

Teardown Report

Nokero Solar Light

Overview:

Handheld solar powered LED light that can recharge a single NiMH AA battery for up to 2 years.



Nokero Crestone N200 Solar Light Bulb

Zebulon
Solutions, LLC



- Product: Solar charged light bulb
- Manufacturer: Nokero
- Purchase price: \$15.00
- Country of origin: USA
- Key specifications:
 - Approximate dimensions: 73mm dia x 55mm tall excluding handle
 - Swivel handle for propping or hanging accordingly
 - One 1000 mA-hr NiMH AA rechargeable battery
 - Four 11mm x 22.5mm solar cells
 - Four wide angle LED lights
 - Three light switch settings: off, dim and bright
 - Bright light setting automatically switches off to save charge
 - Rainproof
 - Portable
- Notes
 - “Nokero” is short for *no kerosene* — this light is designed for 3rd world applications as a replacement to kerosene lighting

Why a Zebulon Solutions' Teardown?

- General
 - Understand key sub-systems of existing design
 - Understand supply chain considerations
 - Understand manufacturing process
 - Understand potential design pitfalls
- Specific to the Nokero Crestone N200
 - Understand assembly of the light bulb
 - Itemize components in the assembly
- Disclaimer
 - All information contained herein is based on estimates made without access to any design documentation or proprietary information
 - These estimates may or may not accurate
 - No warranty is provided or implied

High Level View



Light assembly w/hanger



Top (showing four solar cells)

Nokero Crestone N200

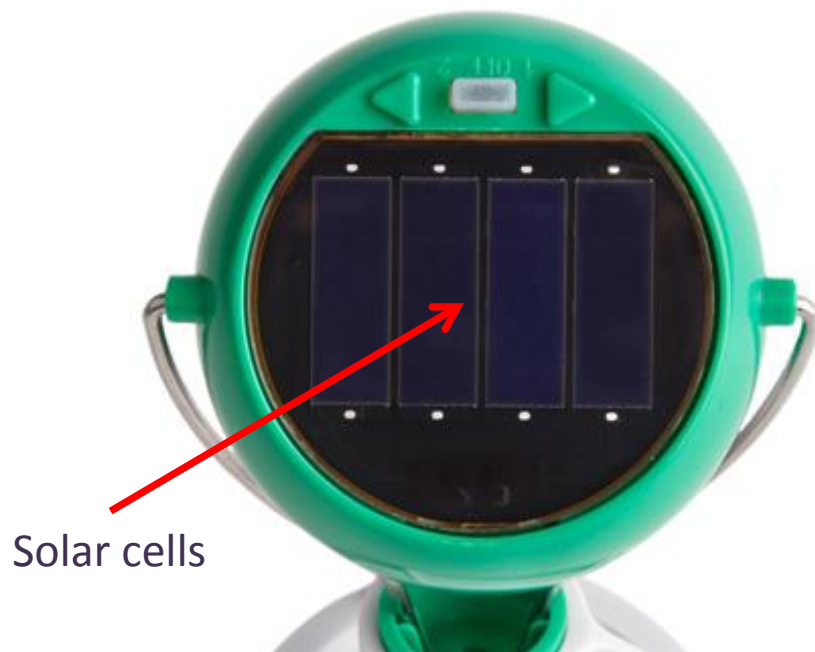
- Single AA rechargeable battery
- Four LED lights, two brightness settings
- Portable and rainproof

Features



- The battery is a 1.5 V Nickel Metal Hydride (NiMH) battery reportedly rated at 1000 mA-hr
- This will not give as many lumen hours as a Lithium Ferro Phosphate (LFP_ battery used in higher end lamps, but it helps keep the costs down

- The solar panel uses 4 cells, most likely from salvaged fragments from larger solar cells, which is the standard practice in this industry



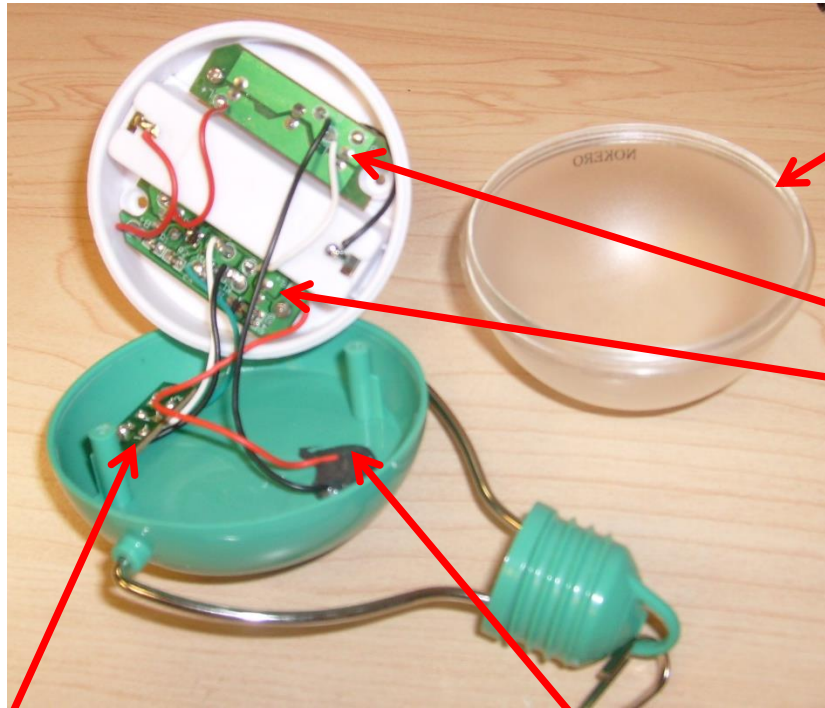
Teardown of Internals

- The light diffuser appears to be made of clear plastic, likely polycarbonate, and uses a very heavy texture on the inner surface to create the diffusing effect
- Unfortunately this method of diffusion, while cheap, does not do as good a job at diffusion as the more typical technology— TiO_2 doped plastic—that is used in other solar LED products (for example the SunKing Eco)
- The TiO_2 technology typically also has less optical loss, resulting in more of the light put out by the LED being usable



