and wind system or a single solar wind system, depending on the potential of wind energy and solar radiation in the selected site of the project.

The project is divided into the following steps:

1. Selection of the location and determination of solar radiation and wind energy potential and water quality.
2. Specifying and planning the RO system, calculating the needed energy for such system.
3. Specifying and designing the power supply system based on the needed energy and the potential of the solar radiation and wind energy in the selected site.
4. Coordinating and designing the whole plant; site preparation; purchasing the system components.
5. Building the plant and installing the measuring system components for control and testing; functional testing of the installed plant.

6. Collecting data and evaluating energy supply and water quality.
7. Optimizing the system's components and the system as a whole, relying on the results of the evaluation; noticing the improvements resulting from optimization.
8. Documentation and final reports; meeting for coordination, at least once a year.

The whole project is divided into three phases. The implementation period for each is one year. The first stage contains steps 1 to 4 and will be implemented in the first year, the second stage contains step 5 and will be implemented in the second year, and the third phase contains steps 6 to 8 and will be implemented in the third year.

The time schedule for implementing the project is shown in Table 5.

(c) Estimated costs

The steps listed in Table 5 should be carried out in order to implement the proposed project. The cost of the project components is estimated at $2,400,000. The cost break down is shown in the Table 6.

Table 5
Project Time Table

Phase No.	Steps No.	Description of the activities	Time											
			Year 1				Year2				Year3			
			1	4	8	12	1	4	8	12	1	4	8	12
	1.	Selection of the location, determination of solar radiation & wind energy potential, and the water resource & quality												
	2.	Specifying & planning of the RO systems, calculation of needed energy												
1.	3.	Specifying & designing the power supply system based on the needed energy												
	4.	Coordination & design of the whole plant												
	4.	Site preparation												
	4.	Purchasing the system components												
2.	5.	Building up the plant & installation of the measuring systems for control & testing												

Phase No.	Steps No.	Description of the activities	Time											
			Year 1				Year2				Year3			
			1	4	8	12	1	4	8	12	1	4	8	12
	5.	Function test of the installed plant												
	6.	Data collection & evaluation concerning energy supply & water quality												
	7.	Optimization of the systems depending on the results of the evaluation												
3.	7.	Realization of the improvements concerning the optimization												
	8.	Documentation & final report												
	8.	Meeting for coordination												

Table 6
Cost Break - Down

No.	Item of cost	Estimated cost ($)		
		Y1	Y2	Y3
1.	Meteorological data collection and evaluation, determination of the potential of water resources and quality. Site selection, infrastructure and site preparation. Specifying, planning and designing the systems of the whole project.	600,000		
2.	Systems (RO system, power supply system, control and measuring systems purchase and installation) and training activities.		1,.300,000	
3.	Executing field tests, data collection and evaluation, systems optimization, realization of the improvements, documentation, final report, official meetings.			500,000
4.	Total		2,.400,000	

(d) Benefits

By treating and desalinating brackish and salty water using RO systems, to produce drinking water, a double profit is gained: on the one hand, the problem of brackish and salty water is solved, on the other, clean water can be supplied.

This has far-reaching positive effects. With the help of the desalinated water, remote areas which are not inhabited because of the shortage of drinking water, can be helped. Besides improving the supply of fresh water, the social and economic situation of the inhabitants in remote regions can also be improved. Another benefit of the project is that it utilizes renewable energy, which means minimal cost and no pollution.

The use of renewable energy for the purpose of water desalination is a novel project that presents interest to all sunny regions. Although the single components are not new, the combination of components (solar cells, wind energy converters, power conditioning units, batteries, pumps, etc.) sets high requirements on the know-how of electrical engineers.

The transfer of water desalination technology and the experience gained during the installation and operation of the plant can be used by other countries of the region with similar problems.

The concept of the project is not only to start a know-how transfer, but also to evaluate the project technical and economic feasibility.

(e) Environmental Impact and Ethical Considerations

Social Impact

If the project is carried out efficiently, the living conditions of the inhabitants of remote areas will be improved, drinking water will be made available, the time saved by the fact that drinking water was made available can be utilize for other activities, such as improving education and the income.

Environmental Impact

It has already been mentioned that water desalination has several positive environmental effects: use of renewable energies, sustainable management of natural resources and preservation of soil. Sustainable management will be approximated both in the energy sector and regarding the material benefits.

8. <u>Project Title: Regional Training Center in the Field of Renewable Energy</u>

(a) Background

Within the framework of the R&D project in the field of renewable energy technology, which was designed and implemented by the Renewable Energy Research Center (RERC) of the Royal Scientific Society (RSS), various solar and wind energy technology systems were installed in Tal Hassan station, 13 km north of Azraq. The scientific objective of the project was to test system components, system optimizing and system monitoring under fields conditions. After completion of the R&D activities, RSS intends to upgrade the station to a regional training center in the field of renewable energy technologies as the project integrates different solar and wind energy systems in a remote area which has ideal climate conditions for measuring, testing and evaluating solar energy systems. Such a centre is needed in view of the widespread use of the solar energy systems, particularly their multiple applications in Jordan and other countries of the region. This means that there is a great need for various training activities for decision makers, engineers, technicians and students who work in this field.

