Sončna energija in stavbe

Ogrevanje in hlajenje stavb s soncem

Dr. Sašo Medved, Univerza v Ljubljani, Fakulteta za strojništvo

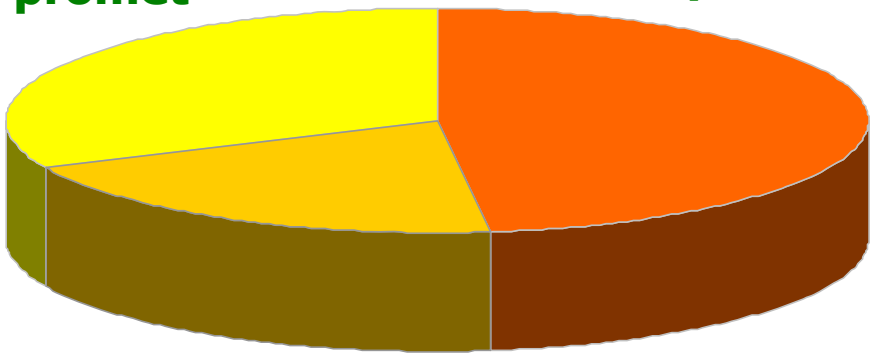
Vrste SOS

“pasivni sistemi”; integrirani v stavbe

“aktivni sistemi”; ogrevalni sistemi

“visoko temperaturni sistemi”; s koncentratorji

Raba končne energije v EU



31% promet

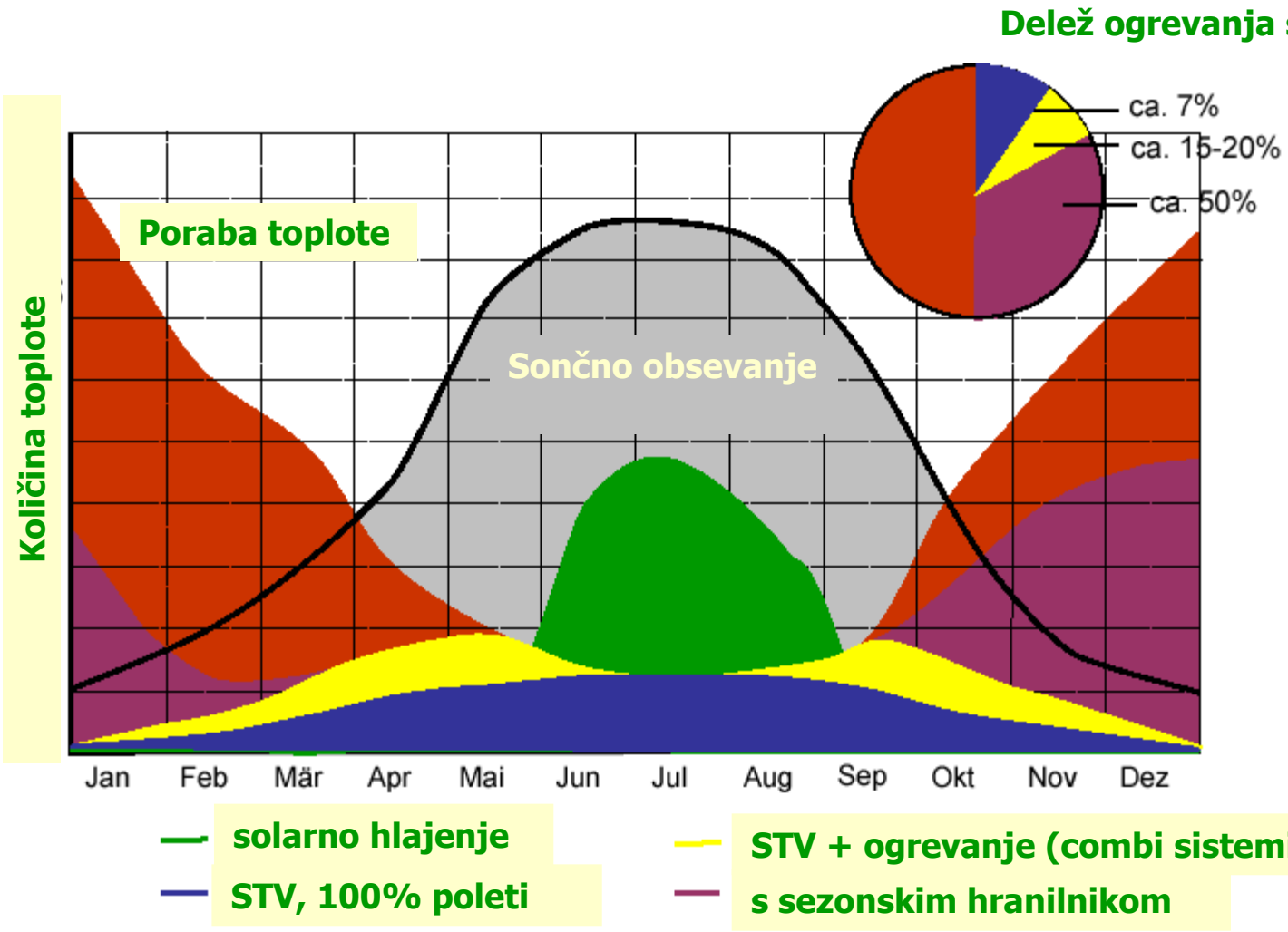
49% toplota

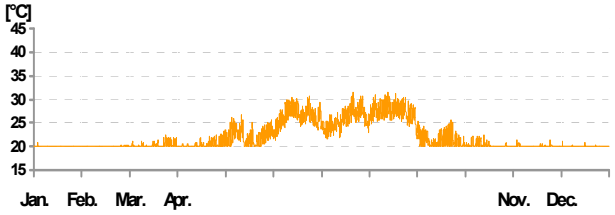
20% električna energija

28% v industriji

80% na temperaturnem nivoju do 250°C

Poraba toplote in delež solarnih ogrevalnih sistemov




[°C]
45
40
35
30
25
20
15
Jan.
