

Avtomatizacija, informatizacija in vizualizacija tehnoloških procesov turističnih kompleksov in »wellness« centrov

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ENERGY, ECONOMY AND ECOLOGY

Abstract: *Automation, information and visualisation of technological processes of energy – consumption systems in hotel objects and wellness centres is an important instrument for energy saving. Also simplicity and transparency of handling the complex systems in these objects is an important issue. Integral planing with energy efficient systems provides minimum costs in function time of the object, reliability, long-life and compatibility for all systems in the object, at low maintenance costs and minimum maintenance personal.*

Rewards of AURE (Agency for Rational Energy Consumption) and leadership of Firm Unior d.d., sinking of energy consumption are confirmation for what we have done!

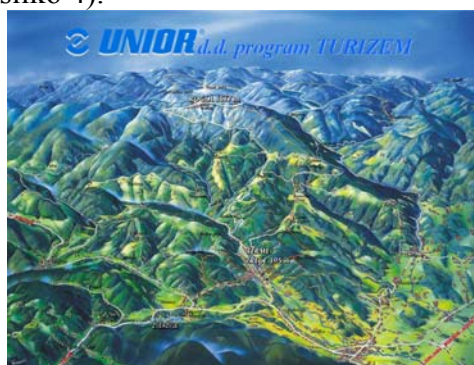
1. Turizem

V industriji, gospodarstvu in tudi turizmu se soočamo z vedno višjimi stroški energije, velikimi investicijami v ekologijo, neizprosno konkurenco in tržno ekonomijo (glej sliko 1).

Z integralnim načrtovanjem gradbenih objektov, energetskih naprav in tehniških sistemov, s spremljanjem energentov in z ukrepi racionalne rabe energije-URE, z vgradnjo energetsko varčnih naprav in z uporabo obnovljivih virov energije-OVE uspemo zmanjšati dobavo in porabo energije, vode in kemikalij, zmanjšamo emisije škodljivih snovi v zraku, znižamo stroške in posvečamo večjo skrb za okolje oziroma ekologijo v obeh turističnih centrih (glej sliko 2 in 3).

Pri celovitem načrtovanju turističnih kompleksov sodelujejo vsi subjekti: lastniki, investitorji in uporabniki, projektanti prostorske ureditve, arhitekture, statike in notranje ureditve, strojnih instalacij, elektro instalacij in

bazenske tehnike, dobavitelji opreme in izvajalci del, zunanji strokovni sodelavci, pripravljalci novih pravilnikov, inšpekcijske službe, fakultete in inštituti, upravni organi... (glej sliko 4).



Slika 1-Zreško Pohorje in program Turizem



Slika 2-Termalno zdravilišče Terme Zreče



Slika 3-Klimatsko zdravilišče, olimpijski in smučarski center KTC Rogla



Slika 4-Organigram sodelovanja subjektov

2. Avtomatizacija tehnoloških procesov

Velik pomen avtomatizaciji, informatizaciji in vizualizaciji tehnoloških procesov namenjajo tudi lastniki in investitorji turističnih kompleksov in »wellness« centrov-preventivna skrb za zdravje in dobro počutje gostov.

Za centre dobrega počutja in zdravja-wellness imenujemo odgovornega projektanta, kateri opravi energetske pregled kompleksa in posamezne systemske enote, investitorju predlaga tehnološko-tehniške rešitve in koordinira načrtovanje, nadzira operativno izvedbo vseh del in zagon energetskih naprav, tehniških sistemov ter krmilno-regulacijskih in nadzornih sistemov.

Pristop pri gradnji objektov, vgradnji energetskih naprav in tehniških sistemov ter postavitvi krmilno-regulacijskih in nadzornih sistemov vsebuje naslednje korake:

- upoštevanje zakonske regulative in nacionalnih programov-zavest lastnikov in investitorjev, da smo del Evrope, Slovenije, Zreškega pohorja in Unior-ja in s tem povezani zakoni, pravilniki, standardi, smernice in direktive: gradnja objektov ZGO, načrtovanje bazenov-DIN standardi in SI pravilniki, prezračevanje, ogrevanje in hlajenje-HVAC sistemi, sledenje materialov in postopkov v turizmu-Danski standard HACCP, kvaliteta proizvoda-CE znak, certifikat kakovosti-ISO 9000 in okoljski standard-ISO 14000, nacionalni energetske program-NEP, zakon o varovanju okolja-ZVO, energetske zakon-EZ, obnovljivi viri energije-OVE, ukrepi racionalne rabe energije-URE...

