Hybrid Photovoltaic-Diesel-Battery Systems for Remote Energy Supply

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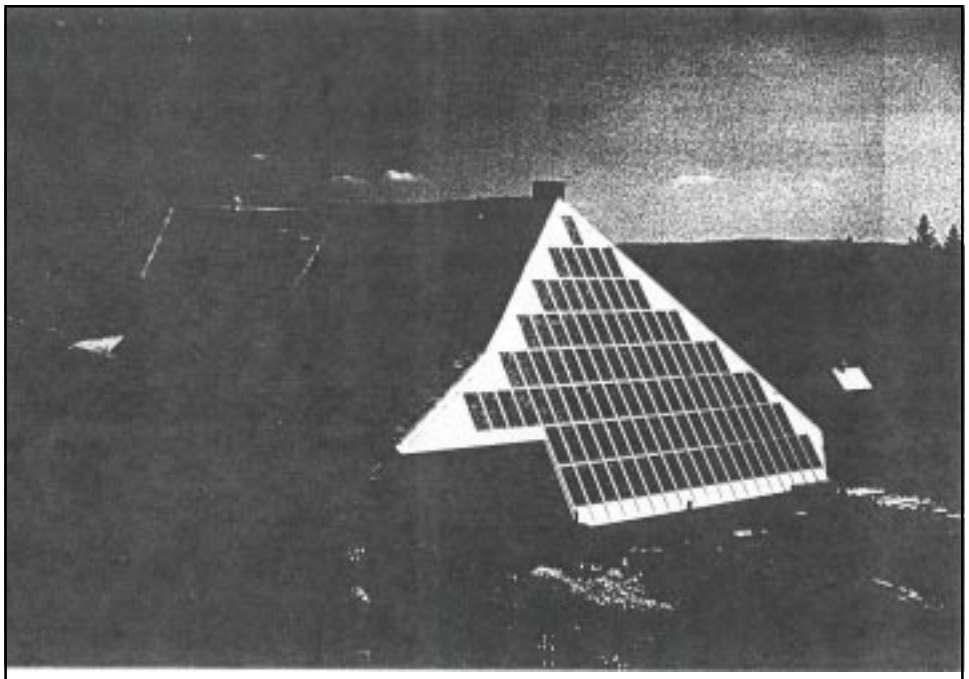

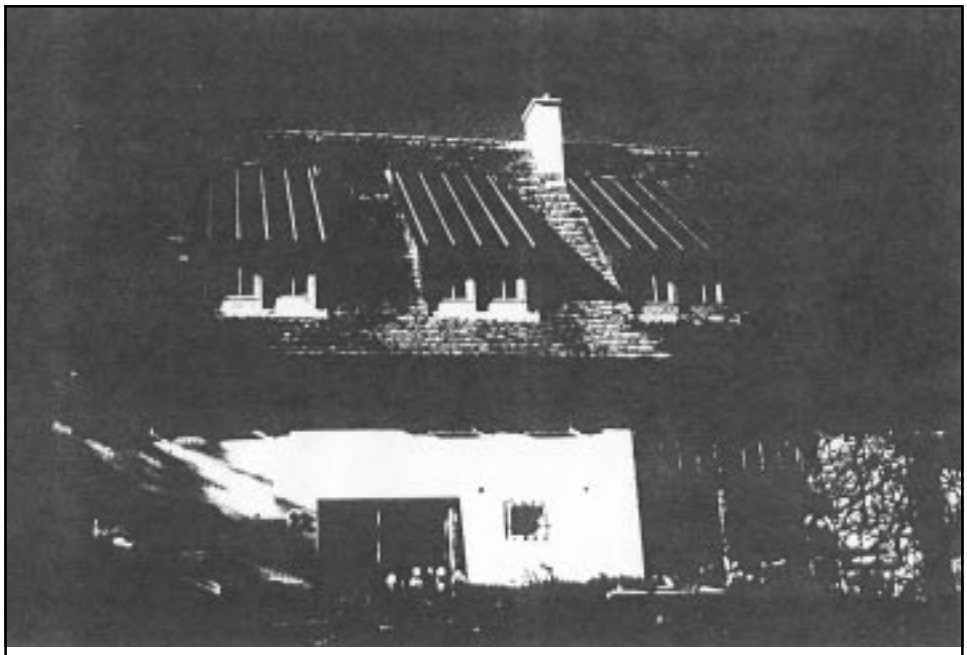

Basic technical goals:

- provide a continuous (24 hours) AC-supply
- reach a high supply reliability
  (most systems are for commercial use: farms, tourist facilities)
- reduce the operating times and the fuel consumption of existing diesel generators considerably (thus reducing operating costs and pollution through noise and exhaust gases)

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Hybrid Photovoltaic-Diesel-Battery Systems for Autonomous Energy Supply

Buildings without energy supply from a public electricity grid (in Europe)

Holiday & weekend residences	500 000
Permanently inhabited houses & farms	300 000
Facilities for tourists: mountain lodges, hikers inns, ...	several thousands

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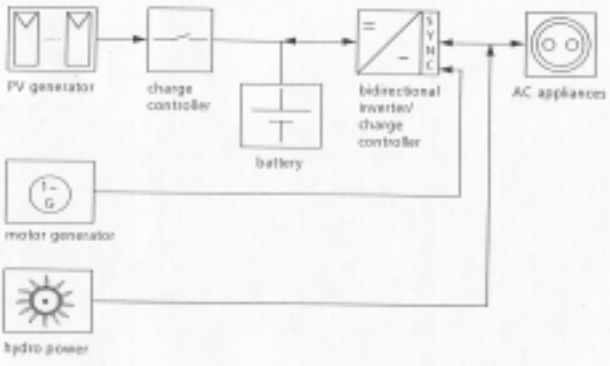

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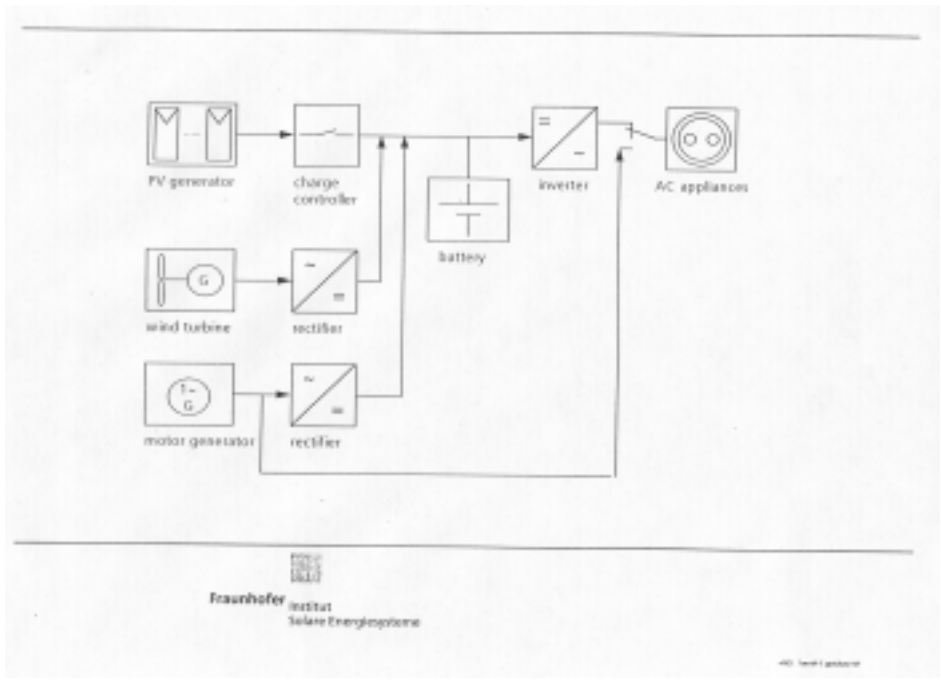

System layout: Rappenecker Hof

Daily load	9	kWh
Inverter, nominal power	4	kW
Battery, energy stored	32	kWh
PV-generator, nominal power	3,8	kW
Wind turbine, nominal power	1,0	kW
Diesel Generator, nominal power	16	kW

