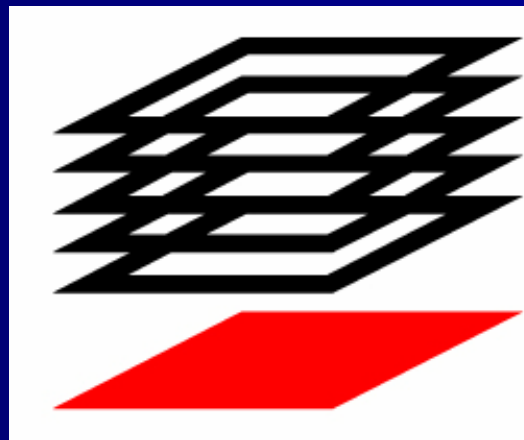
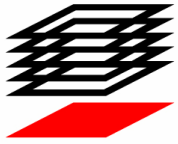


# Hrvatska komora inženjera strojarstva

[info@hkis.hr](mailto:info@hkis.hr)

[www.hkis.hr](http://www.hkis.hr)

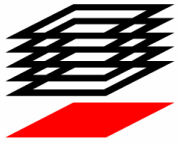




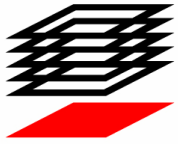
# NOVI ENERGETSKI KONCEPTI

Dario Hrastović, dipl.ing.stroj.  
[dario.hrastovic@gmail.com](mailto:dario.hrastovic@gmail.com)

Hrastović inženjering d.o.o. Đakovo  
[www.hrastovic-inzenjering.hr](http://www.hrastovic-inzenjering.hr)

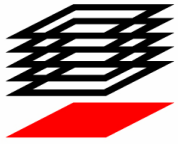


# ENERGETIKA ZGRADE

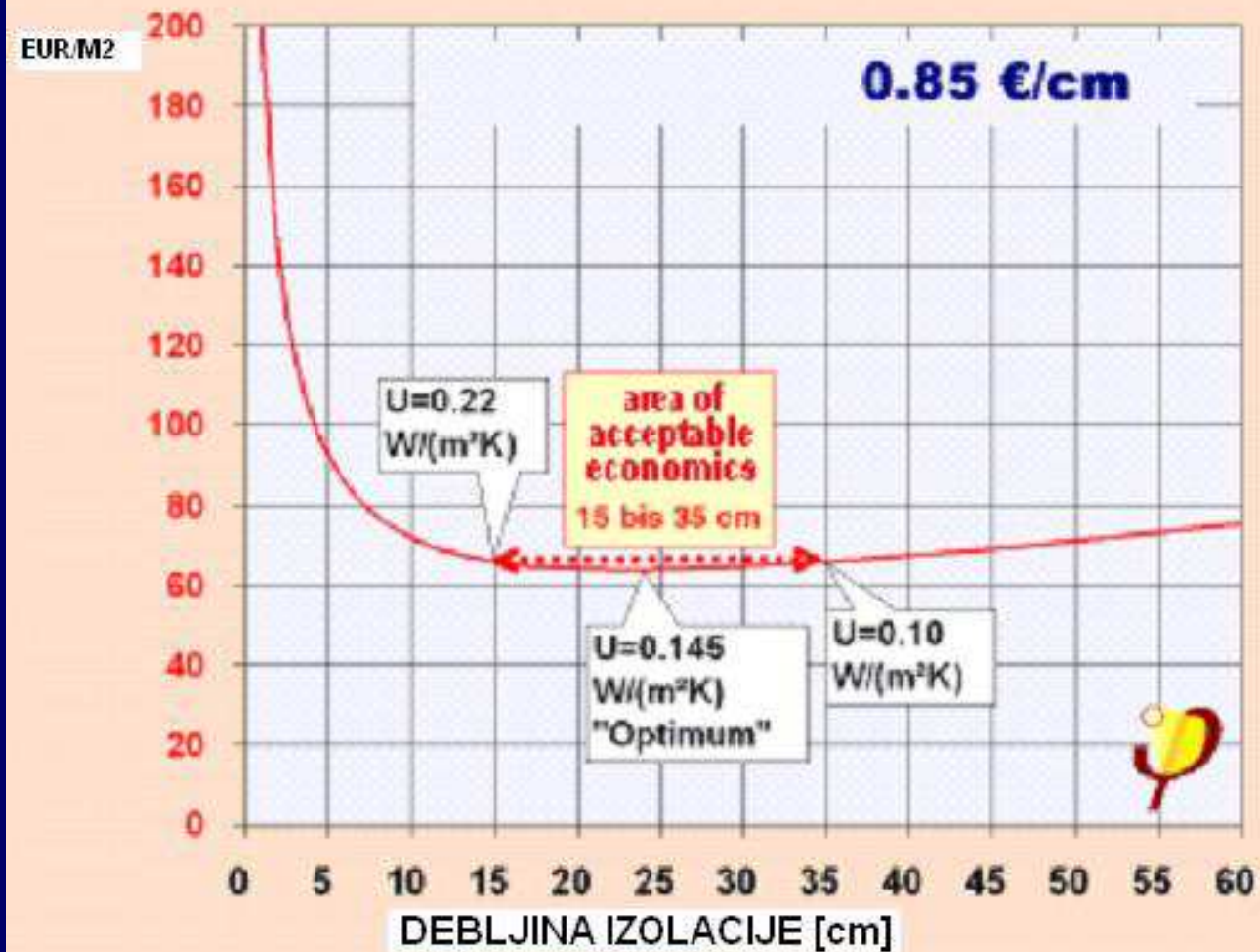


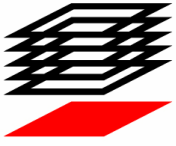
## ENERGETIKA ZGRADE – KLIMATSKE ZONE



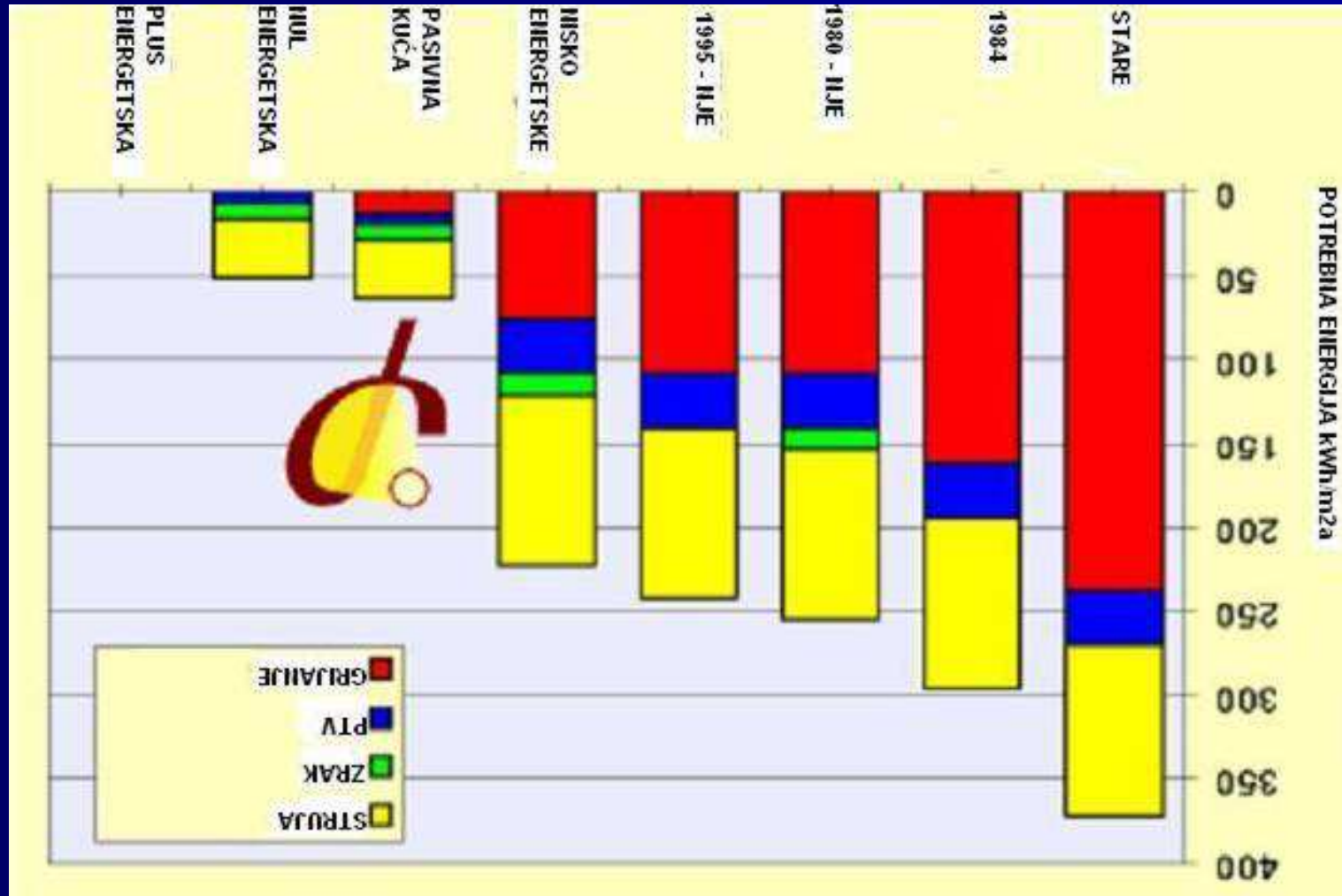


## ENERGETIKA ZGRADE – OPTIMALNA IZOLACIJA

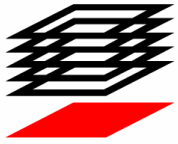




## ENERGETIKA ZGRADE – UKUPNA POTREBNA ENERGIJA







# ENERGETIKA ZGRADE – ENERGETSKE KLASSE



**Energetski certifikat za stambene zgrade**

**Zgrada**  nova  postojeća

Vrsta zgrade  
K.č, k.o.  
Adresa  
Mjesto  
Vlasnik / Investitor  
Izvođač  
Godina izgradnje

prema Direktivi 2002/91/EC

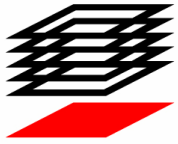
$Q_{H,nd,ref}$	kWh/(m <sup>2</sup> a)	Izračun
		<b>49</b>
<b>A+</b>	≤ 15	
<b>A</b>	≤ 25	
<b>B</b>	≤ 50	<b>B</b>
<b>C</b>	≤ 100	
<b>D</b>	≤ 150	
<b>E</b>	≤ 200	
<b>F</b>	≤ 250	
<b>G</b>	> 250	

**Podaci o osobi koja je izdala certifikat**

Ovlaštena fizička osoba  
Ovlaštena pravna osoba i imenovana osoba  
Registarski broj ovlaštene osobe  
Broj certifikata  
Datum izdavanja i rok važenja  
Potpis

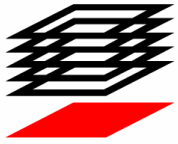
**Podaci o zgradi**

$A_e$  [m<sup>2</sup>]  
 $V_e$  [m<sup>3</sup>]  
 $\xi$  [m<sup>-1</sup>]  
 $H_f$  [W/(m<sup>2</sup>K)]

