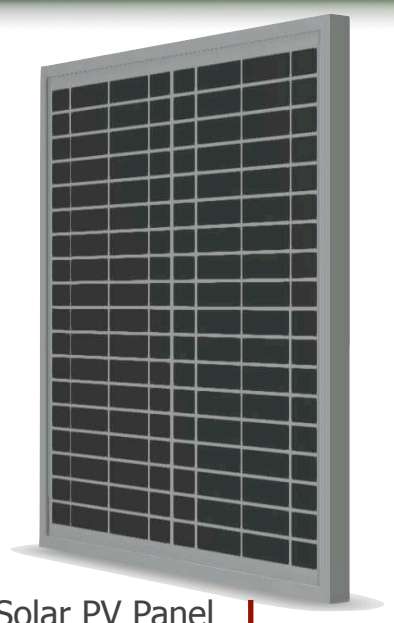
# SHS/UPS “EGAO”

2018/9/30

PEAR CARBON OFFSET



Solar PV Panel


TV

or

LED Lights





USB Appliances
(e.g. mobile phone)



Mobile Battery with Torch



Controller
w/ battery



Radio

Fan

AC
Appliances

Grid

*Flow of Electricity*

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**Motivation of Developing “EGAO”**

The services provided by electricity is necessary for development. Especially, for early stage, lighting and education play key roles to meet basic human needs for SDGs.

Moreover, not only lighting and mobile phone charging, but also other services, e.g., TV, are needed for growing desire for better life, as well as with higher quality of power supply.

Electric power can enhance the opportunities of people dramatically. A recent survey report (GOGLA 2018, “Powering Opportunity: The Economic Impact of Off-Grid Solar”) shows that the explicit monthly economic profits is around USD 35, in average, for the households who enjoyed business activities thanks to the SHS, in addition to implicit benefits of cost saving of kerosene and mobile phone charging, and much better quality of life, such as more light, education, TV, radio, health, safety, etc.

We believe that highly efficient and reliable Japanese technologies should contribute to the situation with limited energy sources. “EGAO” family is an answer.

EGAO has its unique feature as an SHS (solar home system) which can drive TV (19″) and a variety of AC-based appliances (< 200W) in the market. It is made ready for PAYGo (pay-as-you-go) payment scheme for AC-usage. It is best suitable for on- but unstable grid areas because it has a UPS (uninterruptible power supply system) function.

We believe that people’s motivation for electricity in the coming few years is driven by a strong desire for entertainment, e.g., watching football games by TV. Flexibility to use a variety of AC-based appliances could attract peoples’ needs, in off-grid area.

In addition, another huge market is found for power supply backup system to avoid frustrating power outage time by complete UPS function; compatible with both AC input and output (i.e., no need to use expensive and non-diversified DC appliances).

The followings list up several characteristics which make EGAO different from others, especially **for distributors**.

“**EGAO**” implies “**smile**” in Japanese representing our eager to make people happy.

“**PEAR**” stands for “Partnership for Environmental Action with Responsibility”.

## Characteristics of "EGAO" Family

TV (19"; Color LCD) to attract people's hidden but very strong desire for entertainment and news.

Dual inputs including Solar PV panel and AC. The latter can solve the problem of frustration during the outage time for on-grid people as a backup power supply with complete UPS (Uninterruptible Power Supply) functionality (in this case, solar PV panel is not needed).

Dual outputs [DC 12V x 3; DC 5V(USB) x 2; AC 120/240V x 1].

"EGAO" model with TV is a good choice for conventional SHS users to extend or replace it.

"EGAO" model is made up of many up-to-date Japanese reliable and efficient technologies.

"EGAO" is a one-set Plug-and-Play type SHS, and allows the distributor to avoid cumbersome inventory control of many parts of SHS to be assembled on site by skillful technicians (in Bangladesh).

Two mobile Li-Ion batteries (2,500Ah each) with LED torches are in the set for outdoor and indoor use.

