

Places and Technologies 2015

KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES

Nova Gorica, Slovenia, 18.–19.6.2015

PT2015

BOOK OF CONFERENCE PROCEEDINGS

A healthy city is one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential.
Health Promotion Glossary (1998)

ORGANIZERS:



Универзитет у Београду - Архитектонски факултет
University of Belgrade - Faculty of Architecture
www.arh.bg.ac.rs

URBANLAB
PROFESSIONAL ASSOCIATION URBAN LABORATORY



SPLOŠNA BOLNIŠNICA "DR. FRANCA DERGANCA" NOVA GORICA

University of Ljubljana
Faculty of Architecture



University of Belgrade,
Faculty of Architecture, Serbia

University of Ljubljana,
Faculty of Architecture, Slovenia

Professional Association,
Urban Laboratory, Serbia

General Hospital, »Dr Franca
Derganca« Nova Gorica, Slovenia

SPONZORS:



KREAL, Creative Aluminium, Kidričevo, Slovenia

SUPPORTERS:



MESTNA OBČINA
NOVA GORICA



ISOCARP
Knowledge for better Cities



SLOVENSKA KULTURNO-GOSPODARSKA ZVEZA
UNIONE CULTURALE ECONOMICA SLOVENA

DUPPS
TSPAS
DRUŠTVO URBANISTOV IN
PROSTORSKI
PLANERJEV
SLOVENIJE
TOWN AND
SPATIAL
PLANNING
ASSOCIATION OF
SLOVENIA



Tempus

RESEARCH

Restruktuiranje studijskog programa Arhitekture u program sa integriranim
Masterom, uskladen sa standardima Evropske Unije



European Grouping of Territorial Cooperation
Gruppo europeo di cooperazione territoriale
Evropsko združenje za teritorijalno sodelovanje

CIP - Kataložni zapis o publikaciji

Narodna in univerzitetna knjižnica, Ljubljana

614:711.4(082)(0.034.2)

INTERNATIONAL Academic Conference Places and Technologies (2 ; 2015 ;
Nova Gorica)

Keeping up with technologies to make healthy places [Elektronski vir]
: book of conference proceedings / [2nd International Academic Confer-
ence] Places and Technologies 2015, Nova Gorica, 18.-19. 6. 2015 ; editors
Alenka Fikfak ... [et al.]. - Ljubljana : Faculty of Architecture, 2015

ISBN 978-961-6823-68-5

1. Gl. stv. nasl. 2. Dodat. nasl. 3. Fikfak, Alenka
279986432

Places and Technologies 2015

**KEEPING UP WITH
TECHNOLOGIES TO MAKE HEALTHY PLACES**

BOOK OF CONFERENCE PROCEEDINGS

Editors:

Alenka Fikfak, Eva Vaništa Lazarević,
Nataša Fikfak, Milena Vukmirović, Peter Gabrijelčič

Nova Gorica, Slovenia



Contents

INTRODUCTION	10
HEALTHY CITY - TECHNOLOGY AND URBAN RESILIENCE EVA VANIŠTA LAZAREVIĆ	11
A PLACE FOR PLACES: LIVE AND STAY NATAŠA FIKFAK	13
NOVA GORICA MATEJ ARČON	14
HEALTHY CITY - TECHNOLOGY AND URBAN RESILIENCE RUŽICA BOŽOVIĆ STAMENOVIĆ	17
INNOVATING AT LISBON'S WATERFRONT PLACE, THE "TAGUS PLATFORM" PROJECT PEDRO RESSANO GARCIA	19
TOPIC I: Architecture and Health	19
HEALTHY BUILDINGS: THE ICF CLASSIFICATION AS A DESIGNING TOOL ALBERTO ARENGHI, DANIELE MALGRATI, MICHELE SCARAZZATO	20
THE HEALTH ASPECTS OF SUSTAINABLE ARCHITECTURE KOSARA KUJUNDŽIĆ	26
UNIVERSITY AND DWELLERS' ASSOCIATIONS TOGETHER FOR CREATING SUSTAINABLE AND HEALTHY URBAN ENVIRONMENTS LUCIA MARTINCIGH, FRANCESCO BIANCHI, CECILIA DE MARINIS, MARINA DI GUIDA, GIOVANNI PERRUCCI	32
"VERTICAL" CITY DAMJANA LOJANIČIĆ	39
HEALTHY WORKPLACE: UTOPIA OR REALITY OF MODERN ARCHITECTURAL DESIGN IN BOSNIA AND HERZEGOVINA TIJANA VUJIČIĆ, TANJA TRKULJA	45
SUSTAINABLE DESIGN FOR IMPROVEMENT OF HEALTHY BUILT ENVIRONMENT ALEKSANDAR PETROVSKI, OGNEN MARINA, GEORGI DIMKOV, DIMITAR PAPASTEREVSKI	52
HEALTHCARE DESIGN REVISITED – NEW APPROACHES TO USER – CENTRIC, EFFICIENT AN EFFECTIVE DESIGN EVA VANIŠTA LAZAREVIĆ, JELENA MARIĆ, MILENA VUKMIROVIĆ, GORAN RADOVIĆ	59
BUILDING MATERIALS AND HUMAN HEALTH: DESIGNERS' PERSPECTIVE SAJA KOSANOVIĆ, ALENKA FIKFAK, MIRKO GRBIĆ	74