2.1. Energetika:

- pregled gradbenih objektov, energetskih naprav in energetskih dovodov-karakteristični

podatki objektov, spremljanje energentov-poraba energije, vode in kemikalij, pregled tehniških sistemov-glavnih, pomožnih in varnostnih ter obstoječih klimatskih in krmilno-regulacijskih naprav (glej tabelo 1 in [1]),

Poraba energije glede na število nočitev in kopalcev

	1999	2000	2001	2002	2003
celotna raba energije MWh	17.818	17.458	17.606	18.367	20.706
poraba kurilnega olja MWh	4040	3663	3880	3874	3741
število nočitev	171.265	177.197	181.896	201.267	200.393
število kopalcev	189.863	212.806	109.843	253.028	255.124

LETNI PRIHRANKI

Terme Zreče	19 %	1750 MWh	17,5 mio SIT
KTC Rogla	12 %	750 MWh	7,5 mio SIT
Skupaj Turizem	17 %	2500 MWh	25,0 mio SIT

ZMANJŠANJE ŠKODLJIVIH EMISIJ (t/leto)

	CO ₂	CO	SO ₂	NO _x	Org. spoj.
Terme Zreče (zem. plin)	134,0	0,015	0,069	0,124	0,096
KTC Rogla (ELKO, propan)	111,0	0,085	0,222	0,085	0,002
Skupaj UNIOR Turizem	245,0	0,100	0,291	0,209	0,098

Tabela 1-Energija, prihranki, zmanjšanje emisij

- strategija energetske učinkovitosti-analiza in pokazatelji ter investicijska primerjava vračanja energije ali OVE, sistemi vračanja energije-zavržen zrak in zavržena voda (primeri iz prakse),
- ukrepi racionalne rabe energije in OVE-organizacijski ukrepi, izboljšanje gradbene fizike objektov, vgradnja varčnih naprav, vračanje energije-zavržen zrak in voda, frekvenčna regulacija elektro motorjev črpališč in telemetrična povezava vrtin z bazeni, programsko vodenje in nadzor vodnih efektov in nočno pranje filtrov, vgradnja tipizirane tehnološke opreme, digitalne regulacije in krmiljenja-DDC, vizualizacija s sistemom nadzora in vodenja tehnoloških procesov-CNS, usposabljanje tehniškega osebja in predstavitev ukrepov vodstvu podjetja-menedžmentu,

2.2. Projektiranje:

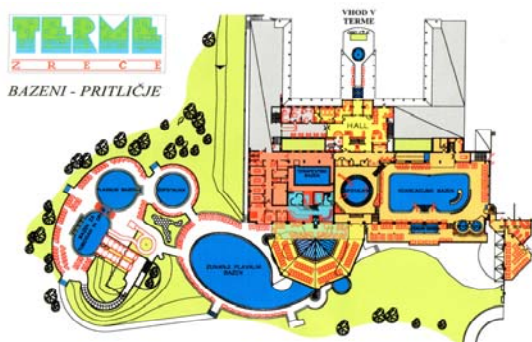
- integralno načrtovanje gradbenih objektov, energetskih naprav in tehniških sistemov: zaključen krog posameznih aktivnosti-tržne potrebe, projektna naloga, idejne rešitve in potrditev sprememb, izdelava projektne dokumentacije, izvedba del, tehnični prevzem in ovrednotenje investicije-kvaliteta izvedbe in končna vrednost (glej sliko 5 in [2], [4]).



