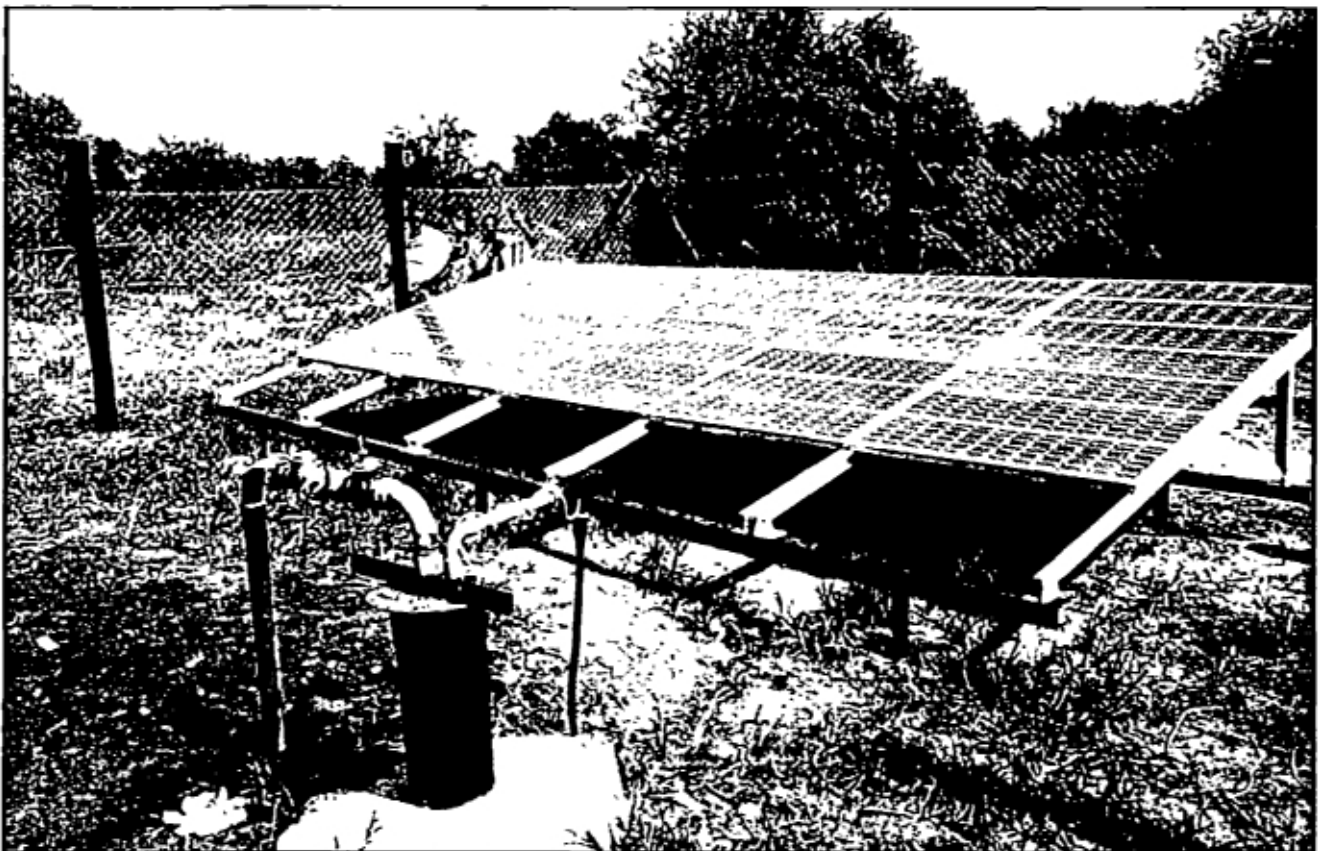


# WATER and ENGINEERING

Technical Supply Bulletin No. 10



Solar Energy Systems for Rural and Emergency Applications

163-13301

UNICEF  
7 Avenue Louise  
1200 Brussels  
BELGIUM

# What is Photovoltaics?

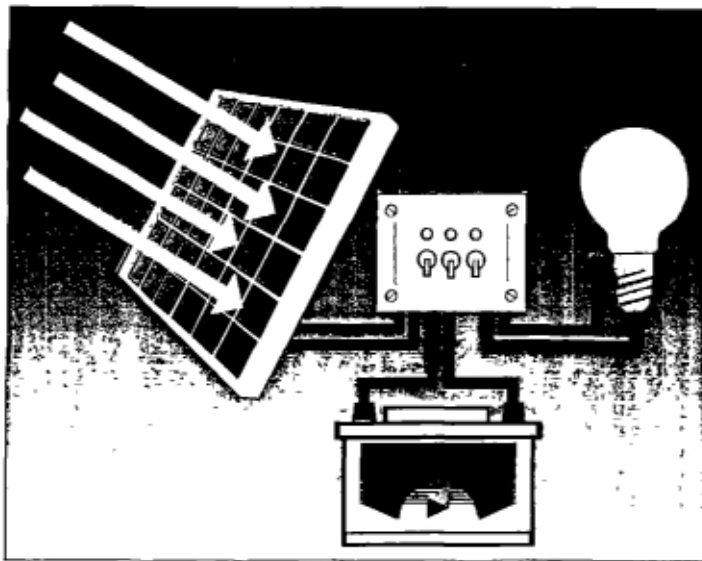
*Photovoltaics is a technology that can convert light directly into electricity.*

When light falls upon the active surface of a Silicon Solar Cell, the electrons in the solar cell become energised, in proportion to the intensity and spectral distribution of the light. When their energy level exceeds a certain point a potential difference, or open circuit voltage is established between the cells. This is then capable of driving a current through an external load.

Solar cells are interconnected in series and in parallel to achieve the desired operating voltage and current. They are then assembled to form a solar electric module. These modules form the basic building of a solar array. Solar electric modules may be connected in series and parallel to achieve the required solar array characteristics.