TOWARDS A NEW UNDERSTANDING OF HEALTHY PLACE SAJA KOSANOVIĆ, EVA VANIŠTA LAZAREVIĆ, SLADAN TIMOTIJEVIĆ	80
ENVIRONMENTAL FEATURES OF BUILDING MATERIALS OF TRADITIONAL OHRID HOUSE AND THEIR CONTRIBUTION TO ITS HUMAN DESIGN RADMILA TOMOVSKA, ANA RADIVOJEVIĆ	86
HEALTHY ARCHITECTURE AS A RESULT OF BALANCED INTEGRATION OF ARTIFICIAL AND NATURAL RULES DŽENANA BIJEDIĆ, RADA ČAHTAREVIĆ, SENAIDA HALILOVIĆ	93
HEALTHY ARCHITECTURE FOR CHILDREN JULIJA ALEKSIĆ	101
MEDICINE AND ARCHITECTURE IN THE CONTEMPORARY SOCIETY ILKA ČERPES	107
MARGINALISATION OF LOCAL COMMUNITIES ALONG THE STRAIT OF SINGAPORE MAGNUS NICKL, VERENA STECHER	115
THE SCALE OF ACUTE CARE HOSPITALS IN SERBIA - THE NEED FOR RETHINKING MARKO MATEJIĆ	121
ARCHITECTURE AND HEALTHY LIVING SPACE GORAN RADOVIĆ	127
TOPIC II: Physical Planning and Quality of Place	140
DEVELOPMENT DIRECTIONS OF URBAN STRUCTURE THROUGH REGISTRATION OF CHANGES OF SEGMENTS OF URBAN COMPLEX VELIMIR STOJANOVIĆ	141
THE TRANSFORMATION OF THE SQUARE CARICA MILICA IN NOVI SAD (SERBIA) IVANA SENTIĆ, KSENIJA HIEL	147
VARESE LIGURE: AN ITALIAN RURAL MUNICIPALITY WHICH HAS IMPLEMENTED AN EXEMPLARY MODEL OF SUSTAINABLE DEVELOPMENT GIOVANNI SERGI, CARLO BERIO, GIULIA CANTON, GIACOMO CROVO	154
CYBERPARKS CHALLENGES - NEW DIGITAL MEDIA FOR ATTRACTIVE URBAN OPEN SPACES INA ŠUKLJE ERJAVEC, CARLOS SMANIOTTO COSTA	163
MEDIA ARCHITECTURE AND SUSTAINABLE ENVIRONMENT JASNA ČIKIĆ-TOVAROVIĆ, JELENA IVANOVIĆ-ŠEKULARAC, NENAD ŠEKULARAC	171



