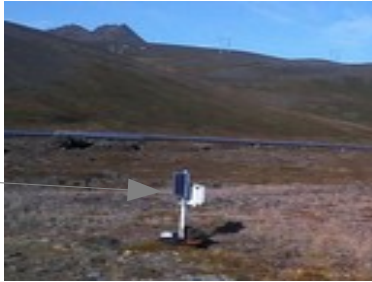


Power gadgets with your own electricity

Iceland – no sun
but
photovoltaics



escape the basement and make the
sun work for you



Renewable energy isn't for wealthy investors only. You can have it, too.



Contents

- A really short **introduction** into the available power sources like sun, wind etc. + some Pipedreams
- We'll show you how much power you can **expect** from which source.
- We'll show you how much **sunshine you can expect** at your place.
- As a follow-up we'll show you the **amount of power various things need**.
- **Building the system**, the **easy, boring** and fully-legal way
- The **difficult** way: Put your own power **into the public grid**.

power sources

- The Sun!
 - Direct: **Photovoltaics**
 - Via Heat: **Mirrors, Receiver, Turbine, Generator**
 - Via air pressure difference: **Wind**
 - Via evaporation from water bodies: **Water**
- Kinetic energy of planets
 - Via waves: Wave power **at sea at the beach**
 - Via tides: **Tidal energy**
- Radioactive decay + the heat from the big bang
 - **Geothermal energy**

Good

Bad

some pipe-dreams

- Salt gradient energy

Photo:
Bjoertvedt



- Damming the mediterranean



Energy?

- kWh=Kilowatthour
- Simple:
- Watt = Power = The more the better
- Hour = Time worked using Power
- Kilo = „*1000“

Sun: What do you get?

- Sun: solar constant $1,361 \text{ kW/m}^2$
- Clouds
- Longitude
- Winter
- Photovoltaic efficiency
- Realistic, germany (Berlin): $100 \text{ kWh/m}^2\text{*a}$
- Calculate yourself: http://valentin.de/calculation/pvonline/pv_system/
- Solarkataster: <http://www.enbausa.de/solar-geothermie/fotovoltaik/staedte-mit-solarkataster.html>
- Fluctuations

How about here?

Solaratlas Berlin - Mozilla Firefox

http://www.wirtschaftsatlas.berlin.de/mapguide/Apps/Solar/Public/index.jsp

olarkataster hamburg

Marzipanstellen

Notizen -

Solaratlas Berlin

Solaratlas Berlin

alexanderplatz 1

Alexanderplatz 001, PLZ: 10178, Mitte

Projektseite Ansicht | Datenschutz Haftungsausschluss Benutzerhinweise Impressum

Legende

- ☒ Solaratlas
 - ☒ Standorte
 - ☒ Bestandsanlagen
 - ☒ Branchenstandorte
 - ☒ Solarpotenzial Photovoltaik
 - ☐ Eignung der Teildachflächen
 - ☒ Eignung pro Gebäude
 - ☐ Mögliche CO₂ Einsparung
 - ☐ Mögliches Investitionsvolumen
 - ☐ Möglicher Stromertrag
- ☒ Übersichtskarte

1: 3000

Der Solaratlas Berlin wird aus dem Europäischen Fonds für Regionale Entwicklung (EFRE) gefördert

EUROPEISCHE UNION
Europäischer Fonds für
regionale Entwicklung
Investition in Ihre Zukunft

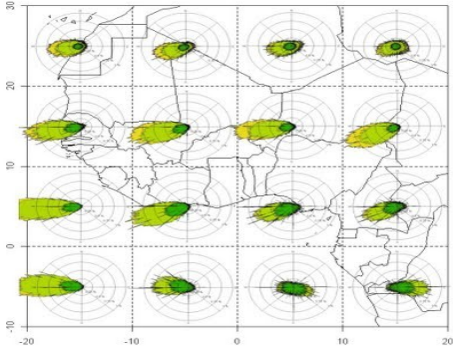
EFRE

berlin Berlin

Wind: What do you get?

- Wind maps:

Michael Kemp, <https://sites.google.com/site/michaelukemp/wind-maps>



- Fluctuations: less.