EGAO can install Pay-As-You-Go (PAYGo) allowing the distributer to control on/off of the AC output following the user's installment payment by sending the activation code (w/ expiration period) by SMS.

Original Design Manufacturing (ODM) can be applicable for the distributor to sell the product with its brand, color and logo.


**Controller with Li-Ion Battery**

## Promising Users

### Off-grid areas

- SHS users, well aware of the benefits of SHS, for extension or upgrading to watch TV and enjoy other AC appliances.
- Pico-solar users with similar desire as above.
- Non-solar product users who has several mobile phones.
- Non-solar product users having desire for better quality of life and can pay the down payment.
- Non-SHS users who want to initiate new business or extend his/her current business (a report says USD 30–50/month).
- Off-grid shop owners wishing to extend the business hours and/or to utilize the TV as a sales device to attract people.

### On- (but unstable) grid areas

- Users frustrating the unreliability of the grid power supply.
- Users requiring higher quality power without outage and stable voltage (e.g., desktop PC users).
- Users cannot access to the grid due to high connection fee.

PAYGo (Pay-As-You-Go) functionality (by activation code) is installed for the users to pay at regular interval, e.g., USD 20 per month (a survey report shows that there is a threshold of willingness-to-pay at around USD 30 for down payment).

## Typical Models of "EGAO" Family [1]

| | EGAO OFF-TV-X | EGAO OFF-TV-L | EGAO OFF-S | EGAO ON-TV-X | EGAO ON-TV-L | EGAO ON-S |
|---|---|---|---|---|---|---|
| | Off-grid models | | | On-grid models | | |
| **TV** | 19" | 19" | – | 19" | 19" | – |
| **PV (solar) panel** | 40 $W_p$ | 20 $W_p$ | 10 $W_p$ | – | – | – |
| **Li-Ion battery (Controller)** | 146 Wh | 73 Wh | 73 Wh | 146 Wh | 73 Wh | 73 Wh |
| **LED room light (Tube or Bulb)** | 300 lumen x 3 | 300 lumen x 2 | 300 lumen x 2 | 300 lumen x 3 | 300 lumen x 2 | 300 lumen x 2 |
| **Mobile battery (2,500Ah) with Torch** | 2 | 2 | 1 | 2 | 2 | 2 |
| **DC 12V output / USB-A output** | 3 / 2 (USB) | 3 / 2 (USB) | 3 / 2 (USB) | 3 / 2 (USB) | 3 / 2 (USB) | 3 / 2 (USB) |
| **AC input** | Yes | Yes | Yes | Yes | Yes | Yes |
| **AC Output [2]** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Cables** | 8m (PV) + 3m x 4 | 8m (PV) + 3m x 2 | 8m (PV) + 3m x 2 | 3m x 4 | 3m x 2 | 3m x 2 |
| **Pay-As-You-Go availability** | Yes | Yes | Yes | Yes | Yes | Yes |

[1] *The distributor can choose any configuration of the components* (with MOQ 500), incl., other AC appliances, such as radio, fan, satellite TV, etc.
[2] The users can use plural AC appliances, once they use a power strip, while the maximum should be less than 200W.