Feb.
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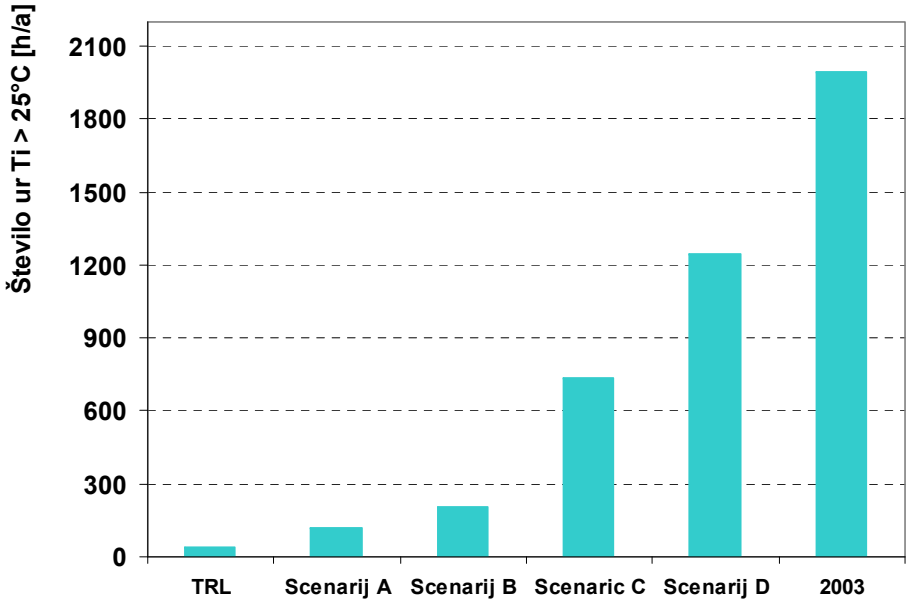
Število ur Ti > 25°C [h/a]
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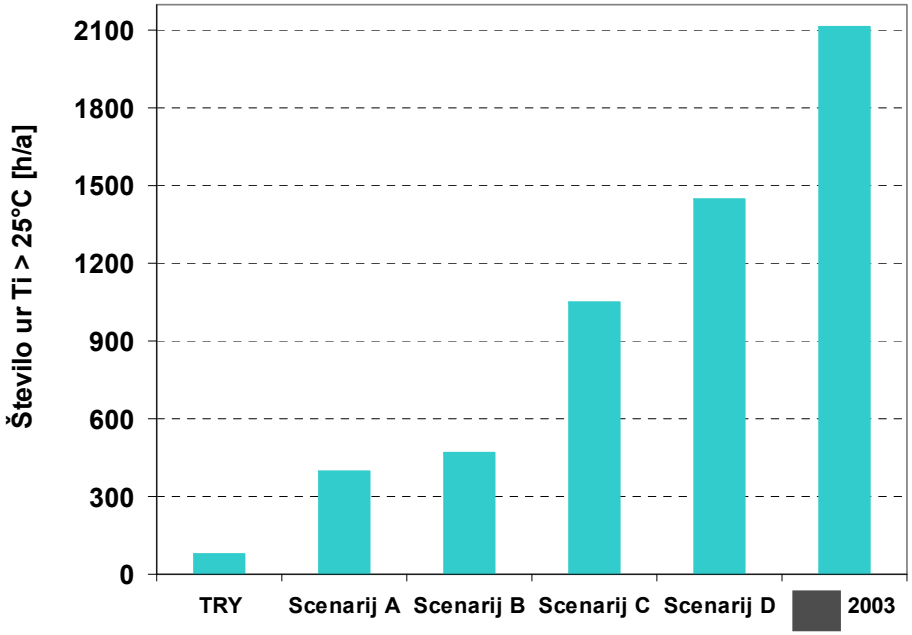
Scenarij D
2003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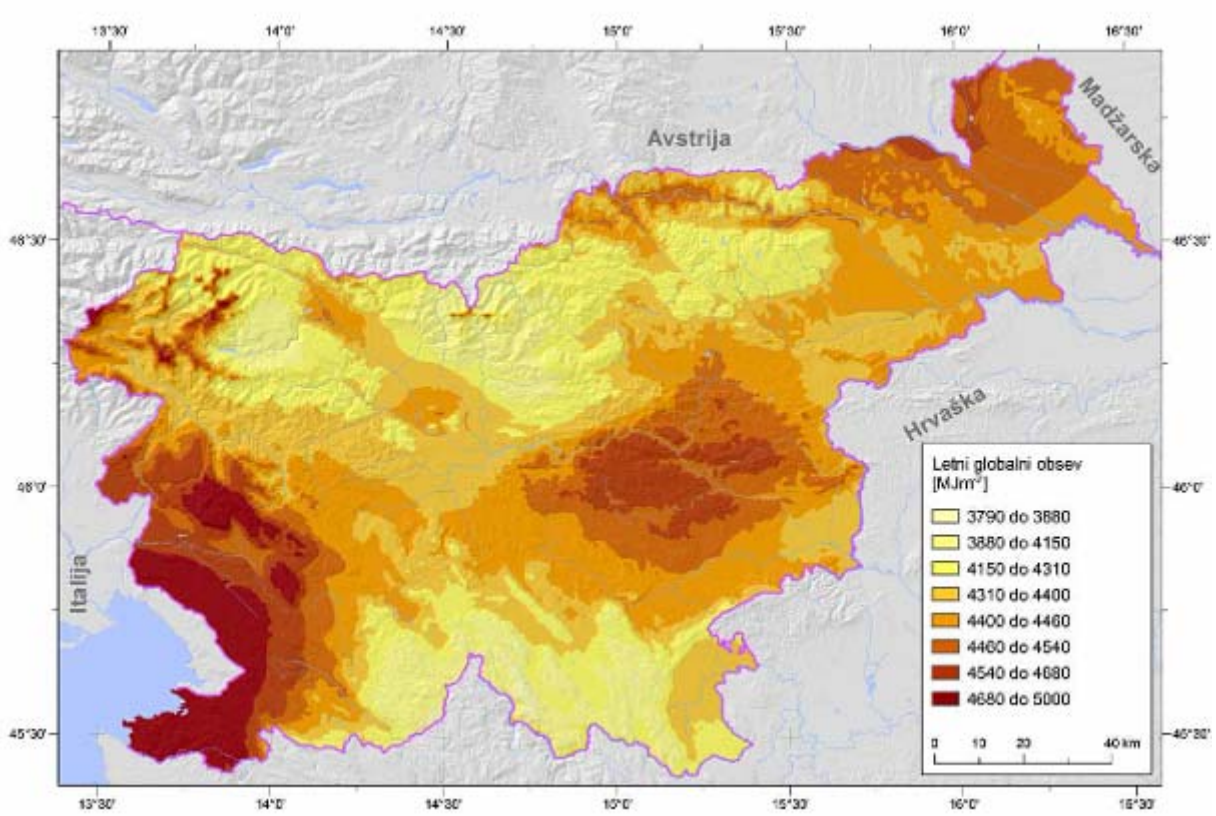
Scenarij A
Scenarij B
Scenarij C
Scenarij D
2003

Potencial sončne energije v Sloveniji

Sončno obsevanje med 1100 in 1380 kWh/m^2 v letu ali 93.000 PJ na površini SLO. Sedanja poraba primarne energije je okoli 310 PJ. Tehnični potencial je ocenjen na 10.000 in 19.000 PJ na leto.