The United Nations Educational Scientific and Cultural Organization (UNESCO) approved the transformation of the center into as a regional training center on renewable energy in a cooperation agreement signed with the RSS.

(b) Objectives

The objectives of the project are as follows:

1. Building Arab capability in the field of renewable energy technology.
2. Studying the technical and economic feasibility of the systems in utilizing renewable energy sources.
3. Evaluating and developing these systems to generalize their use in the region.
4. Exchanging the experience and studies in the field of renewable energy between RSS and other institutions through the participants and lecturers in the training programmes.
5. Intensifying scientific and technological cooperation in this field between RSS and similar institutions.

(c) Present Tal Hassan Station

The RSS station at Tal Hassan has a 50,000m^2 area which has been cultivated and planted with different kinds of trees (fruit and forest trees) suited to the climate of the remote areas of Jordan. The station consists of the following systems:

1. Solar passive building designed to utilize developed materials' passive features and insulation materials.
2. Solar thermal system for hot water heating system with 60m^2 of locally made solar collectors.
3. Cooling system with 3 desert coolers.
4. Mechanical wind pumping system with a locally made windmill and two (55 m^3) water storage tanks to deliver an annual average of 40m3/day of water for drinking and irrigation purposes.
5. Stand-alone wind farm for water pumping and heating purposes. This system consists of two electrical wind energy converters, the rated power of each is 20kW.
6. Photovoltaic pumping system to deliver an annual average of 40m^3/day of water.
7. Photovoltaic power supply system to provide the necessary power of resistive and

inductive loads (220/380V AC) with a daily load of 43,78 kWh/day for electrification and power supply of different electrical equipment.

8. Electrical wind energy converter systems with a medium-scale down wind machine for generating electricity and water pumping with rated power of 10 KW

The station is also well equipped with measuring and monitoring devices and recorders.

(d) Project Requirements

The following additional equipment is requested to upgrade the Tal Hassan station to a regional training center in the field of renewable energy:

1. Small demonstration systems for training purposes, such as small solar home systems, small solar water pumping systems, small solar flat plate collectors systems, etc.
2. Additional measuring and calibration equipment.
3. 10 personal computers and software for simulation of system design, load, etc.
4. Electronic and mechanical workshop for small repairs.
5. A lecture hall furnished with the necessary facilities.

(e) Teachers' Curriculum

In principle, the teachers (lecturers, instructors) can be provided by the RSS, mainly by its RERC. For special lectures, teachers or experts might be invited from the countries of the region or even from Europe. The curriculum development will be worked out according to the target group requirements.

(f) Workplan

The implementation programme of this project consists of the following phases:

Phase 1: Determine the systems and their specifications, design the systems, tender documents, tender invitation, collect and evaluate the quotations and purchasing the systems.

Phase 2: Prepare the sites for the systems and build the lecture hall.

Phase 3: Ship and install the systems and execute the operational and functional test.

Phase 4: Prepare and develop the curriculum for the training courses.

The expected duration for the implementation of the entire project is 14 months, as shown in the following table:

Table 7
Project Time Table

Implementation phases	Time (Month)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Design system														
Prepare tender documents and tender invitation														
Collect and evaluate the quotations														
Purchase and ship systems														
Prepare sites														
Build the lecture hall														
Install, operate and test														
Develop curriculum														

(g) Estimated Costs

The estimated total cost for additional equipment needed by the project is $700,.000, as shown in the following table:

Table 8
Project Cost Estimated

Requirements	Cost ($)
Small demonstration systems	150,000
Measuring and calibration equipment	50,.000
Personal computers and software for simulation of systems design, load, etc.	100,000
Electronic and mechanical workshop for testing and repair	50,000
Building of lecture hall (15-20 persons)	80,000
Manpower	120,000
Pilot phase of training for one year	130,000
Development of curriculum	20,000
Total	*700,000*