With no moving parts and all delicate surfaces protected, the solar electric modules can be expected to provide power for more than 20 years.

The term "system" is used to describe the complete set of equipment used in converting solar energy to the final requirement, e.g. light, pumped water or refrigeration. Solar electric systems are normally used as stand alone systems to provide a power supply independent of any grid.



A stand alone system can normally be divided into three main parts.

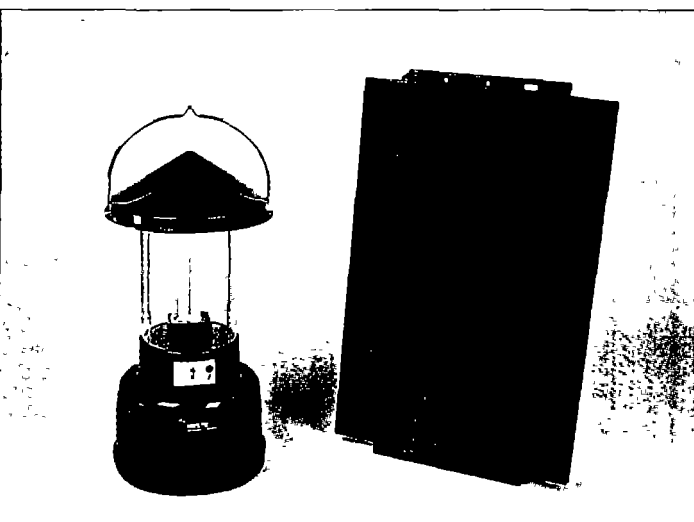
1. The solar electric modules and array with supporting structure, which converts solar energy to DC electricity.
2. The Power conditioning equipment which includes
  - cables
  - charge controller which controls and protects both the battery and the load
  - batteries which are used for energy storage
  - inverters which convert the DC electricity to AC electricity
3. Load and end use equipment.

The products described are based on both field experiences and resulting technical innovations in providing dependable and reliable power in remote locations throughout the world.