## Specifications at a Grance

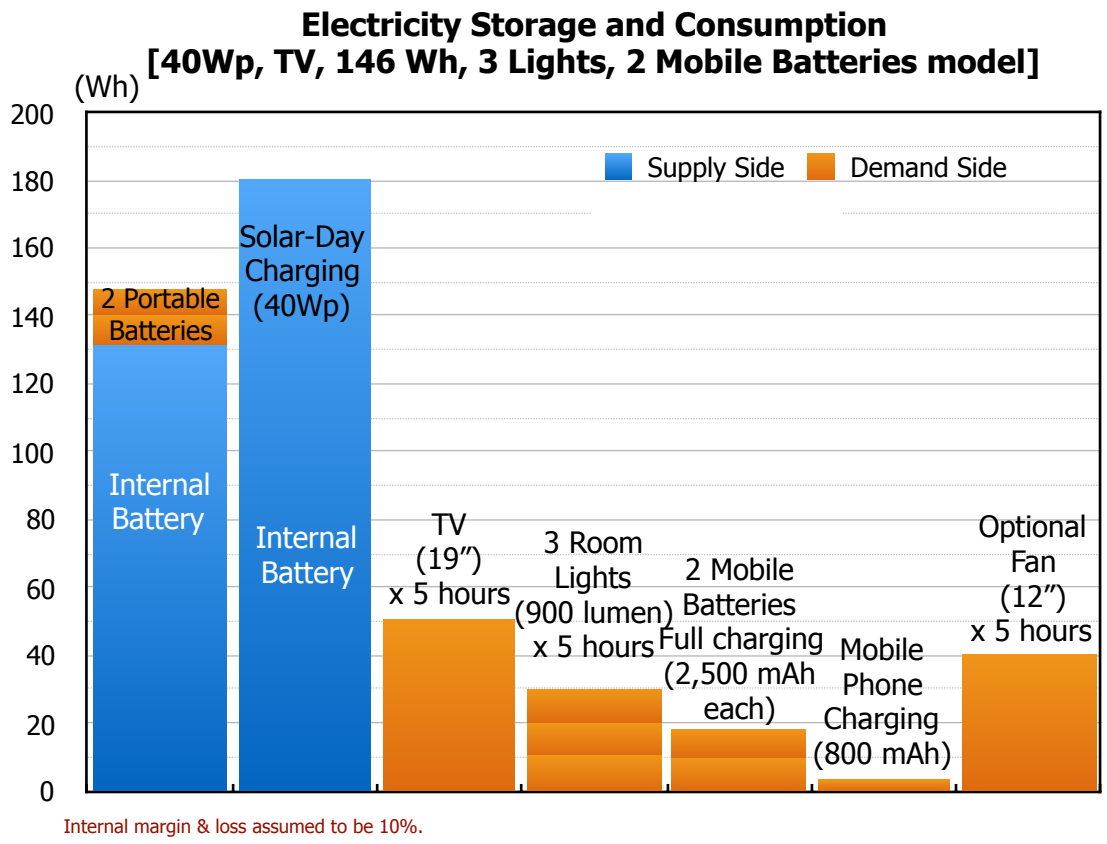
| Appliance | Description | Included/Option | Quantity | Spec | Supplemental Info |
|---|---|---|---|---|---|
| **PV Panel** | Polycrystal silicon PV panel<br>$10W_p$, $20W_p$, $40W_p$ | Included | 1 | For $10W_p$, $V_{mp}$: 17.8V, $V_{oc}$: 21.5V<br>$I_{mp}$: 0.56A, $I_{sc}$: 0.61A<br>Application class: A (IEC/EN61730) | Cable connected at factory in order to avoid local engineering. |
| **Controller** | Li-Ion battery and controlling circuits packaged with dual inputs (PV or AC) for charging and dual outputs for devices ($12V_{DC}$ and $5V_{DC}$ (USB)) (AC: max 200W) [11cm x 11cm x 22cm; 1.5kg] | Included | 1 | **Li-Ion battery**: 73Wh or 146Wh (rated capacity).<br>**Input** charging source: PV and AC (AC for Plug-and-Play type).<br>**Output**: $12V_{DC}$ (4A) x 3 and $5V_{DC}$ (USB, 2A) x 2; AC (multi-country type) x 1.<br>**PAYGo** functionality (activation code type; 10-key with number display and status indicator).<br>5 battery status indicators are included. | Several protection elements are included against irregular use.<br>Dual Inputs and dual outputs (DC and AC).<br>UPS outage reaction time: 4 msec. AC output is modified pure sine wave.<br>USB (2A) for quick charging. |
| **LED Room Light** | Tube-type or bulb-type LED lights with 300 lumen each connected to $12V_{DC}$. | Included | 3 or 2 | Luminosity: 300 lumen each (outside of the cover). Load: 2W each for both tube and bulb-type. | Chip level: 330 lumen. Transmittance of polycarbonate is 90%. |
| **Portable Battery with Torch** | Portable Li-Ion battery with USB output (5V, 1A) and LED torch (20 lumen) [2.5cm x 2.5cm x 12cm; 86g] | Included | 2 (or 1) | Rated capacity of the battery: 2,500 mAh (9.2Wh) (equivalent to full charge of typical smart phone). | USB-A – Micro-USB cable (30cm) attached.<br>Suitable for charging mobile phones, etc. |
| **Cables** | 8m: PV panel to controller.<br>3m: Controller to each LED light. | Included | 1 (8m)<br>2 or 3 (3m) | Switch is attached to each cable from controller to LED light. | Extra cables are provided locally. |
| **TV** | 19” color LCD TV (AC) | Included (or optional) | 1 (or 0) | Load: 10W. LCD TV with universal tuner for terrestrial broadcasting. | Antenna not included.<br>Satellite TV (AC) optional. |
| **Mount** | Mount/fixture is used to fix the PV panel correctly on the roof-top or another suitable place. | (provided locally) | 1 | Dependent on local situation. | Suitable angle and how to fix the panel is shown in the technical manual. |