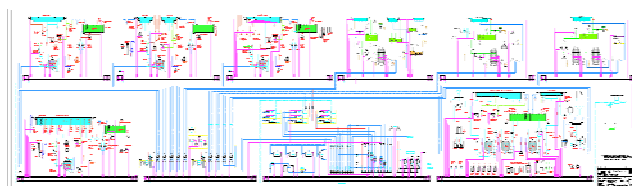
Slika 5-Organigram integralnega načrtovanja

Vodilo celovitega načrtovanja je zavest lastnika in investitorja o pomenu vlaganj in ekonomiki, upoštevanje zakonske regulative in varnosti ljudi, poenotenje opreme in s tem enostavna obvladljivost vseh kompleksnih sistemov, zanesljivosti delovanja in dolga življenjska doba, modularnost zgradbe, kompatibilnost, fleksibilnosti in komunikacija med tehničnimi sistemi ali podsistemi, malo število zastojev, učinkovita tehnična služba in nižji stroški obratovanja oz. vzdrževanja, učinkovita raba energije in uporaba obnovljivih virov energije, skrbi za okolje in naravo, predvsem pa ponuditi gostom in obiskovalcem dodatne storitve, ustrezno klimo in ugodje, [2] in [4],

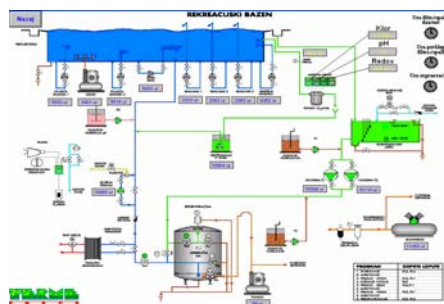
- izhajamo iz arhitekturne podloge-tlorisa (glej sliko 6) in energetske sheme turističnega centra in systemske enote (glej sliko 7), pripravimo tehnološke sheme tehniških sklopov (glej sliko 8), izrišemo blok sheme krmilnikov-DDC (glej sliko 9) in pripravimo povezave na sistem nadzora in vodenja-CNS (glej slike 10, 11, 12).



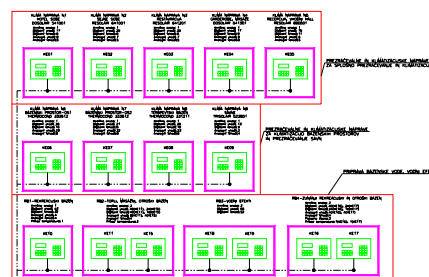
Slika 6-Arhitekturna podloga Terme Zreče



Slika 7-Energetska shema zdravstva z bazeni



Slika 8-Tehnološka shema bazena z efekti



Slika 9-Blok shema digitalnih krmilnikov



Slika 10-Lokalni sistem nadzora in vodenja

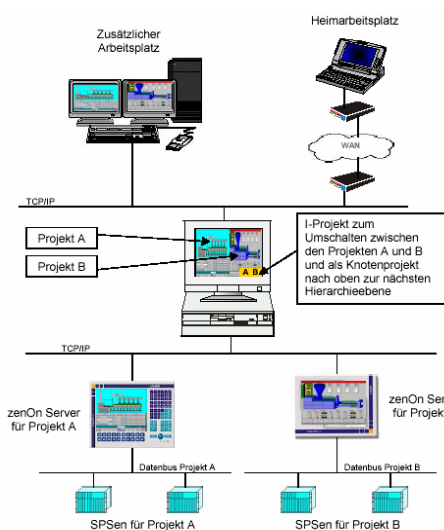


Abb. 5: Multihierarchisches Mehrprojektsystem

Slika 11-Centralni sistem nadzora in vodenja



Slika 12-Glavni, pomožni in varnostni sistemi

2.3. Ekonomika:

- analize in izračuni o upravičenosti in ekonomiki investicije-naredimo preglednice projektnih podatkov in izmerjenih vrednosti, maksimalnih zasedenosti objektov, primerjave različnih tehnoloških postopkov, ocene investicije, stroške obratovanja, vzdrževanja in uporabe objektov, projektiranje in parametri bazenov po DIN standardih in SI pravilnikih...