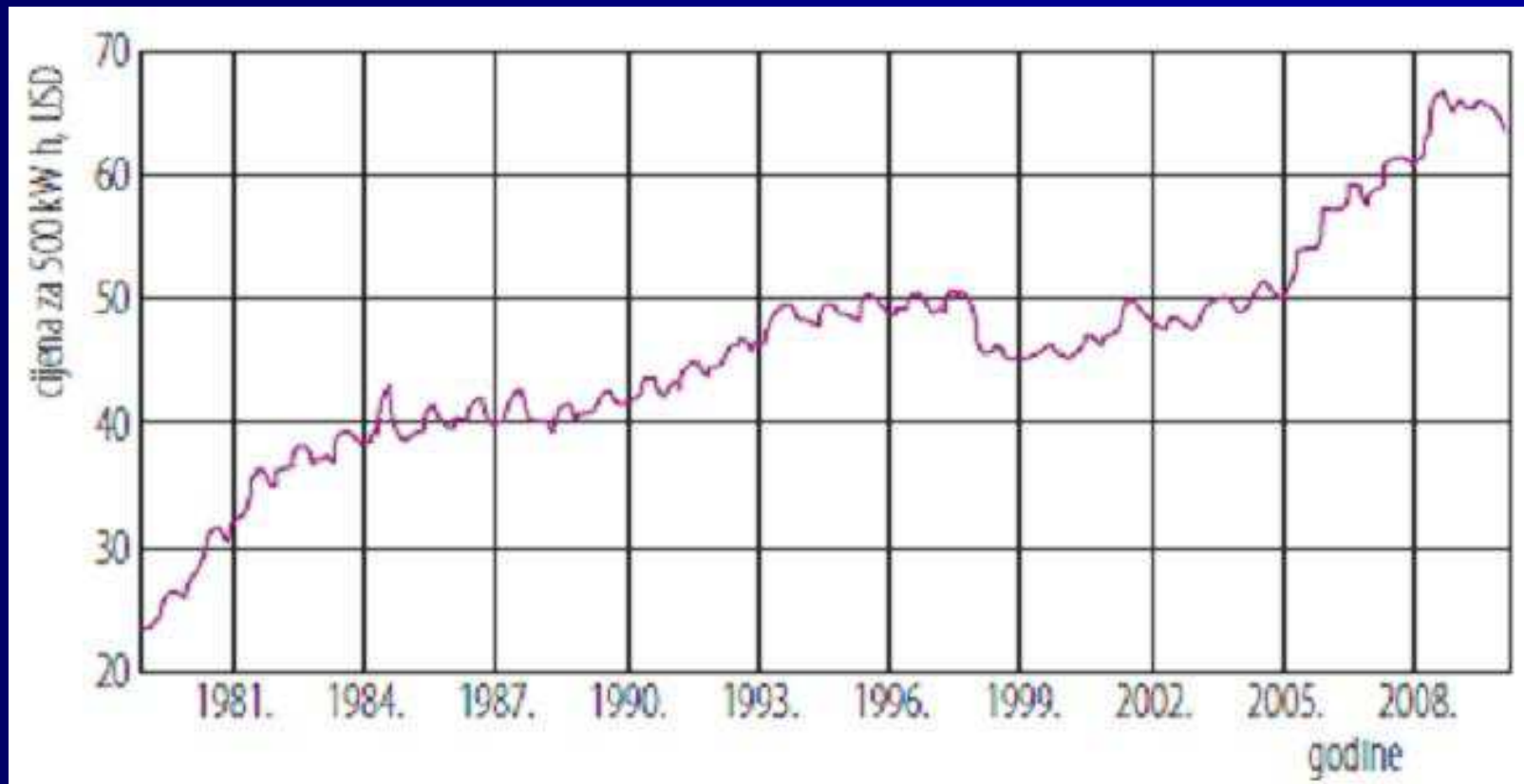


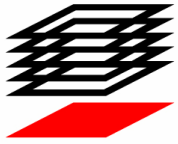
OVISNOST O DISTRIBUTERIMA?