IMPLEMENTATION OF NORWEGIAN EXPERIENCE TO SLOVENIAN HOSPITAL SECTOR	179
ALENKA TEMELJOTOV-SALAJ, SVEIN BJOERBERG, SIMON VRHUNEC, ANDREJ BARIČIČ	
TOWARDS OPEN, THERMODYNAMIC CITY P&T 2015	186
MARIJA BOJOVIĆ, IRENA RAJKOVIĆ, SANJA PAUNOVIĆ ŽARIĆ	
INTERWEAVING OF BANJALUKA'S URBAN AND RURAL LANDSCAPES	194
DIJANA SIMONOVIC	
AN APPLICATION OF THE "ENVIRONMENTAL ISLAND": A PRESCRIPTIVE TOOL TO CREATE HEALTHIER URBAN ENVIRONMENTS	201
LUCIA MARTINCIGH, CECILIA DE MARINIS, JANET HETMAN	
DEVELOPMENT OF PUBLIC SQUARES IN NORTH WESTERN EUROPEAN CITY CENTRES	209
BOB GIDDINGS, JAMES CHARLTON	
MUSIC AND SOUND AS A TOOL INTO DESIGNING HEALTHIER ENVIRONMENT	216
ANJA KOSTANJŠAK, MORANA PAP, TENA LAZAREVIĆ	
DESIGNING PARKING STRUCTURES IN SERVICE OF PUBLIC HEALTH	225
TANJA TRKULJA, TIJANA VUJIČIĆ	
DESIGNING THE WORKING ENVIRONMENT WHEN PLANNING BUSINESS ZONES	232
GREGOR ČOK	
FOUR PARADIGMS FOR THE VENETO REGION'S CENTRAL AREA	240
ENRICO ANGUILLARI	
MUNICIPALITY POLICY AS KEY FACTOR FOR THE ROLE OF ARCHITECTURE AND TECHNOLOGY IN PUBLIC HEALTH	248
DEJAN VASOVIĆ, NATAŠA ČUKOVIĆ IGNJATOVIĆ, DUŠAN IGNJATOVIĆ	
INDUSTRIAL HERITAGE IN ALBANIA AND THE OPPORTUNITIES FOR REGENERATION AND ADAPTIVE RE-USE	255
FLORIAN NEPRAVISHTA	
THE POSSIBILITIES OF THE APPLICATION OF THE CONCEPT OF HEALTHY CITY IN ILLEGAL SETTLEMENTS IN SERBIA	266
BRANISLAV ANTONIĆ, BISERKA MITROVIĆ	
URBAN REGENERATION AS A TOOL FOR POPULATION HEALTH IMPROVEMENT	272
FILIP PETROVIĆ	
URBANIZATION OF METROPOLITAN AREAS – THE IMPORTANCE OF NEW SPATIAL DATA ANALYSIS TOOLS	281
HANNA OBRACHT-PRONDZYNSKA	



AQUAPONICS BASED ARTIFICIAL BIOSPHERE INCLUDED IN ARCHITECTURE: FROM
MITIGATION OF NEGATIVE IMPACTS TO POSITIVE ADDED VALUES OF URBAN
SPATIAL STRUCTURES ON LOCAL, REGIONAL AND GLOBAL SCALE 288