Teardown of Internals

- Remove diffuser/light cover (threaded plastic)
- Remove battery/LED mount (2 screws)



Diffuser/light cover

Two LED PCBs (44.5 x 15mm each)
Each PCB consists of two LED lights

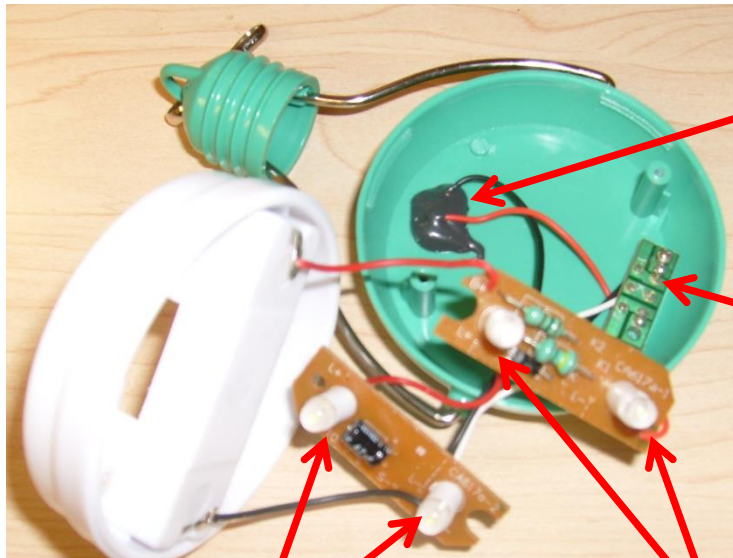
Light switch PCB

Wires from solar panels are
potted/RTV to the housing

Teardown of Internals

- Remove LED PCBs (2 screws)
- Remove light switch (2 screws)

- A clear molded rubber switch boot is used for moisture ingress, but other means for keeping out moisture (o-rings etc.) were noted



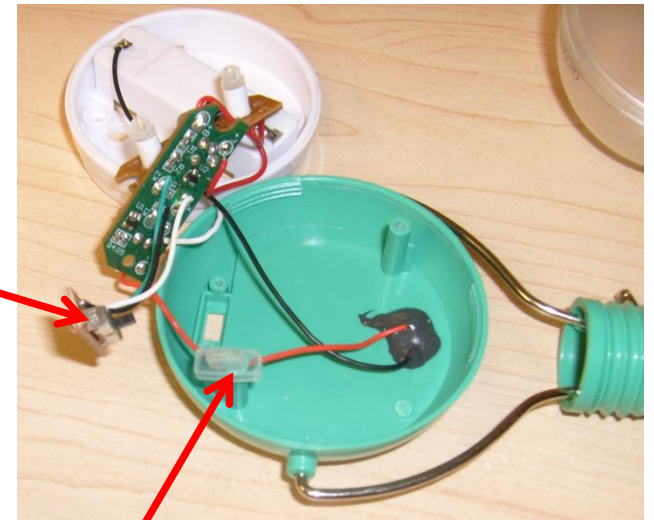
Wire leads to
solar panels

Light switch PCB
24mm x 8.7mm

LEDs

LEDs

- Light switch is a 3 way slide switch
- Dimming still uses all 4 LEDs, but with a different ballast resistor to set current and light output



Switch boot
(moved from its proper
location for clarity)

- **Critical elements of the supply chain would include:**
 - **Molded plastic parts**
 - **LEDs**
 - **Solar panel**
 - **Switch**
 - **NiMH battery**

Bill of Materials

Level	Quantity	Description	MPN	Comments
1	1	Light assembly		
2	1	wire hanger assembly		
3	1	wire hanger		
3	1	molded plastic cap		
3	1	screw		
3	1	washer		
3	1	clip		
2	1	diffuser/cover		
2	1	battery enclosure		
3	1	AA Battery		rechargeable NiMH battery
3	1	battery door		
4	2	screws		
3	1	LED PCB 1	CA617A-1	PCB has 2 LEDS and resistors
3	1	LED PCB 2	CA617A-2	PCB has 2 LEDS and capacitor
3	1	heat sink fan shroud		
4	4	screws		
2	1	solar panel/ switch assembly		
3	1	solar panel housing		solar panels are encased within the plastic housing
3	1	light switch PCB assembly		
3	1	switch boot		used to prevent water ingress
	2	screws		

- **Product is an inexpensive solar powered flashlight intended for remote/third world applications**
- **Uses a 1.5V rechargeable NiMH battery which is less expensive than a lithium battery but will require more frequent charging which could reduce its life**
- **The external plastic parts may be prone to UV degradation, becoming brittle and less resistant to impact**
- **Manufacturing method to diffuse the emitted light, while inexpensive results in light loss (low efficiency)**

Zebulon Solutions is a product development services company specializing in productization: turning R&D projects into manufacturing ready products.

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