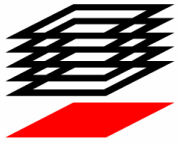
## ELEKTRIČNA ENERGIJA 3-4% god





## ZEMNI PLIN 4-5% god

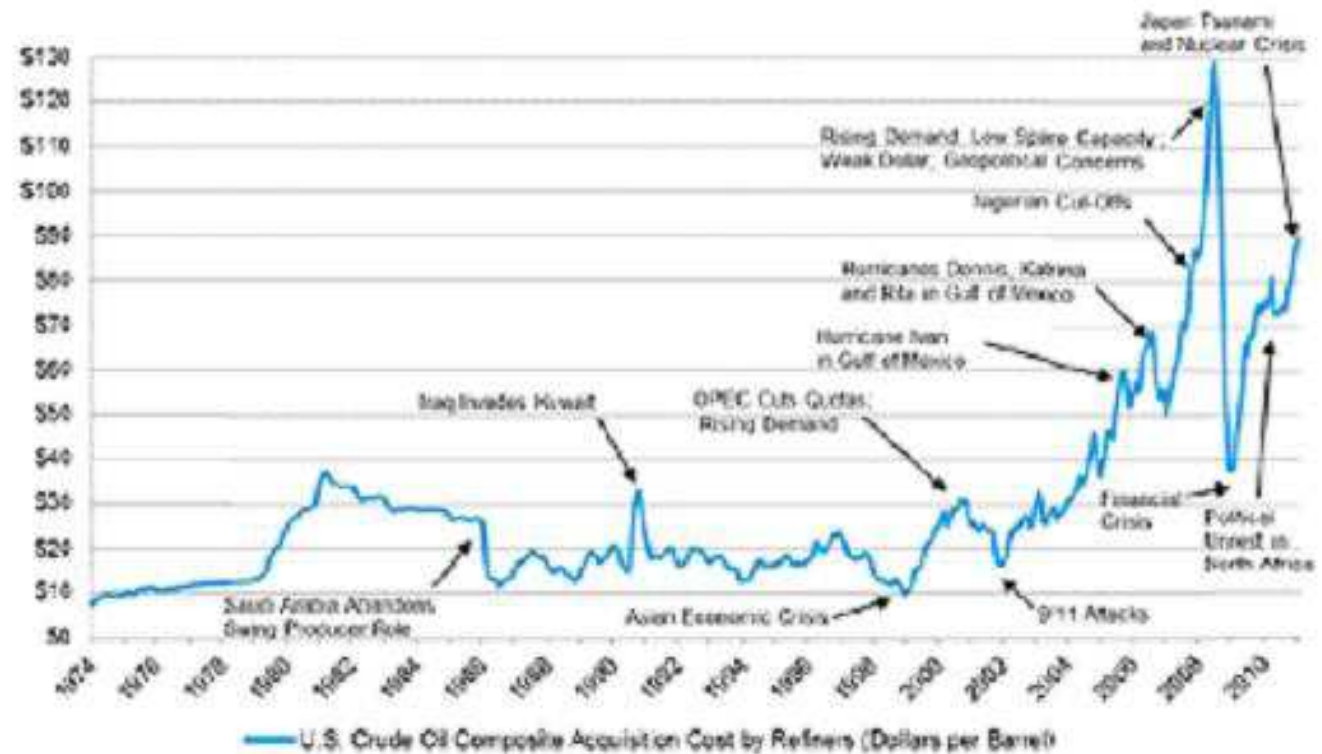


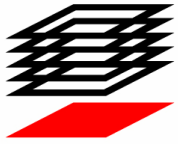


# CIJENA NAFTE

Oil price chronology 1974-2011

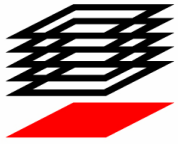
Dollars per barrel



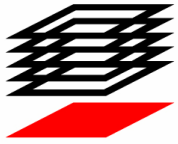


## ZAMJENA KIŠNICOM, BUNARSKOM VODOM



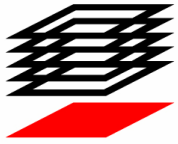


# AKUMULIRANA SUNČEVA ENERGIJA

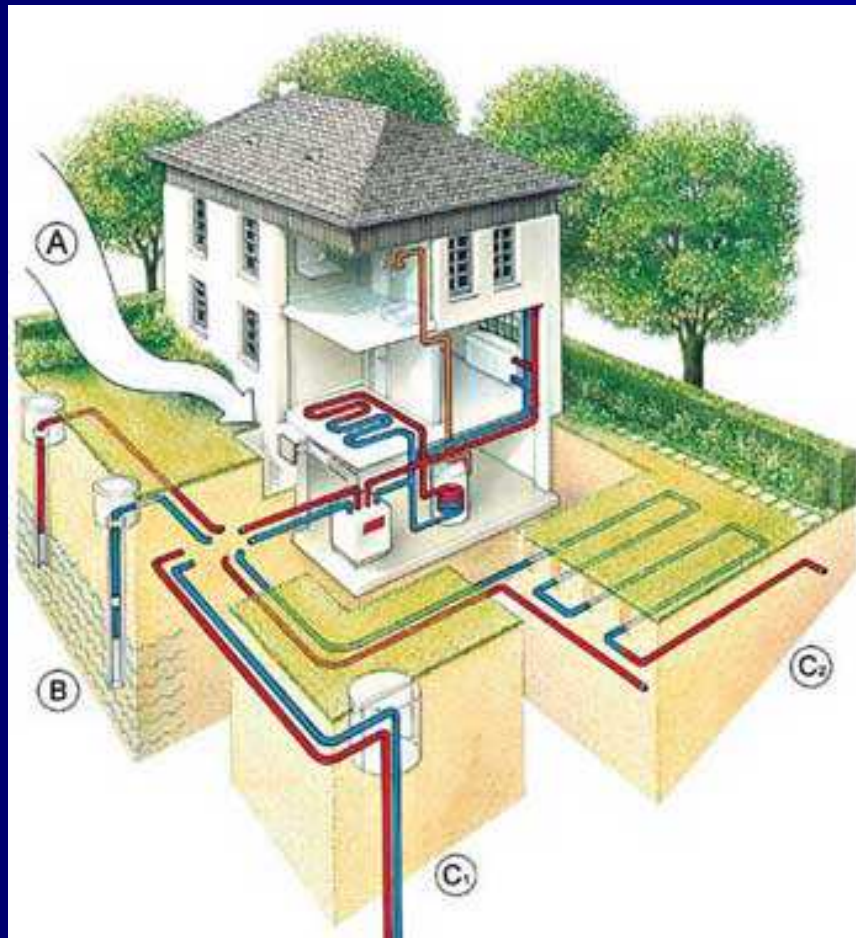


# AKUMULIRANA SUNČEVA ENERGIJA BIOMASA – VODA – ZRAK – ZEMLJA

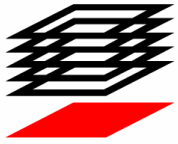




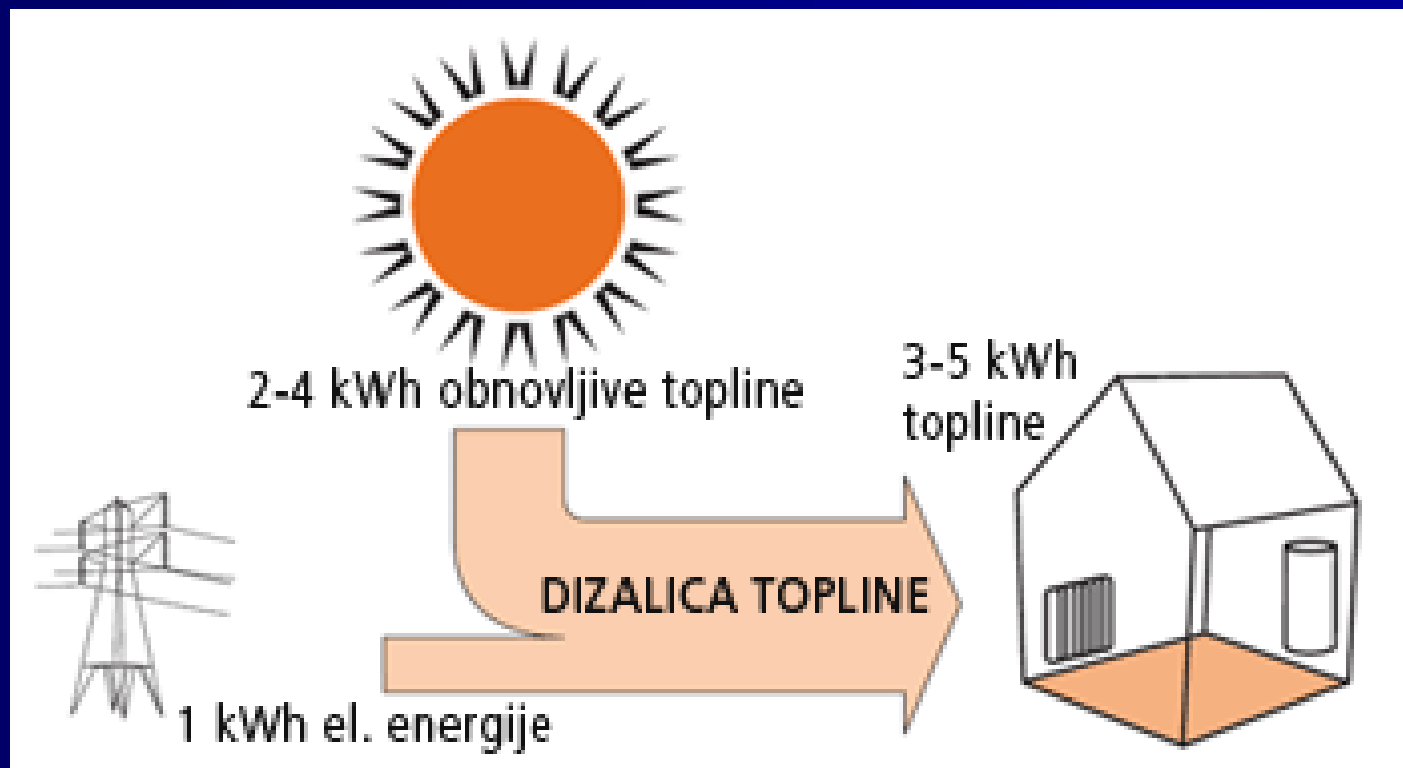
# ENERGETSKI IZVORI DIZALICA TOPLINE VODA – ZRAK – ZEMLJA

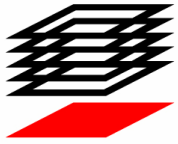




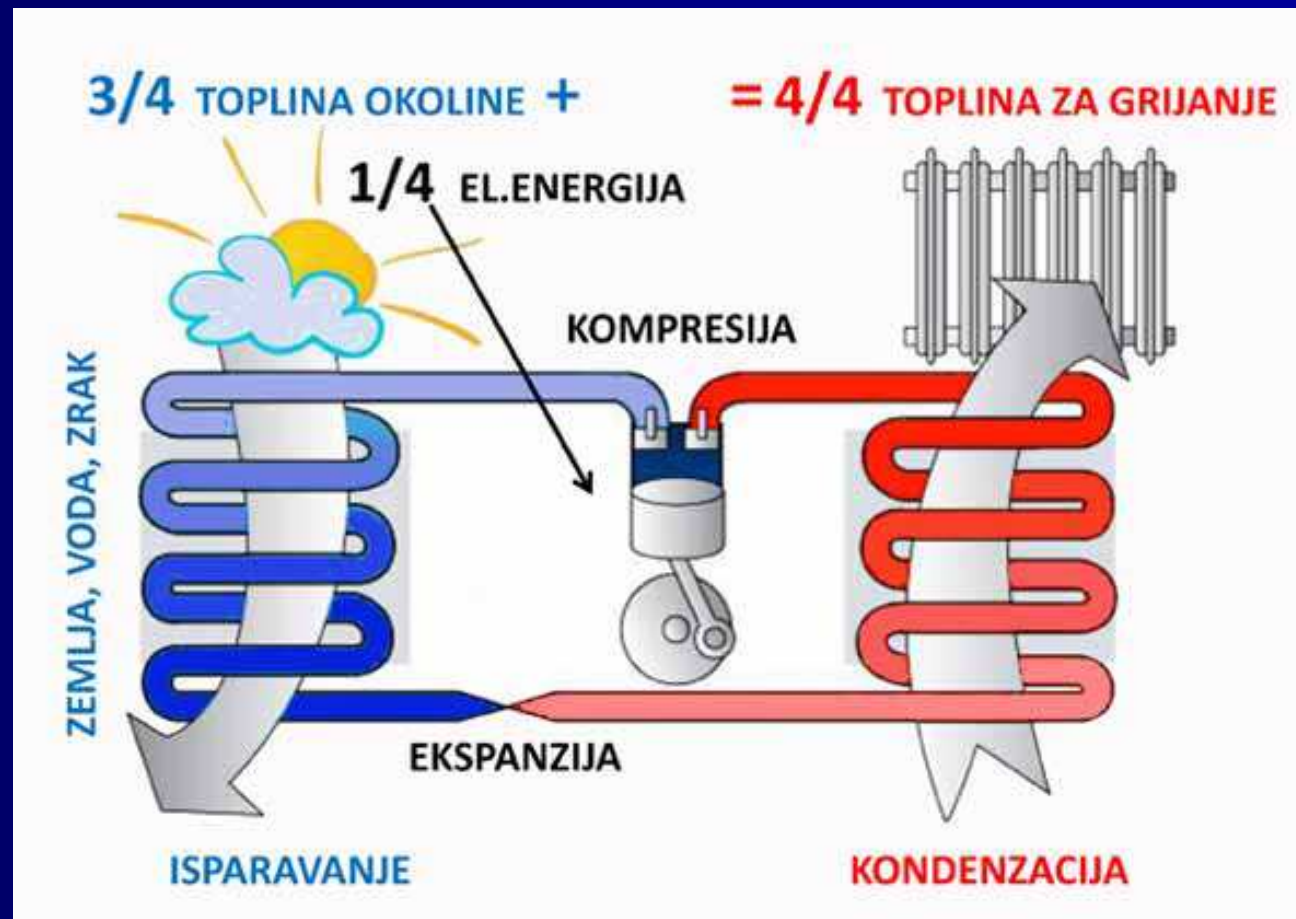


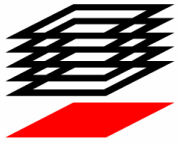
## ENERGETSKI TOK DIZALICA TOPLINE



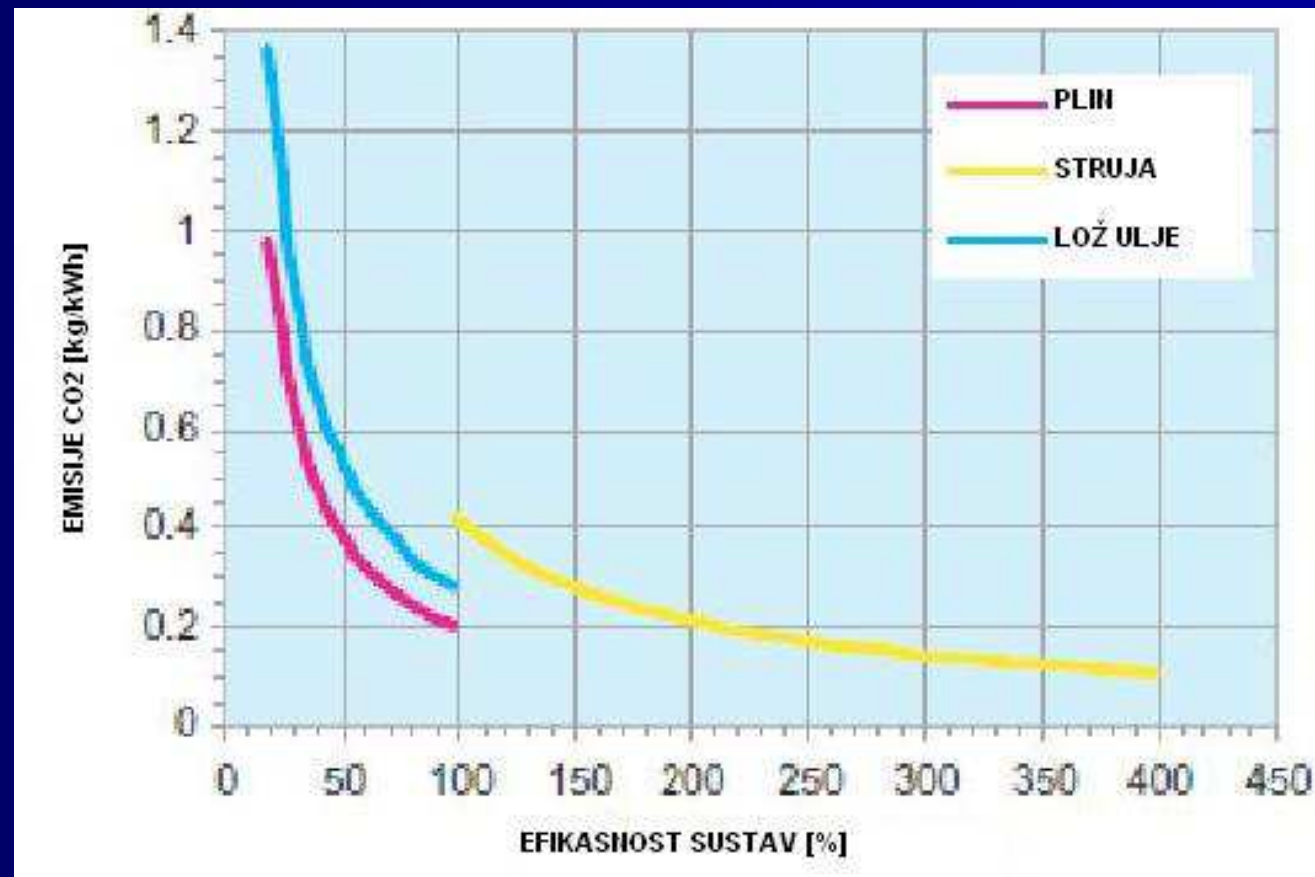


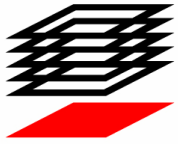
## KOMPRESORSKI KRUG DIZALICE TOPLINE





## DIZALICE TOPLINE - EMISIJA CO2





## OPTIMALNI TOPLINSKI SUSTAV

SUNČANA KUĆA

TOPLINSKI PRETVORNIK

BIOMASA

KLASIČNA MREŽA

SUNČANA KUĆA

FOTONAPONSKI PRETVORNIK

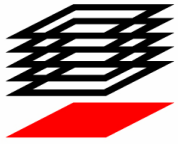
DIZALICA TOPLINE

-ZRAČNA

-VODENA

-GEOTERMALNA

ZRAČNI ILI VODENI SUSTAVI

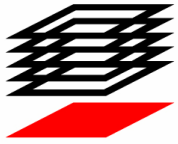


## DIZALICE TOPLINE



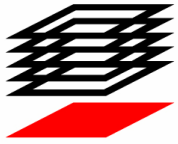
### ZRAČNE DT

- opravdana primjena u Primorskoj Hrvatskoj
- potrebne su visoke zimske temperature
- max COP 3,5
- max SPF 2,5 do 3,5



TOPLINSKI IZVOR  
PLAVA – TEMPERATURA ZRAKA  
ZELENA – TEMPERATURA ZEMLJE NA 1,7 m  
SMEĐA – TEMPERATURA ZEMLJE NA 75 m

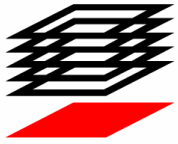




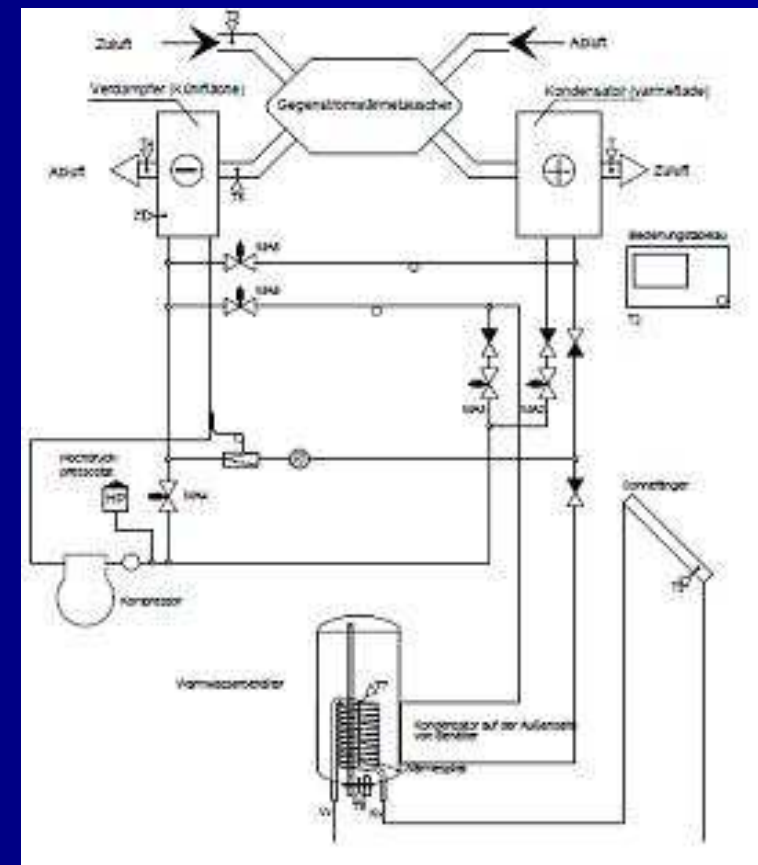
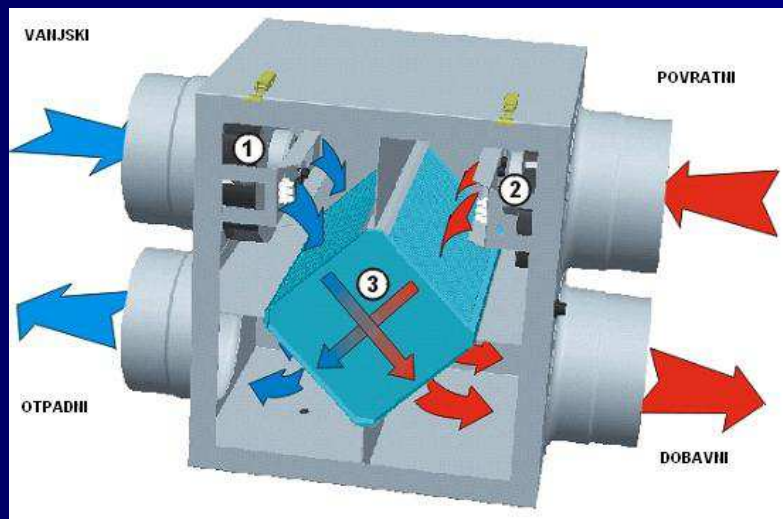
# GEOTERMALNI ZRAČNI IZMJENJIVAČ