| Component | Warranty |
|---|---|
| **Whole System and each component (except for PV panel)** | 3 years |
| **PV Panel** | 25 years for PV panel itself; 3 years for cable and connector |

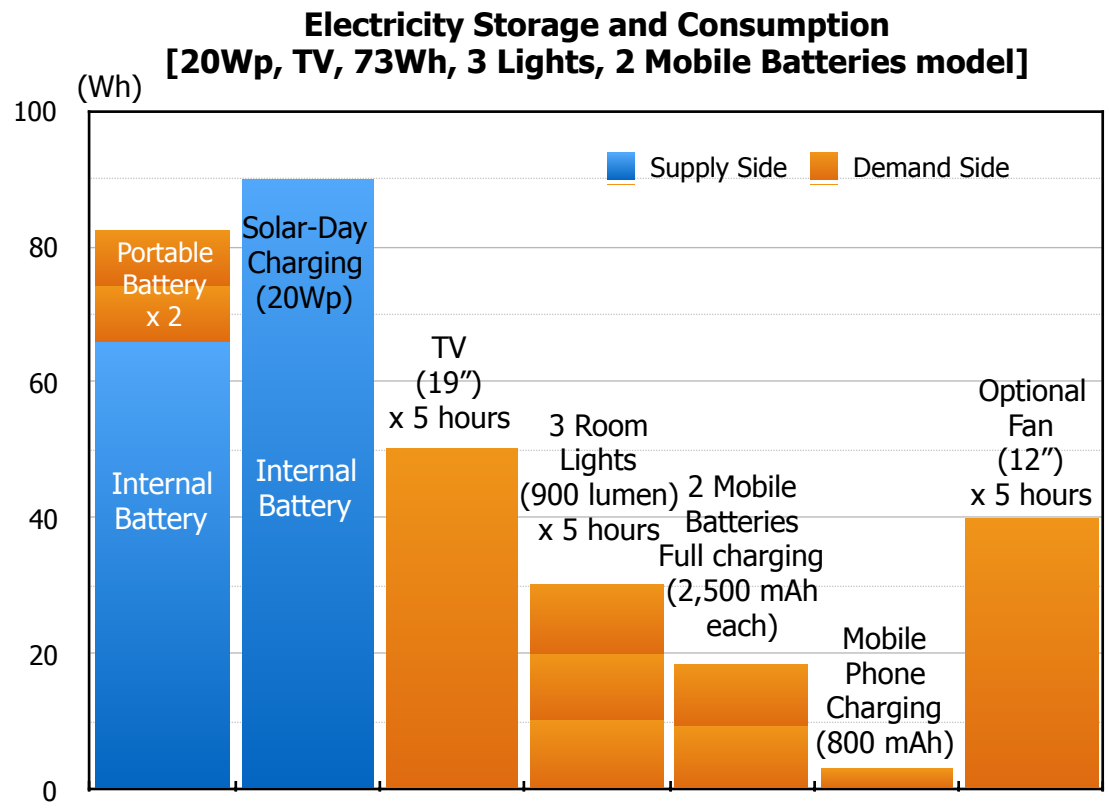
## High Quality Characteristics and Protections

