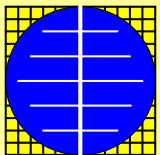


# Photovoltaics in Hungary

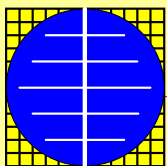
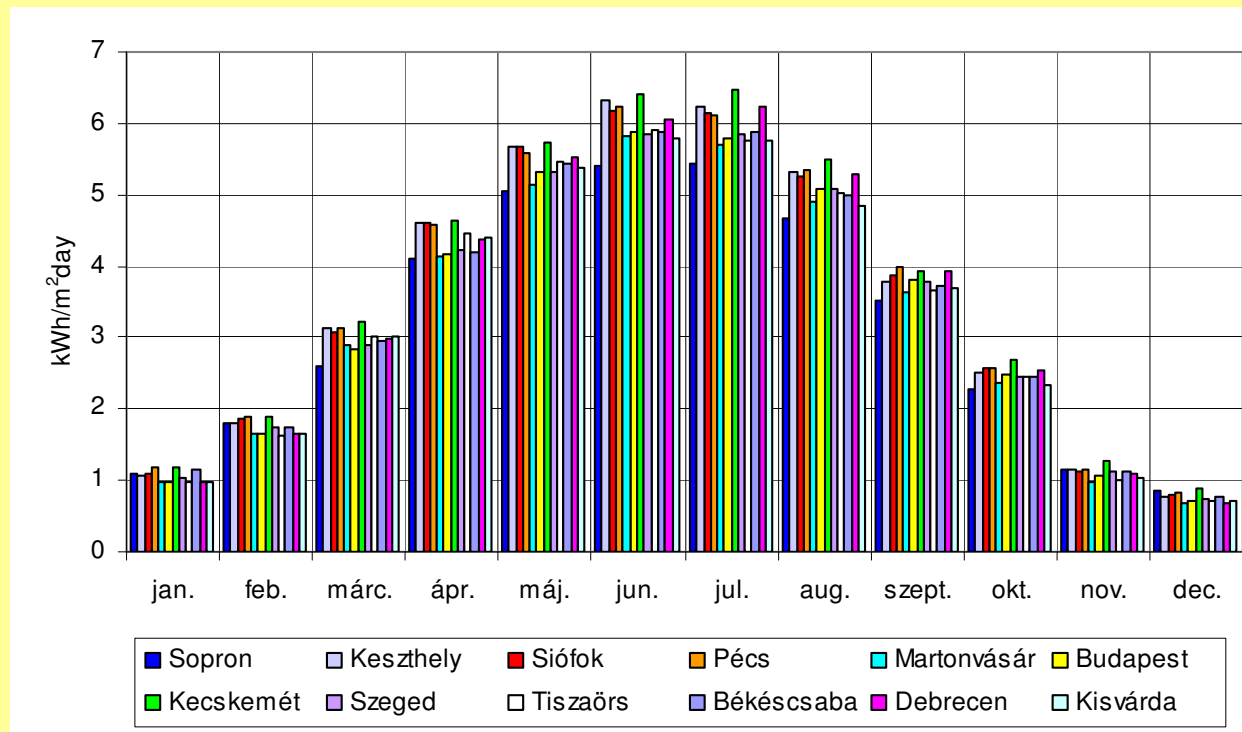
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Miklos Palfy  
Solart-System

