50. MEĐUNARODNI KONGRES KGH, BEOGRAD 05.12.2018.

RELaTED

Beogradske elektrane
BELGRADE PUBLIC UTILITY COMPANY

Konverzija mreže daljinskog grejanja u niskotemperaturske sa povećanom upotrebom lokalnih solarnih sistema, u skladu sa programom Horizon 2020 – projekat Related.

Ljubiša Vladić, Radmilo Savic
JKP "Beogradske elektrane"

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 768567

Uvod

- Projekat RELaTED (REnewable Low TEmperature District) je zajednička inicijativa 14 kompanija i istraživačkih ustanova širom Evrope

- Projekat se finansira sredstvima EU iz istraživačkog fonda Horizon 2020

- Fokus je na daljinskom grejanju (DG) kao energetski najefikasnijem sistemu za grejanje gradova i koji ima ključnu ulogu u smanjenu emisije CO2 u Evropi.

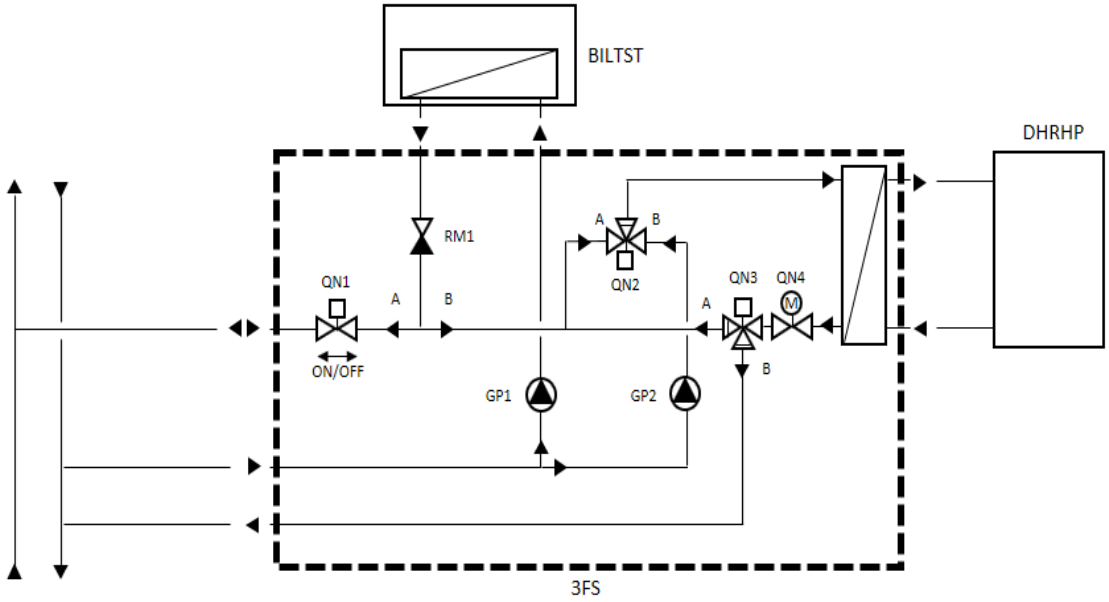
- Projekat RELaTED će se realizovati u 4 gradova:
  - Vinge, Danska
  - Tartu, Estonija
  - BELGRADE, Srbija
  - Iurreta, Španija