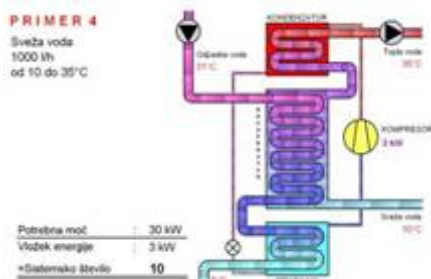
Primeri investicij s pozitivnimi učinki:

- primerjava dezinfekcijskih sredstev za bazene: elektroliza, plinasti klor, natrijev in kalcijev hipoklorid-strošek investicije in obratovanja znaša samo polovico vrednosti (glej tabelo 2),

TERME ZREČE - ANALIZA DEZINFEKCIJSKIH SREDSTEV ZA ZUNANJE BAZENE (VODNI PARK)					1 EUR = 223,00 SIT
OPIS ANALIZE	PLINASTI KLOR/TEHNIČNI	EL. ELEKTROLIZA NAPRAVA	NATRIJ HIPOKLORID NAČRTO	CALCIJ HIPOKLORID-CAICHO2	
PROIZVAJALEC	TKI HRASSTNIK, SLOVENIJA	WALLACE&TERMINA/NEMLJA	TKI HRASSTNIK ALI UNVOZ	STOTINKA-CHEMOFORM	
OZNAKA/TIP	JEKLENJE 4x500KG-2000KG	OSEC.NT 200, NT 1000	NACIO NATRIJEV HIPOKLORIT	GRANUDOS plus-STOTINKA	
INVESTICIJA	105.500,00 EUR	101.600,00 EUR	26.500,00 EUR	29.930,00 EUR	
OBRTAVANJE	16.825,00 EUR	20.725,00 EUR	182.000,00 EUR	136.530,00 EUR	
Letni strošek	500.000,00 SIT	895.000,00 SIT	5.570.760,00 SIT	5.569.200,00 SIT	
Letno transport	250.000,00 SIT	55.000,00 SIT	2.560.000,00 SIT	620.000,00 SIT	
AMORTIZACIJA	5 LET	5 LET	5 LET	5 LET	
SKUPAJ	122.325,00 EUR	122.325,00 EUR	208.660,00 EUR	166.460,00 EUR	

Tabela 2-Dezinfekcijska sredstva za vodni park

- vračanje energije iz zavrženega zraka in vode-investicija povrnjena v dveh letih (glej sliko 13),



Slika 13-Vračanja energije »wellness« center

- programsko vodenje efektov-zmanjšanje porabe energentov (glej tabelo 3 in sliko 14),