Kastelec D.; Rakovec J., Zakšek K.; Sončna energija v Sloveniji, SAZU 2007

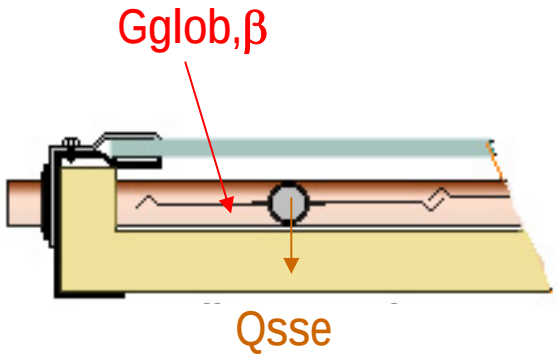
PURES, sept 2008

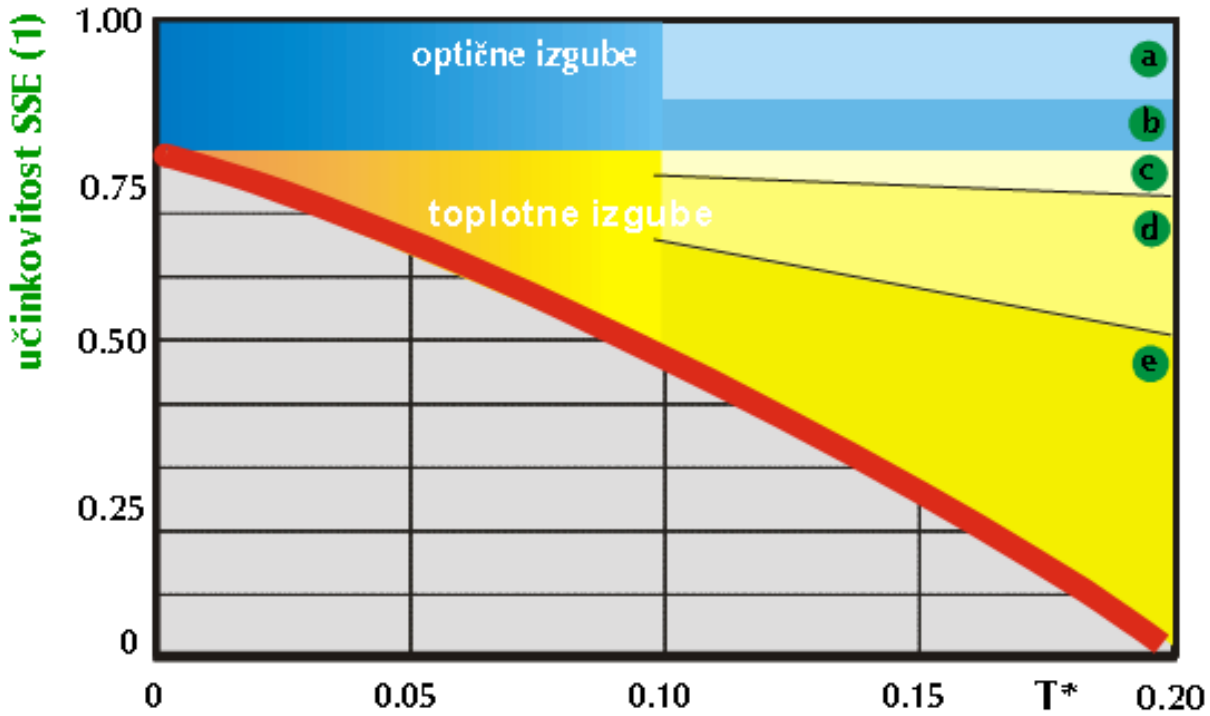
	Ogrevanje	Prezračevanje	Hlajenje	Topla voda
Okolje(zrak, voda, zemlja)				
Sončna energija				
Biomasa				
Geotermalna energija	Moči za gretje, prezračevanje, hlajenje in toplo pitno vodo moramo v stavbah zagotoviti z obnovljivimi viri energije			
Energija vetra	Priključek na sistem daljinskega ogrevanja in hlajenja iz OVE zunaj stavbe			

25%?

	Ogrevanje	Prezračevanje	Hlajenje	Topla voda
Okolje(zrak, voda, zemlja)				
Sončna energija	SSE min(6m^2; 4+0,02. $A_{bivalno}$ ~ 1000m^2 -> 24 m^2)			
Biomasa				
Geotermalna energija				
Energija vetra				

Vrste in učinkovitost sprejemnikov sončne energije





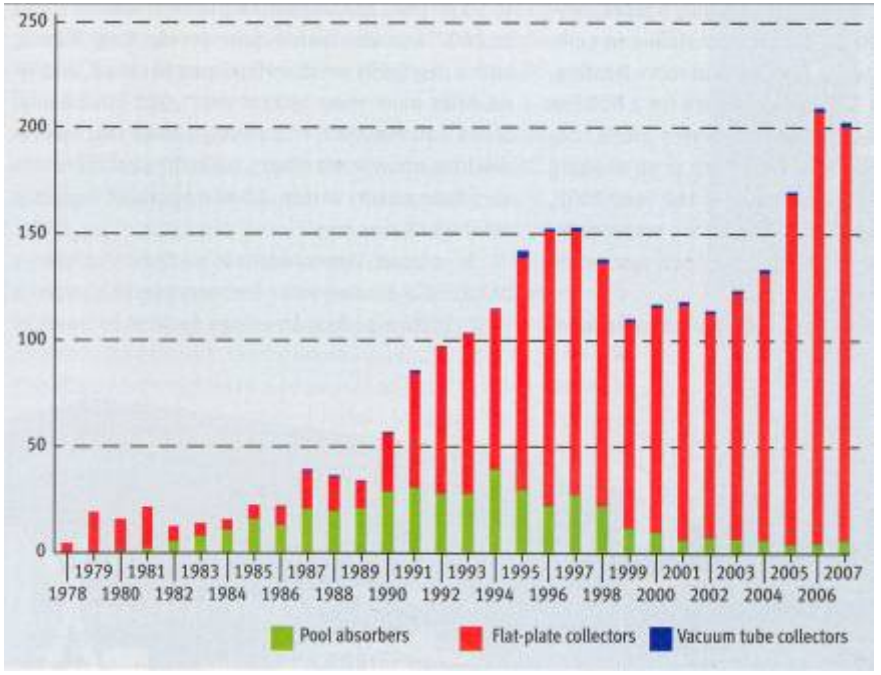
Sodobni sprejemniki sončne energije (SSE)

Belo steklo, visoka absorpcija sončnega sevanja

Sevanje segretega absorberja

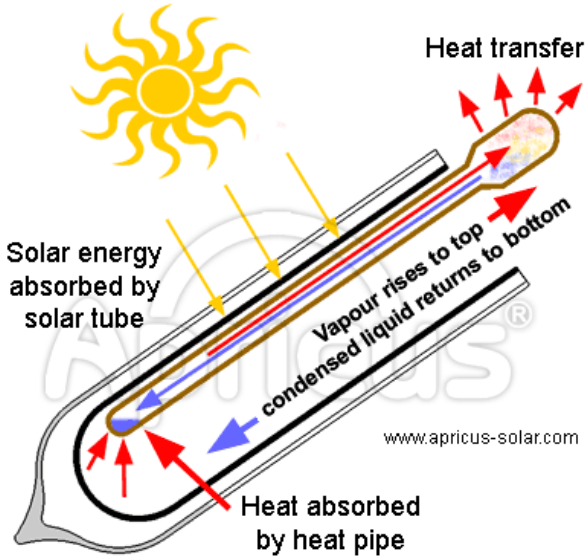
$$S = \frac{\alpha_s}{\varepsilon_{IR}}$$

Selektivnost S:
1- običajna črna barva;
2-4- srednje selektivni
20 - visokoselektivni

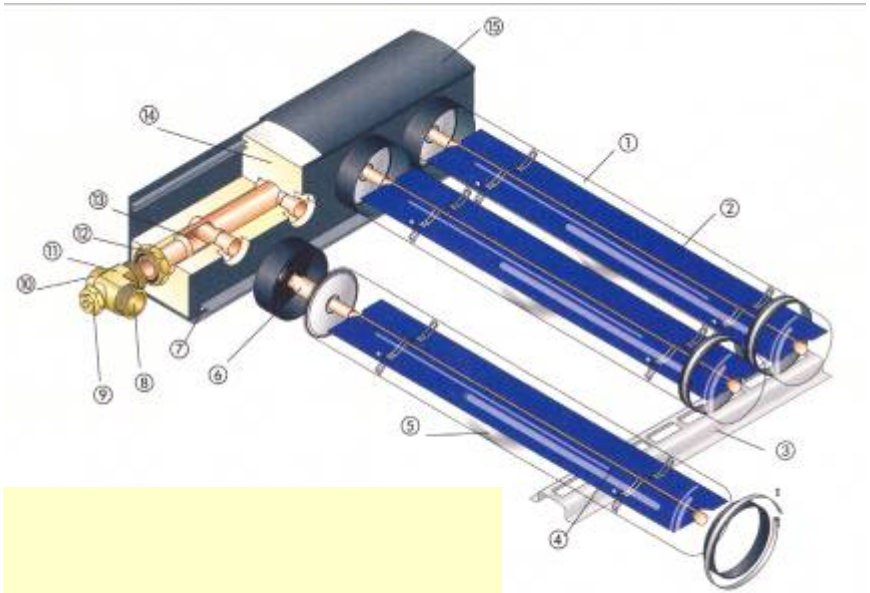


Vakuumski SSE

S toplotno cevjo in cevnim ali ravnim absorberjem



Z neposrednim obtokom



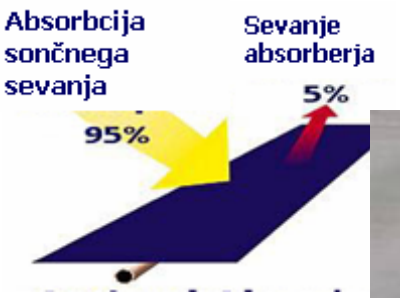
Vakuumski SSE

Vrste in učinkovitost sprejemnikov sončne energije

Količina toplote opredeljena glede na tehnologijo sprejemnikov sončne energije – **moč za selektivne in vakuumske SSE 0,7 kW/m²**