## **Equipment available for emergency delivery:**

30 complete Power Packs each inclusive 4 solar modules  
 5 complete Solar Powered Vaccine Fridge systems  
 20 units Magic Lantern  
 1 complete Water pump inclusive 32 solar modules

*The equipment will be delivered to the nearest international airport within 24 hours after order  
 (All batteries are approved for air shipment as non dangerous and non spillable)*



## **Portable lantern**

The Magic Lantern is a rechargeable portable lantern designed for regular and sustained use every night. The lantern will give 6 hours of light (low setting) per night from a sunny day's charge and 3 hours of light on high level setting.

The system is delivered complete inclusive a 6 Watt solar electrical module, a lantern and a spare 7 Watt fluorescent PL-tube, battery integrated

*Packing dimentions. 540 x 343 x 245 mm 8.3 kg  
 Delivered from stock, within 1 week  
 Typical price USD 120,- per unit*

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## Solar Power Kit

The Solar Power Kit is an expandable 12 Volt solar electrical system for DC lights, consumer fridge, small water pumps, laptop computers, VHF radio and a TV/Radio-cassette player. The basic kit contains 1 solar module 53 W, controller, 4 spot lights, 2 halogen lamps, all mounting equipment needed.

The system can be supplied with 2 parallel mounted 120 Ah dry charged batteries nominal capacity 240 Ah, or delivered without battery for air shipment.

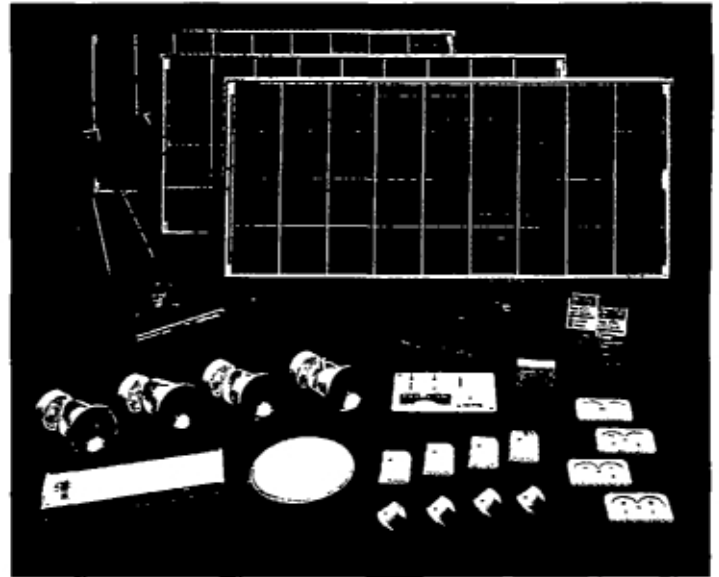
A 3-module system produces anywhere on a clear sunny day up to 55 Ah per day.

### Packing dimensions

Complete 3 module system and 2 batteries 105 kg, 0,50 m<sup>3</sup>

Typical price for 3 module system inclusive battery USD 1 960,-

Delivery from stock



## Refrigerators and Freezers

Because of the depletion of the ozone layer of the atmosphere, the parties to the Montreal protocol have agreed to phase out the use of CFCs and HCFCs (chlorofluorocarbons and hydrochlorofluorocarbons). WHO/EPI and UNICEF is committed to the implementation of the Montreal protocol, and from January 1996 refrigeration equipment supplied to the EPI by manufacturers in the industrialized countries must conform to currently acceptable CFC-free standards.

## Solar Refrigerators for Vaccine Storage

Camel Fridge CFS49IS, for vaccine storage and ice-pack freezing. Meets the WHO/ UNICEF standard E3/RF.4. Delivered as a complete system with 4 solar electric modules each 53 Wp, structure, cabling, table, tools, vaccine boxes, ice-packs and a stainless steel 12 volt refrigerator with LED temperature display and alarm functions. Supplied with either a stationary or transportable power pack included valve-regulated (sealed) or vented lead acid batteries. The Power Pack features an integral controller with quick-fit cables and connectors.

The refrigerator is completely CFC free.