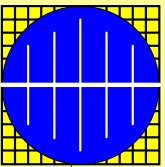
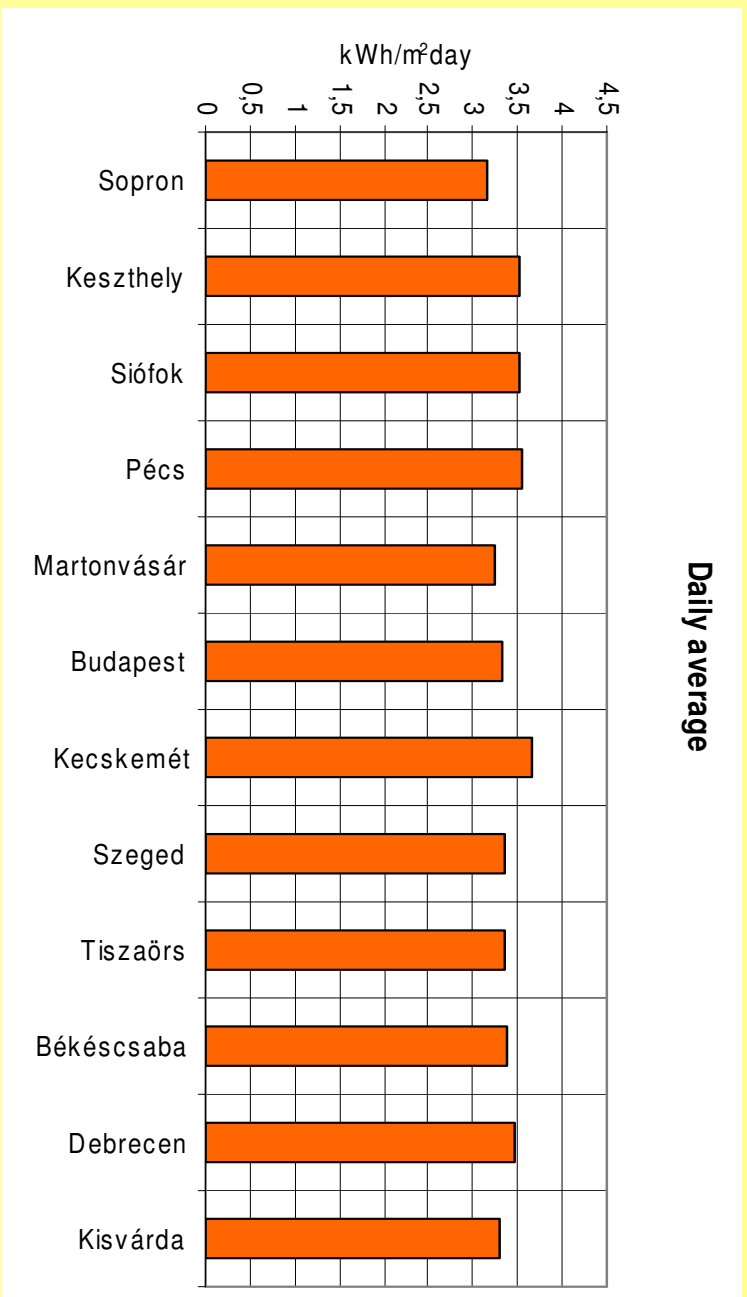


[www.solart-system.hu](http://www.solart-system.hu)

# Solar radiation in Hungary



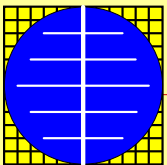
# Solar radiation in Hungary



# Solar radiation in Hungary

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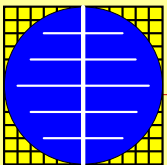
- 1150-1332 kWh/m<sup>2</sup>
- Yearly total in Hungary  $1.16 \cdot 10^{14}$  kWh/year. 1250 kWh/m<sup>2</sup> average
- 2900 fold of the Hungarian yearly demand of electrical energy.
- Yearly home electrical energy demand = 1,5 m<sup>2</sup> solar radiation.



# PV History in Hungary

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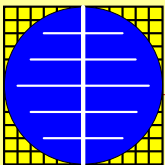
- 1973. PV development started.
- 1975. First PV installation.
- 1979. Silicon solar cell developed with 15 % conversion efficiency. Patented.
- 1982. PV Working Group founded in the Hungarian Electrotechnical Association.
- 1983. Hungarian Solar Energy Society founded.
- 1989. Pannonglas SOLARLAB founded.