Nezastekleni 250 kWh/m²a

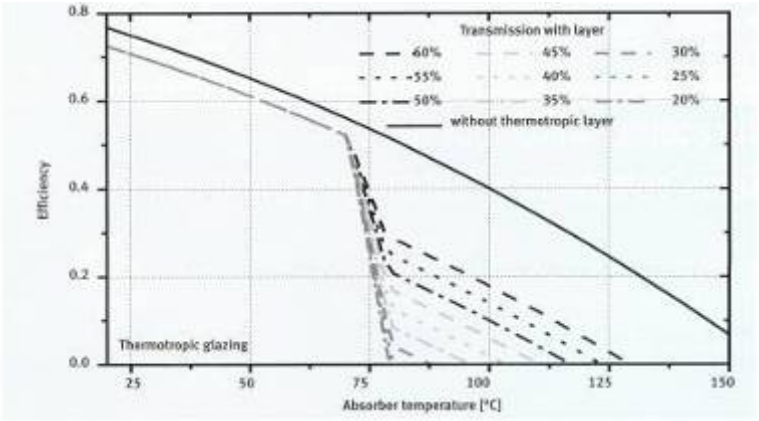
Neselektivni 350 kWh/m²a



Selektivni 500 kWh/m²a

Vakuumski 600 kWh/m²a

Nove tehnologije lahko pripomorejo k večji tržni uveljavitvi



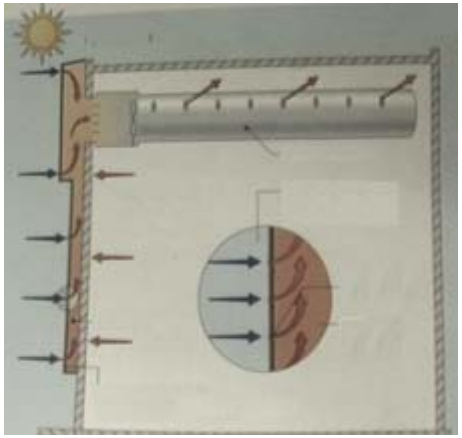
Vir: UNI FS, GEASol

as 0,626 eIR 0,325
as 0,835 eIR 0,368
as 0,876 eIR 0,400

Vir: UNI FS, KI, Gorenje Tiki

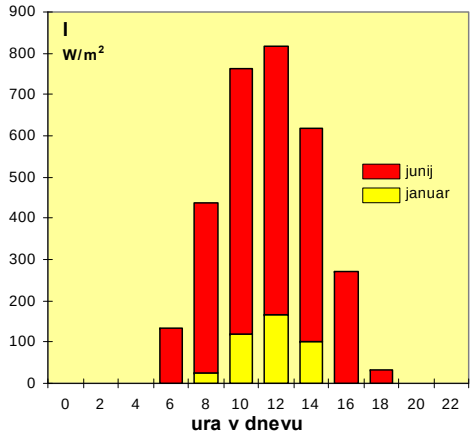
Segrevanje zraka za prezračevanje s fasadnimi sistemi

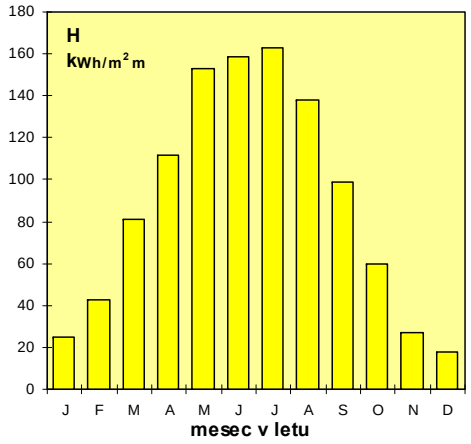
SolarWall je perforirana fasadna obloga z rego skozi katero sesamo zunanji zrak za prezračevanje

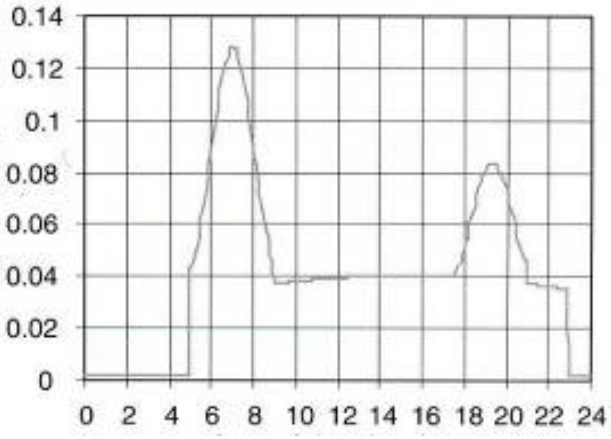


Trimo prezračevani paneli

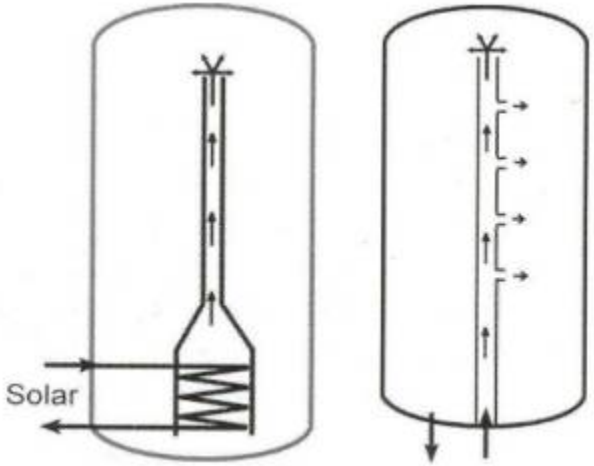
- Ohraniti eksergijo (temperaturo, ki jo zagotavlja SSE)
- Shraniti čim večjo količino toplote