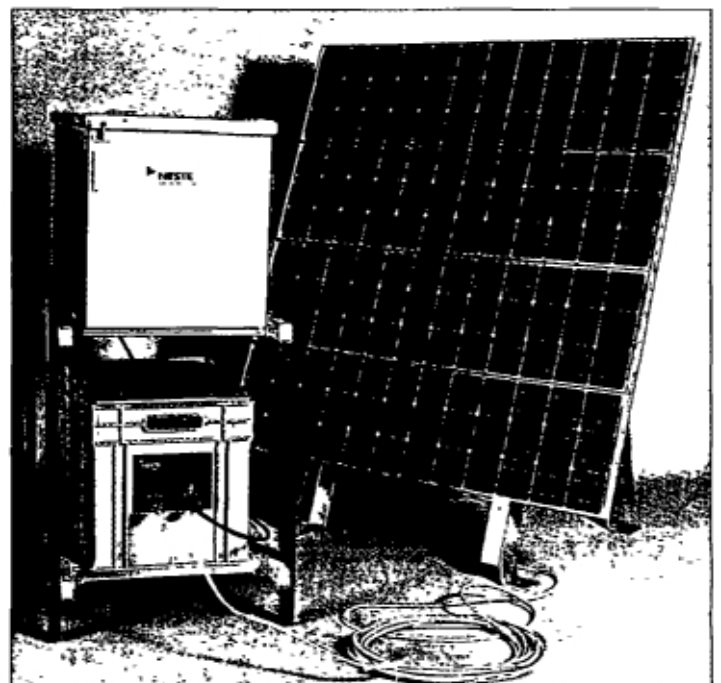
Gross internal volume	58 litre
Net vaccine storage volume	38 litre
Net ice-pack freezing capacity	4 ice-packs of 0.6 litre in 16 hours.
Ice-pack storage capacity	5 frozen ice packs of 0.6 litre
Power consumption	44 Ah per 24 hour at ambient temperature 32 °C and ice-pack freezing

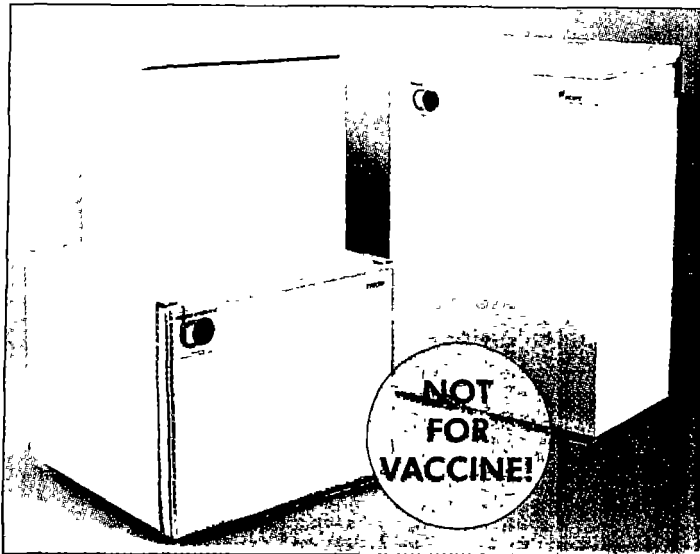
Shipping data as a stationary system Weight 300 kg  
Volume. 2,8 m<sup>3</sup> inclusive 2 x 150 Ah batteries

Approx 30 systems can be packed in a 20 feet container  
Delivery time. Quantity less than 30 systems normally stored for emergency operations (24 h)

Larger quantities normally 12 weeks

Typical price for a 4-module system USD 4 500,- per system





Low energy consuming CFC free refrigerators and freezers for 12 VDC.

## Domestic Refrigerators

Refrigerator, model Sun Cooler, 60 litre with top opening. Delivered with thermostat and wire basket. Typical power consumption 8,5 Ah/day at 25 °C. Powered by a 2 module Power Kit with 2 batteries 12 V, 220 Ah total power.

