

Power & Storage Management in the Field

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Power in the Field: Generators and Consumers

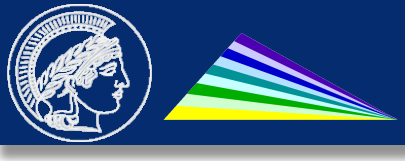


- positive power balance important: generators need to produce more power than consumers “eat”
- energy generated and consumed over time, can be stored in batteries.

Energy = Power * Time, Power = Voltage * Current

Power Generating Devices

- Solar panel
- Diesel/Gasoline generator
- Wind turbine
- Fuel cell
- Batteries



Power Consuming Devices

- Audio recorder
- Video camcorder
- Photo camera
- Laptop
- Hard disk
- Lights
- GPS
- Phone
- …

Points of Concern

- Great variety of norms (mechanics, voltages, power, energy)
- Every company has own non-compatible power adapters/ chargers
- Non-rechargeable batteries heavy if you need many, not good for environment
- Rechargeable batteries have their quirks
- Solar power setup rather complex

Non-rechargeable Batteries

- Two major types: Lithium and Alkaline
- Lithium: high capacity but more expensive
- Alkaline: regular cell batteries
- Simple and robust, almost no self-discharge
- In case of heavy usage, need to bring many (in AND out of your field site!)

  -> high weight
- Not good for the environment

Rechargeable Batteries

Battery Type	Max Cycles	Memory effect	Self discharge/ month (21ºC)	Typical usage
Nickel-Cadmium	>1000	strong	20%	AA cells, portable electronics (disappearing)
Nickel-Metal Hydride	500-1000	little	30%	AA cells
Nickel-Metal Hydride (low self-discharge)	500-1500	little	1-2%	AA cells
Lithium-Ion	500-1000	none*	5-10%	Portable electronics, laptops
Lithium-Polymer	500-1000	none*	5%	Portable electronics, laptops

* No memory effect but sudden strong decrease of capacity when max cycles reached

- Memory effect: reduction of capacity due to frequent charging when battery is not yet fully discharged
- Prevent "deep discharge" -> recharge batteries once every few months if they're not being used
- High temperatures not good for batteries: less capacity, faster self-discharge, shorter life time
- Capacity reduction of 20% per year possible when storing the battery fully charged, even if it's not in use. Better to store at 40% charged.
- External chargers usually quicker than charging in device itself

Laptop battery

- Leaving battery inside the laptop when using it on mains power is not ideal: heat and frequent partial recharges may quickly reduce life time
- If possible, remove the laptop battery when using it on mains power
- Once in a while, fully use the battery and fully charge it again to keep it in good shape

Laptop power consumption

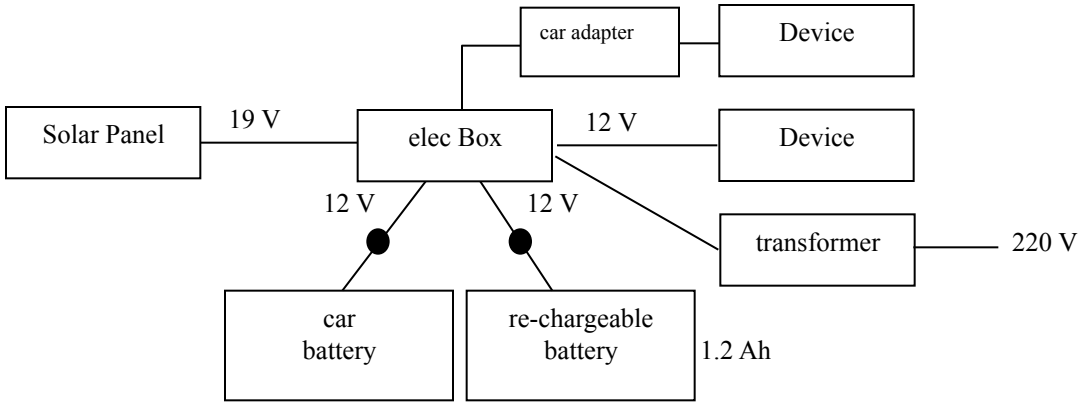
tests with Fujitsu-Siemens Lifebook S5582 (old)

P3-800-Speedstep, 256 MB, 30 GB, DVD/CDRW, 13”, 8MB

Activity	consumption	incl. charging
only charging notebook battery		25
notebook in standby mode	0	
normal notebook consumption	16.5	
normal with switched off hard disk	14.8	
normal with switched off hard disk and screen	10	
+ hard disk activity	18	
+ hard disk and graphics board	18.5	
+ graphics board and CDROM	23	
high CPU load only	23	
copy from CDROM to hard disk	24.4	48
CDROM writing (8 speed)	23	
minimal backlight on display	22.7	
maximal backlight on display	27.7	

Solar Power

- Generated voltage dependent on light (and dust and angle)
- Packaging (size) and type of cells determines voltage and max current
- MPI uses 2 types:
  - foldable stiff panels: 60 W max
  - flexible plastic panels: 32-62 W max
- Don't connect panel directly to 12 V equipment, use a solar controller and buffer battery
- Battery needed to store energy for later use and to provide more stable current



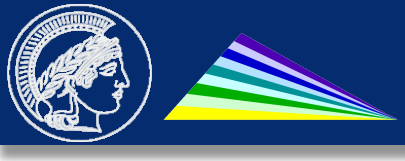
Power in the Field

- Calculate how much power you will consume
- Take power generators that are suitable for your field site and produce sufficient power for the consumption you calculated

Storage Management Audio

- 1h audio linear PCM 16bit 48 kHz stereo ± 700 MB, not really a problem:
- 16 GB flash card will hold more than 22 hours of uncompressed audio
- Even if you don't bring a computer into the field, you can buy sufficient cards for the whole trip (16 GB = about 10 €)

- Current small laptop hard disks up to 1.5 TB
- Large external hard disk up to 3 TB (heavier, consume more power)



Storage Management Video

- 1h DV needs 13 GB
- 1h MPEG1 about 700 MB – factor 18
- 1h MPEG2 standard definition about 3.5 GB
- 1h MPEG4 (AVCHD) 1080p HD about 12 GB
- 1h MPEG2 1080p HD about 17 GB
- Storage of video becoming less of an issue with larger hard disks becoming available
- Processing video in the field power and time consuming, more so for High Definition video