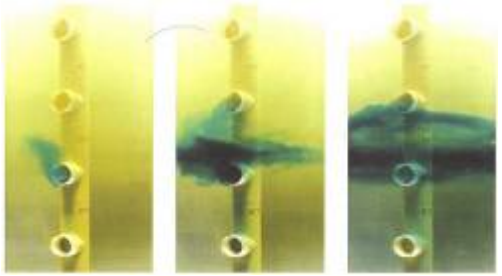






Sistemi z variabilnim pretokom -T je konstantna

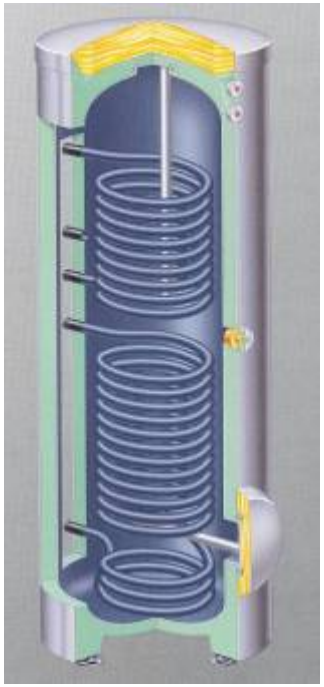




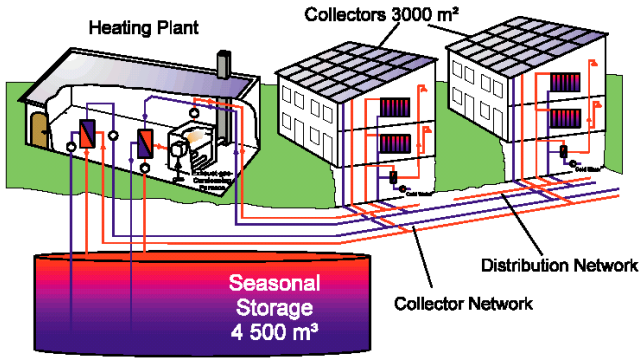
Sistemi z variabilnim pretokom

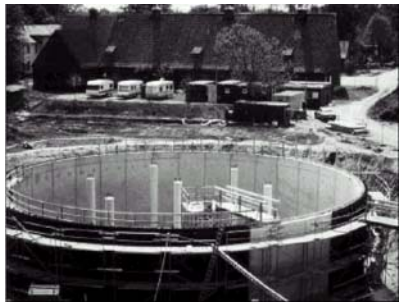
Hranilniki toplote

Z vgrajenim hranilnikom tople sanitarne vode



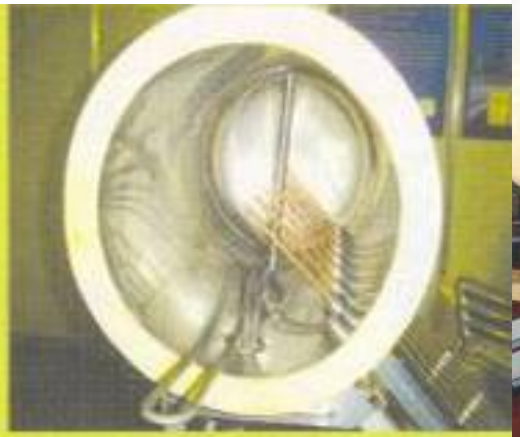
Sezonski hranilniki toplote (?)

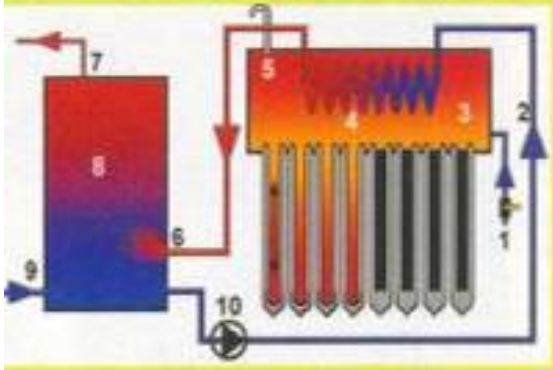


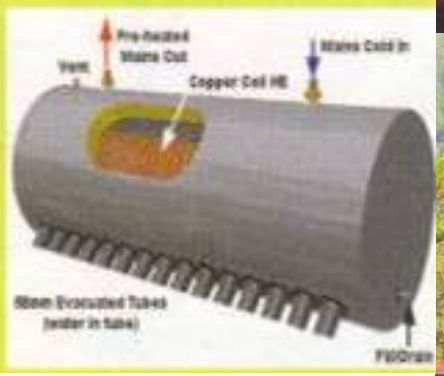


Hranilniki s temperaturnim razslojevanjem

Sistemi z naravnim kroženjem - termosifonski sistemi

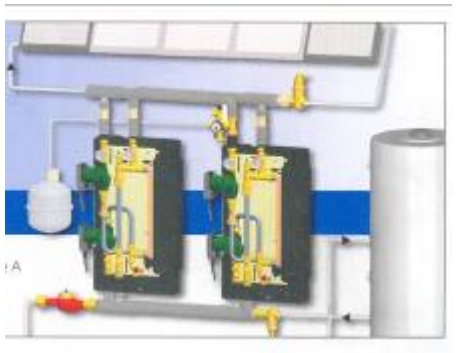






Sistemi s prisilnim obtokov

- Pri sprejemnikih sončne energije uporaba novih materialov, Al in PC
- Hranilniki toplote s temperaturnim razslojevanjem z možnostjo ogrevanja stavb
- Hidravlične enote z energijsko varčnimi črpalkami in sistemi z izpraznitvijo (drain-back)
- Sistemi v povezavi s TČ in plinskim ogrevanjem
- Povečevanje celoletne učinkovitosti sistemov ->733 kWh/m^2
- Uveljavljajo se merila kakovosti Solar Keymark, GSR



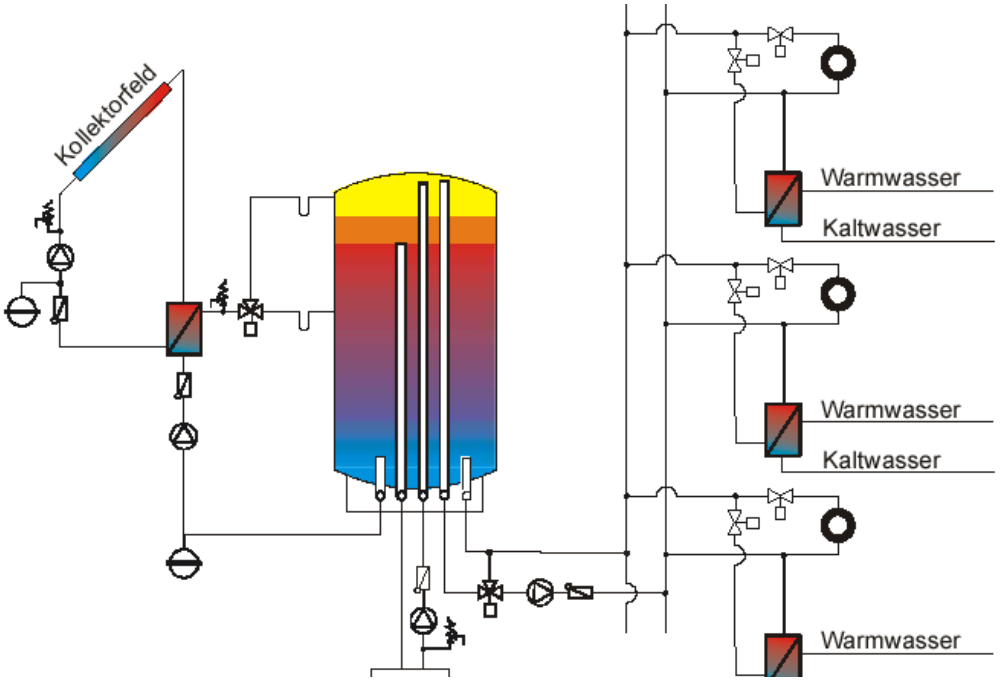
Sistemi s prisilnim obtokov

Tipična poraba toplote za pripravo sanitarne vode v eno družinski stavbi je 18 to 25 kWh/m² a

S solarnimi ogrevalnimi sistemi jo lahko zmanjšamo na 4,5 do 6,5 kWh/m² a

Podpora ogrevanju stavb

Solarno ogrevanje večstanovanjskih stavb



“dvocevni” sistem:

- **merjenje porabe +**
- **odstranjen problem legionel.**

Veliki solarni ogrevalni sistemi

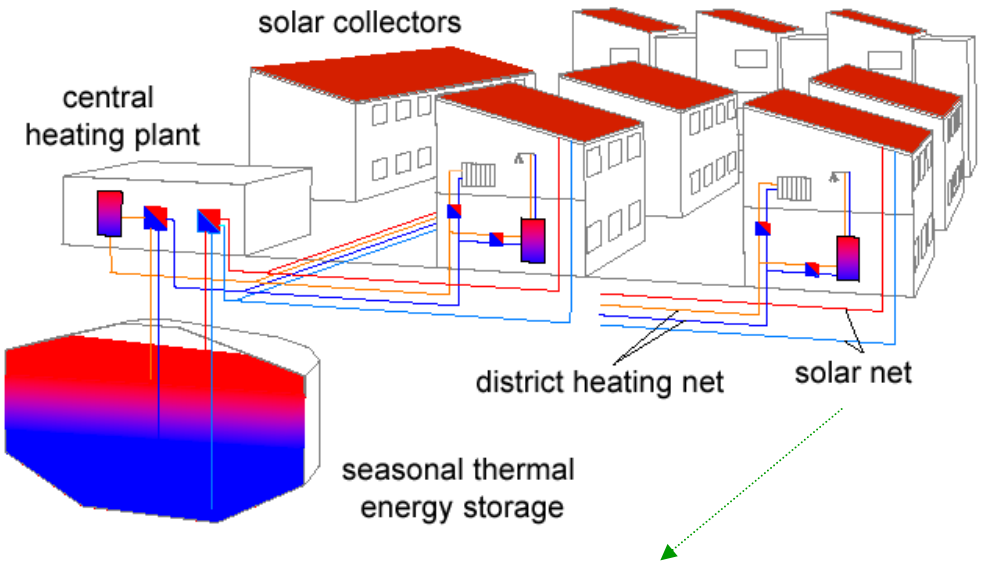
Debeli rtič, 108 m²

Impoljca, 90 m²

Gradišče, 90 m²

Šežana, 2 x 45 m²

Veliki solarni ogrevalni sistemi – ogrevanje naselij



Example: Central solar heating plant in Hamburg-Bramfeld

Example: Solar village in Gneiss-Moos, Salzburg

Daljinski sistemi z ogrevanjem na biomaso

Daljinski sistemi z ogrevanjem na biomaso (SLO)

Preddvor

Vransko

Načrtovanje, primeri dobre prakse velikih SOS

SOLARGE

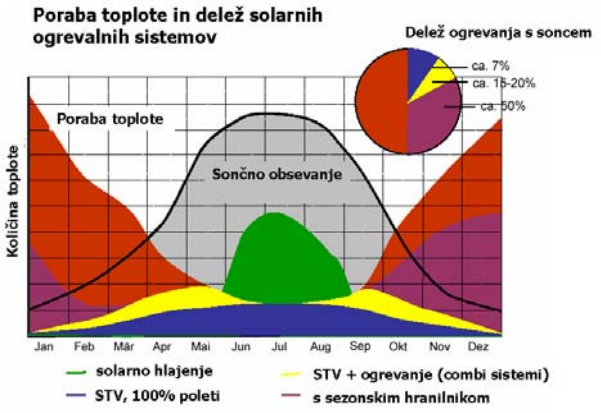
Enlarging Solar Thermal Systems in Multi-Family-Houses, Hotels, Public and Social Buildings in Europe

Solarno hlajenje

Solarne ogrevalne sisteme lahko uporabimo tudi za **solarno hlajenje**. Dva osnovna principa:

Absorbcijsko hlajenje; Ohlajena voda s temperaturo 7-12°C, ki jo uporabljamo za hlajenje stavb z običajnimi (konvektorskimi) hladilnimi ali klimatizacijskimi sistemi.

Potrebna temperatura toplote, ki jo proizvajamo s sprejemniki sončne energije proizvajamo toploto (80-85°C)

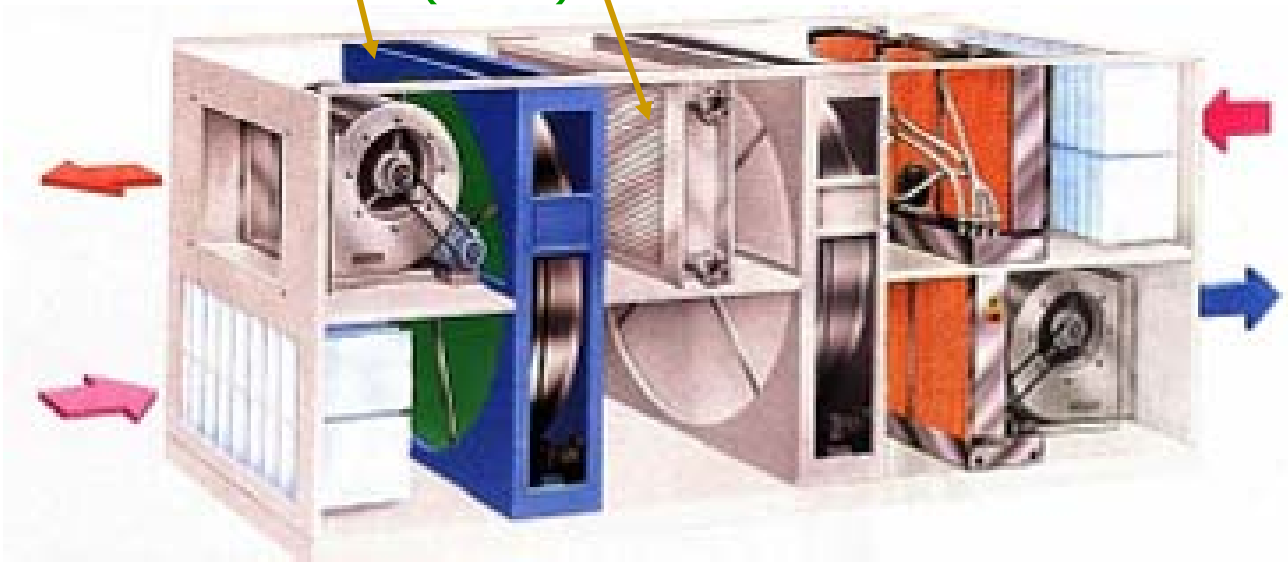


Kompaktni absorbcijski hladilni sistem, hladilna moč 5kW, temperatura hlajene vode 5-7°C

Solarno hlajenje

Kot del prezračevalne naprave (klimatske) naprav v kombinaciji **s hlapilnim navlaževanjem svežega zraka**.

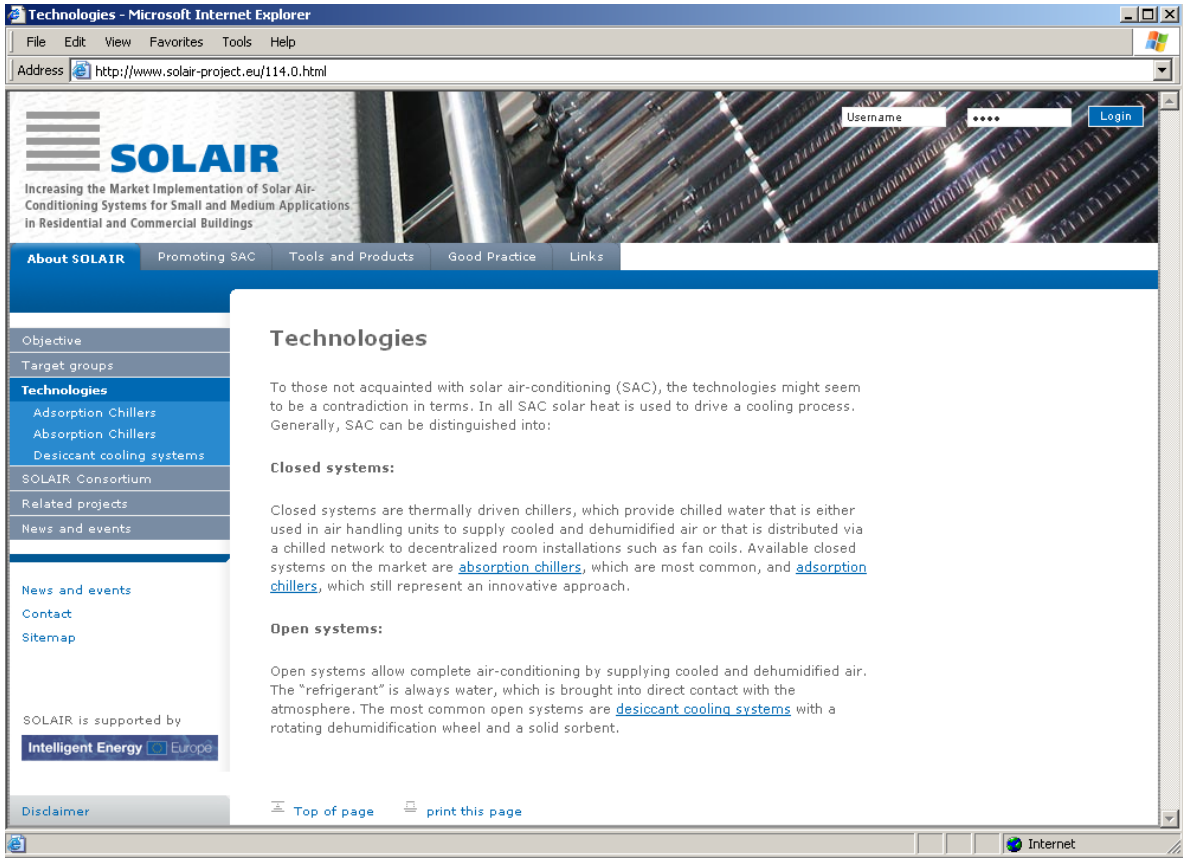
Pred navlaževanjem mora biti zrak čimbolj suh, zato ga sušimo s sušilnim kolesom. To je vrteče satovje, ki je prevlečeno z adsorpcijsko (trdno) snovjo, ki vsrka vodno paro, ki jo ponovno razvlažimo s toplim zrakom SSE (70°C)



