

# Solar power infrastructure for community networks

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# Community networks & Power

- Location of CNs
- Use of solar



# Issues with solar energy

- Alignment maximizes energy generation
  - Pointing towards the equator, tilted
- Knowledge, materials, tools, time
- Cost related to the size of the panel
- Impact of the local market
  - Time and price



# Storing Energy

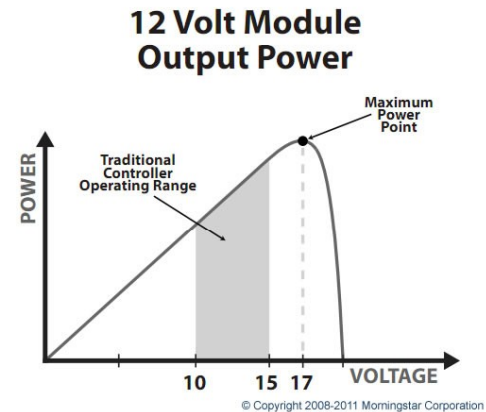
- Size and cost
  - Loads
  - Days of autonomy
- Life-span depends on
  - Maintenance
    - Not overcharge
    - Not over discharge
  - Temperature
- Handled with care
  - Human
  - Environment



# Regulators and cabling

- PWM vs MPPT

- Price
- Efficiency



- Cables and fuses

	2012 (from 15 August)	2013	2014	2015 (until 30 April)
a) Damaged router		2	3	
b) "Salty cables"	1	9	9	1
c) Fuse blown	8	16	13	3
d) Problem in socket		5	1	
e) Loose cable		1		
f) Damaged Regulator		2		
g) Router no sound		3	4	2
h) Battery down			4	3
TOTAL	9	38	34	9

# Loads

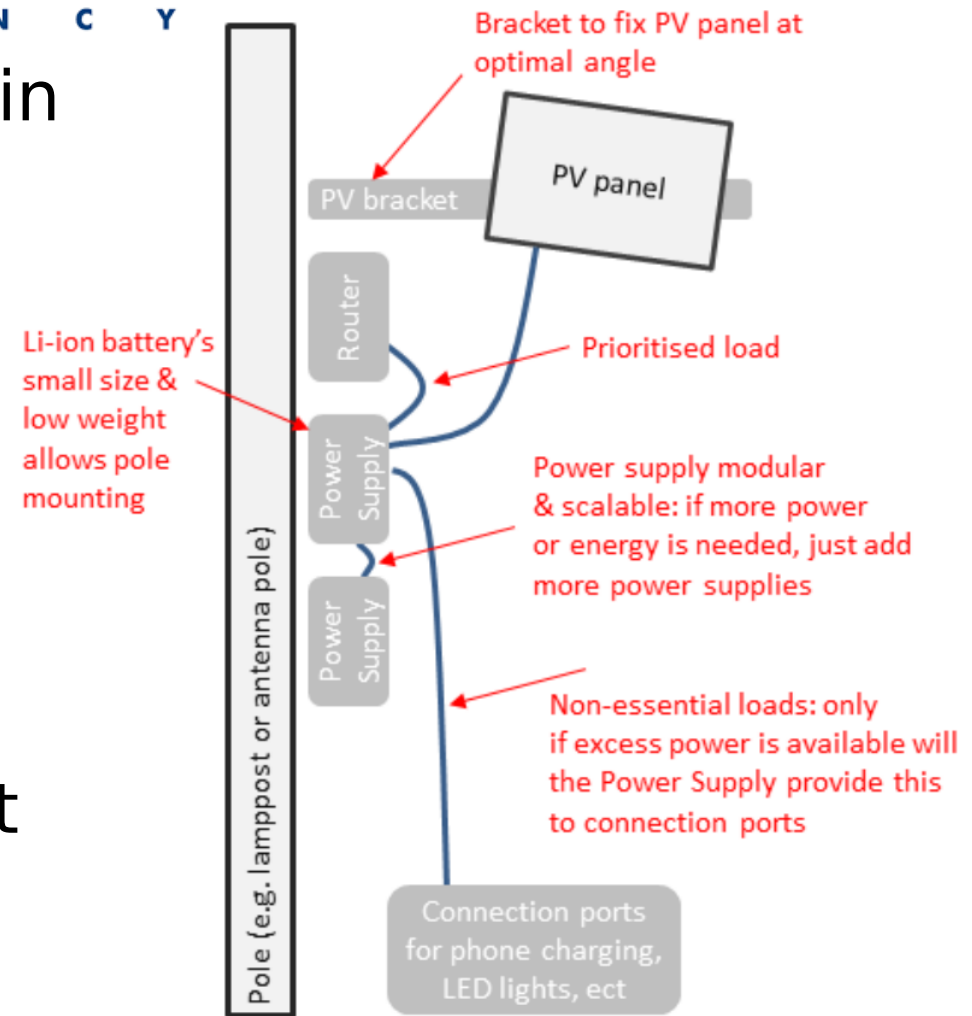
- Router(s)
- Charging phones, providing lights (12V L.E.D)



# Solar power infrastructure for community networks



- Easy to install and maintain
- Flexibility
- Maximize energy harvest
- Pre-dimensioned for different scenarios
- Maximizes life span
- Data communications port
- Cost