# PV History in Hungary

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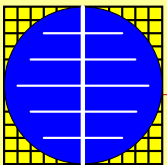
- 1990. Solart-System Ltd. founded.  
[www.solart-system.hu](http://www.solart-system.hu)
- 1993. ISES Solar World Conference and Exhibition held in Budapest.
- 1997. Dunasolar amorphous PV factory founded.
- 2004. SANYO PV module production plant founded.  
[www.sanyo.com](http://www.sanyo.com)
- Different Institutions and Companies are involved in PV development and applications today.  
[www.pv-nas.net](http://www.pv-nas.net)



# PV applications in Hungary

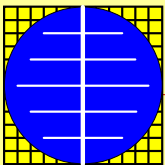
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- Off grid systems (80 kWp)
- Grid connected systems (55 kWp)
- Quasiautonomous power supplies (3 kWp)
- Consumer products (n.a.)



# 1975. The first PV installation in Hungary. (Off grid)

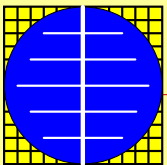
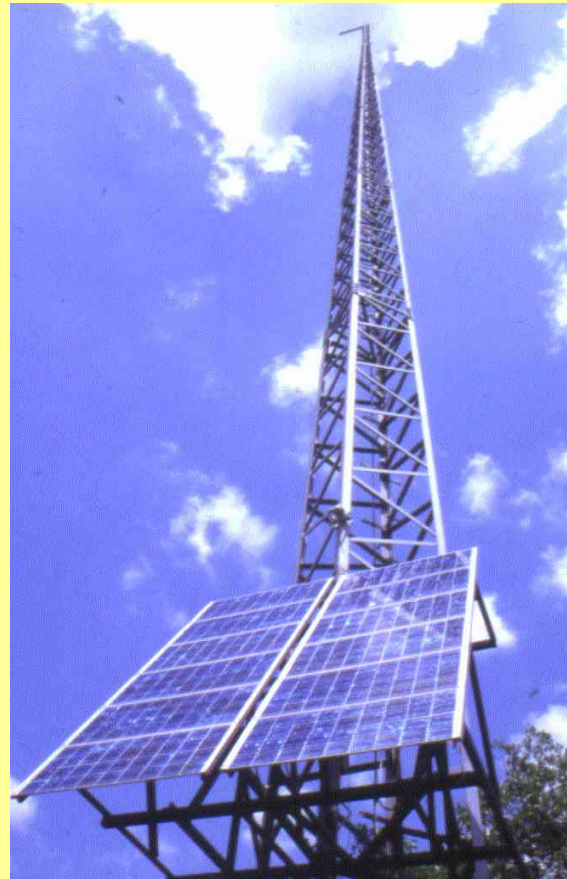
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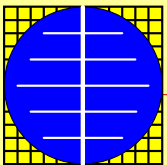
# PV powered telecom (Off grid)

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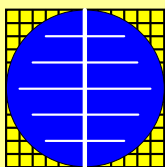
# PV & wind combined. (Off grid)

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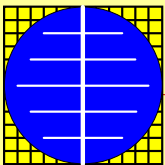
# 10 kWp grid connected PV systems

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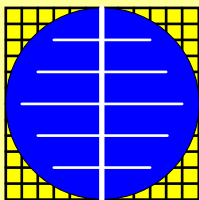
# 10 kWp grid connected PV systems