RELaTED koncept

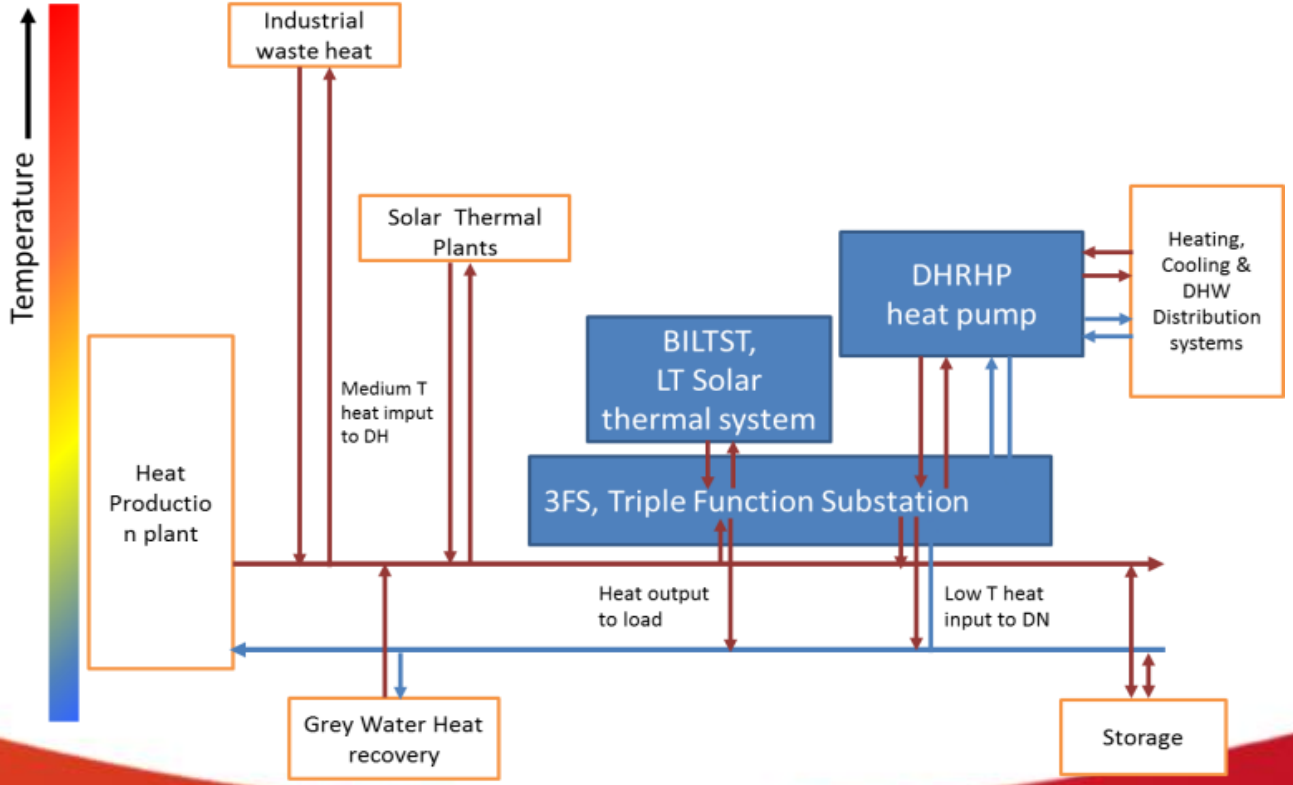
- Razvijanje ultra niske temperaturne mreže (ULT) u sistemu DG (~45ºC)
- Integrisanje obnovljivih i otpadnih izvora toplote u sistem DG
- Smanjenje operativnih troškova usled manjih toplotnih gubitaka
- Veća energetska efikasnost toplotnih izvora
- Razvijanje sledećih tehnologija:
  - Building Integrated Low Temperature Solar Thermal Systems (BILTST)
  - Triple Function Substations (3FS)
  - District Heating connected Reversible Heat Pump (DHRHP)