Solarno hlajenje

SOLAIR

Increasing the Market Implementation of Solar Air-Conditioning Systems for Small and Medium Applications in Residential and Commercial Buildings



www.solair-project.eu

Toplotne sončne elektrarne

Europe looks to draw power from Africa

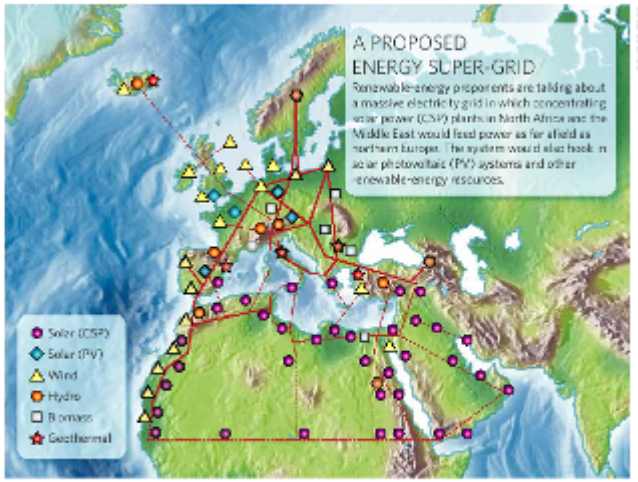
The power needs of Europe, the Middle East and North Africa could be met by an ambitious idea to network renewable energies across the region. The cornerstone of the plan, developed by a group of scientists, economists and businessmen, involves peppering the Sahara Desert with solar thermal power plants, then transmitting the electricity through massive grids.

Prince Hassan bin Talal of Jordan was scheduled to present this green energy idea, dubbed DESERTEC, to members of the European Parliament in Brussels on 28 November.

The vision is ambitious: it would require roughly 1,000 100-megawatt power plants, using mirrors to concentrate energy from the Sun's rays, throughout the Middle East and North Africa to meet the region's projected energy needs. A high-efficiency electricity grid, yet to be built, would then ferry the power around and across the Mediterranean Sea and northern Europe.

"The technology for the DESERTEC concept is available and can offer unlimited, cheap and carbon-dioxide-free energy to Europe," says Gerhard Knies, a retired physicist based in Hamburg, Germany. Knies is co-founder of the Trans-Mediterranean Renewable Energy Cooperation (TREC), which came up with the DESERTEC idea.

The European Union has a binding target to get 20% of its energy from renewable sources by 2020, so the idea is gaining support in some

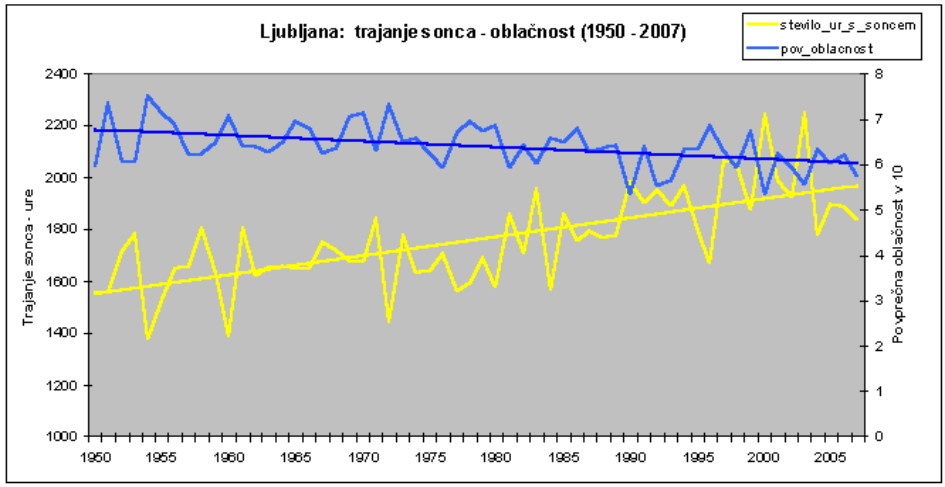


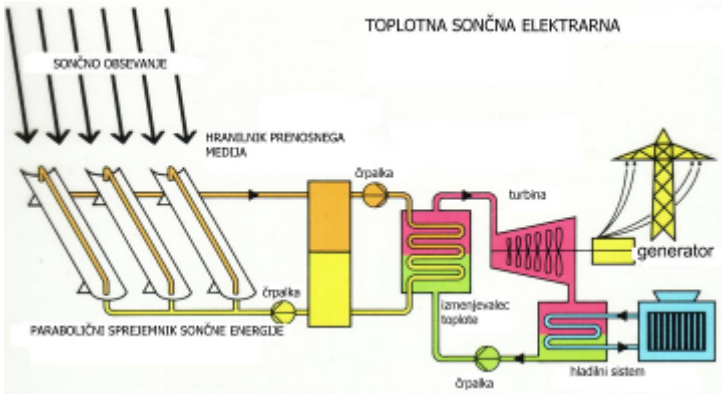
Power sharing: how the proposed renewable-energy network might look.

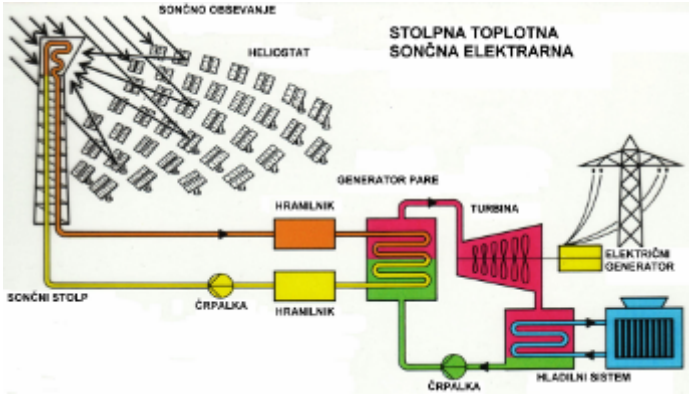
inventor who built a prototype solar thermal plant in Egypt in 1913. But the idea never took off, and today solar power in the region comes from relatively small solar-cell installations on houses and other individual buildings.

and scale could bring that down to less than 10 eurocents per kilowatt-hour, making it more competitive with coal.

