DISTINKCIJE O OBNOVLJIVIM IZVORIMA ENERGIJE I ZAŠTITI KULTURNOG NASLEĐA

DISTINCTIONS ON RENEWABLE ENERGY SOURCES AND CULTURAL HERITAGE PROTECTION

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Dokument o politici za integraciju perspektive održivog razvoja u Konvenciju o svetskoj baštini, koji je usvojila Generalna skupština država članica (UNESCO, 2015), ističe značaj primene obnovljivih izvora energije u oblasti zaštite kulturnog nasleđa. Komparativnom analizom naučnih rezultata u međunarodnoj praksi o primeni obnovljivih izvora energije u zaštiti baštine, u ovom radu istražuju se distinkcije značajne za formulisanje semantičkog plana primene obnovljivih izvora energije u zaštiti baštine, sa akcentima na parametrima ograničenosti i funkcionalnosti primene na značajnim objektima kulturnog nasleđa.

Ključne reči: *obnovljivi izvori energije, kultuno nasleđe, semantički plan*

A policy document on the integration of a sustainable development perspective into the World Heritage Convention, adopted by the General Assembly of States Parties (UNESCO, 2015), emphasizes the importance of implementing renewable sources of energy into the field of cultural heritage protection. Comparative analysis of scientific results in international practice on the application of renewable energy sources in heritage protection, in this paper explores the distinctions important for formulating a semantic plan for the application of renewable energy sources in heritage protection, with emphasis on the parameters of limitations and functional applicability for significant cultural heritage objects.

Key words*: renewable energy, cultural heritage, semantic plan*

1 Introduction

Renewable energy research is commonly conducted in the context of energy and economic savings and sustainable development in the age of globalization, and very rarely includes the *specificums* of cultural heritage protection. The support for the introduction of renewable energy sources in the field of cultural heritage protection has existed, officially, since 2015, when the policy document for the integration of the sustainable development perspective into the World Heritage Convention explicitly stated the necessity for the introduction of renewable energy sources. The document warns that any negative impact on the environment and cultural diversity should be avoided and, if this is not possible, mitigated when preserving and managing the world's heritage and its wider environments. It is recommended that this can be achieved by promoting environmental impact assessment tools in the sectors such as urban development, transport, infrastructure, mining and waste management, using sustainable patterns of consumption and production, as well as promoting the use of renewable sources of energy [1].

Several major European projects addressing the problems of integrating renewable energy into cultural heritage show different modalities of thinking: the application of solar energy in the old city of Edinburgh [2], Berlin and St. Petersburg [3], or the implementation of shallow geothermal energy systems in an Italian city Ferrara, known for the preservation of its pristine authentic Renais-

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sance historic core [4], that is, the application of wind farms in the Spanish city of Navarre, along the culturally significant St. James Road [5].

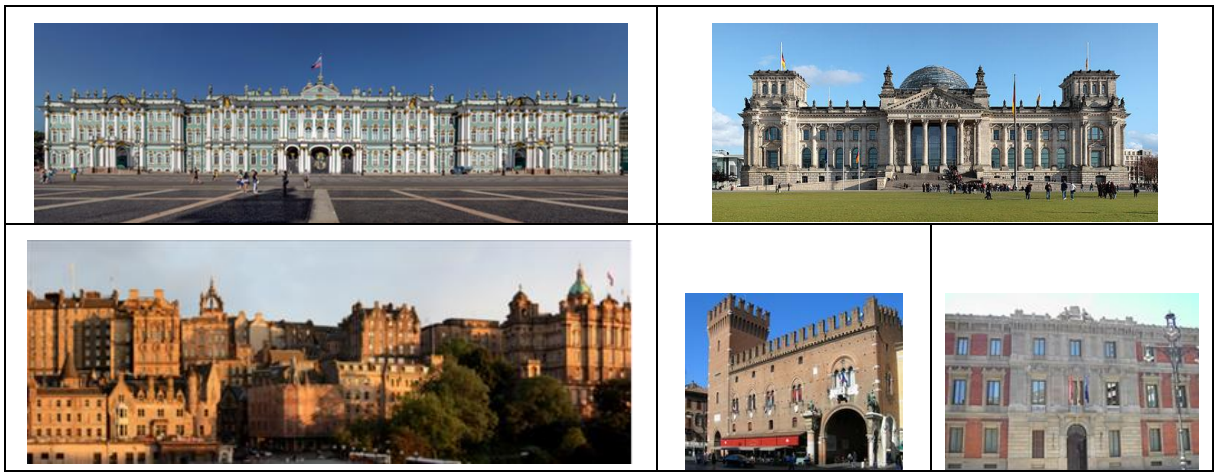

Fig.1: Old Town: St. Petersburg, Berlin, Edinburgh, Ferrara, Navarre [6-10]

Bearing in mind that each of the presented models follows the specificity of the cultural heritage variety explored in the individual studies, the need to investigate the proposed models from the perspective of possible common contents was noted. When it comes to cultural heritage, in terms of energy and economic savings, heritage values are given priority, so there are distinctions about renewable energy in the domain of connotative meanings and visualization models. Therefore, in the field of cultural accumulation, an integrated perspective is required for the use of renewable energy sources. Comparative research has shown that the required perspective is based on two creative principles in the domain of distinctions, belonging to the corpus of universal values:

Subtilitas intelligendi representing the requirement of precision in comprehension and *Subtilitas explicandi* as the requirement in precision of interpretation. These are principles that represent some of the most important principles of semantics in cultural heritage protection.