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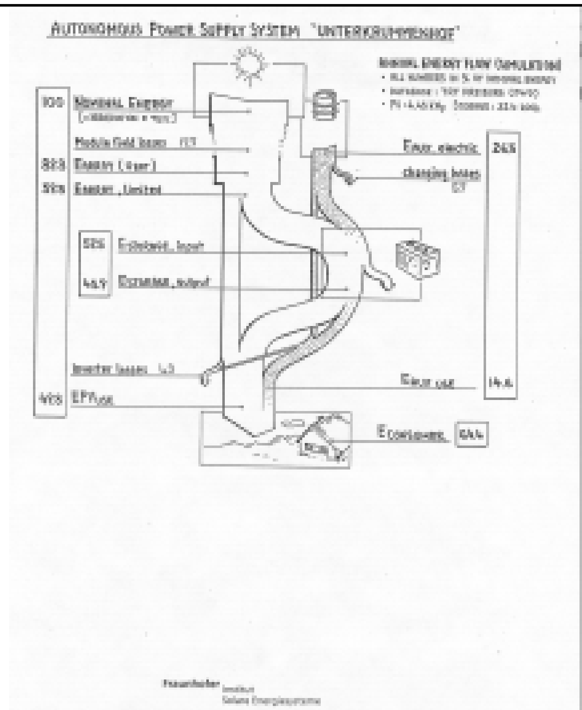
AUTONOMOUS POWER SUPPLY SYSTEM
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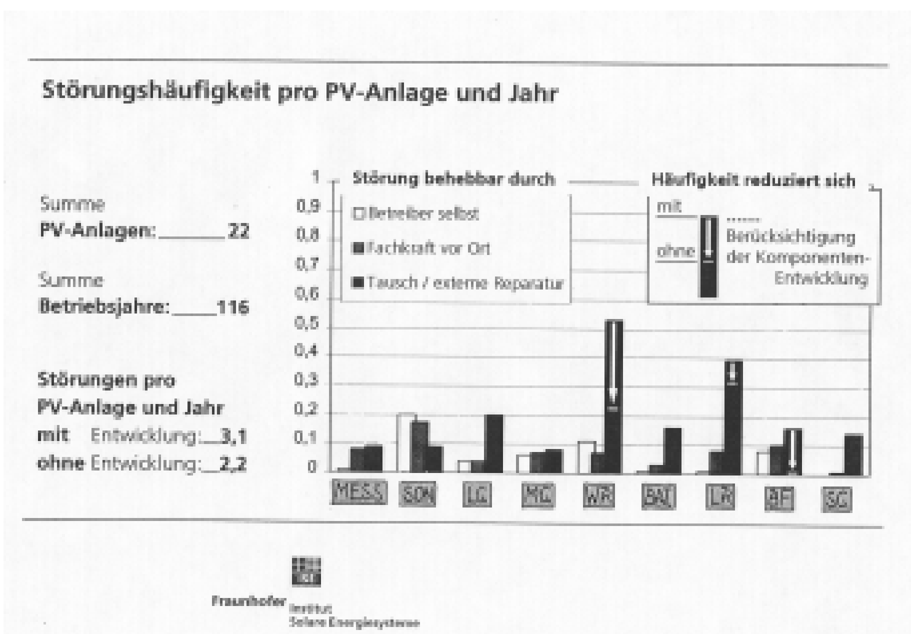
Störungshäufigkeit pro PV-Anlage und Jahr
Summe
PV-Anlagen: 22
Summe
Betriebsjahre: 116
Störungen pro
PV-Anlage und Jahr
mit Entwicklung: 3,1
ohne Entwicklung: 2,2
Störung behebbar durch
Betreiber selbst
Fachkraft vor Ort
Tausch / externe Reparatur
Häufigkeit reduziert sich
mit
ohne
Berücksichtigung der Komponenten-Entwicklung
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
MESS
SON
LG
MC
WR
BAT
LR
BF
SG
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Operating experience / lessons learnt

PV-modules:	usually the most reliable part of the system
Batteries:	limited lifetime of three to five years solution: intelligent charge control
Inverters:	high part load efficiency is absolutely necessary, few good inverters are on the market

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Operating experience / lessons learnt (continued)

Appliances:	energy saving must be an integral part of system planing
Supply reliability:	not yet satisfying solution: professional maintenance schemes