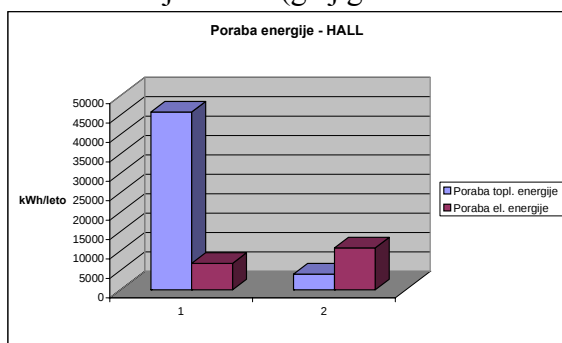
Dr. Vredn. efekti	Program 1	Program 2	Program 3	Program 4	Program 5	Program 6	Program 7	Program 8	Program 9	Program 10	Program 11	Program 12	Program 13	Program 14	Program 15	Program 16	Program 17	Program 18	Program 19	Program 20	Program 21	Program 22	Program 23	Program 24	Program 25	Program 26	Program 27	Program 28	Program 29	Program 30	Program 31	Program 32	Program 33	Program 34	Program 35	Program 36	Program 37	Program 38	Program 39	Program 40	Program 41	Program 42	Program 43	Program 44	Program 45	Program 46	Program 47	Program 48	Program 49	Program 50	Program 51	Program 52	Program 53	Program 54	Program 55	Program 56	Program 57	Program 58	Program 59	Program 60	Program 61	Program 62	Program 63	Program 64	Program 65	Program 66	Program 67	Program 68	Program 69	Program 70	Program 71	Program 72	Program 73	Program 74	Program 75	Program 76	Program 77	Program 78	Program 79	Program 80	Program 81	Program 82	Program 83	Program 84	Program 85	Program 86	Program 87	Program 88	Program 89	Program 90	Program 91	Program 92	Program 93	Program 94	Program 95	Program 96	Program 97	Program 98	Program 99	Program 100	Program 101	Program 102	Program 103	Program 104	Program 105	Program 106	Program 107	Program 108	Program 109	Program 110	Program 111	Program 112	Program 113	Program 114	Program 115	Program 116	Program 117	Program 118	Program 119	Program 120	Program 121	Program 122	Program 123	Program 124	Program 125	Program 126	Program 127	Program 128	Program 129	Program 130	Program 131	Program 132	Program 133	Program 134	Program 135	Program 136	Program 137	Program 138	Program 139	Program 140	Program 141	Program 142	Program 143	Program 144	Program 145	Program 146	Program 147	Program 148	Program 149	Program 150	Program 151	Program 152	Program 153	Program 154	Program 155	Program 156	Program 157	Program 158	Program 159	Program 160	Program 161	Program 162	Program 163	Program 164	Program 165	Program 166	Program 167	Program 168	Program 169	Program 170	Program 171	Program 172	Program 173	Program 174	Program 175	Program 176	Program 177	Program 178	Program 179	Program 180	Program 181	Program 182	Program 183	Program 184	Program 185	Program 186	Program 187	Program 188	Program 189	Program 190	Program 191	Program 192	Program 193	Program 194	Program 195	Program 196	Program 197	Program 198	Program 199	Program 200	Program 201	Program 202	Program 203	Program 204	Program 205	Program 206	Program 207	Program 208	Program 209	Program 210	Program 211	Program 212	Program 213	Program 214	Program 215	Program 216	Program 217	Program 218	Program 219	Program 220	Program 221	Program 222	Program 223	Program 224	Program 225	Program 226	Program 227	Program 228	Program 229	Program 230	Program 231	Program 232	Program 233	Program 234	Program 235	Program 236	Program 237	Program 238	Program 239	Program 240	Program 241	Program 242	Program 243	Program 244	Program 245	Program 246	Program 247	Program 248	Program 249	Program 250	Program 251	Program 252	Program 253	Program 254	Program 255	Program 256	Program 257	Program 258	Program 259	Program 260	Program 261	Program 262	Program 263	Program 264	Program 265	Program 266	Program 267	Program 268	Program 269	Program 270	Program 271	Program 272	Program 273	Program 274	Program 275	Program 276	Program 277	Program 278	Program 279	Program 280	Program 281	Program 282	Program 283	Program 284	Program 285	Program 286	Program 287	Program 288	Program 289	Program 290	Program 291	Program 292	Program 293	Program 294	Program 295	Program 296	Program 297	Program 298	Program 299	Program 300	Program 301	Program 302	Program 303	Program 304	Program 305	Program 306	Program 307	Program 308	Program 309	Program 310	Program 311	Program 312	Program 313	Program 314	Program 315	Program 316	Program 317	Program 318	Program 319	Program 320	Program 321	Program 322	Program 323	Program 324	Program 325	Program 326	Program 327	Program 328	Program 329	Program 330	Program 331	Program 332	Program 333	Program 334	Program 335	Program 336	Program 337	Program 338	Program 339	Program 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423	Program 424	Program 425	Program 426	Program 427	Program 428	Program 429	Program 430	Program 431	Program 432	Program 433	Program 434	Program 435	Program 436	Program 437	Program 438	Program 439	Program 440	Program 441	Program 442	Program 443	Program 444	Program 445	Program 446	Program 447	Program 448	Program 449	Program 450	