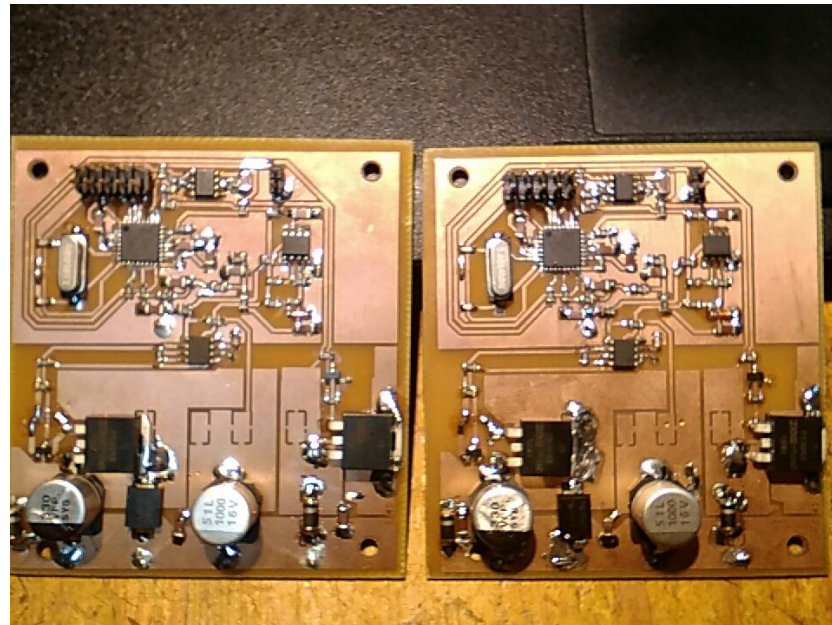
# Easy to install





# Maximize energy harvest

- To align to the north and provide the right tilt
  - Full year / Winter / Twice a year / Four times
- MPPT (Updated Freifunk's OpenMPPT)



# Flexibility

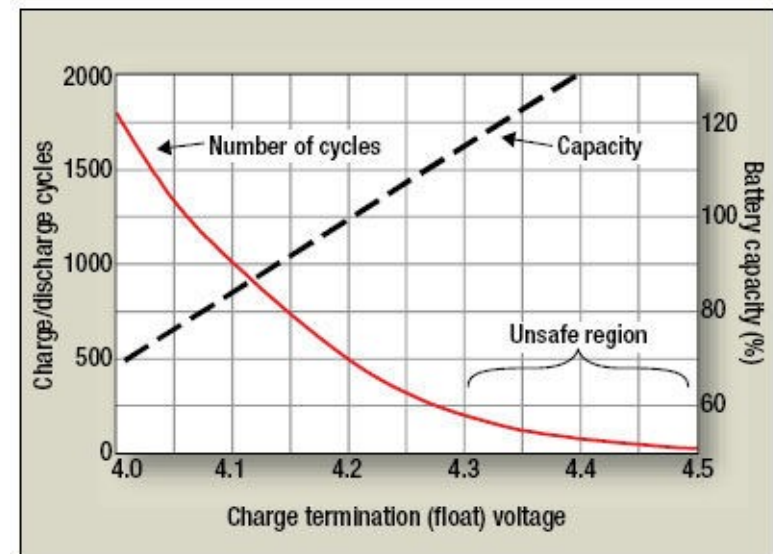
- Allows for different output
  - Prioritized Port (12V PoE or mounting screws): Router
  - Non-Prioritized Port (5V): LED lights, phone charging
- Allows for different input
  - Solar panel
  - Grid power (with surge protector)
- Allows different battery chemistries (configured by software)
  - LiFePo
  - Li-Ion
  - SLA

# Pre-dimensioned

- 20 Ah battery (LiFePo)
  - 3 days autonomy 24h low-power router (3W) & additional power for non-priority loads (phone charging and lights)
  - 3 days autonomy 16h (Power efficiency LibreRouter) higher-power router (5W)
- Big solar panel (90W) to charge battery with any light available
- Parallelling (additional 90W and 20Ah)
  - 2 x above
  - 3 days autonomy 24h higher-power router (5W) & additional power for non-priority loads (phone charging and lights)
  - 3 days autonomy 16h (Power efficiency LibreRouter) higher-power router (5W) & additional power for non-priority loads (phone & laptop charging and lights)

# Maximizes life span

- Monitors temperature for battery use
  - 50% life time reduction for 10 °C above room temperature
  - Battery destroyed if charging above 40 °C
- Power off the router at night
  - Commutation between uC and router
- Two set-ups for each battery chemistry
  - "Higher capacity & shorter service life"
  - "Reduced capacity & longer service life"
- Disconnect priority and non-priority loads
  - Different cut-off voltages



**Fig. 2.** Battery cycle life, capacity and float voltage are inter-related. This shows that float voltages above 4.3 V should be prevented.

The design life for all project component deliverables is at least 5 years, but aiming for 10 years

# Cost

- Working on it for the first prototype (270 USD)
  - Bracket 25USD
  - 20Ah LiFePo 112 USD
  - 90W Panel 90 USD
  - OpenMPPT 20 USD
  - Other (casing, cabling, fuses) max 23 USD
- Economies of scale will reduce it considerably

# Conclusion

Community networks are about the people

Electricity is key for the network

The easier and cheaper it is to power the network,  
the more time can be used to build community

Let's keep reducing the barriers

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