Photo: Marlec
Engineering
Co Ltd

What you need

- As a follow-up to part 2 we'll show you the amount of power various things need. You can do the math yourself afterwards to see what you can power from your balcony.

What you need

- Calculator: Microwatts.
- Arduino: Milliwatts.
- Kindle: 0,002 Wh/page
- Ipad: 0,6 Watt
- Fluorescent bulb: 8 Watt
- Netbook: 35 Watt
- Laptop: 60 Watt
- Human being (=you): 80-250 Watt

Tiny!

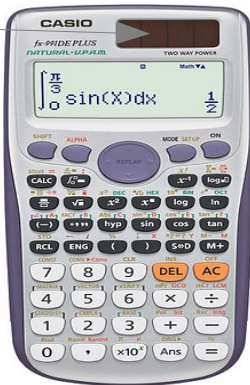


Photo: CC-BY-SA Jörg Reddmann

What you need

- Desktop non-gaming machine: 250 Watt
- Car: 50.000 Watt
- Google: 260.000.000 Watt
- Bus: 200.000 Watt
- ICE3 train at full power: 16.000.000 Watt
- Germany: 607.800.000.000 kWh/a



Photo CC-BY-SA
Sebastian Terfloth

Building the system, the easy and fully-legal way

- Parts lists,
- schematics and
- Instructions.
- Not here but on Google.
- Acquire the necessary stuff without paying too much.

Components

- Generator
- Diode and / or Charge Controller
- Battery (lead-acid!)
- Voltage (and frequency) converter
- Cabling

102,85 €

Conrad - Ihr Online Shop für Elektronik, Computer, Multimedia, Modellbau & Technik - Mozilla Firefox

http://www.conrad.de/ce/de/OrderprocessCart.html?x=72&y=14

debian pinning

Marzipanstollen

Notizen -

Conrad - Ihr Online Shop für E...

Mixing Debian testing and un...

	Conrad Amorphes Solarmodul 10W, 12V Leistung 10 Wp Nennspannung 17,5 V » Best.-Nr.: 110700-62 Auf Lager ☐ Gleich mitbestellen: 48 Monate Garantie für diesen Artikel (Aufschlag € 3,50) Auf die Wunschliste»	1 Stück	€ 49,95*	€ 49,95*	entfernen
	Conrad Solar-Laderegler 12 W/4 A 200007 Last-Strom 4 A Ladespannung 13,8 V » Best.-Nr.: 113344-62 lieferbar ab 12.01.2012 Auf die Wunschliste»	1 Stück	€ 16,95*	€ 16,95*	entfernen
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	Flachsteckhülse isoliert 4,8 x 0,8 mm 0,5 - 1,0 mm² Vordr. » Verbindungstechnik » Best.-Nr.: 736933 - 62 € 0,41*	1 Stück			entfernen
	Flachsteckhülse isoliert 4,8 x 0,8 mm 1,5 - 2,5 mm² Vordr. » Verbindungstechnik » Best.-Nr.: 736957 - 62 € 0,44*	1 Stück			entfernen
	DC/DC-Wandler TES-Serie 1 W TracoPower TES 1-1211 In 12 VDC Out 5 VDC 200 mA 1 W » Best.-Nr.: 156536-62 Auf Lager Auf die Wunschliste»	1 Stück	€ 7,50*	€ 7,50*	entfernen

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[Gutschein »](#)
[Zahlungsarten »](#)
[48 Monate-Langzeit-Garantie »](#)
[Online-Finanzierung »](#)
[Hilfe »](#)

Alle Ihre Geschenke rechtzeitig zum Weihnachtsfest...

Bei all Ihren Bestellungen bis zum 22.12.2011, 18:00 Uhr, 12:00 Uhr erhalten Sie Ihre Lieferung von ab Lager verfügbaren Artikeln noch bis zum 24. Dezember 2011.