Nova tehnologija – 3F trofunkcionalna PS

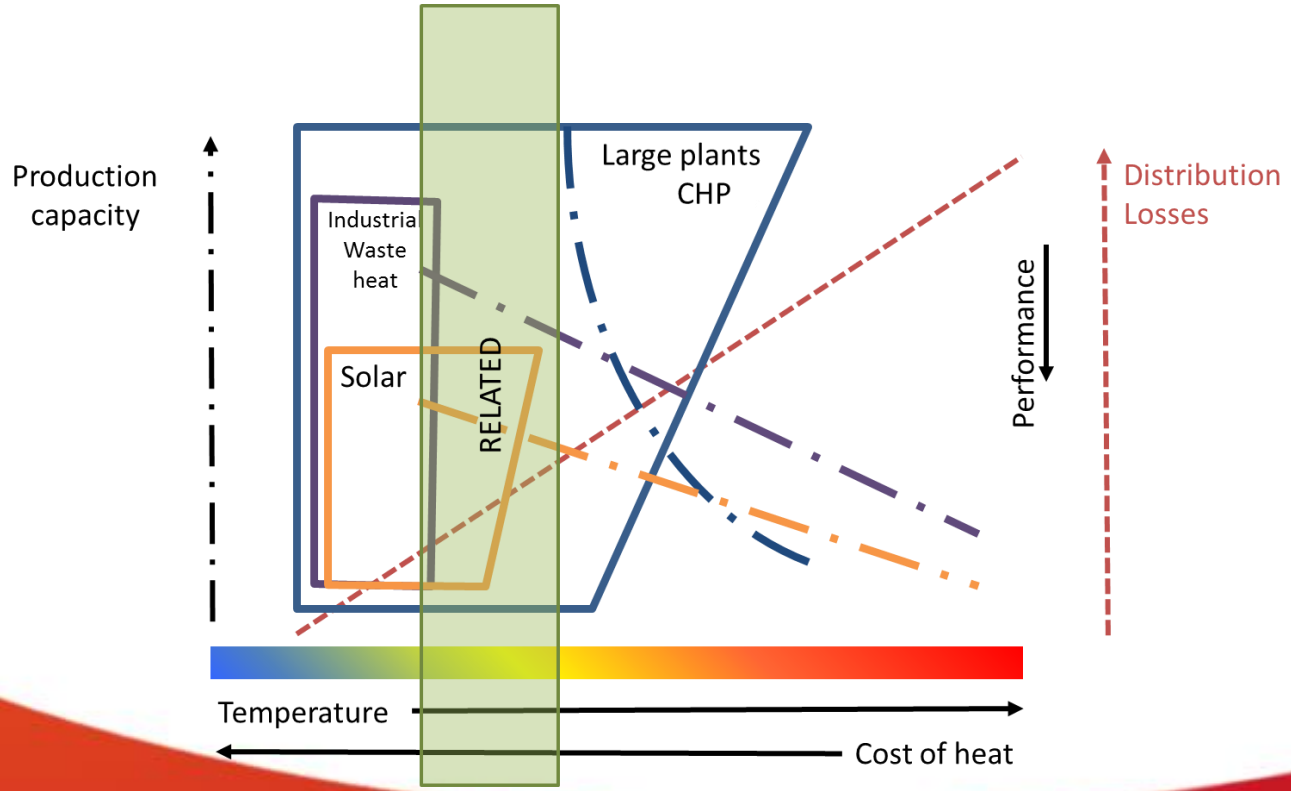
- Preuzima TE iz mreže DG
- Dodaje TE više temperature u razdovni vod DG
- Vraća TE niže temperature u povratni vod DG



RELaTED koncept



RELaTED koncept



Tipični temperaturni režimi u mreži DG i zahtev za ULT u ovom projektu:

- DH High Temperature System (HT), 100/50 °C ; 90/70 °C ; System type: Radiators
- DH Low Temperature System (LT), 80/40 °C ; 70/50 °C ; System type: Radiators
- DH Very Low Temperature System (VLT), 60/30 °C ; 55/35 °C ; System type: Radiators
- DH Ultra Low Temperature System (ULT), 45/35 °C ; 35/30 °C ; System type: Floor heating

Demo lokacija Beograd, Srbija

- JKP “Beogradske elektrane” – osnovane - 1965.
- Broj toplotnih izvora 48
- Instalisani kapacitet 3.000 MW
- Dužina trasa 730km
- Broj podstanica 8.800
- Grejana površina objekata 22.000.000 m²
- Broj priključenih stanova 330,000
- Godišnja proizvodnja 3,000 GWh
- 51% Beograda je povezano na daljinski sistem

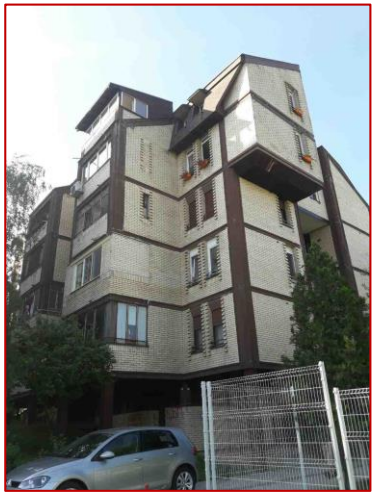
Aktivnosti i ciljevi projekta RELaTED

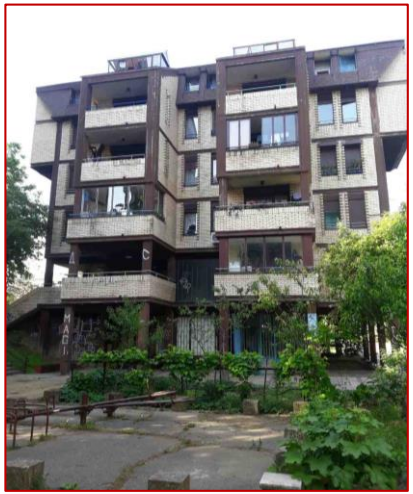
- **Demo lokacija 1: PS Vinogradski Venac 36 za 5 stambenih zgrada**
  - Smanjenje temperature u sekundarnoj mreži – rekonstrukcija PS
  - Razdvajanje merenje potrošnje TE grejanja i PTV za svaku zgradu posebno