PIOTR MAREK SMOLNICKI

INSTITUTIONAL CHALLENGES IN THE URBAN PLANNING
WATER SENSITIVE PLACES 297

VIŠNJA SRETOVIĆ BRKOVIĆ, MATIJA BRKOVIĆ

TOPIC III: Lifetime Communities and Participation 308

COHOUSING FOR BUILDING REUSE 309

ADOLFO BARATTA, FABRIZIO FINUCCI, ANNALISA METTA, LUCA MONTUORI

HOW TO DESIGN HEALTHY BUILDING FOR HEALTHY LIVING? 315

ANJA JUTRAŽ, SANJA ŠTIMAC

PARTICIPATORY URBAN PLANNING AND PUBLIC POLICY 326

VIŠNJA KUKOČ

TOPIC IV: Cultural Patterns and Sensitivity 332

SENSE OF PLACE IN ARCHITECTURAL DESIGN:
TOWARDS HEALTHY PLACES P&T 2015 333

EGLÉ NAVICKIENÉ

HOLIDAY HOMES IN THE VICINITY OF SPLIT, CROATIA, DESIGNED
BY FRANO GOTOVAC – CONTINUITY OF ARCHITECTURAL HERITAGE 341

VESNA PERKOVIĆ JOVIĆ

ARCHITECTURE AND ITS AFTERLIFE; GREEN URBANITY 347

GABRIELLA MEDVEGY, GÁBOR VERES

INVESTIGATION OF RELATIONSHIP BETWEEN CULTURE
OF THE INHABITANTS AND QUALITY OF HOUSING 353

ANA ŠPIRIĆ, SANJA TRIVIĆ

UTOPIAN PROJECTS DRAWINGS AS INDICATORS
OF MODERN SOCIETY NEEDS 361

VLADIMIR KOVAČ

YOUTH AND THE FEELING OF SAFETY IN PUBLIC SPACES 368

SVETLANA STANAREVIĆ, STEVAN TATALOVIĆ



TOPIC V: Health Intensive Care **375**

OPTICAL COHERENCE TOMOGRAPHY - GUIDED PRIMARY PERCUTANEOUS CORONARY INTERVENTION IN ACUTE MYOCARDIAL INFARCTION	375
IGOR KRANJEC	
FRACTAL ARCHITECTURE OF THE CORONARY ARTERY TREE	386
MATJAŽ KLEMENC	
HUMANIZATION OF DIALYSIS: GREEN AND COZY	392
JADRANKA BUTUROVIĆ-PONIKVAR	
CONTEMPORARY CHALLENGES OF PUBLIC HEALTH AND AN ACTIVE APPROACH TO OVERCOME THEM	397
MARKO VUDRAG	
ANALYSIS AND CONTEMPORARY APPROACH OF SPACE DESIGN OF INTENSIVE PSYCHIATRIC CARE UNIT	406
NEVENA DUTINA, ALEKSANDRA DUTINA	

TOPIC VI: Inclusive and Accessible Environment **413**

TOWARDS INCLUSIVE FIRE SAFETY DESIGN	414
VALERIA TATANO, ELISABETTA CARATTIN	
INCLUSIVE AND THERAPEUTIC URBAN ENVIRONMENT: INVOLVING USERS IN THE DESIGN PROCESS	422
ILARIA GAROFOLO, BARBARA CHIARELLI	
DEVELOPING INNOVATIVE SOCIAL HOUSING TO FOSTER INCLUSIVE COMMUNITIES	429
SILVIA GRION, PAOLA COLONI	
URBAN PUBLIC SPACES ACCESSIBLE FOR ALL: A CASE STUDY IN A HISTORICAL DISTRICT OF ROME	436
LUCIA MARTINCIGH, CECILIA DE MARINIS	
ECOLOGICAL LANDSCAPE, PHYTODEPURATION AND MANMADE WETLANDS IN MAGOK LAKE PARK, SEOUL	445
CRISTIAN SUAU, CARMELO ZAPPULLA	
ADVANCED SYSTEMS FOR IMPROVING COMMON HEALTH	458
URŠKA KALČIČ, JANEZ PETER GROM	
INCLUSIVE AND ACCESSIBLE ENVIRONMENT: PLANNING FOR THE FUTURE	466
SANKALP SHUKLA, APOORVA GANGRADE, ANSHULA GUMBER	
FACTS4STOPS – USER NEEDS REGARDING PUBLIC TRANSPORT STATIONS AND ENVIRONMENT	472
CHRISTINE CHALOUPKA-RISSER, DANIEL BELL	



TOPIC VII: Environmentally Friendly Transport 478

SHIFTING TO MORE ENVIRONMENTALLY FRIENDLY MODES IN LONG-DISTANCE TRANSPORT	479
ALEKSANDRA NEŠIĆ, IVANA ČAVKA, OLJA ČOKORILO	
ASSESSING PUBLIC TRANSPORT EFFICIENCY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT	485
EVGENIA YOSIFOVA	
THE ROLE OF PUBLIC TRANSPORT PRIORITY IN SUSTAINABLE URBAN MOBILITY	492
DINO ŠOJAT, DAVOR BRČIĆ, MARKO SLAVUJ	
APPLICATION OF PV MODULES ON NOISE BARRIERS	498
BUDIMIR SUDIMAC, ANDJELA DUBLJEVIĆ	
PLANNING OF ELECTRIC TRANSPORTATION IN THE KRŠKO REGION	505
ANA TIVADAR, STANKO MANOJLOVIĆ, SIMON PODKORITNIK	
INTELLIGENT TRANSPORT SYSTEMS FOR SMART CITIES	511
BIA MANDŽUKA, LJUPKO ŠIMUNOVIĆ, MARIO ĆOSIĆ	