9. Other projects

(a) **Expansion of distillation capacity**
Cost (Million $): 80-140

(b) **Sulphur recovery plant**
Cost (Million $): 5-10

(c) **Merox upgrade**
Cost (Million $): 1

(d) **Continuous catalytic informer**
Cost (Million $): 85

(e) **Hydro desulphurisation for diesel**
Cost (Million $): 50-60

(f) **Modern fluid catalytic cracker**
Cost (Million $): 200

(g) **Isomerisation unit**
Cost (Million $): 30

(h) **Alkylation unit**
Cost (Million $): 30

(i) **Hydrocracking**
Cost (Million $): 100

(j) **Gasification**
Cost (Million $): 225

ZIMBABWE

1. Enhancing capacity in present research institutions to provide information on climate change

2. Training and capacity building for climate change decision making in industry

3. Reviewing, updating and systematic dissemination of climate change data

4. Enhancing policy analysis capacity to enhance climate change activities

5. Curriculum development for climate change

6. Studies on energy efficiency improvements in small-scale industries and in the informal sector

7. Investigate systematic options for including solar energy in the Rural Electrification Master Plan

8. Alternative energy initiatives

9. Mitigation projects

1. Enhancing capacity in present research institutions to provide information on climate change

This project will provide technical and financial support to institutions, listed in the communication under the chapter on Research and Systematic Observations, to enable them to extend their present research programmes to include information relevant to climate change. For example, climate change studies in Zimbabwe have been rather weak in the area of vulnerability adaptation. Such studies are useful in assisting decision makers to make informed decisions in the face of climate change. Critical areas for such studies include population at risk, severity of impact, economic losses, and ecosystems damage, among others.

2. Training and capacity building for climate change decision making in industry

Present capacity building projects focus on awareness creation and building a national consultation mechanism on climate change. By and large, this has been reasonably achieved. This project will focus on decision-support capacity building among individual enterprises. Its objective is to enhance their ability to introduce the various climate change mitigation or emission reduction techniques, some of which are listed in the chapter on Programmes, Policies and Measures. It is acknowledged that mitigation options studied to-date are in a generic format which cannot be readily adopted by individual enterprises.

3. Reviewing, updating and systematic dissemination of climate change data

The present set of data needs to be continuously updated and disseminated in a systematic manner than presently experienced. This project will conduct such reviews and updates through broad-based national consultations, information packaging and user feedback mechanisms. This will build onto the national climate change Web site developed for Zimbabwe under the CC:INFO programme. If successful, this project should enhance internal climate change communications within the country – a must for successful implementation of any mitigation and adaptation options.

4. Enhancing policy analysis capacity to enhance climate change activities

Climate change concerns bring in a new shift in policy objectives and therefore, policy analysis. This project will conduct a series of training and consultations among various public sector institutions including sector and central planning ministries on new perspectives on policy making under climate change. One typical area to be included is energy pricing and related analysis and the use of incentives, standards and regulations as tools for achieving desired effects in climate change mitigation.

This will also include new perspectives on national disaster preparedness and long range strategic planning for the agricultural and other natural resource-based sectors.

5. Curriculum development for climate change

Present educational curricula, naturally, are not designed with the climate change paradigm in mind as this has not been the operational environment hitherto. The advent of climate change and the new socio-economic thrust that must emerge from demands of climate change requires that a systematic review of educational curricula be conducted to ensure that young citizens build climate change into their knowledge systems. This project will be an assessment of possible options for curricula improvement for the purpose of generating appropriate recommendations.

6. Studies on energy efficiency improvements in small-scale industries and in the informal sector

Zimbabwe expects a significant share of new employment and industrial expansion to come from the small-scale sector. This sector is expected to continue to grow. Traditionally, no formal policy or programmes have focused on this sector. The emphasis has been on formal and larger scale industries. This project will study the policy and practical needs of small-scale and informal sectors regarding energy efficiency and management. This will include equipment and appropriate technology choices, procurement options as well as general energy management technical support such as energy audits and staff orientation.

7. Investigate systematic options for including solar energy in the Rural Electrification Master Plan

Zimbabwe has just completed drafting its Rural Electrification Master Plan with the support of the African Development Bank. It is also currently concluding the GEF photo-voltaic project on the dissemination of solar PV devices in low income rural households. From these two experiences, it has been learnt that rural electrification can make intermediate use of solar PVs in areas where the grid is too expensive as an electrical energy delivery mode. It is not clear, however, how the incorporation of PVs could be successfully introduced. Assessments will be conducted taking into account experiences of the GEF PV project and the thrust of the Master Plan.

8. Alternative energy initiatives

Zimbabwe intends to further develop current initiatives in alternative energy development in the following appropriate technologies: improved woodstoves; low mass stoves; coal stoves and biogas digesters.

9. Mitigation projects

The majority of mitigation options are in the energy sector. Projects for emissions reduction will therefore focus on implementing recommendations listed in the chapter on Programmes, Polices and Measures. The incremental cost and emission reduction potential of these projects are fully documented in the two climate change mitigation studies carried out with the support of UNEP and the US Country Studies Programme. In addition to the national options, regional response options in the power sector are being studied under a programme supported by GTZ. Results from the first phase of these studies which focused on producing an inventory of emissions from the SADC power sector are provided in the report "Zimbabwe's Ooptions for Greenhouse Gas Mitigation Under Power Pooling in Southern Africa". In addition, the following projects will also be conducted.

(a) Investing in demand side management in the electricity sector. This would include auxiliary consumption and reducing losses in transmission

(b) Investment in small-scale hydroelectricity power stations to supply rural and peri-urban consumer

(c) Install solar mini-grid utilities to serve rural centres not connected to the grid

(d) Accelerated promotion of biogas technology in rural low income household

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