Program 451	Program 452	Program 453	Program 454	Program 455	Program 456	Program 457	Program 458	Program 459	Program 460	Program 461	Program 462	Program 463	Program 464	Program 465	Program 466	Program 467	Program 468	Program 469	Program 470	Program 471	Program 472	Program 473	Program 474	Program 475	Program 476	Program 477	Program 478	Program 479	Program 480	Program 481	Program 482	Program 483	Program 484	Program 485	Program 486	Program 487	Program 488	Program 489	Program 490	Program 491	Program 492	Program 493	Program 494	Program 495	Program 496	Program 497	Program 498	Program 499	Program 500	Program 501	Program 502	Program 503	Program 504	Program 505	Program 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589	Program 590	Program 591	Program 592	Program 593	Program 594	Program 595	Program 596	Program 597	Program 598	Program 599	Program 600	Program 601	Program 602	Program 603	Program 604	Program 605	Program 606	Program 607	Program 608	Program 609	Program 610	Program 611	Program 612	Program 613	Program 614	Program 615	Program 616	Program 617	Program 618	Program 619	Program 620	Program 621	Program 622	Program 623	Program 624	Program 625	Program 626	Program 627	Program 628	Program 629	Program 630	Program 631	Program 632	Program 633	Program 634	Program 635	Program 636	Program 637	Program 638	Program 639	Program 640	Program 641	Program 642	Program 643	Program 644	Program 645	Program 646	Program 647	Program 648	Program 649	Program 650	Program 651	Program 652	Program 653	Program 654	Program 655	Program 656	Program 657	Program 658	Program 659	Program 660	Program 661	Program 662	Program 663	Program 664	Program 665	Program 666	Program 667	Program 668	Program 669	Program 670	Program 671	Program 672	Program 673	Program 674	Program 675	Program 676	Program 677	Program 678	Program 679	Program 680	Program 681	Program 682	Program 683	Program 684	Program 685	Program 686	Program 687	Program 688	Program 689	Program 690	Program 691	Program 692	Program 693	Program 694	Program 695	Program 696	Program 697	Program 698	Program 699	Program 700	Program 701	Program 702	Program 703	Program 704	Program 705	Program 706	Program 707	Program 708	Program 709	Program 710	Program 711	Program 712	Program 713	Program 714	Program 715	Program 716	Program 717	Program 718	Program 719	Program 720	Program 721	Program 722	Program 723	Program 724	Program 725	Program 726	Program 727	Program 728	Program 729	Program 730	Program 731	Program 732	Program 733	Program 734	Program 735	Program 736	Program 737	Program 738	Program 739	Program 740	Program 741	Program 742	Program 743	Program 744	Program 745	Program 746	Program 747	Program 748	Program 749	Program 750	Program 751	Program 752	Program 753	Program 754	Program 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838	Program 839	Program 840	Program 841	Program 842	Program 843	Program 844	Program 845	Program 846	Program 847	Program 848	Program 849	Program 850	Program 851	Program 852	Program 853	Program 854	Program 855	Program 856	Program 857	Program 858	Program 859	Program 860	Program 861	Program 862	Program 863	Program 864	Program 865	Program 866	Program 867	Program 868	Program 869	Program 870	Program 871	Program 872	Program 873	Program 874	Program 875	Program 876	Program 877	Program 878	Program 879	Program 880	Program 881	Program 882	Program 883	Program 884	Program 885	Program 886	Program 887	Program 888	Program 889	Program 890	Program 891	Program 892	Program 893	Program 894	Program 895	Program 896	Program 897	Program 898	Program 899	Program 900	Program 901	Program 902	Program 903	Program 904	Program 905	Program 906	Program 907	Program 908	Program 909	Program 910	Program 911	Program 912	Program 913	Program 914	Program 915	Program 916	Program 917	Program 918	Program 919	Program 920	Program 921	Program 922	Program 923	Program 924	Program 925	Program 926	Program 927	Program 928	Program 929	Program 930	Program 931	Program 932	Program 933	Program 934	Program 935	Program 936	Program 937	Program 938	Program 939	Program 940	Program 941	Program 942	Program 943	Program 944	Program 945	Program 946	Program 947	Program 948	Program 949	Program 950	Program 951	Program 952	Program 953	Program 954	Program 955	Program 956	Program 957	Program 958	Program 959	
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- dekloriranje bazenskih voda in vračanje toplotne energije iz odpadnih voda-boljše delovanje čistilne naprave-ekološki vidik...[1]