TOPIC VIII: Building Technologies 518

RETROFITTING OF MULTI-FAMILY BUILDINGS TOWARDS HEALTHIER SETTLEMENTS	519
ALEKSANDRA KRSTIĆ-FURUNDŽIĆ, ALEKSANDRA ĐUKIĆ	
FERROCEMENT ARCHITECTURAL STRUCTURES FROM THE ASPECT OF SOCIAL WELL-BEING	526
ALEKSANDRA NENADOVIĆ	
DAYLIGHT ANALYSES OF "READY-MADE" FAÇADES WITH MODULAR OPENINGS - CASE STUDY LOCATION IN PODGORICA	532
SANJA PAUNOVIĆ ŽARIĆ, IRENA RAJKOVIĆ, MARIJA BOJOVIĆ	
ACTIVE SOLAR SYSTEMS – STUDY OF POTENTIAL FOR APPLICATION IN THE MATERIALIZATION OF TOURIST FACILITIES IN MONTENEGRO	539
IRENA RAJKOVIĆ, SANJA PAUNOVIĆ ŽARIĆ, MARIJA BOJOVIĆ	
PREFABRICATED PASSIVE HOUSE VENTILATED FAÇADE PANEL SYSTEM WITH RECYCLED CONCRETE	548
LJUBOMIR MIŠČEVIĆ, IVANA BANJAD PEČUR, BOJAN MILOVANOVIĆ	
POTENTIAL ANALYSIS OF DYNAMIC, THERMAL BUILDING SIMULATIONS AND DEVELOPMENT OF MEASUREMENT AIDED SIMULATION TECHNIQUE	556
ISTVÁN KISTELEGDI, BÁLINT BARANYAI, BÁLINT BACHMANN	



TOPIC IX: Adaptive Reuse and Urban Renewal 561

COMPARISON OF THE SUSTAINABILITY OF DIFFERENT TECHNIQUES
FOR THE STRENGTHENING OF REINFORCED CONCRETE SLABS 562

TANYA CHARDAKOVA, MARINA TRAYKOVA

SYSTEMS FOR THE REQUALIFICATION OF NON-LISTED ARCHITECTURE:
THE "ADAPTIVE EXOSKELETON" 569

FRANCESCA GUIDOLIN

RECONSTRUCTION AND REVITALIZATION OF THE COMPLEX SENARA, WITHIN
THE MONASTERY HILANDAR, IN ORDER TO ADAPT TO MODERN TRENDS AND
SOCIAL CHANGES 575