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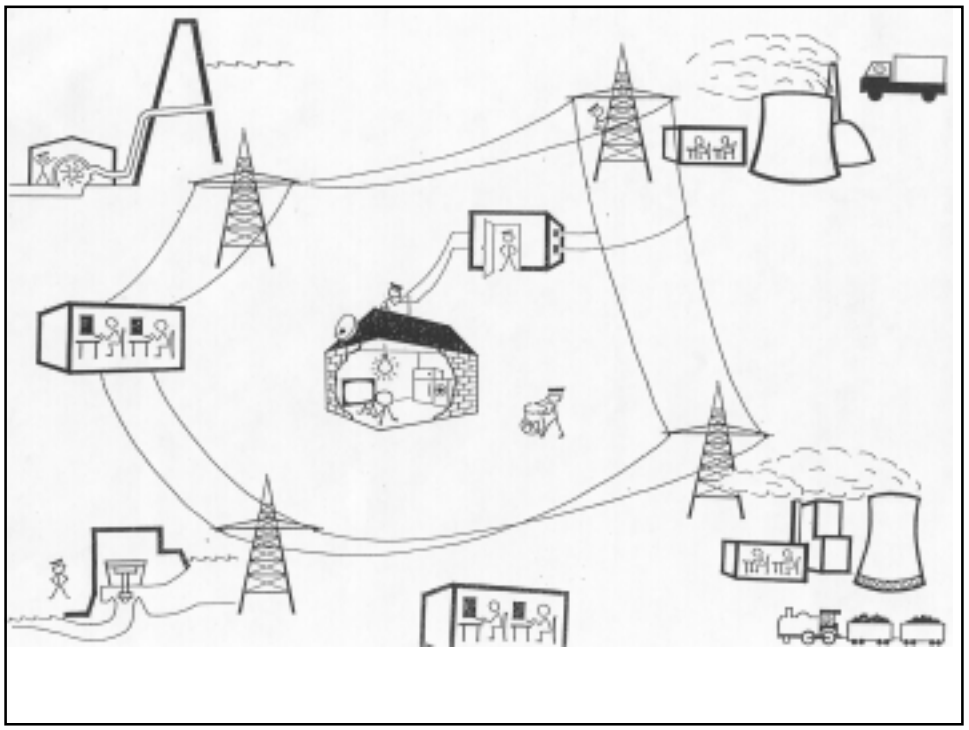

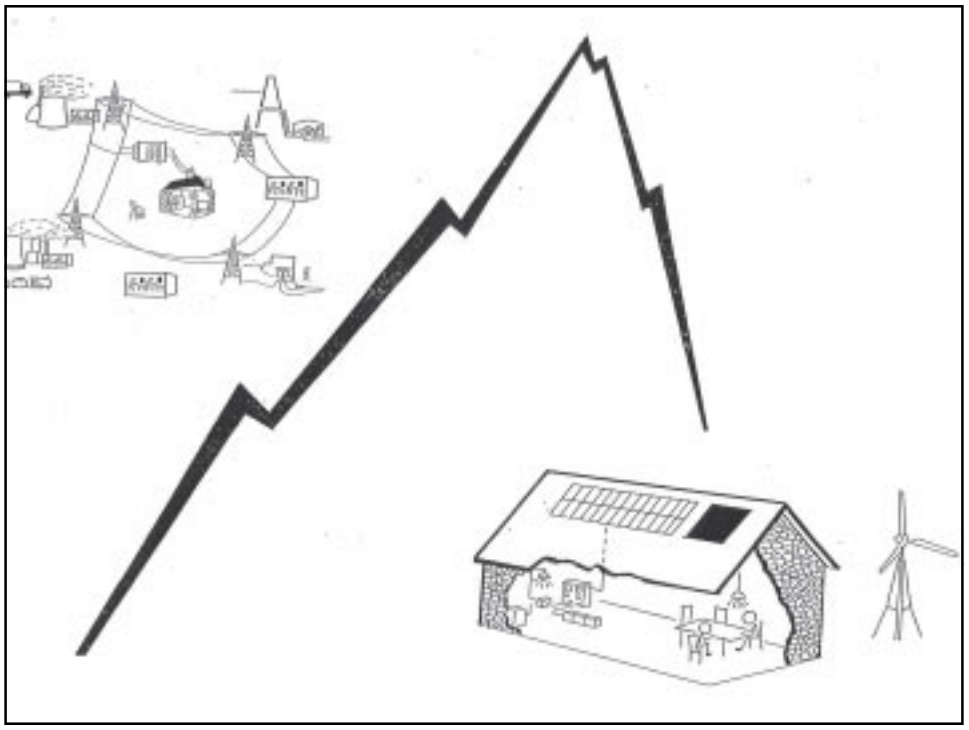

Conclusions

Hybrid Photovoltaic-Diesel-Battery-Systems for remote energy supply are a proven technology.

Potential for improvements

- system reliability
- standardization (modularity) of components and system layout
- battery lifetimes
- energy flow management

Economic evaluation is still under discussion.

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