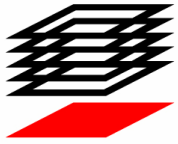




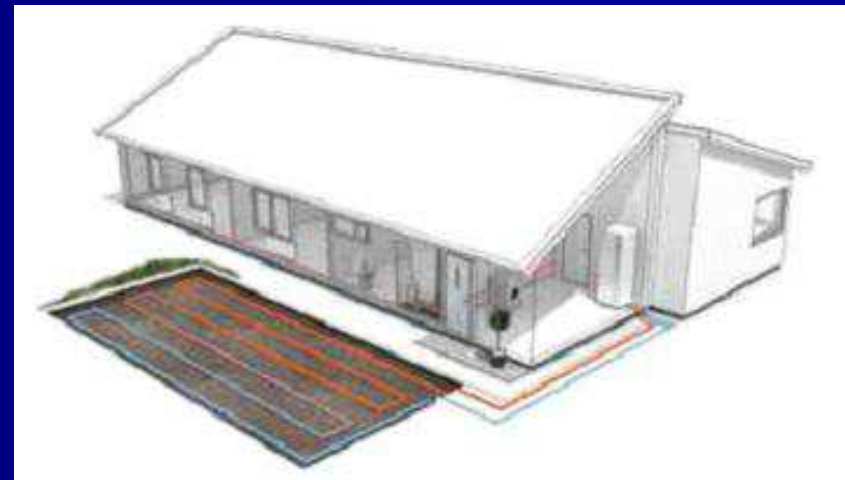


# REKUPERATORI



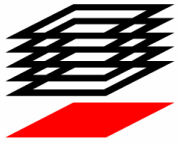


## DIZALICE TOPLINE



### ZEMNI KOLEKTORI

- potrebna je velika površina
- ovisno o sastavu tla i rasporedu 15-40 W/m<sup>2</sup>
- površina kolektora 1,5-2,5 građevine
- max COP 4,5
- max SPF 3,5 do 4,0

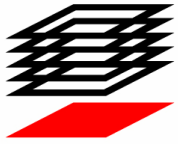


## DIZALICE TOPLINE

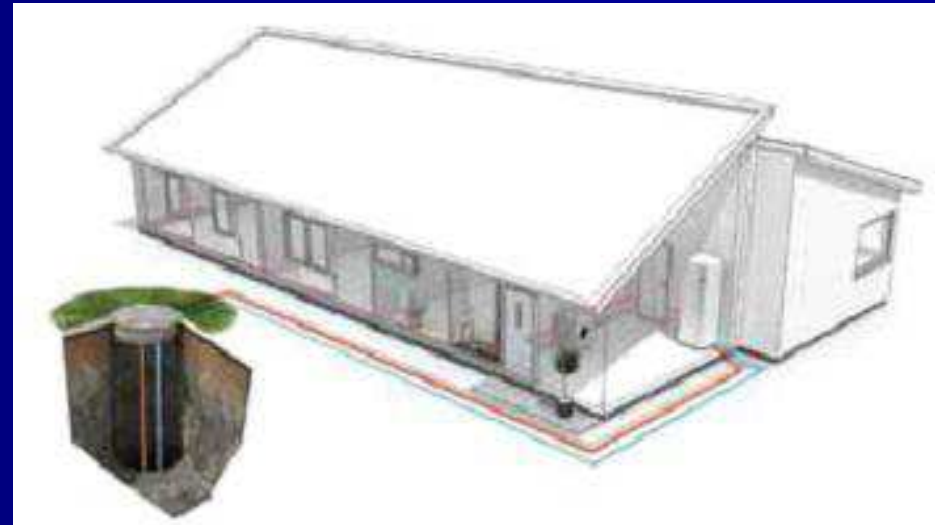
### MODELI RASPOREDA

- rijetki raspored
- spiralni, slinky raspored
- višeslojni raspored
- kapilarni kolektor
- dno jezera



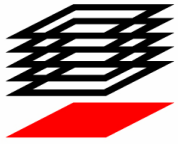


## DIZALICE TOPLINE

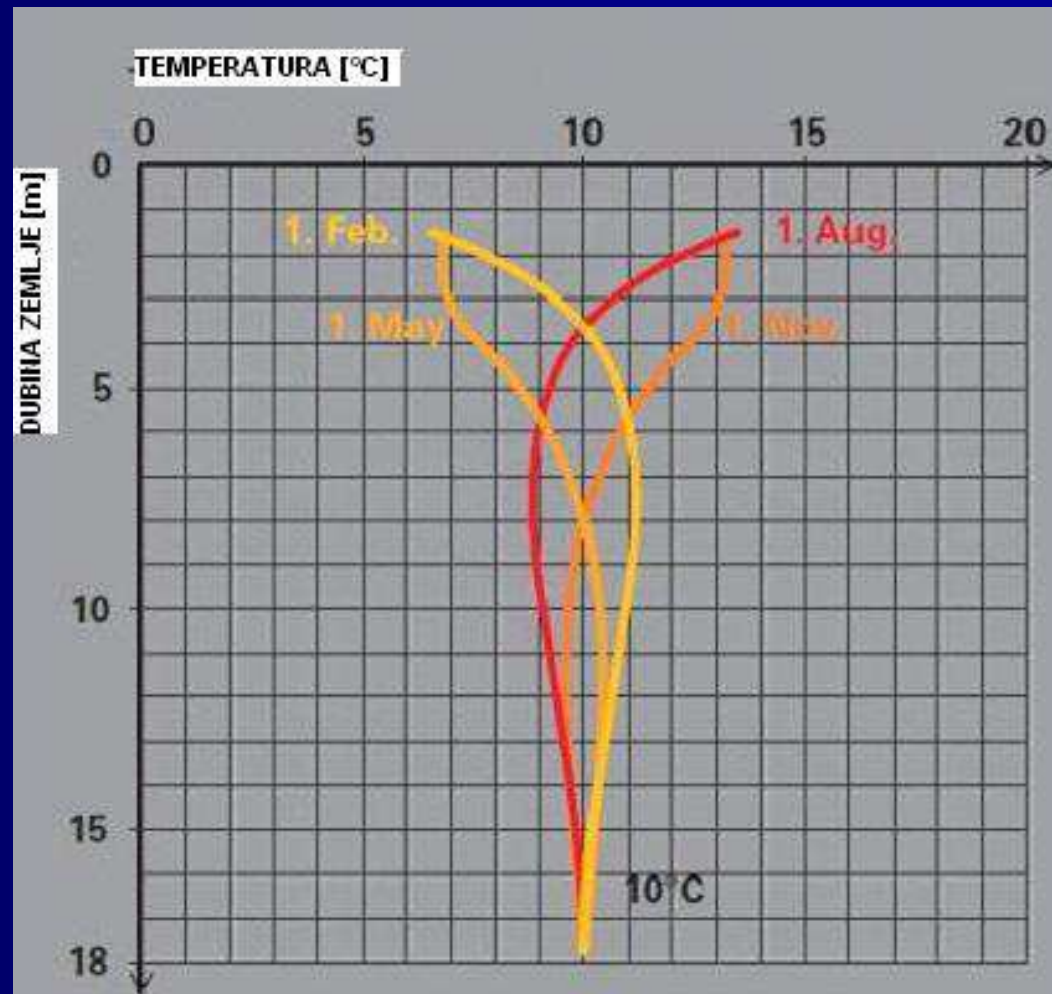


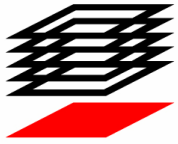
### SONDE

- mogu se primjeniti skoro u svim vrstama tla
- toplinski dobitak 25-85 W/m
- sonda od 100m = 30000-100000 kn
- max COP 4,5
- max SPF 3,5 do 4,0

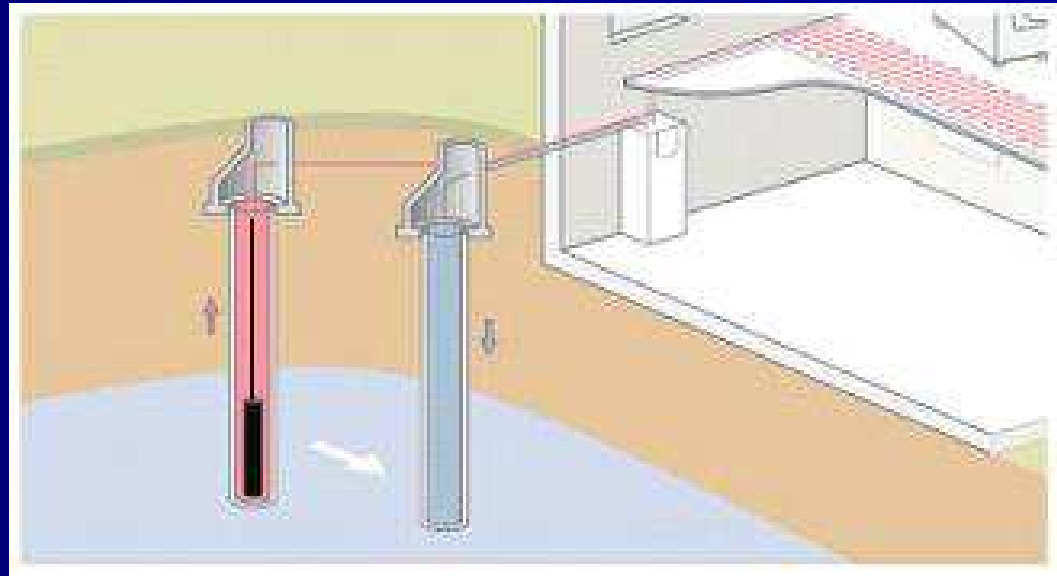


# GODIŠNJA PROMJENA TEMPERATURE ZEMLJE





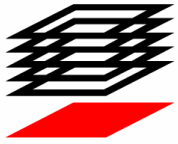
## DIZALICE TOPLINE



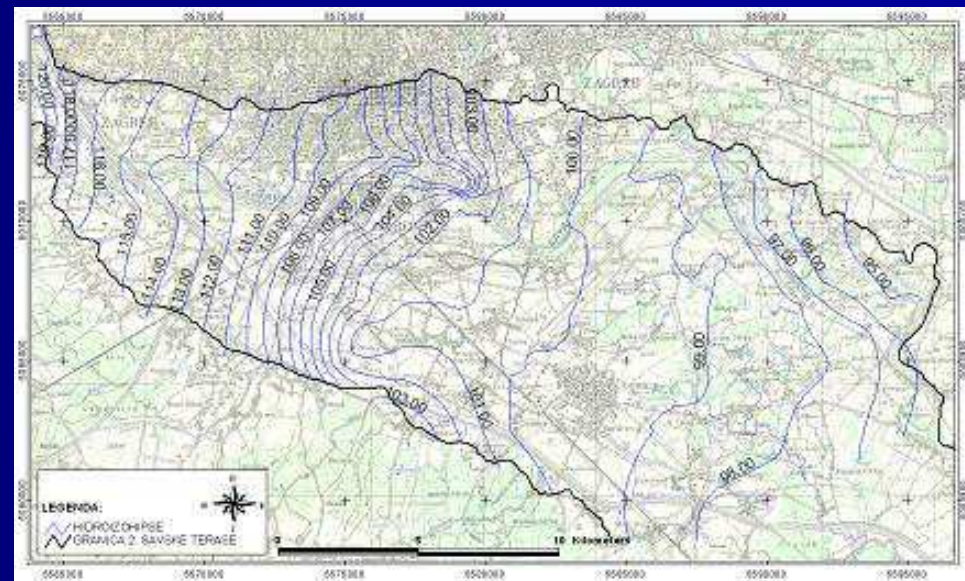
### BUNARI

- upojni i izljevni bunar, max 25m dubine
- područja bogata podzemnom vodom
- max COP 5,5
- max SPF 4,5 do 5,0