JELENA IVANOVIĆ-ŠEKULARAC, JASNA ČIKIĆ-TOVAROVIĆ, NENAD ŠEKULARAC

RENEWAL OF JUGOMONT PREFABRICATED RESIDENTIAL BUILDINGS JU-61 582

IVAN MLINAR, LEA PETROVIĆ KRAJNIK, TAMARA MARIĆ

BROWNFIELDS AS PLACES AND RENEWABLE ENERGY SYSTEMS
AS TECHNOLOGIES: POTENTIALS AND RISKS IN CASE OF SERBIA 588

ANITA STOILKOV-KONESKI, ZORAN KONESKI

LANDFILL JAKUŠEVEC IN ZAGREB – POTENTIAL FOR NEW SPACE
IDENTITY AND ENHANCEMENT OF QUALITY OF LIFE 595

LEA PETROVIĆ KRAJNIK, DAMIR KRAJNIK, IVAN MLINAR

TOPIC X: Active Living and Health 601

OPEN PUBLIC SPACES FOR HEALTHIER CITIES 602

ALEKSANDRA STUPAR, ALEKSANDRA ĐUKIĆ

RESPONSIBILITY TO THE EMPLOYEES' HEALTH UNAVOIDABLE
IN THE CREATIVE AND INNOVATIVE DESIGN OF OFFICE SPACES 610

NIKOLA Z. FURUNDŽIĆ, DIJANA P. FURUNDŽIĆ, ALEKSANDRA KRSTIĆ- FURUNDŽIĆ

HEALTHY PLACES, ACTIVE PEOPLE 617

KATARINA ANA LESTAN, IVAN ERŽEN, MOJCA GOLOBIČ

THE IMPACT OF QUALITY OF PEDESTRIAN SPACES ON
WALKING AS A MODERATE PHYSICAL ACTIVITY 623

MILENA VUKMIROVIĆ, EVA VANIŠTA LAZAREVIĆ

TOPIC XI: Health Promotion, Protection and Prevention 638

OUTDOOR GYMS: "NO MORE EXCUSES FOR PEOPLE WHO CANNOT
AFFORD MEMBERSHIPS. GET OUT AND GET IN SHAPE!" 639

ANNE-KATHRIN WILL



STUDENT PHYSICAL EDUCATION FOR HEALTHY LIFESTYLE ALEŠ GOJJA	646
KEY POINTS OF HUMAN AWARENESS AND EMERGENCY PLANNING. SCHOOLS AS A CASE STUDY MADDALENA COCCAGNA	655
ANOTHER SIDE OF THE COMFORT OF LIVING – ELECTROMAGNETIC POLLUTION NEBOJŠA ARSIĆ, JORDAN RADOSAVLJEVIĆ, NATAŠA FIKFAK, SAŠA ŠTATKIĆ	661
RECOMMENDATIONS FOR UNIVERSAL DESIGN OF OUTDOOR LEISURE AND RECREATIONAL AREAS LARA SLIVNIK	667
TOPIC XII: Social Networks and Human Basic Needs	673
VISUAL REPRESENTATION AND EXPERIENCE OF PLACE: CASE STUDY ALHAMBRA IN GRANADA ISIDORA KARAN, VEDRANA IKALOVIĆ	674
BEYOND THE QUANTIFIED SELF: A LOOK AT THE SOCIAL DIMENSION OF HEALTH SVEA HEINEMANN	680
SKYSCRAPER'S PUBLIC AREAS: THE IMPACT ON SPACE AND SOCIAL LIFE ALICJA STEFAŃSKA	686
THE IMPACT OF SOCIAL NETWORKS USE ON REDUCTION OF DEPRESSION IN CANCER PATIENTS LEILA HABIBI, HAMID REZA FARPOUR	691



MUNICIPALITY POLICY AS KEY FACTOR FOR THE ROLE OF ARCHITECTURE AND TECHNOLOGY IN PUBLIC HEALTH

Dejan Vasović¹

PhD candidate, Assistant, University of Belgrade, Faculty of Architecture, Bul. kralja Aleksandra 73/II, Belgrade, Serbia, d.vasovic@arh.bg.ac.rs

Nataša Ćuković Ignjatović

PhD candidate, Assistant Professor, University of Belgrade, Faculty of Architecture, Bul. kralja Aleksandra 73/II, Belgrade, Serbia, natasa@arh.bg.ac.rs

Dušan Ignjatović

PhD candidate, Assistant Professor, University of Belgrade, Faculty of Architecture, Bul. kralja Aleksandra 73/II, Belgrade, Serbia, ignjatovic.dusan@arh.bg.ac.rs

ABSTRACT

The construction of the so-called "social infrastructure" (kindergartens, schools, health centres, hospitals), which is the basis for a "public health" in a broader sense, in many countries is led by the administration (state and municipal). The quality of the built environment largely depends on the quality of financier, in this case embodied in some kind of state/municipal authorities, committees and civil servants. In this paper, an example of the application of up to date high-tech design methods and technologies in the design and construction of public buildings is presented. Belgrade public buildings designed and constructed in the period 2009 – 2013, is shown. The first five projects for construction of energy efficient kindergartens (up to passive house standard) with the use of renewable energy sources and realised through architectural competition, were considered as a passing fad, but such a practice has become standard procedure for the design of the other public buildings, and even the only option for the construction project of 1400 social apartments in Borča. The paper presents these projects, and, in particular, highlights the necessary processes and procedures established to ensure that these projects would be implemented.

Keywords: *municipality policy, energy efficiency, architectural competition, healthy places.*

¹ Corresponding author



INTRODUCTION

World Health Organization defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1948). In the broader sense, it means that social well-being is one of the key elements of people’s health. Even more, in UNDP study “Stuck in the Past” (UNDP, 2004) it was clearly stated that if the Serbian society wanted to develop, decrease of energy consumption would be mandatory.

City of Belgrade spends around 30% of the energy produced in Serbia (Belgrade’s Energy Sector Development Strategy, 2008). Therefore, the decrease of the energy consumption in Belgrade is crucial both for the citizens, and for the City Municipality. However, as the price of the energy sources is subsidised by the Government, there is no economical motivation for the rational usage of the energy or for the application of the renewable energy sources. For that reason, it is the mission of the local authority to be a leader in the energy saving process: on one side, to reduce its own expenses for the energy sources, and on the other to start the development of the energy saving industry (education of financiers, architects, engineers, constructors, supervisors, final users ...). These tasks imply the change of the many administrative bodies which is always a big challenge.