| Items | Key points | Explanations |
|---|---|---|
| **Power supply for basic needs** | 3 or 2 bright LED in-house lights (300 lumen each) with 2 portable torches (with a mobile battery each). | Several bright LED lights are prepared for divergent demand, e.g., for outside and educational uses.<br>The battery can be used for charging mobile phones, … |
| **Highly efficient LED** | LED chip efficiency: 160 lumen/W<br>LED light efficiency: 140 lumen/W (dep. on opaqueness) | LED light is around a twice more efficient than CFL and around 10 times more efficient than incandescent lamp. |
| **Huge and reliable rechargeable Li-Ion battery** | 146 or 73 Wh cylinder type Li-Ion battery and 2 x 2,500 mAh (9.2Wh) portable Li-Ion battery (rated capacity).<br>The former has cell-balancing circuit in it to assure the lifetime of 3 years or more and to avoid explosion with other safety measures. | Rated capacity: 146 or 73 Wh (12V) and 2 x 9.25 Wh (5V). The capacity is almost equivalent to twice of that of latest Notebook Computer (for 146 Wh). The cell balancing circuit can make the lifetime longer. In reality, the battery can be used over 5 years in most cases. |
| **Protections** | AC<br>• Over voltage protection (4.2V for battery)<br>• Low voltage protection (2.75V for battery, recover at 3V)<br>• Over temperature protection (Inverter cooling >65℃; lock-up until temp. decreases below the threshold)<br>• Over load protection (200W for effective value (400W for peak); lock-up until disconnected)<br>• Output short circuit protection (Lock-up until disconnected)<br>• During protection, AC power switch should be turned off, open again, DC output will be opened when the switch is turned on again.<br>DC<br>• USB over current protection (2.6A) for 5V with auto recovery<br>• Over current protection (4A) for 12V with auto recovery<br>• Over charge protection<br>• Over discharge protection<br>When connected AC-In, charging and DC circuits work.<br>Several designs to avoid misuse, misconnection and on-site skillful engineering. | Many designated protections with circuit design with specific chips, etc. are introduced by using Japanese technologies. |
| **Affordability** | One of the most affordable models of this kind, dependent on the quantity and other conditions. | The distributor (w/ MFI) is expected to provide loan to end users by using PAYG function. |

Designed and made in Japan, ensuring Japanese quality.




Internal margin & loss assumed to be 10%.