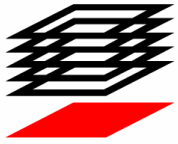
## DIZALICE TOPLINE



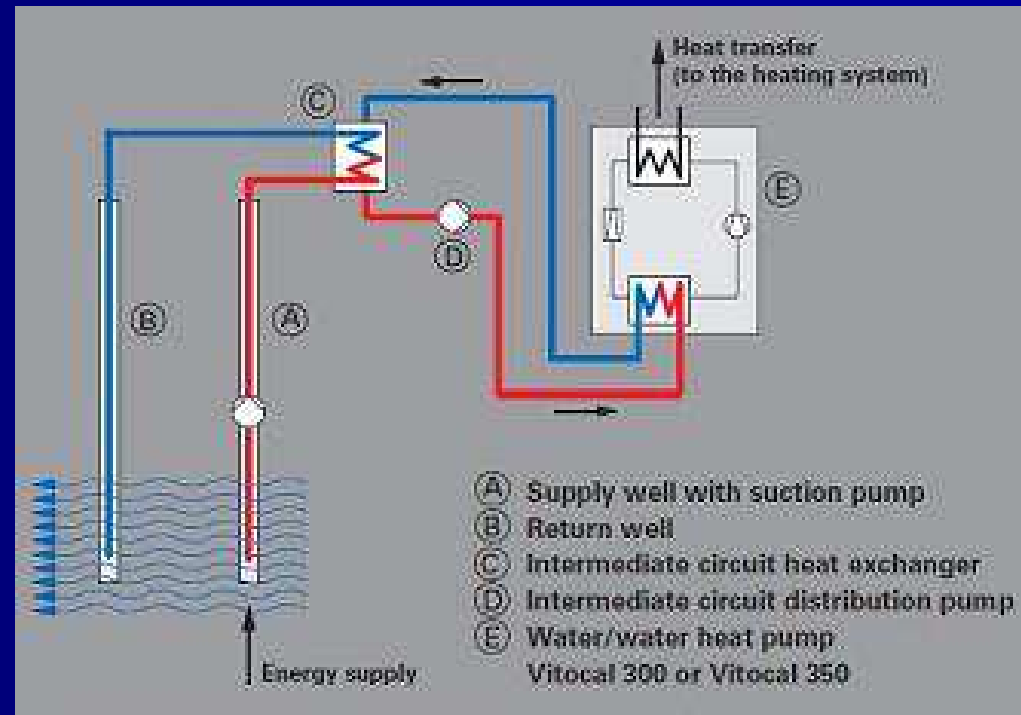
## ZAGREBAČKI ALUVIJALNI BAZEN

- hidroizohipse iste razine podzemnih voda
- mikrolokacije sa šljunkovito-pjeskovitim slojevima bogatim podzemnim vodama