DEFINING OF THE MUNICIPALITY POLICY

The main goal was to improve the design, construction and management of the public buildings, to lower their energy consumption in exploitation and to use renewable energy sources for this lowered energy needs. Having in mind some failed attempts, a decision was made to start more projects in different fields simultaneously. University, professional associations, public companies, interested private companies, relevant city secretariats, agencies and municipalities – they all had their representatives included. To avoid partition and segregation, the projects were linked by the mutually dependent goals, and teams’ members took different roles in different projects. Special attention was made to ensure equal presence of the members of the City authority and other contributors in different projects. In that way, one participant could reach more different results, one project would be finished and other one started, the projects which did not progress were put on hold temporarily, while the same participants remained active in other on-going projects. This organisation brought on higher activity of the employees in the city authorities and different ideas how to improve the system itself. The very system started to change itself.

A very important decision was made to acquire all the design solutions through the public competition with more equal rewards, and to have the entries and results published. In this way, all the participants, and not only those rewarded, became the promoters of new ideas.



STUDIES AND SURVEY OF CURRENT STATE

City of Belgrade (Directorate for Energy) provided yet in 2003/2004 energy efficiency studies made for 20 kindergartens and schools (“EnPlus“), projects “Energy revitalisation and comfort optimisation”, with the exact outcomes such as economic analysis of measures, recommendations of possible scenarios of energy recovery with precise information about the investment vs. benefit, but nothing had ever been realised due to lack of interest. However, Directorate for Energy continued the activities by making following studies of the housing, hydro potential, and Energy information system:

Atlas of the Energy Characteristic of the Building Envelopes in Belgrade

The study was made by Faculty of Architecture, University of Belgrade in 2012. Atlas made the identification, classification, architectural and thermo-visual analysis of the performance of the building envelopes, suggested the measures to be undertaken accompanied by financial estimation of the costs for 30 typical building in Belgrade. The buildings made in the period before the first thermal protection regulations, mostly during 60-ties and 70-ties (even during 80-ties) have the biggest savings potential. The possible savings, which include all measures, are around 50% of the current consumption.

Detailed Research on Sub-Geothermal Water Resources of Belgrade – Potential, Usage Possibilities and Energy Evaluation

The study was made by Faculty of Mining and Geology, University of Belgrade in 2012. The subject of the Study is sub-geothermal energy with low enthalpy, which can be used in heat pumps, with the depth of 200-300 meters, for the defined temperature range 9-30°C. The conclusion of the study is that one third of the thermal needs of the buildings attached to the central heating system can be obtained by using available sub-geothermal thermal energy. According to general calculation, total available thermal power for Belgrade is around 1.5 MW.

Cadastre of the Geothermal Wells in the Territory of the City of Belgrade and Forming of the Geothermal Information Database

This is the first classification of the information of this type and it covers collection of all available data related to existing geothermal wells in the territory of the City of Belgrade (number of exploitation wells that are or can be used for the heating/cooling needs of the buildings; current number of geothermal energy users). This conceptual approach enables the forming of the base for the sustainable usage and management of the hydro-geothermal resources in the City territory.



Research on Wind Energy Potential and Identification of the Most Favourable Locations for the Wind Power Plants in the Territory of City of Belgrade

The research was made by School of Electrical Engineering, University of Belgrade, and it is an indicative city/regional study made after one-year-measurement in three referential locations (height of 35-63 m). The possibility of development of the wind power plant with the power of more than 3 MW was analysed and there were eight established micro-locations in the broader City territory on the right side of the Danube, with the optimal possibility of usage of the south-east and north-west winds (net usage coefficient of the 25 do 30% capacity on yearly basis, estimated installed power around 110MW).

Informational System of the Energy of City of Belgrade (ISEB)

Implantation of the Informational system of the energy should continuously monitor the energy flows in the territory of Belgrade, so that data analysis might prevent supply disturbances, enable planning and disposal of the energy, define measurements for the loss reduction, influence growth of the energy efficiency, optimise the consumption of all forms of energy and minimise the environment pollution.

REALISED PROJECTS

By Major's decision, City of Belgrade decided to adopt energy efficiency (EE) measures and use renewable energy sources (RES) through construction of new buildings. The first occasion was the construction of five new kindergartens with passive house standard (less than 15kWh/m² for heating). Design briefs were acquired through public architectural competition initialised in 2010, when the participants were clearly (for the first time in Serbia) asked to use EE measures and RES. Public competition and following main design completion were used to encourage and educate the professionals to adopt EE and RES knowledge.



Figure 1: Kindergarten "Tesla – Science for Life" in Block 67, New Belgrade. Design: DVA STUDIO. Photo: D. Vasović.