2.4 Primeri dobre prakse:

Povečanje učinkovitosti vračanja energije zavrženega medija-zrak:

Primer 1 - regenerativno vračanje toplote
-učinek vračanja>90% (glej graf 1 in sliko 16),

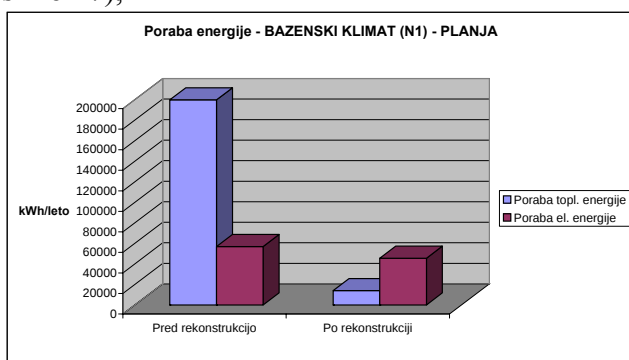


Graf 1-Poraba energije klimatske naprave Hall

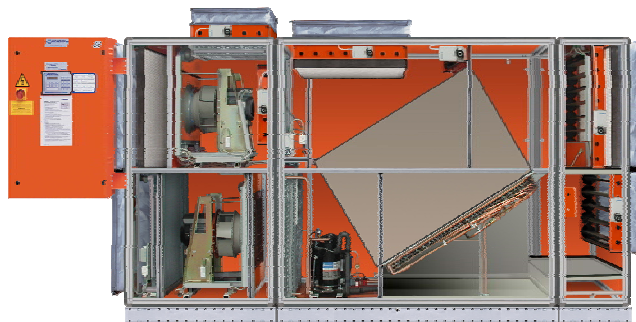


Slika 16-Klimatska naprava Hall Terme Zreče

Primer 2 - rekuperativno vračanje toplote
-skupni učinek vračanja 90-95% (glej graf 2 in sliko 17),



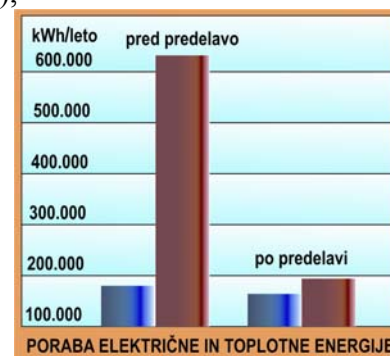
Graf 2-Poraba energije klimatske naprave bazen



Slika 17-Klimatska naprava za notranje bazene

Povečanje učinkovitosti vračanja energije zavrženega medija-zrak in voda:

Primer 3 - toplotna črpalka in rekuperator-
skupno grelno število znaša 10,8 (glej graf 3 in sliko 18),



Graf 3-poraba električne in toplotne energije



Slika 18-Vračanje energije wellness centra
Avtomatizacija termalnih vrtin in bazenov:

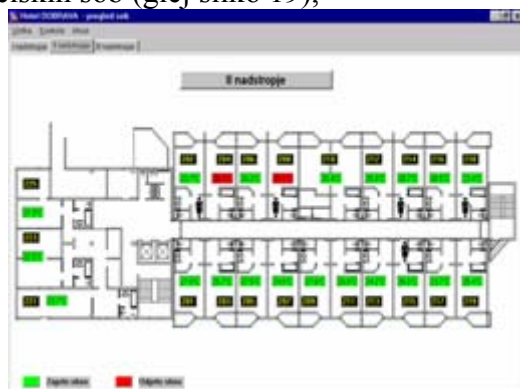
Povečanje učinkovitosti delovanja vrtin,
distribucije in obdelave termalne vode

Primer 4-frekvenčne regulacije in ukv povezave
vrtin-zniževanje porabe EN (glej sliko 15),

Nadzor in vodenje energentov hotelskih sob:

Zavržen medij: zrak in voda (razsvetljava, ostali
porabniki, toplotna in hladilna energija, SOS...)