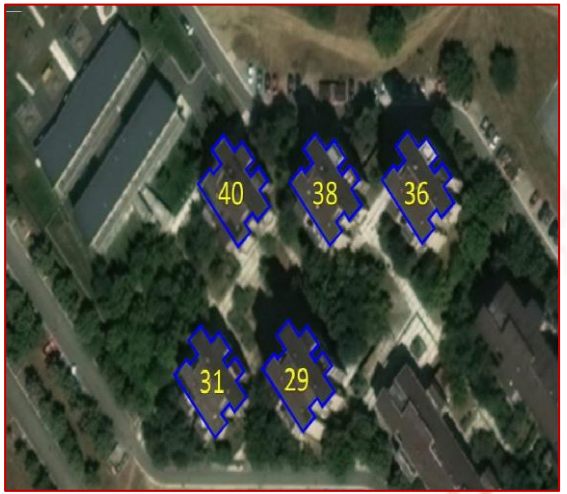
- **Demo lokacijae 2: PS Borova 8 – OŠ Ujedinjene nacije**

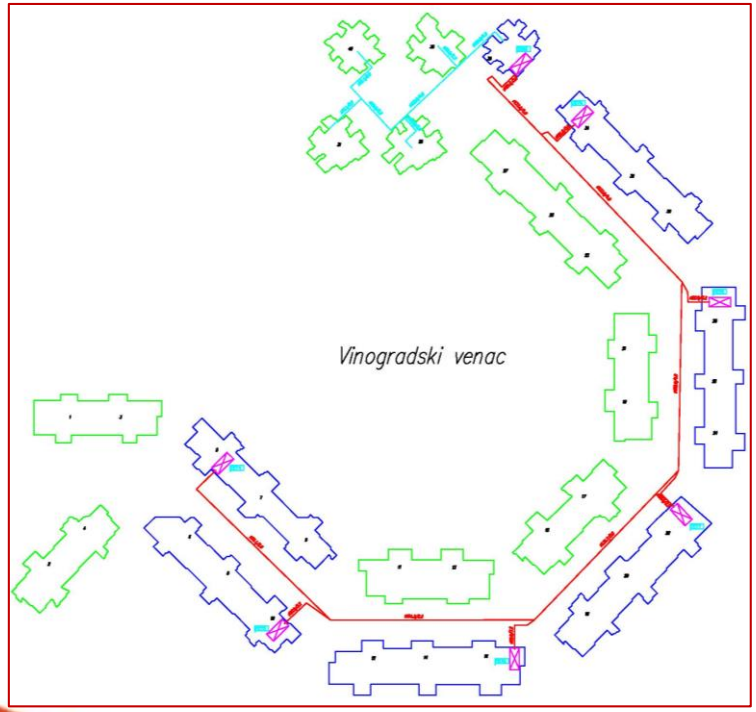
- Implementacija solarnog sistema u sistem DG
  - Primena 2F PS
  - Postavljanje solarnih kolektora na krov zgrade (70m2, max 90KW)