Volume 1.13 m<sup>3</sup>  
 Delivery time. Normally from stock  
 Typical price USD 2350,- per complete unit

## Domestic Freezers

Freezer, model F60H, 60 litre, with top opening. Delivered with thermostat and wire basket. Typical power consumption 45 Ah/day at 25 °C. Powered by 2 module Power Kit with 2 batteries 12 V 220 Ah total power.

Volume 1.13 m<sup>3</sup>  
 Delivery time 2 weeks  
 Typical price USD 2350,- per complete unit

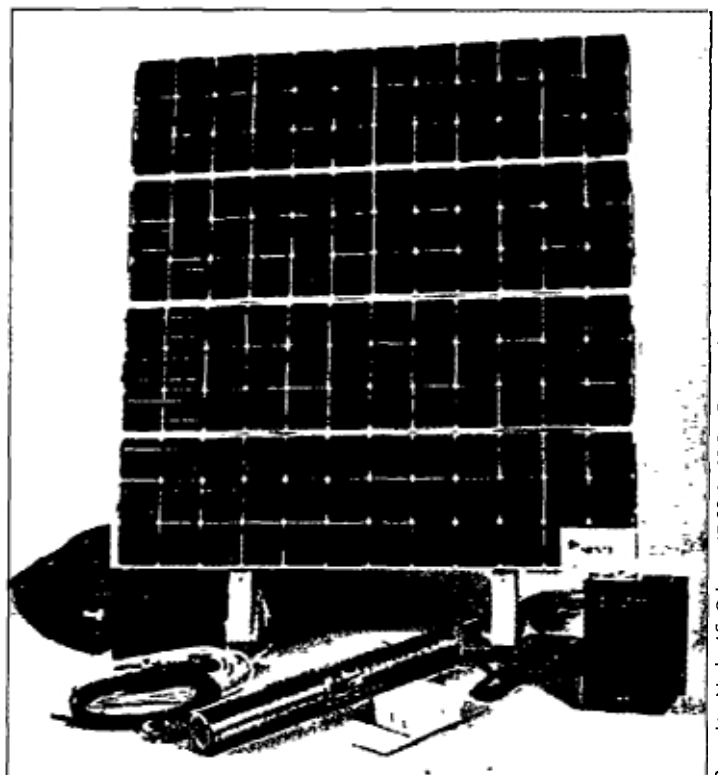
## Solar Powered Water Pumps

The needs of solar electrical modules and pump model is depending on location, static head and required water volume per day. All pumps are delivered complete with solar electrical modules, mounting structure, submersible pump with AC motor, inverter and all cable and accessories needed. A typical submersible pump for static head of 30 m and a daily pumping water volume of 30 m<sup>3</sup> consist of 32 solar modules each 50 Watt and pumping model SP3A-10.

Packing dimensions 465 kg 2,7 m<sup>3</sup>  
 Delivery time Smaller quantity (1-3 systems) normally from stock, 1 week  
 Larger quantity 4 weeks  
 Typical price. USD 14.500,- per system

A typical submersible pump for a static head of 15 m and a daily pumping water volume of 4 m<sup>3</sup> consist of 4 solar modules of each 50 Watt and pumping model SP 1 A-6/60 VDC Solar.

Packing dimensions 75 kg 0,7 m<sup>3</sup>  
 Delivery time Normally 4 weeks  
 Typical price USD 900,- per system



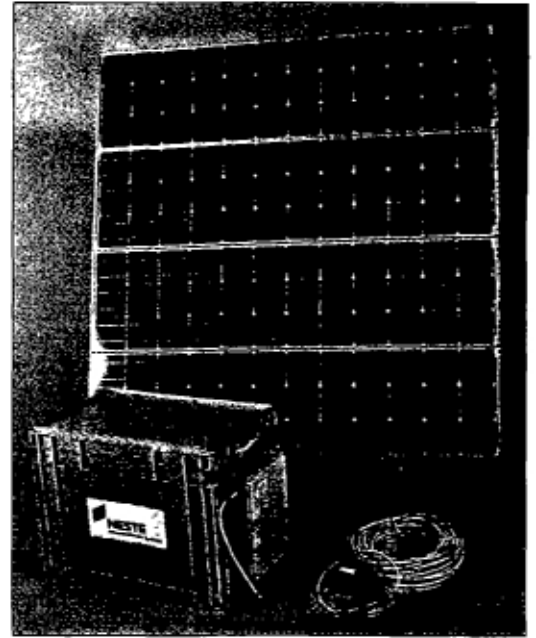
All SP pumping models can be equipped with a float for pumping from lakes, rivers and the like.