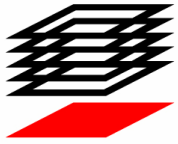
## DIZALICE TOPLINE



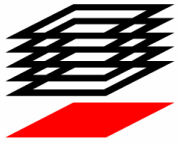
POVRŠINSKE VODE rijeke, jezera, mora

-max COP 5,5

-max SPF 4,0 do 5,0



# DIREKTNA SUNČEVA ENERGIJA

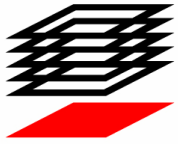


## PRIMJENA AKUMULIRANE ENERGIJE U OKOLIŠU

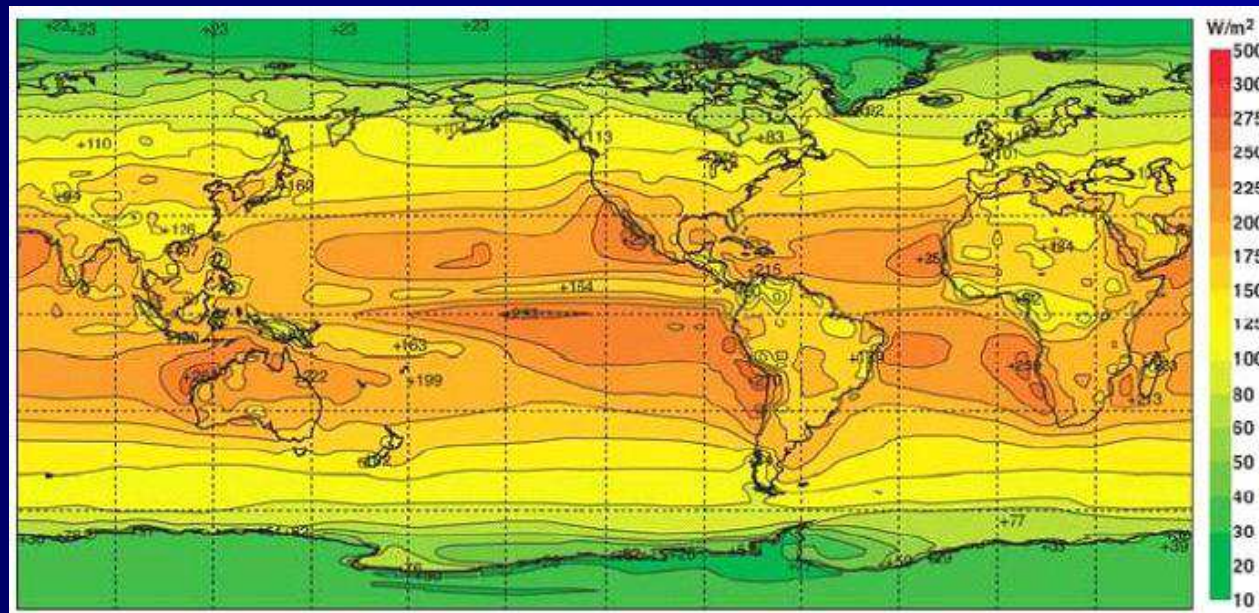
### ENERGIJA SUNCA

- dozračena
- akumulirana

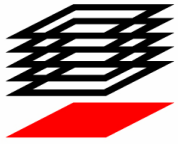




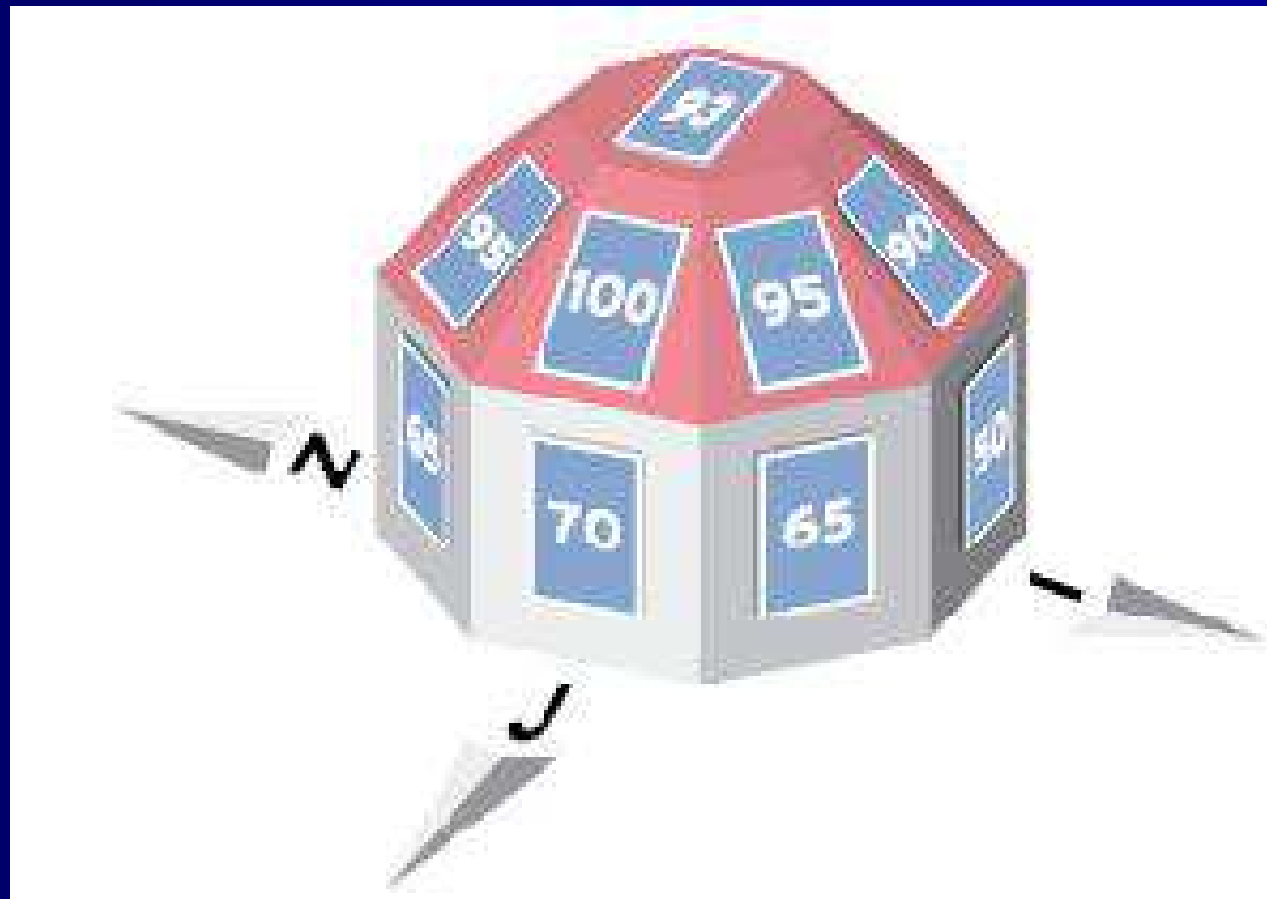
## SUNČEVO ZRAČENJE



GLOBALNA KARTA SUNČEVOG ZRAČENJA

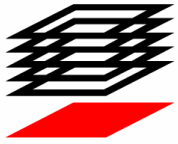


## ORIJENTACIJA POLJA





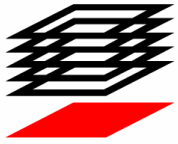




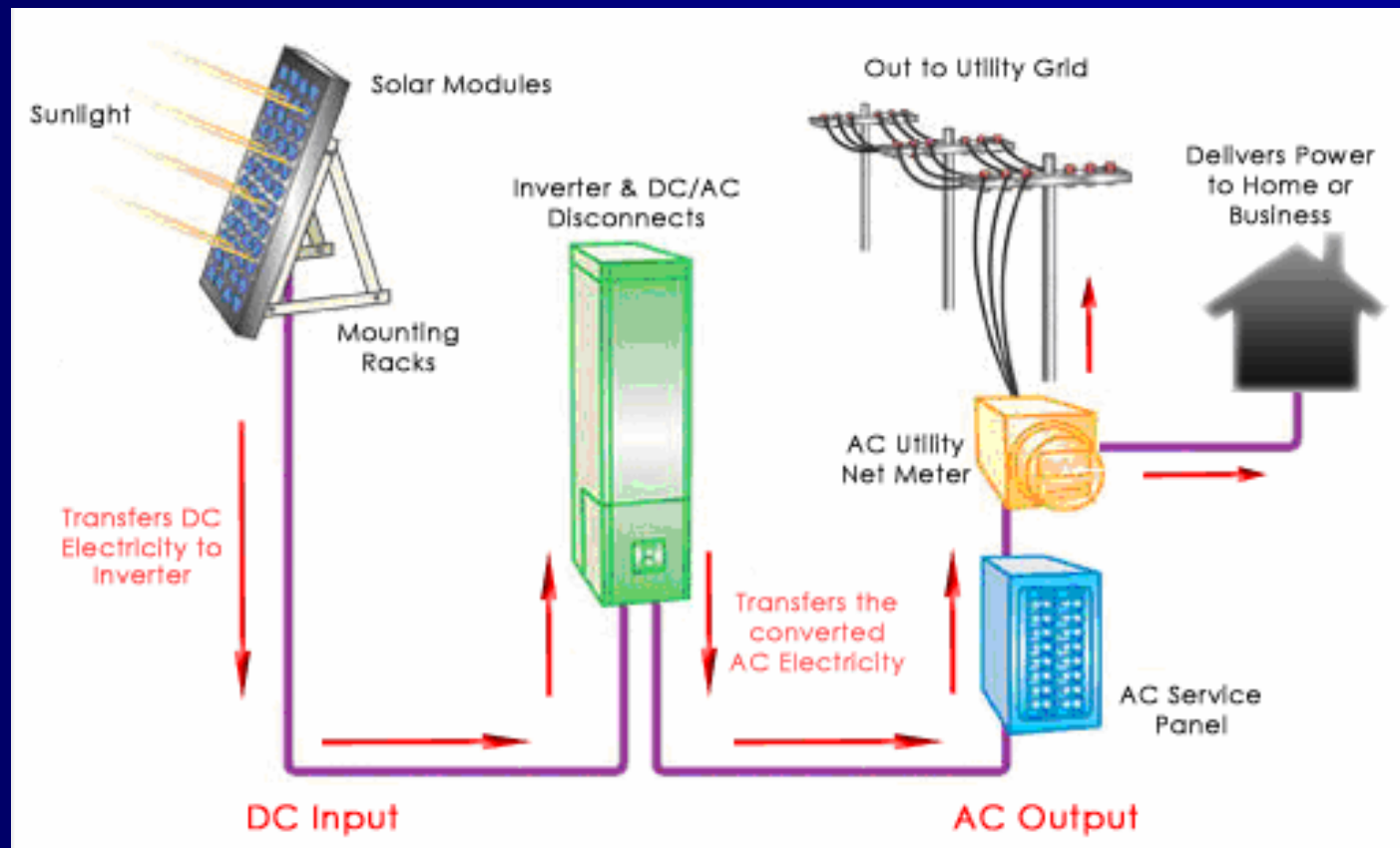
# DNEVNA SUNČEVA ENERGIJA



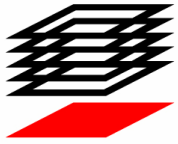




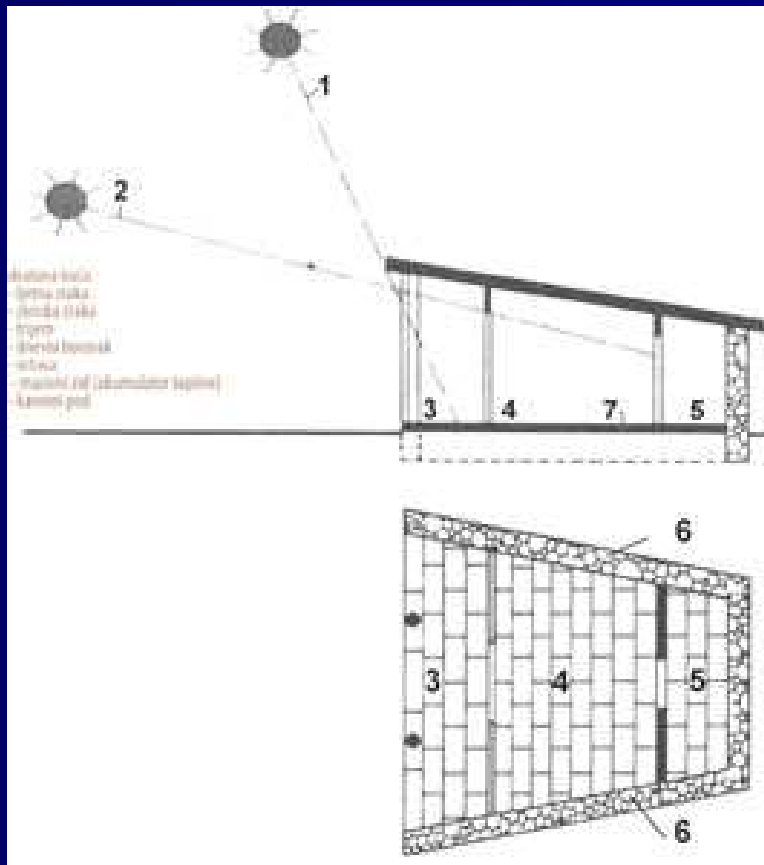
# ELEKTRIČNA ENERGIJA



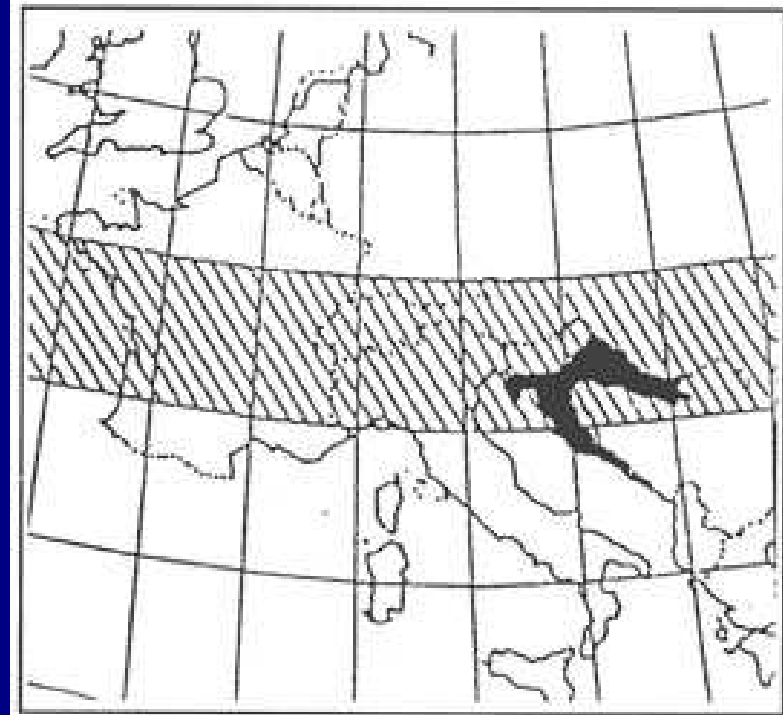
## ON-GRID SUSTAV

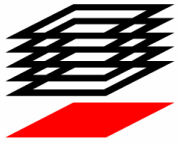


## SUNČANE KUĆE – VELIKE STAKLENE PLOHE

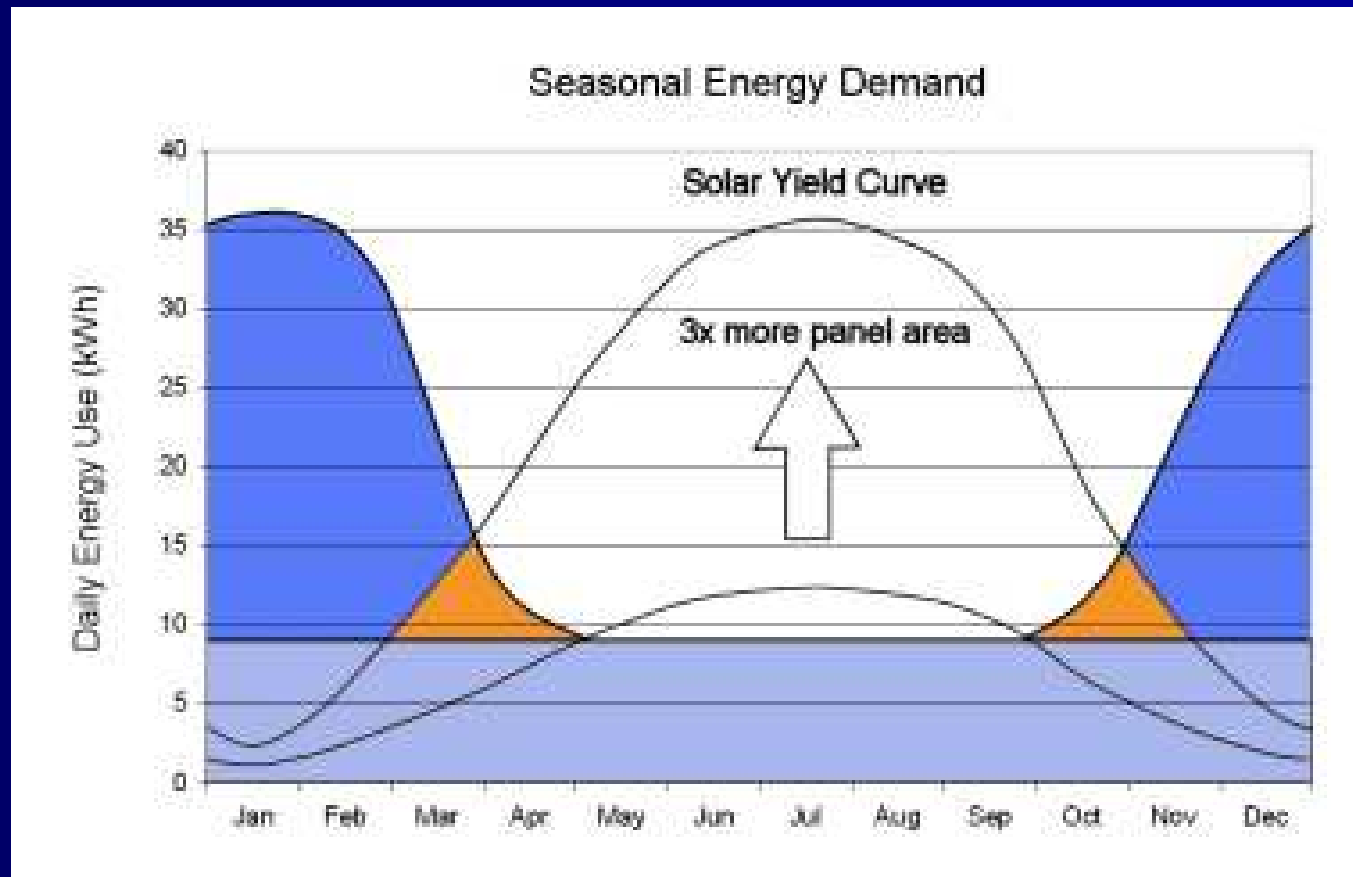


slika 1: Hrvatska i optimalan zemljopisni pojas za korištenje sunčeve energije na pasivan način, prema Komisiji Europske zajednice (CEC) još iz 1983. godine