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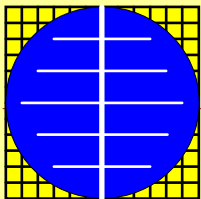
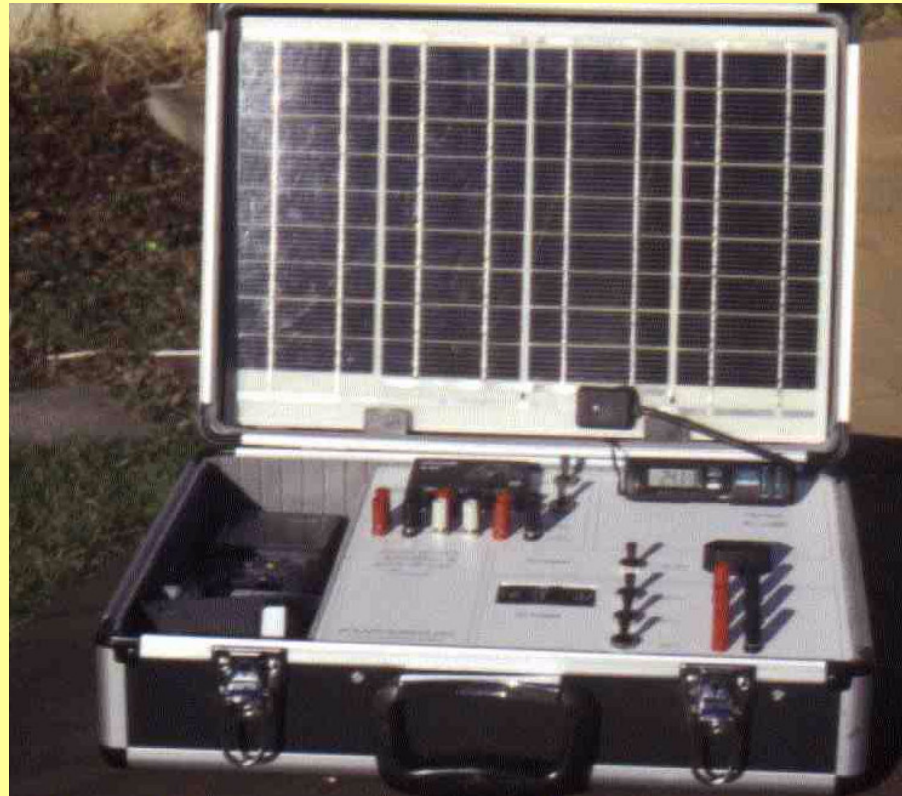
# 1,35 kWp quasiautonomous PV

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# SPMBB Solar Powered Measuring and Backup Bag (Off grid)

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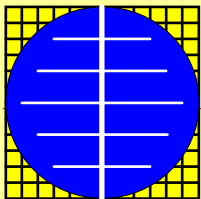


# PV Potential in Hungary

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## PV installations

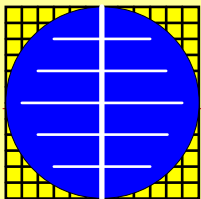
- For buildings and for other objects
- For free land areas
- Data input: Hungarian Statistical Yearbook



# PV Potential in Hungary

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- Solar modules could be installed principle on one side of the saddle roofs and on 0,431\*flat roofs.
- Solar modules could be installed really only 50% of the principle areas and 25% of the railway. (shading & others)
- Because of orientation loss the effective solar areas are with 10% lower

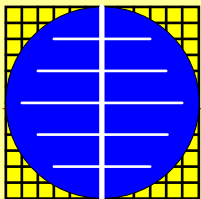




# PV Potential in Hungary

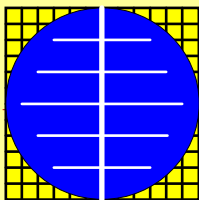
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- Calculating with 10% average module efficiency 1 m<sup>2</sup> solar module nominal power = 100 Wp
- Calculating with 80% matching and other conversion losses 1 kWp solar arrays produce yearly average in Hungary at different tilt angles as follows: at 30° 1200 kWh/year, at 45° 1150 kWh/year and at 60° 1100 kWh/year.