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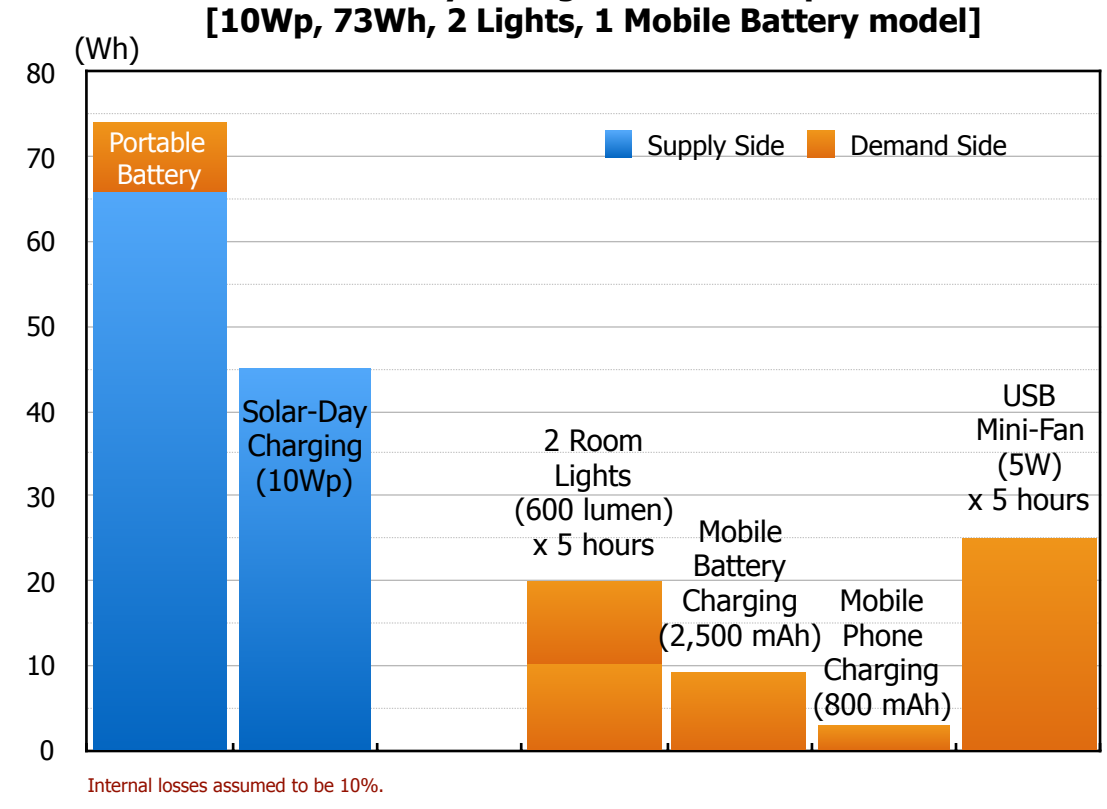


Internal losses assumed to be 10%.

The graphs shows that the "blue" bars shows supply side and "orange" bars shows demand side of the electricity.
Please note the scale of the vertical axes are different.

Left bar of the "Internal Battery" shows the capacity of the stored electricity of the Li-Ion battery in the Controller, if fully charged.

Right bar of the "Internal Battery" shows the generated electricity by the solar PV panel to be stored in the internal battery in a day under some 'standardized' condition (see below). It is noted that this bar can be longer than left bar because charging can be done simultaneously to the use of devices (like TV).

The "electricity" is energy specified by the unit of Watt-hour (Wh).
The solar PV panel generates electricity proportional to its rated capacity shown with the unit of $W_p$ (Watt-peak).

"EGAO" has a generation capacity of $10W_p$, $20W_p$ or $40W_p$. Taking internal losses conservatively into account, EGAO system generates

- 45Wh for $10W_p$
- 90Wh for $20W_p$
- 180Wh for $40W_p$

in a 'standard' solar-day.
It is noted that the 'real sunny day' in developing countries may generate more electricity than the standardized 'solar day'.

For the on-grid areas, solar PV panel is not needed since the battery can be charged through AC during non-outage time.
(Please ignore 'Solar-Day Charging' in the graphs in this case).

On the other hand, the internal Li-Ion battery can store 146 or 73Wh (rated capacity) of electric energy (not power).

Using stored electricity, devices/appliances can be used. For example,

- TV (19") requires 50Wh for 5h watching,
- 2 x 2W LED room light consumes 20Wh during one night (5h).
- One mobile battery (2,500 mAh) requires 9Wh for full charging,
- typical mobile phone (800 mAh) requires 3Wh for full charging, and
- 5W appliance, such as mini-fan, consumes 30Wh (6h usage).

It is noted that electricity cannot be generated fully in cloudy and rainy days.