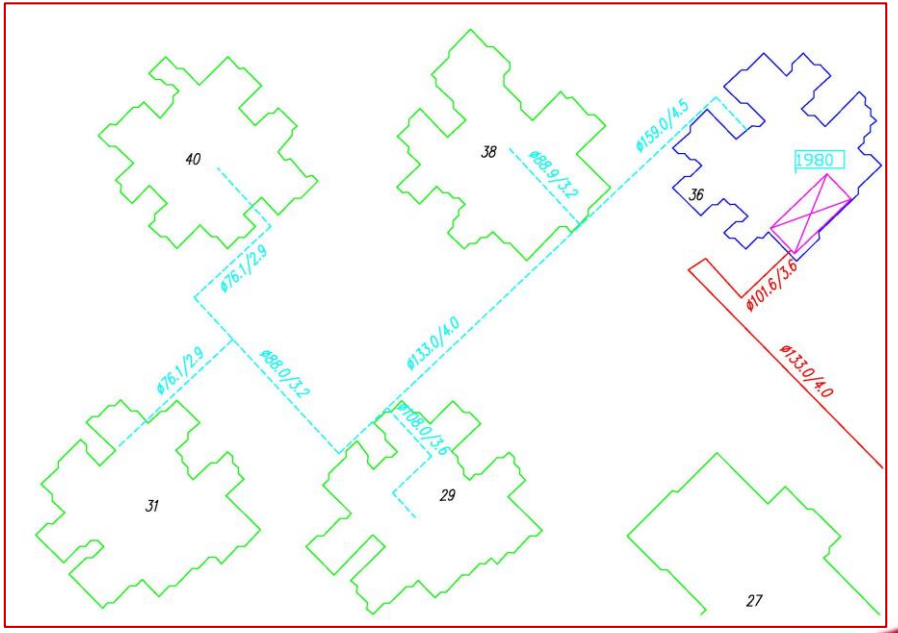
Demo lokacija 1: PS Vinogradski Venac 36



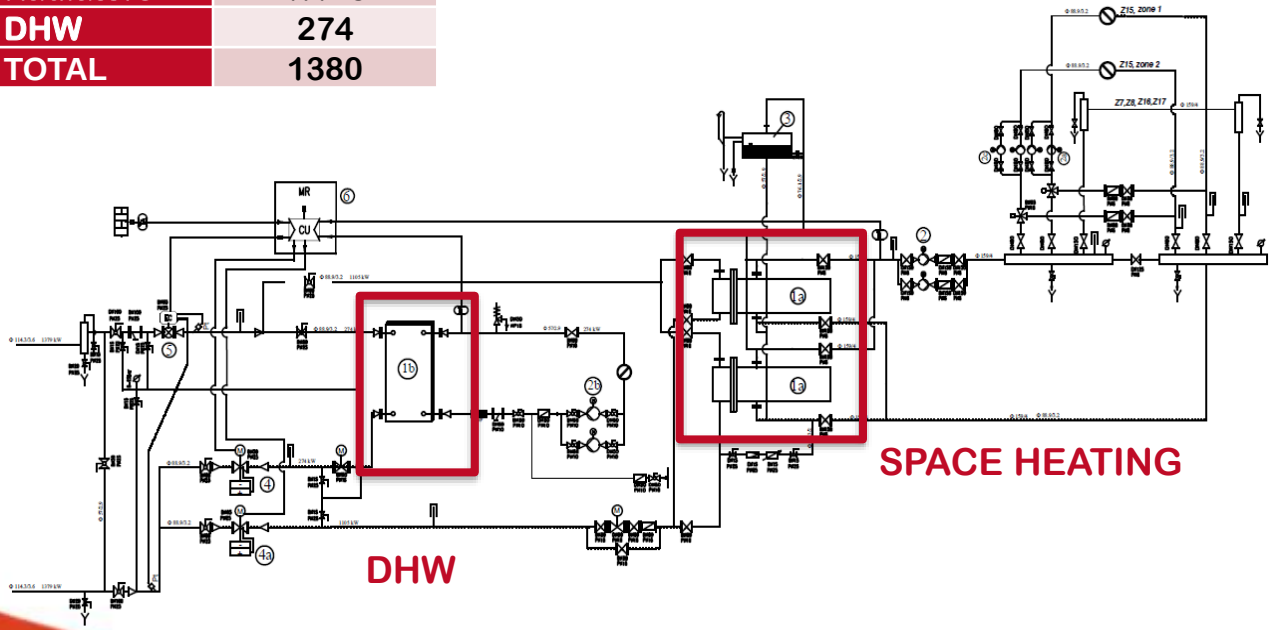





Vinogradski venac


40
38
36
1980
31
29
27
ø76.1/2.9
ø88.9/3.2
ø159.0/4.5
ø133.0/4.0
ø108.0/3.6
ø101.6/3.6