# PV Potential in Hungary

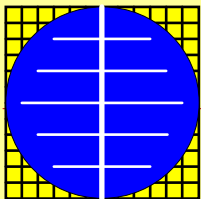
	Horizontal area (km <sup>2</sup> )	30° tilted area (km <sup>2</sup> )	45° tilted area (km <sup>2</sup> )	60° tilted area (km <sup>2</sup> )	Principal solar module area (km <sup>2</sup> )	Really solar module area decr. with orientation losses (km <sup>2</sup> )	Tilt angle of installation (°)	Solar module power to be installed (MWp)	Yearly average energy production (10 <sup>9</sup> kWh)
Apartment houses with panel&block techn.	3,94				1,698	0,764	30	76,416	0,0916996
Other dwelling houses			63		63	28,350	45	2835	3,26025
Agricultural buildings with flat roofs	13,5				13,5	6,075	30	607,5	0,729
Agricultural buildings with saddle roofs			10,125		10,125	4,556	45	455,625	0,5239688
Educational buildings with flat roofs	1,68				0,724	0,326	30	32,5836	0,0391003
Educational buildings with saddle roofs			2,744		2,744	1,235	45	123,48	0,142002
Community buildings with flat roofs	1,992				0,859	0,386	30	38,63484	0,0463618
Community buildings with saddle roofs			3,2536		3,254	1,464	45	146,412	0,1683738
Field&grazing ground	10610				4573	2057,810	30	205780,95	246,93714
Agricultural land area not subsidized	10000				4310	1939,500	30	193950	232,74
Along the rails		47,388			47,388	10,662	30	1066,23	1,279476
Sound barriers				1,00513	1,005	0,452	60	45,23085	0,0497539
TOTAL	20631,112	47,388	79,1226	1,00513	9027,207	4051,581		405158,06	486,00713



# PV Potential in Hungary

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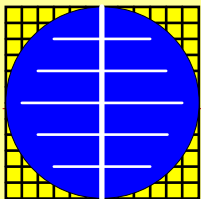
- Yearly average electrical energy production of the solar equipment to be installed potentially in Hungary = 486 billion kWh.
- Yearly demand of the electrical energy in Hungary today < 40 billion kWh.
- PV potential more than 12 fold.
- Remarks for PV fields: + Building facades  
– Solar thermal collectors



# RES share in electricity production by 2010 in Hungary

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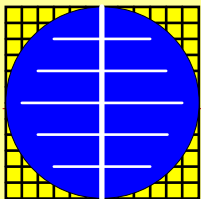
- Obligation = 3,6 %
- Fulfilled in 2005 with converting 3 power station for biomass fuel (wood)



# PV subsidy in Hungary

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- No specific subsidy for PV, only for RES
- More competitive RES subsidized
- Feed in tariff for RES

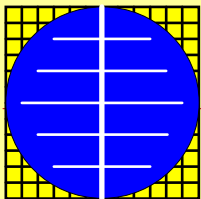


# PV subsidy in Hungary

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2000-2004

- Investment. Max. 30% (max. 1000 € for privates, max. 140.000 for companies). VAT 12/25%
- PV was not competitive in RES. Practically no subsidized.
- Only PV R&D projects were subsidized.

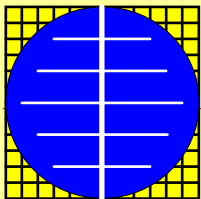


# PV subsidy in Hungary

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2000-2004

- Feed in tariff. 0,114-0,066-0,037 €/kWh (peak-valley-deep valley)
- No obligation under 100 kWp

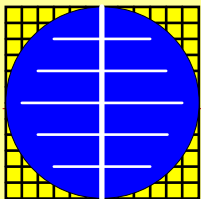


# PV subsidy in Hungary

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2005

- Investment subsidy  $\sim 0$  .  
Previous subsidy expected for 2006
- Only PV R&D projects were subsidized.



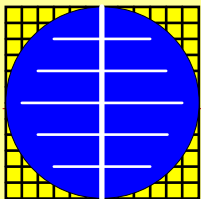


# PV subsidy in Hungary

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2005

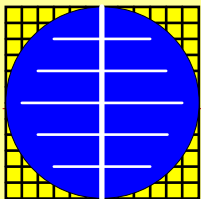
- New Electrical Energy Act (79/2005 September)
- Feed in tariff. 0,092 €/kWh
- 100 kWp lower limit deleted



# We are open for co-operation

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Thank you for your attention



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[www.solart-system.hu](http://www.solart-system.hu)