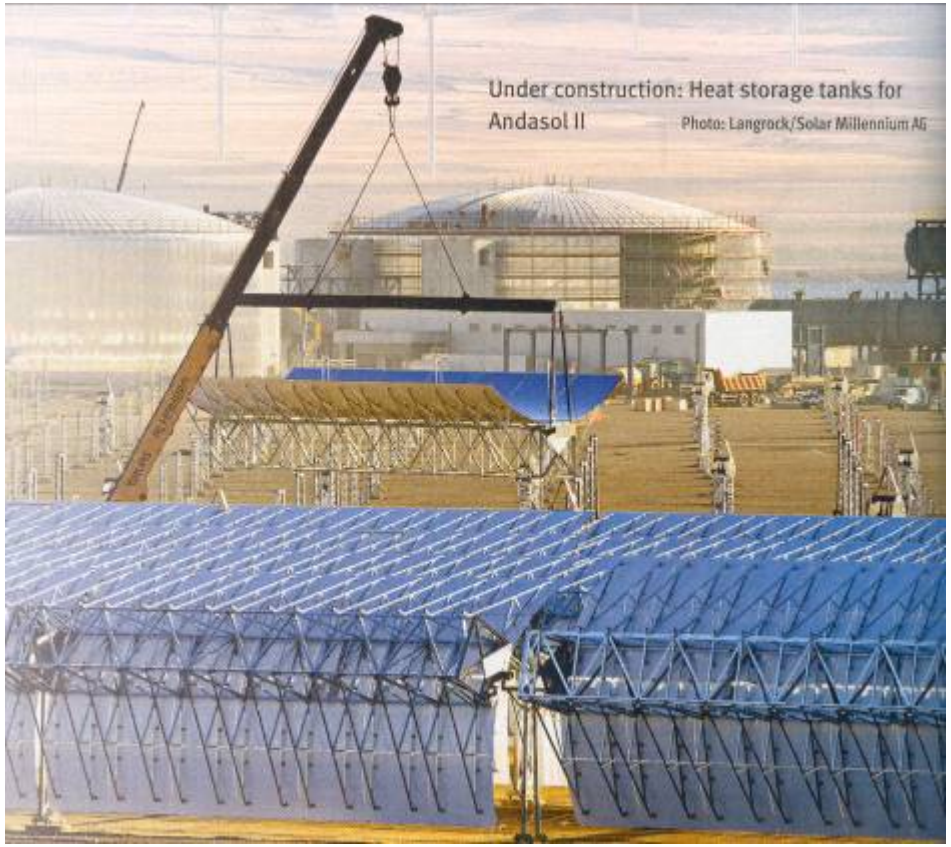
Initial solar thermal plants are being planned in Algeria, Egypt and Morocco, with more

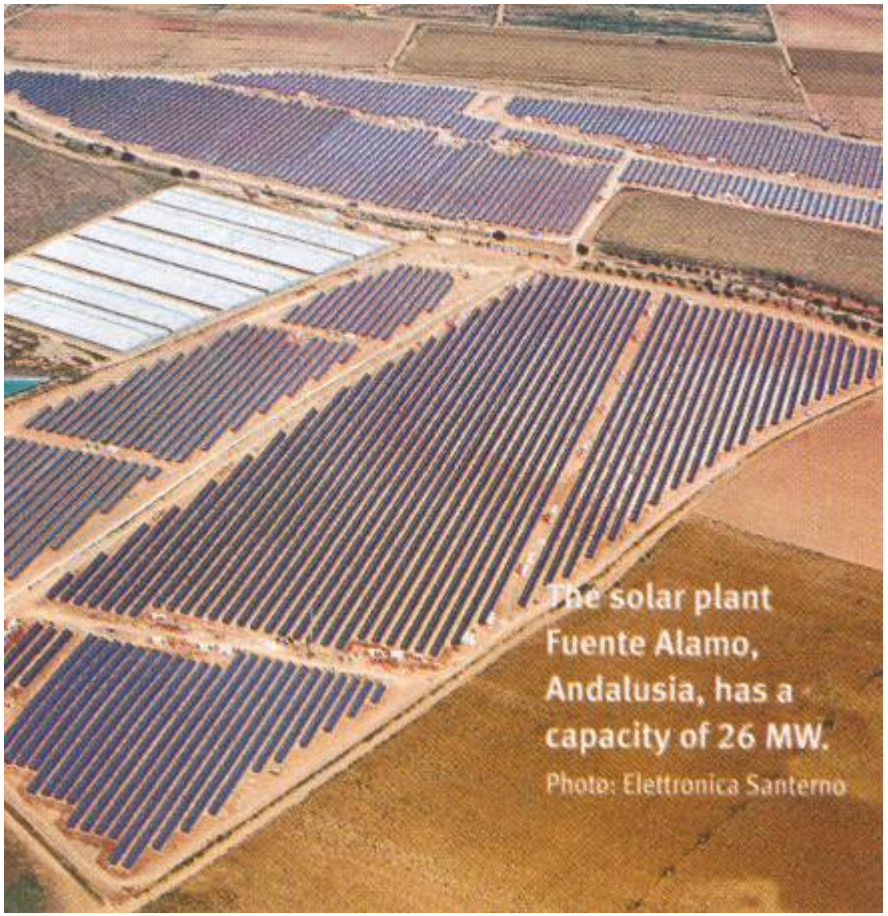






Toplotne sončne elektrarne





Nemčija

18 m² na 1000 prebivalcev

Španija

8 m² na 1000 prebivalcev

Avstrija

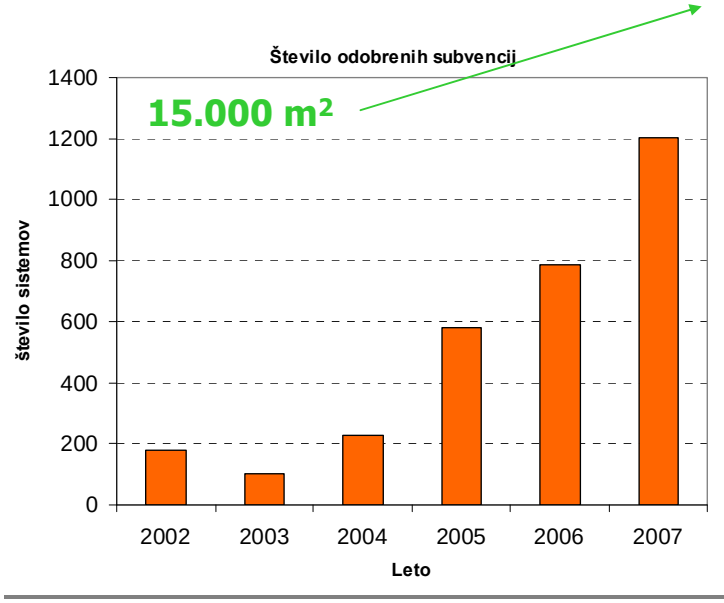
41 m² na 1000 prebivalcev

Francija

4,3 m² na 1000 prebivalcev

Kako gospodarno podpiramo solarne ogrevalne sisteme ?

- V 2008 smo vgradili ~ 15.000 m² SSE
- Novo instalirana moč -> 10,5 MW, v zadnjih 5 letih 33 MW
- Proizvodnja toplote -> 7,5 GWh
- Cena subvencij $kWh_{(10\ let)}$ -> 0,027 €/kWh
- Cena (za državo) zmanjšanih emisij CO2 -> 48 € na tono



Hvala za pozornost

E S T T P
European Solar Thermal Technology Platform

Solar Thermal Vision 2030

New buildings

100% solar heated buildings will be the building standard

Existing building stock

Solar refurbished buildings, > 50% solar heated, will be the most cost effective way to refurbish the building stock

Industrial and agricultural applications

solar thermal systems will cover process heating and cooling demands

Overall goal: Cover 50% of the low temperature need up to 250°C