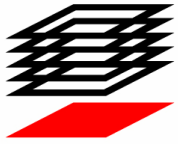




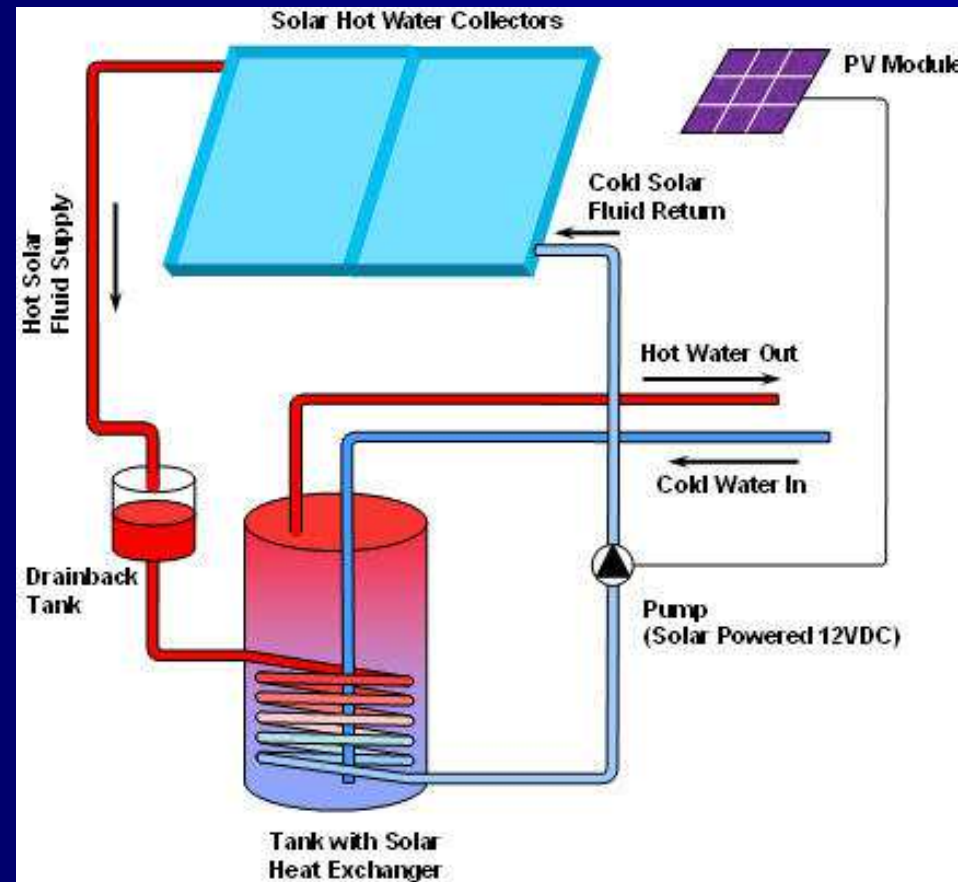
## SUNČANE KUĆE



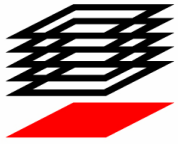
SUNČANI SUSTAV POTPORA GRIJANJU



# SUNČANE KUĆE

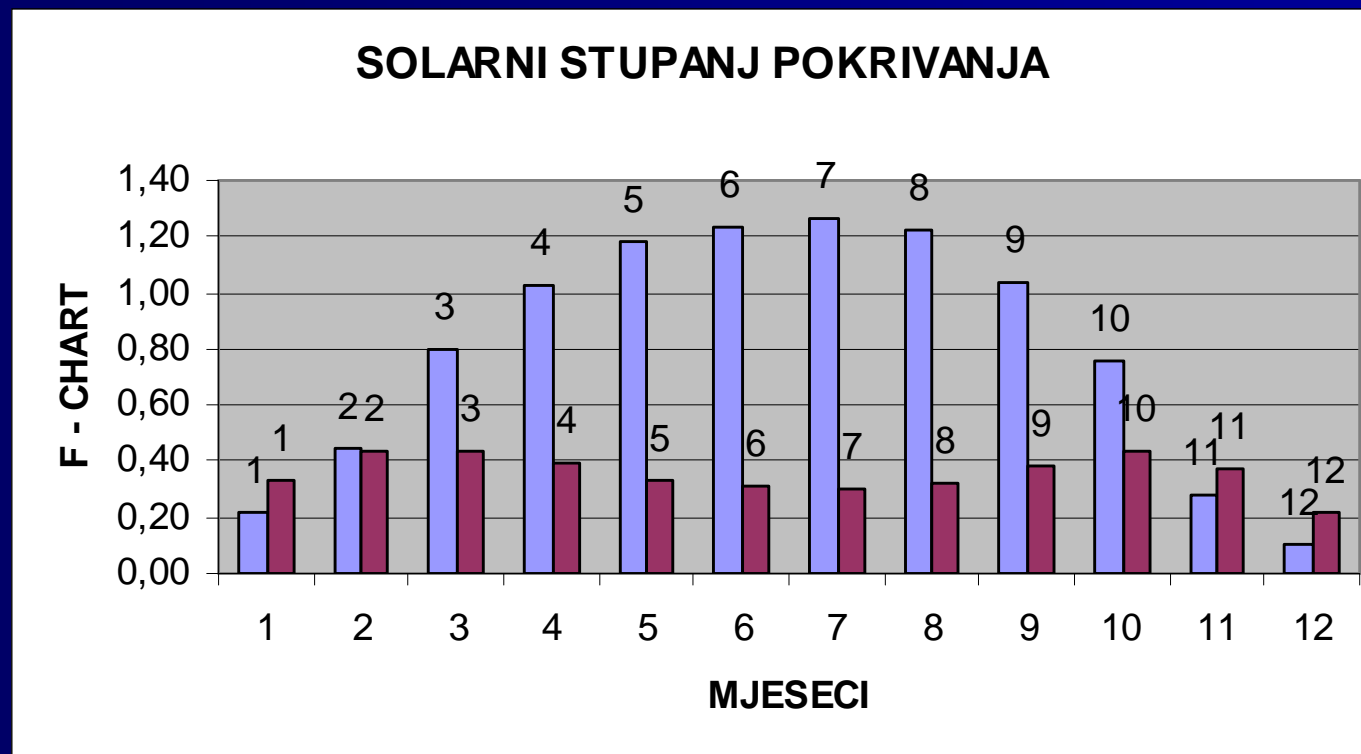


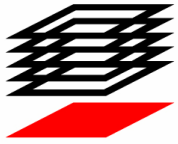
## ZAŠTITA OD PREGRIJAVANJA



## SUNČANI TOPLINSKI SUSTAV

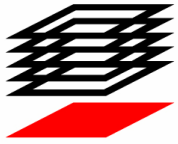
- proračun godišnjeg stupnja pokrivanja
- metoda F-CHART