## Power Packs

Power Packs may be used to operate a variety of 12 or 24 Volt appliances and are specially suited for portable satellite systems, VHF radios, lighting systems, medical equipment and many other DC and AC power supply applications.

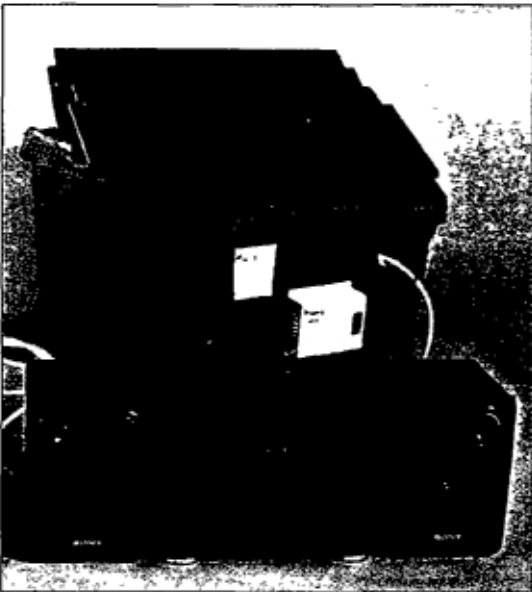
Supplied as a complete system with 2 or 4 solar modules of each 53 Watt, mounting structure, 2 x 100 Ah vent-regulated lead acid battery, integral charge controller with temp. compensation and external digital multimeter. Max. load 45 Amp 12 or 24 Volt.

*Dimensions.* 0.65 m<sup>3</sup>. Packed in strong plywood crate. Weight 173 kg  
*Delivery time* 30 systems stored for emergency operations  
*Typical price* 4 module system USD 3200,- per complete unit



## Audio EduKit

The AudioEduKit is a specially designed solar powered radio-cassette system for distance educational programmes.



All the system components fit into a robust box for safe transport, including the necessary cables fitted with plugs for safe and easy installation.

The radio-cassette player is equipped with 2 loud speakers which cover the listening range of 100 people. The system is designed for operation up to 10 hours per day at 100% volume. The radio has a tuner frequency specially for remote areas and developing countries (FM, MW, SW1 and SW2).

The standard unit is equipped with 2 solar modules of 6 Watt each, cassette player with mix, microphone input jack. Sealed lead acid battery 12 Volt, 24 Ah, NPBR controller centre.

*Dimensions* H x L x W 594 x 396 x 315 Weight 21 kg  
*Delivery time* Quantity less than 500 systems normally from stock  
Larger quantity 12 - 16 weeks.  
*Typical price* USD 400,- per system for smaller quantity