Nur innerhalb Deutschlands



Vattenfall vs. You

- Vattenfall (Berlin): 22,56 Cent/kWh (as of dec 28th, 2011)
- **You**
Storage in Lead-acid batteries: 20 ct/kWh stored
→ Small Battery 12V, 66Ah, 80 €, only discharged to 50% → 750 cycles
Production: Not too expensive...
30% direct use, 70% stored and used later
13,8 ct/kWh produced (see de.wikipedia.org/wiki/Photovoltaik)
- Net result: $13,8 \text{ ct/kWh} + 70\% * 20 \text{ ct/kWh} = 27,8 \text{ ct/kWh}$
- Now deduct 5,90 € fixed fee per month.
- Assumptions: amortisation 25 years, cheap car battery, ..., see Wikipedia

Where to buy

- PV cells: Print your own or:
1,20 €/Watt incl. VAT (Ebay)
- Lead batteries:
cheap car parts shops
- Wind generator: Build your own
(from car alternators)
- If rich: Marlec Ltd.
- Diode: 1 €, your local Radio Shack equivalent

Battery? Take Care

- Lead Acid
 - With fluid acid
 - Gel
- Lithium

The difficult way: Put your own power into the public grid.

- Can't be done.
- Well, yes, can be done.
- Germany: Erneuerbare-Energien-Gesetz. This can make your purse fill up automatically. (anything above 1 kW installation can earn feed-in tariffs) or
- it can (in theory) make your electricity meter go backwards - but that's not actually tolerated. Once the grid company recognizes what you are doing (and German law requires you to tell them) unfortunately they will install a digital meter.
- Digital meters will not count backwards like the Ferraris counters do now...
- Also please note: any installation work that put electricity into the grid has to be done by approved electricians! Even though you could just plug it in - you can't!
- So: Don't do this at home! You have been told!

Small scale feed-in

- Example:
Vattenfall Hamburg:

(3) Vor der Errichtung einer Eigenanlage hat der Anschlussnehmer oder -nutzer dem Netzbetreiber Mitteilung zu machen. Der Anschlussnehmer oder -nutzer hat durch geeignete Maßnahmen sicherzustellen, dass von seiner Eigenanlage keine schädlichen Rückwirkungen in das Elektrizitätsversorgungsnetz möglich sind. Der Anschluss von Eigenanlagen ist mit dem Netzbetreiber abzustimmen. Dieser kann den Anschluss von der Einhaltung der von ihm nach § 20 festzulegenden Maßnahmen zum Schutz vor Rückspannungen abhängig machen.

Components

- Generator
- Grid-Tie
Inverter:



Connections

- Look on stage not here

Now it's your turn

- What needs to be developed:
- **Software / databases**
- Opensolarmap.org – go and measure your city's rooftops
- Openwindmap.org – same thing for wind

Fun with solids and fluids

- **Hardware**
- Grid-tie inverters as open hardware
- Make improved, new and fancy battery technology workable for the enthusiast, example: Redox-Flow batteries
- Make-your-own-solar-panel from sand ... if we can print 3D why can't we grow silicon crystals? TiO Cells?
- Colour the world with electricity-generating paint
- REPRAP solar panel printhead – ask downstairs

Beat 1%

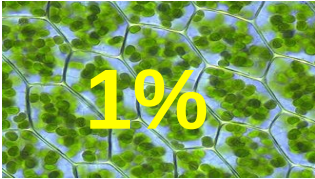


Photo: CC-BY-SA Kristian Peters



Photo: own source

Make use of networks

- Energy server – control the amount of energy your appliances use and match that to current production from your roof.
- Go and disconnect yourself from the grid – just because you can.
- Team up with your neighbors.
- Needs a control port in everything, fridge, freezer, washing machine, computer, electric bike, toaster, ... Isn't that fun?
- And fancy server-side software

The digital meter

- EU wants us to have these.
- Communicate, like UESP Universal Energy Supply Protocol – let the components talk
- What can you do with it? Impress us next year.



CC-BY-SA MdE



CC-BY-SA EvB
Energie AG

Ask questions

- Jörg Dürre
- Gunnar Thöle
- Send email:
- <First name>.<last name>@piraten-hh.de
- Replace Umlauts with their transliteration:
letter without dots + 'e'