# SUNČANA KUĆA

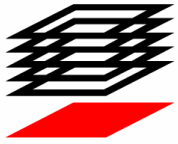




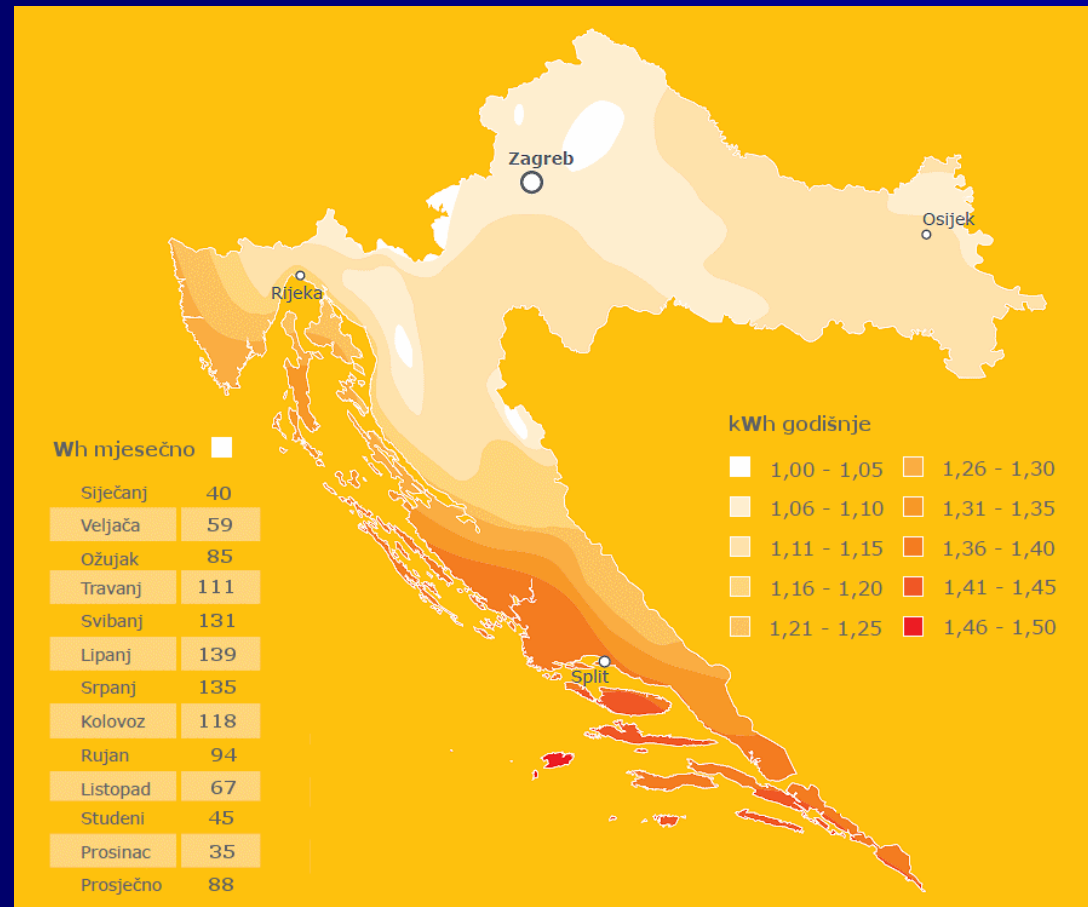
PAMETNE ELEKTRO MREŽE – SMART GRID

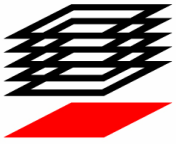
AKUMULACIJA ENERGIJE U MREŽI



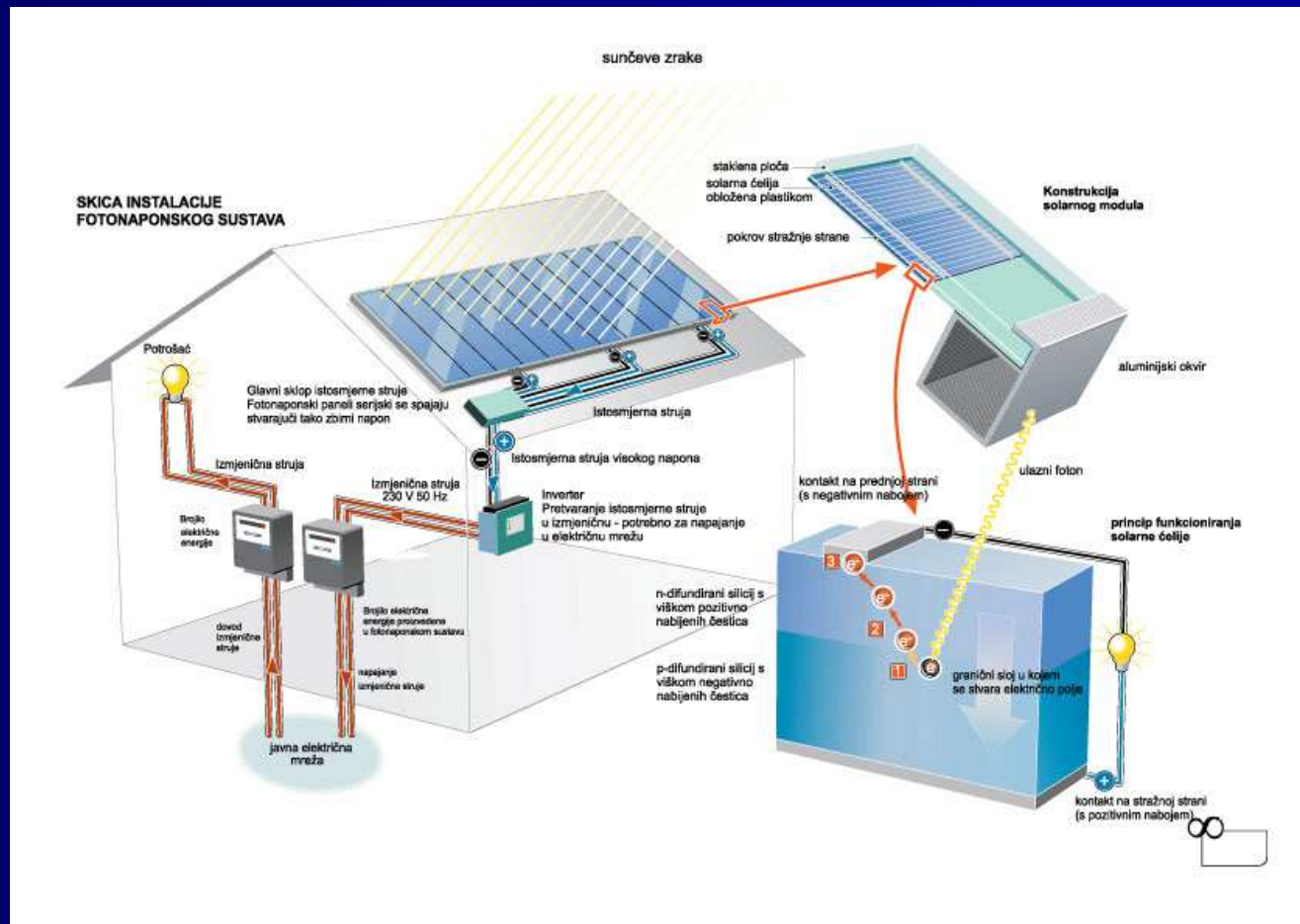


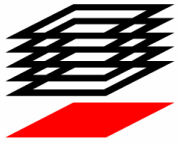
# GODIŠNJA INSOLACIJA HRVATSKE



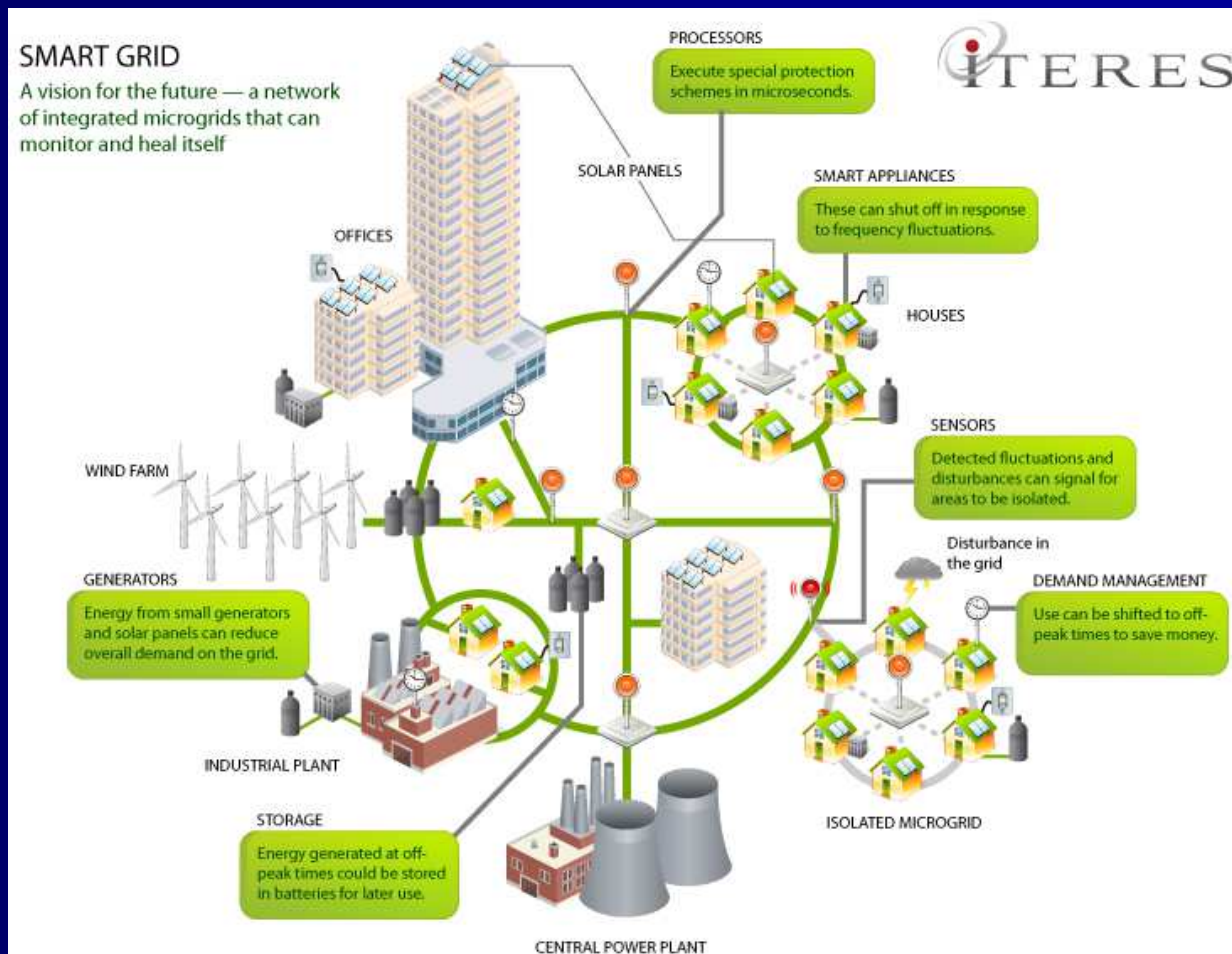


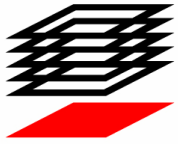
# SUNČANI FOTONAPONSKI PRETVORNICI



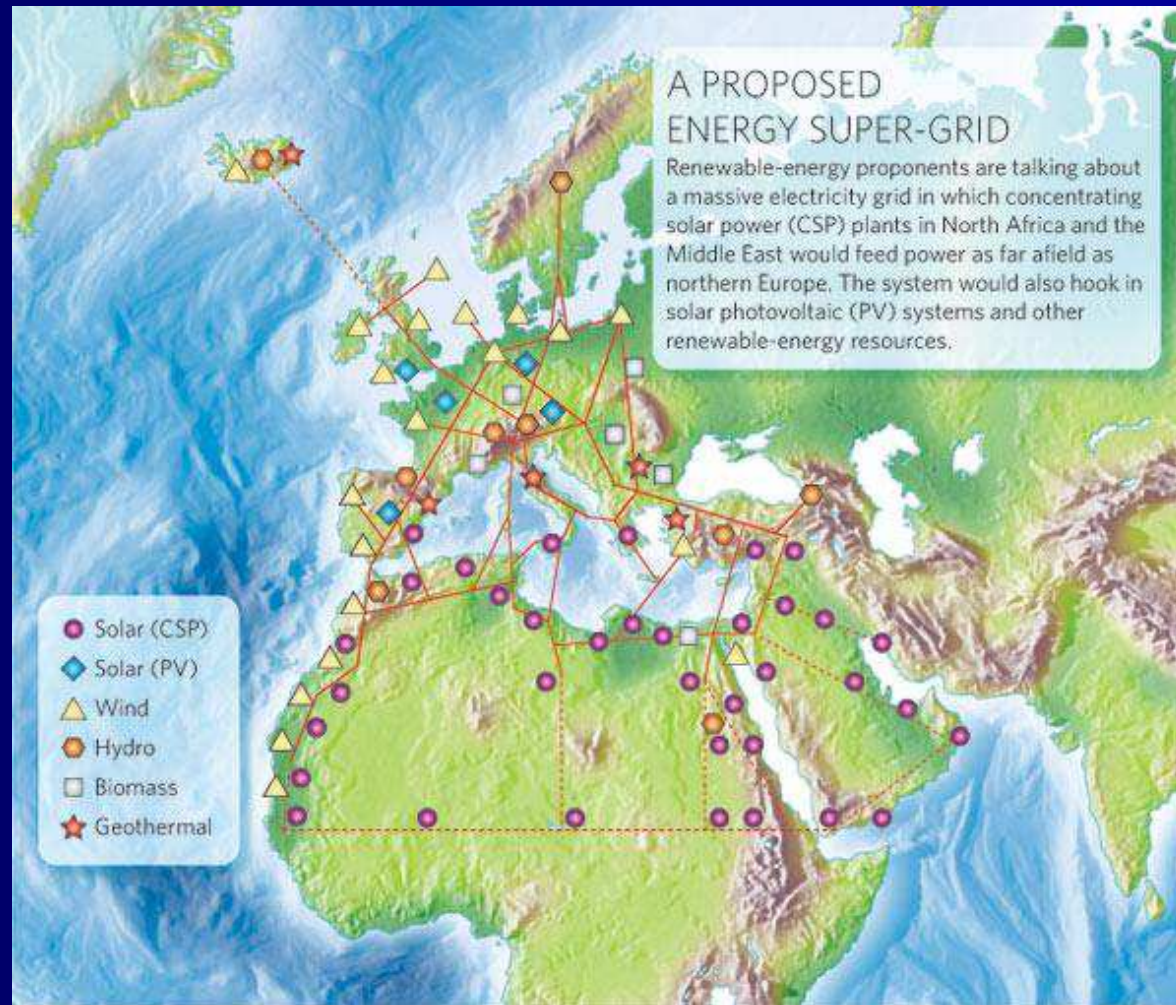


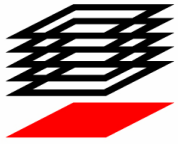
# PAMETNE MREŽE – SMART GRID



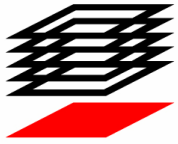


## PAMETNE MREŽE – SUPER GRID - DESERTEC



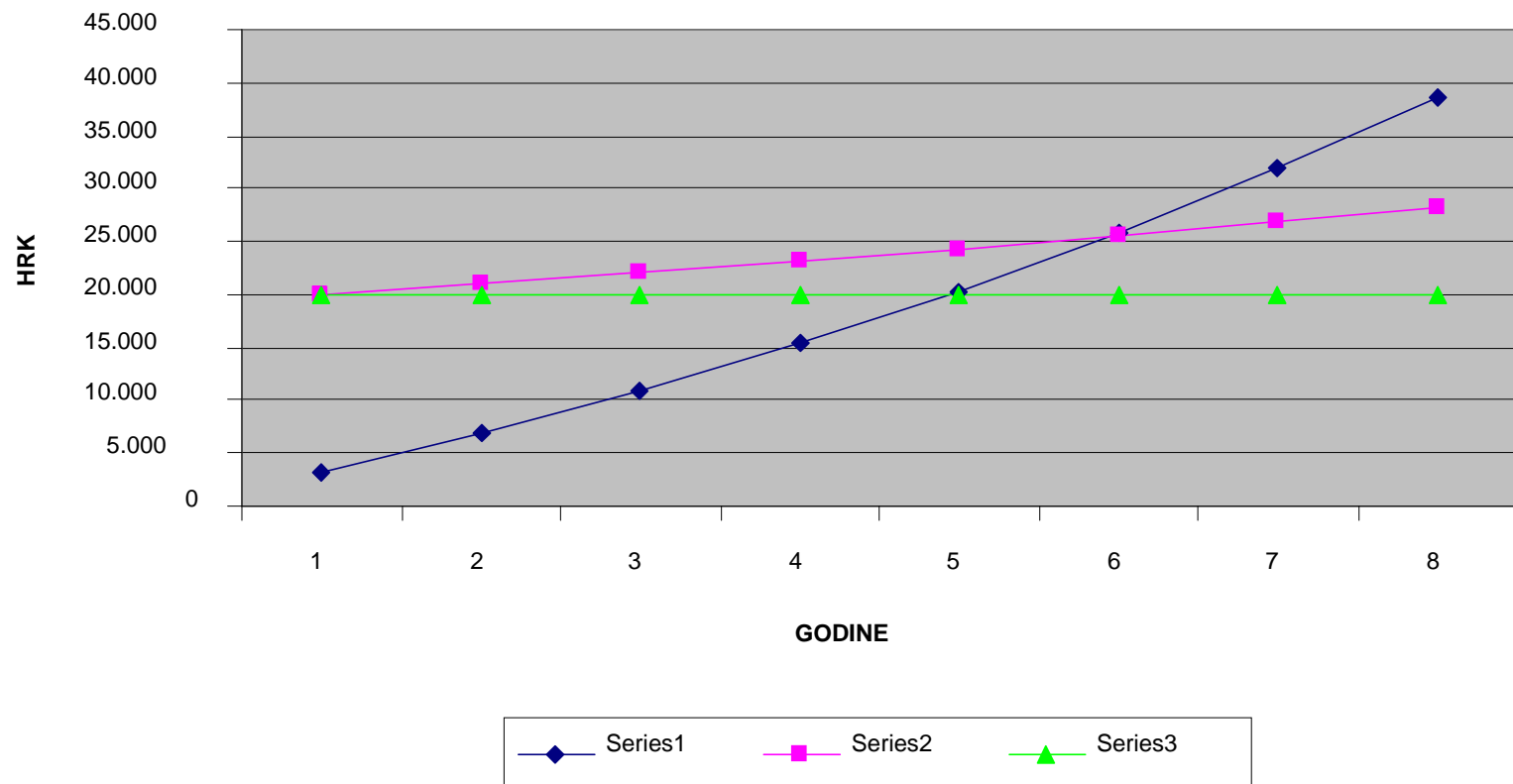


CIJENA SUSTAVA?

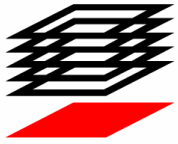


# EKONOMSKA ANALIZA DIZALICA TOPLINE

## ZEMNI PLIN – DIZALICA TOPLINE







## EKONOMSKA ANALIZA DIZALICA TOPLINE

### Analize – Velika Britanija

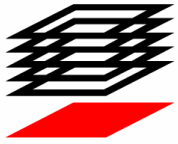
#### Geotermalna dizalica COP 4,3

el.energija	18 god
ulje	29 god
plin	47 god

#### Zračna dizalica COP 3,3

el.energija	10 god
ulje	16 god
plin	31 god





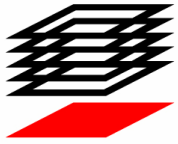
## EKONOMSKA ANALIZA DIZALICA TOPLINE

Ciljano izjednačenja – Velika Britanija

Geotermalna dizalica	8 godina
Zračna dizalica	5 godina

Kako to izvesti ?

- smanjenje cijene opreme
- povećanje cijene energenata
- dodatne subvencije na instalacije



## STVARNA CIJENA SUSTAVA?

### KLASIČNI MODEL

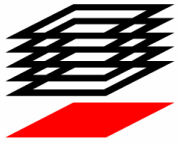
ELEKTRANA – MREŽA – ZGRADA

PLATFORMA – RAFINERIJA – ZGRADA

### ODRŽIVI MODEL

SUNCE – ZGRADA

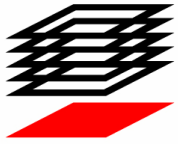
OKOLINA – ZGRADA



# ZAKLJUČAK

Energija Sunca može zadovoljiti sve energetske potrebe zgrade primjenom odgovarajućih transformacijskih tehnologija.

energija Sunca → električna energija  
energija Sunca → akumulirana u okolišu  
električna + akumulirana + DT = toplinska en



# Hrvatska komora inženjera strojarstva

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[www.hkis.hr](http://www.hkis.hr)