Subsystem	Power [kW]
Radiators	1.105
DHW	274
TOTAL	1380

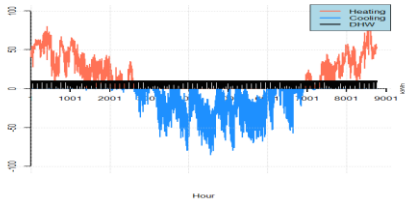


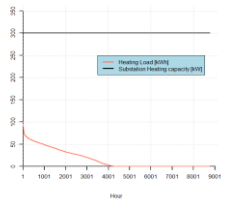
Operation conditions heating	Primary circuit District heating side	Secondary circuit Radiators heating
Tsupply [C]	120	80
Treturn [C]	65	60
Nominal flow [m3/h]	18,07	62

Operation conditions DHW	Primary circuit District heating side	Secondary circuit DHW
Tsupply [C]	65	50
Treturn [C]	22	10
Nominal flow [m3/h]	5,61	7,8

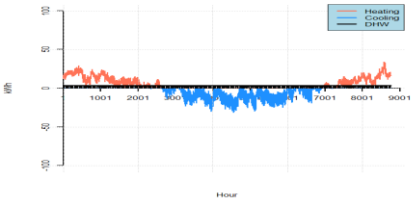
Izvršena je analiza potrebne energije za svaku zgradu