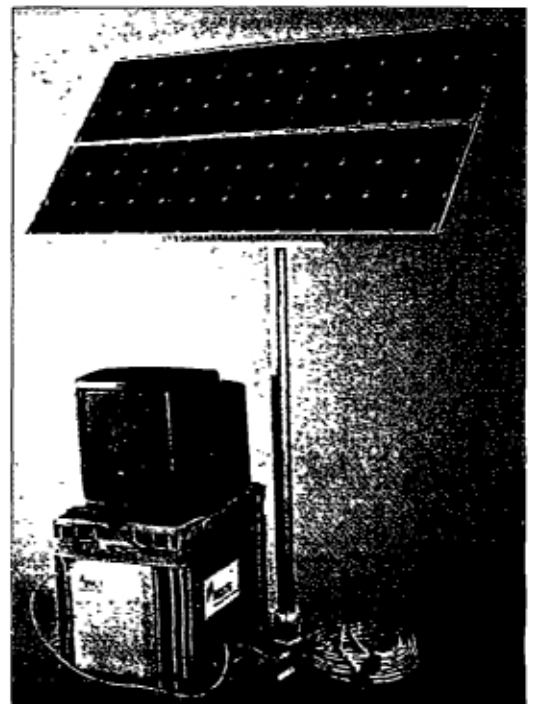
## TV/Video EduKit

The TV/Video EduKit is a specially designed solar powered TV/Video system. It consists of a Power Pack with 2 or 3 solar modules each 53 Wp, mounting pole, a 14 inch TV with a VHS Video player integrated, a 12 VDC/ 220 VAC inverter, a 100 Ah valve regulated (sealed) battery and all necessary cables fitted with plugs for easy and safe installation.

A 2 solar module system will operate the TV/Video up to 4 hours every day.

All equipment packed in a strong transport box.

*Packing dimensions* 200 kg, 0.65 m<sup>3</sup>  
*Delivery time* Normally 4 weeks  
*Typical price* 2 module system USD 3 530,-



**What you need to know to order  
"Solar Powered Products":**

The 2 following products can be ordered from the UNICEF warehouse in Copenhagen

**5045100 (UNICEF No.) Solar Lantern**

A hand held fluorescent tube lantern, with solar rechargeable battery, providing 3-4 hours of light per charge. Robust construction able to withstand tough handling in field conditions. Fully all weatherproof, shockproof, resistant to UV light and water resistant to BS5490. Comes with 8 watt fluorescent tube, giving the equivalent output of a 40W bulb. Rechargeable nickel cadmium battery, fully charged from a single sunny day's charge.

~ \$ US 450

average stocking level: 20 items

**1898000 Solar Power Pack, 12 Volt**

consisting of two batteries connected in parallel, 12 Volt 100 Ah each, with four solar modules (M-55) on a support structure, complete with all connections including an integrated voltage controller regulator, cable and sockets for immediate use.

~ \$ US 3,980

average stocking level: 4 items

**Delivery times: All products can be shipped within less than a week.**

If it is urgent, do not hesitate to get in contact with:



Gunnar Hansson

Tel.: (+45) 35 27 30 14

Telefax: (+45) 35 26 94 21

**e-mail address**

**ghansson@unicef.dk**

**Mailing List Request:** Please add my name and address to the mailing list

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3. [Organisation:] .....
4. [Address:] .....
5. [Zip Code, City:] .....
6. [Country:] .....

Please send photos, illustrations for future covers.

The best and most economic way to contact us is - by sending a telefax with a short description of your problem. This can save money and helps us to organize our work load.

- contact the procurement group directly via telephone. If you do not have the direct extension numbers, please ask for bulletin No. 7, which includes a personal profile of all procurement people in the water and sanitation section.

- try the e-mail address.

Whenever problems occur - concerning **water and sanitation**, or in a wider sense **engineering** - you should not hesitate to contact us. Our aim is to provide you with the best service and technical assistance available.

By the way, you can still order editions from previous years (only English):

- No. 0 AQUA PLUS GUIDE LIST, 1988
- No. 1 HYDRAULIC FRACTURING, HOW IT WORKS AND WHERE TO USE IT
- No. 2 IMPROVED EQUIPMENT FOR RESISTIVITY MEASURING
- No. 3 NEW LUBRICATION FOR DOWN THE HOLE HAMMER DRILLING
- No. 4 STEP DRAW-DOWN PUMPING TEST
- No. 5 TEST PUMP UNITS
- No. 6 MONDESH COUPLERS
- No. 7 PERSONAL PROFILE - PROCUREMENT WAT/SAN
- No. 8 WATER-PURIFICATION-UNIT (French and Spanish translation available)
- No. 9 WAREHOUSE EQUIPMENT GUIDE
- No. 10 SOLAR TECHNOLOGY