Primer 5-centralni nadzor in vodenje energije hotelskih sob (glej sliko 19),

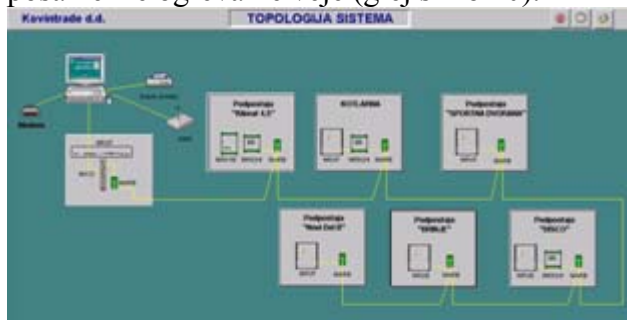


Slika 19-Nadzor in vodenje energentov sob

Rekonstrukcija kotlovnice, toplotnih podpostaj in klimatskih naprav:

Zavržen medij: toplotna energija, zrak in voda

Primer 6-nadzor in vodenje dobave energije za posamezne ogrevalne veje (glej sliko 20).



Slika 20-Rekonstrukcija kotlovnice KTC Rogla

2.5. Ekologija [1], [5]

Najpomembnejši projekti s področja ekologije so:

- bazeni: elektrolizna naprava za izdelavo klora in dekloriranje odpadnih voda (glej sliko 21),
- kuhinje: oljni lovilci za zadrževanje maščob,
- pralnice: zadrževalniki odpadnih voda,
- turistični center, naselje ali objekt: čistilne naprave-centralne ali lokalne (glej sliko 22)...



Slika 21-Elektroliza in dekloriranje bazen.voda



Slika 22-Čistilna naprava KTC Rogla, 2000 PE

2.6. Planirani ukrepi-obdobje 2005 do 2010

- SPTE-kogeneracijska naprava Terme Zreče,
- Sistem dovoda termalne vode in priprave bazenskih voda, Terme Zreče (vrtine B3-B2, kompenzacija, strojnica zunanjih bazenov S2, klorna postaja...)
- Vračanje toplotne energije: strojnic, tušev in bazenskih voda, Terme Zreče,
- Prezračevanje in vračanje TE: kuhinje in pralnice, Terme Zreče in KTC Rogla
- OVE - geotermalna energija, lesna biomasa, energija sonca in vetra-Termie Zreče, KTC Rogla, RTC Krvavec in MRC Rimske toplice...

2.7. Soproizvodnja električne in toplotne energije-SPTE ali kogeneracijska naprava

SPTE-soudeležba TPF v investiciji in delitev realiziranega prihranka 88.000 EUR/leto.



Slika 23-Kogeneracijska naprava Terme Zreče

3. Sklep

Za izvajanje ukrepov s področja učinkovite rabe energije smo se v programu Turizem odločili predvsem zaradi gostov in obiskovalcev, ki jim želimo ponuditi prijetno bivanje, dodatne

storitve in zagotavljanje ustreznih mikroklimatskih razmer v prostorih turistično-termalnih kompleksov, obenem pa skrbeti tudi za okolje in biti z vidika specifične porabe energije na nočitev, gosta ali sobo primerljivi z razvitimi državami Evrope.

Omenjene cilje želimo doseči že od leta 1994, v obdobju od 1998 do 2000 pa smo opravili tudi analizo trga, bhjihove konkurenece in izvajalcev tovrstnih storitev ter sprejeli program celovitega pristopa projektiranja, optimizacije rabe energije in usklajenosti delovanja vseh tehniških sistemov [6], [7], [8] in [9].

Za dosežke na področju energetike, ekonomike in ekologije smo prejeli nagradi AURE 2003-za prispevek k energetske učinkovitosti v podjetju in AURE 2004-energetsko učinkovito podjetje in energetske menedžer leta, katere podeljujeta revija Gospodarski vestnik in Agencija RS za učinkovito rabo energije (glej slike 24 in 25).



Slika 24 - AURE 2003-priznanje za prispevek k energetske učinkovitosti v podjetju



Slika 25 - AURE 2004-Energetsko učinkovito podjetje in priznanje energetske menedžer leta

4. Literatura

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