The first one of those kindergartens was opened in Bežanijska kosa (block 12) in May 2012, and the second one in University City (Block 67) in October 2013. The



Kindergarten in Block 67 was awarded with the Grand Prix of 36th Salon of Architecture in 2014. Kindergartens in Stubline (near Obrenovac) and in Bežanija (block 61) were opened in the beginning of 2015, while the construction of the fifth kindergarten in Voždovac (settlement Banjica) shall soon be launched. The project development defined the usage of different RES for each of five kindergartens (sub-geothermal water, geo probes, photovoltaic and water heating solar collectors, in order to reduce to the minimum the costs for heating, cooling and hot water preparation. The cost for energy consumption for these buildings is less than 1 euro cent/m². For the first time, there are directions for measurements and verification of the energy consumption defined in the project documentation.



Figure 2: Kindergarten “Dragan Laković” in Block 61, New Belgrade. Design: AGM. Photo: D. Vasović.

There is a small solar power plant in kindergarten in Bežanijska kosa, which should supply the electric power to the EPS (Serbian Electric Power Company) not just for pure economic reasons, but also as a role model (7 photovoltaic panels, 3.2 kW installed power). The construction of this kindergarten was the first opportunity for City administration to pass all the procedures for conditions, agreements and approvals, and also for setting-up of the privileged electric energy supplier to sell the electricity per “feed-in” prices. All five kindergartens and social building “Predah”, are subsidised by Republic of Serbia in 4.7% of the total value of the construction of the building, in the RES part - for the works and installations, and thermal exchange.

Successes in kindergarten construction caused the “competition” in application of EE and RES measures in other public buildings. In the end of 2014, “Predah”, a new social building for the temporary and occasional accommodation of children with autism was opened in Shakespeare’s street. There are two compact EE buildings with whole day stay accommodation for the children, kitchen and administration. The buildings use similar EE measures as the five kindergartens: usage of RES for heating and cooling (underground water wells, heat pumps), solar system for the hot water (also for the kitchen and laundry) is combined with the usage of natural gas.



ONGOING PROJECTS

The biggest EE and RES usage should be future social housing project in Ovča settlement in Belgrade. Design briefs were also acquired through public architectural competition. What makes the project unique is the fact that master plan united seven different rewarded designs. Total number of 965 social apartments and solidarity apartments were designed to be constructed in four phases. In total, around 70.000 m² of the apartments and 1.800m² of social and commercial usage, were designed. Preparatory works of the first phase (65 social and 185 apartments of Solidarity Fond) started. The project competes for the funding at European Committee, as aimed to accommodate internal refugees from KC Krnjača. The negotiations for the financial support of the second phase (235 apartments) are pending – Central European Bank might finance it from the Regional housing programme. The main challenge was a complete lack of infrastructure, except roads. Due to lack of sewage installation, there is a need for the wastewater treatment plant, due to lack of the heating system and gas pipeline, the thermal energy for this low energy consumption buildings should be produced in hydrothermal RES sources available at the site (during the summer, underground water will be used as technical water for the greenery). Along with low consumption of electrical energy for the heat pumps, these measures will enable remarkable savings for the apartment users and for the City of Belgrade. Energy and economy efficiency of the buildings are made possible through combination of the passive measures in urban and architectural design and usage of the low temperature energy distribution system – floor heating in the apartments. Along with the significant thermal insulation, both in the facades and roofs, PVC windows should be made of six-chamber profiles with low emission cover, double glazing and argon filling.

CONCLUSIONS

Introduction of high-tech projects in public works is always challenging because of to inertia, complicated procedures, and already established routine. It is not only the building process that is challenging, but the operation time even more. Therefore, it is very important to spread the knowledge and information about new technologies to different levels.

REFERENCES

- Corburn, J. 2009. *Toward the healthy city: people, places, and the politics of urban planning*. MIT Press.
- Prindle, B. et al. 2007. *The twin pillars of sustainable energy: synergies between energy efficiency and renewable energy technology and policy*. Washington, DC: American Council for an Energy-Efficient Economy.



UNDP Country Office of Serbia and Montenegro. 2004. *Stuck in the past – Energy, Environment and Poverty in Serbia and Montenegro*. UNDP Serbia and Montenegro.

Vasović, D. and Radulović, G. 2013. “Energetska efikasnost: Primer grada Beograda”, *Polis* 6, no. 6 (December): 39–45.