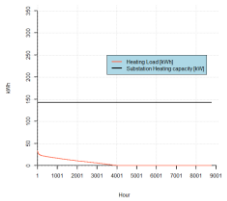
Vinogradski Venac 29



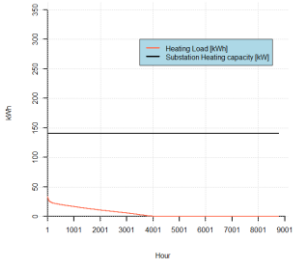


Vinogradski Venac 31

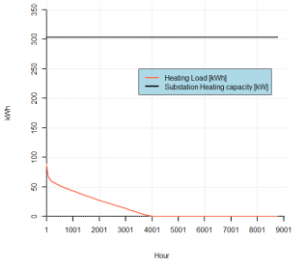




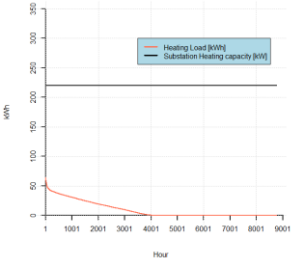
Vinogradski Venac 40



Vinogradski Venac 36

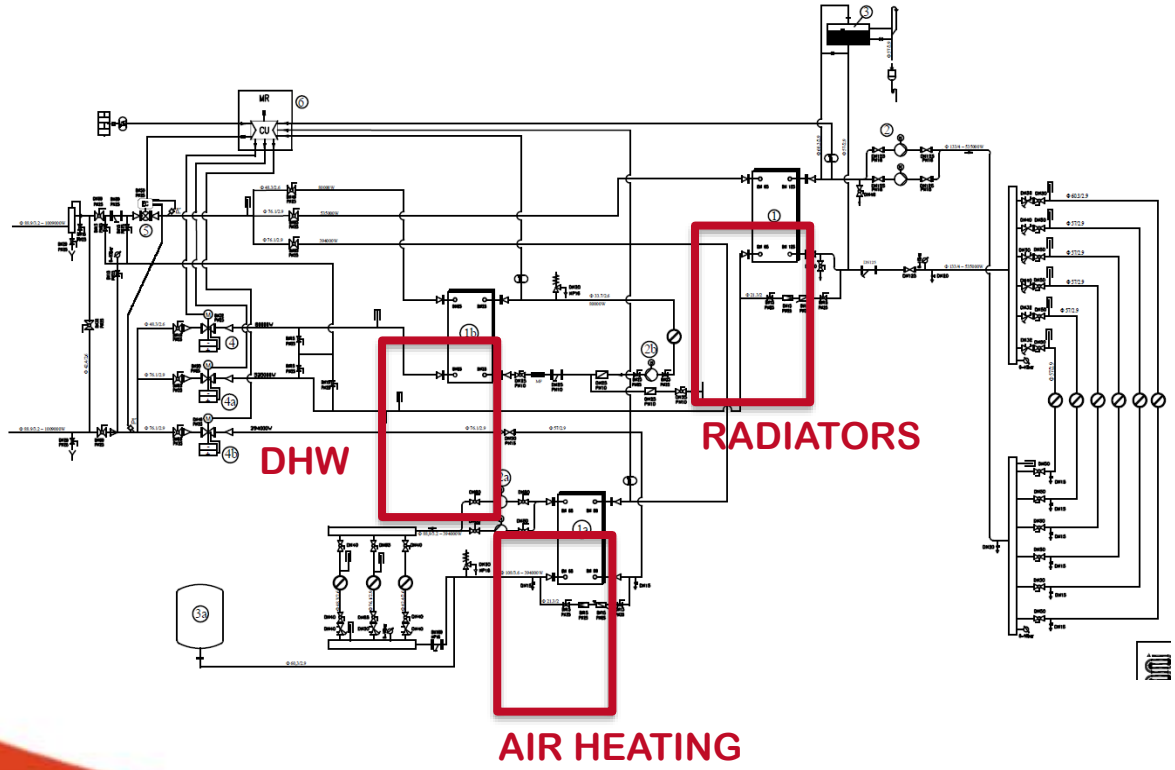


Vinogradski Venac 38



Demo lokacija 2 - PS Borova 8 – OŠ Ujedinjene nacije

Postojeća šema PS

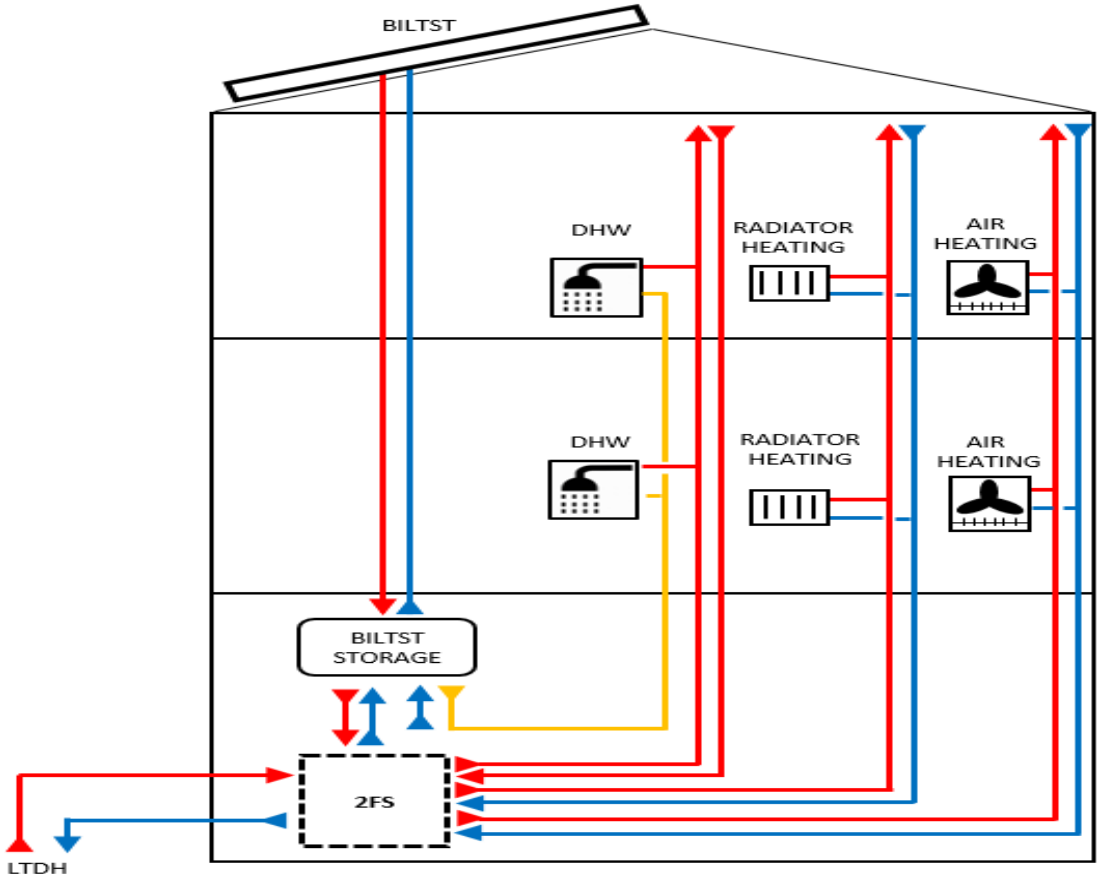


Subsystem	Power [kW]
Radiators	550
Air heating	400
DHW	140

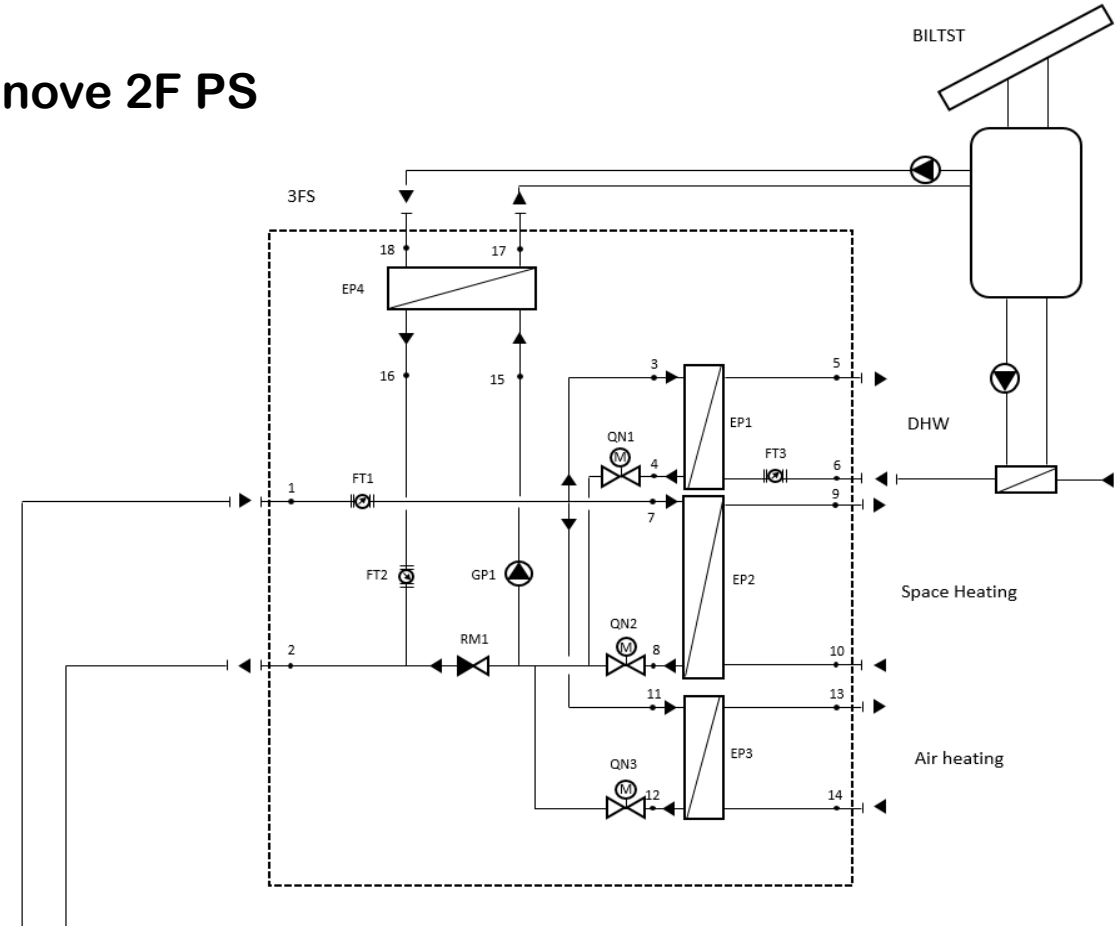
Concept	Primary circuit District heating side	Secondary circuit Radiators heating
Tsupply [C]	120	80
Treturn [C]	65	60
Nominal flow [m3/h]	8,8	30,1

Concept	Primary circuit District heating side	Secondary circuit Air heating
Tsupply [C]	120	80
Treturn [C]	65	60
Nominal flow [m3/h]	6,4	20

Concept	Primary circuit District heating side	Secondary circuit DHW
Tsupply [C]	65	50
Treturn [C]	22	10
Nominal flow [m3/h]	1,62	2


BILTST
DHW
RADIATOR HEATING
AIR HEATING
DHW
RADIATOR HEATING
AIR HEATING
BILTST STORAGE
2FS
LTDH

Šema nove 2F PS



Beogradske elektrane
BELGRADE PUBLIC UTILITY COMPANY

RELaTED

HVALA NA PAŽNJI

dr Ljubiša Vladić, dipl.inž.maš.
ljubisa.vladic@bgdel.rs

dr Radmilo Savić, dipl.inž.maš.
radmilo.savic@bgdel.rs

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 768567