



# Pico PV Systems

- Overview -

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## Pico PV – a new keyword in PV

Definition of Pico PV systems:

- Systems below 10Wp
- mostly with a voltage below or at max. 12V
- Systems mainly with LED lights



## Pico PV – a new keyword in PV

Pico PV make use of some important changes:

- Modules become 2-3 times less expensive
- New, high efficient, stable and inexpensive LEDs are available
- New batteries offer a much higher life span



## Applications of Pico PV

Pico PV offer today following energy services:

- Light
- Charge for cellphones
- Radio
- small fans



# Applications of Pico PV

Pico PV will offer in future following energy services:

- Netbooks
- Projectors (TV)
- evtl. small coolers



# Cost structure for Pico PV

Calculation Basis:

- 10 year system life span
- 3 years battery life

Outcome:

- Battery costs are dominating

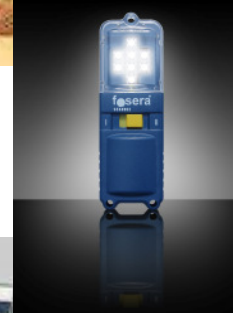




# Types of Pico PV Systems

## Lantern:

- Lamp and battery are built in one housing.
- always moveable
- sometimes with built in module



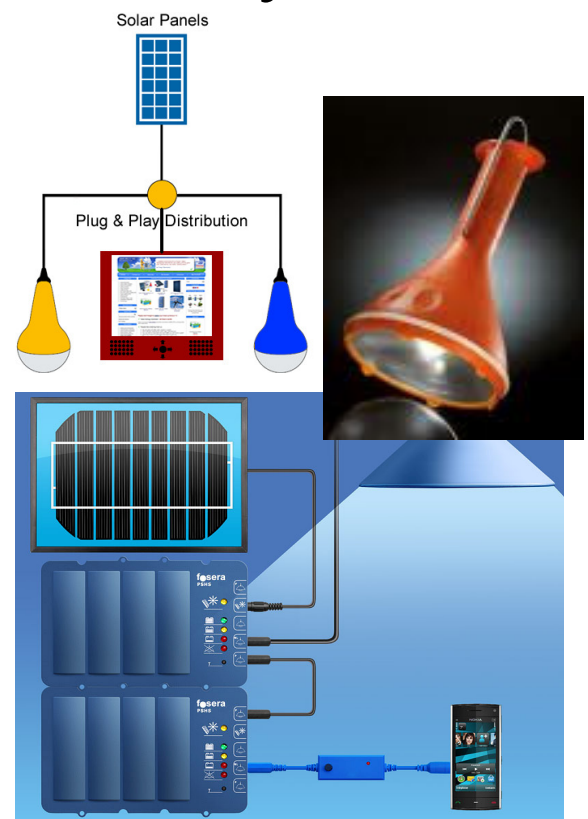
Photos: solux, fosera; Freilassin,



# Types of Pico PV Systems

## Pico System:

- Several systems can be connected in parallel
- System can grow with demand
- Can be used as an financing strategy



Photos: sundaya, phocos, fosera;



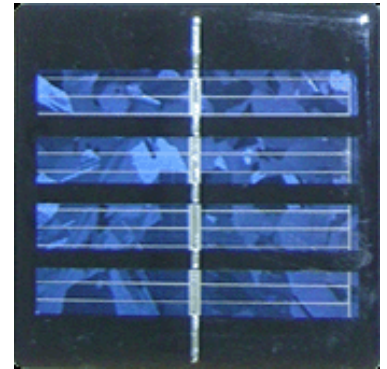
# Quality criteria for Pico PV Systems



Module:

There are different modules available:

- Glas laminate (>>10 years)
- PE laminate (>3 years)
- Epoxy module (< 3years)



Best solution: glass laminate

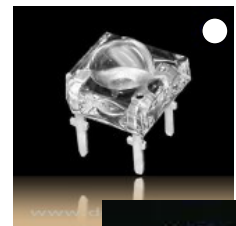
Photos: et; Resin



# Quality criteria for Pico PV Systems

LED:

- many “no name” LEDs show very strong degradation
- there are Power LEDs and small 5mm LEDs available
- Power LEDs have get hot and have in most cases not highest efficiency at higher power



Photos: Nichia, Cree



# Quality criteria for Pico PV Systems

## Battery:

- the battery is the most expensive part of the system
- batteries last between 2 and more than 10 years
- to reach economic operation it is essential to have long battery life
- battery and its charge controller form a undividable unit



# Quality criteria for Pico PV Systems

## NiMeH & NiCd Battery:

- if certain design rules are respected there is no charge control required
- efficiency is 60-70% (poor)
- lifespan 2-3 years
- NiCd show strong and NiMeH little memory effect
- Ni is toxic
- Cd is highly toxic



Photo: Sanyo



# Quality criteria for Pico PV Systems

## Lead Acid Battery:

- a relative complex charge control is necessary.
- efficiency is 80-90% (good)
- lifespan 2 years (AGM) to 5 years (GEL)
- **Pb is toxic**



Photo: NPP



# Quality criteria for Pico PV Systems

## LiCO & LiFePO Battery:

- a relative simple charge control is necessary.
- efficiency is over 95% (excellent)
- lifespan 5 years (LiCO/LiMg) to over 10 years (LiFePO)
- **Co & Mg is toxic**



Photo: AW



# Overview Batteries for Pico PV Systems

Batterytype	Rechargeabl.	Lead Acid	Lead Acid	Lead Acid	NiMeH	NiCd	Li Ion	Li Ion
Feature	Alkaline	Flooded	AGM	GEL			Li-Mg/Co	LiFePO
Nom. Voltage	1,5	2,12	2,12	2,12	1,3	1,3	3,7	3,3
Cycle Life	600 *1) !!	300	300	300	500	500	300	2000
Temp.								
Eng. Efficiency	90	80	80	80	50	60	85	90
Selfdisch. /month	<1	3	3	3	20	20	1	1
Cost / Wh	0,1	0,1	0,15	0,15	0,25	0,25	0,3	0,3
Sizing rule / module	1,1	1,2	1,2	1,2	1,6	1,5	1,1	1,1
Sizing rule / aut. Days	50	3	3	3	2	2	2	2
Specif. stor./[\$/Wh]	1,66667	0,33	0,5	0,5	0,5	0,5	1	0,15
Specific		Sulfation !!	Sulfation !!			Toxic !!!		
Battery Type	No deep	Not for			Efficiency !!	Mmry efct. !!!		
Related Problems	Cycles !!!	Portb. Use !!!				Efficiency !!		
Overall evaluation	--	-	0	+	0	--	+(+)	++(+)



## Pico PV Conclusions:

- Pico PV Systems offer an excellent way to give access to modern energy services
- No financing is required
- High quality is essential for economic use