2 Subtilitas inteligendi

Cultural heritage and renewable energies are phenomena encountered in the field of social responsibility in the 21st century. The imperative of choosing what is best for the protection of cultural heritage rests on the development of specialized technological knowledge, which is applied with methodicality of controlled applications, given the obligation to subject technological knowledge to heuristic evaluations of heritological criteria of applicability [11].

The data collecting and processing within selected conceptual tools that can be applied in each individual study of the desirable energy image of a cultural heritage object is closely related to the issues of visuality and connotative meanings. The combination of a kind of symbolic capital carrying cultural heritage, with the dispositions of technical-technological sciences in maintaining that symbolic capital, requires mutual reflexivity, that is, awareness of all the decisive circumstances in which a new reference energy system is created for a cultural heritage object [12, 13].

Therefore, an integrated perspective comes from compatible perspectives on assessments of authentic states and subsequent interventions on heritage objects, where in the spirit of Heiden White's thinking, it is important to keep in mind that "… a historian does no good to build a seductive continuity between the present world and the one who preceded it. On the contrary, more than ever, we need a history that will educate us about discontinuity, because discontinuity, destruction and chaos are our destiny ... "[14]. In other words, an engineer with the task of designing a renewable energy source appropriate for a cultural object, a historian (art historian / archeologist) is an associate who, by knowing the historical and social circumstances of the creation and survival of the object over time, builds a context, that is, a connotation field for positioning a new reference energy system. Here, we also refer to Robin Collingwood's point of view that in order to explain the work that has existed in the past, it is necessary to make it understandable by reconstructing the

thought processes that govern them [15]. More recently, we call it the reconstruction of technological thinking [16].

Bearing in mind that the style of one time is often defined as the specific balance of all life components of that time, historical sources indicate to us the spirit of the time in which we find current technological thinking. Thus, in the encyclopedic writings of Pliny the Elder, we find: "… Agrippa, during his uniqueness, merged the Marcian's aqueduct with the aqueduct *Acqua Virgo* and repaired and strengthened the channels of other aqueducts. He also commissioned the excavation of seven hundred wells, in addition to five hundred fountains and three hundred and thirty water reservoirs… "[17]. To the engineer looking for modalities for the application of renewable energy sources, when dealing with the task of designing for the needs of sites and structures from the Roman period, this is a significant piece of information that points to previous research of resources in the field. Underground canals of Roman cities, in the writings of Pliny the Elder, testify to the use of water energy; "… For this purpose, there are seven rivers that have been forced through artificial channels to flow beneath the city. Running forward, like all other irresistible currents, these rivers are forced to carry and gather all their sewage, so, since they have swollen from the rainwater, they hit the sides and bottom of their canals… "[17].

Returning to the question of the stylistic characteristics of heritage objects, and paraphrasing Proust, who viewed a style as a kind of transformed intelligence, we can also from an engineering perspective ascertain that cultural heritage objects arouse certain types of perception by their stylistic characteristics, which is reflected in the choice renewable energy source that will be best suited both in style and in the engineering logic by which the object itself and its environment are designed.

When it comes to cultural objects belonging to recent history, where the goal is to introduce renewable energy sources instead of non-renewable ones, the decoding of style-giving messages is more complex, thus creating the term *double coding* that refers to post-modern architecture. Umberto Eco, echoes Charles Jenks's words about postmodern buildings: "… at the same time he speaks on at least two levels: addressing other architects and a handful who understand specific architectural meanings, but also to the general public or locals interested in other things, such as comfort of buildings, tradition, a certain life-style. A building or a postmodern piece of art, when addressing a minority elite audience, uses "high" codes, and at the same time, when addressing a mass audience, uses national codes "[18]. We are obviously talking about the encounter of the two paradigms that significantly transform the nature of the questions raised in the contextualization of renewable energy sources. Due to such a complex articulation between technological thinking and historical reality reflected in social categories, it is evident that different practices for the protection of cultural heritage and the development of renewable energy models have a common content in which they interact and mutually determine in the field of visuality. Therefore, it is more appropriate to speak of essentialization than of analysis in the application of renewable energy sources in relation to cultural heritage.

The complexity of interpreting visuals is also manifested in the evaluation of the landscape that surrounds the cultural good. It is about a value that has been the subject of research since the 1931 Athens Convention [19]. The Land Convention, which was adopted in 2000, emphasizes that the landscape plays an important role for the general interest in the field of culture, so that the heritage is also managed as a cultural asset [20]. In this sense, the choice of a renewable energy model must not impair the landscape (Fig. 2a), regardless of whether its value is linked to the object as a cultural heritage, or whether the landscape itself is protected as a cultural property. With this in mind, in this paper we compare from the comparatively researched studies an exceptional example from Navarre in Spain, from the culturally significant route of St. James (Fig. 2b), where in the interpretation of the semantics of the visual use of renewable energy sources we see absolute correspondence between the cultural and energy reference position, in such a way that the connotation is not questioned at all. On the other hand, we have an example of the Viminacium site in Serbia (Fig. 2c), the former capital of the Roman province of Upper Moesia, and today the site in the immediate vicinity of the Kostolac thermal power plant. Unlike the example of Navarra, we see

the opposite process here: the site develops new facilities by visually incorporating them into the area dominated by the chimney of a thermal power plant, whose proximity makes it meaningless to create an energy system based on renewable energy sources.

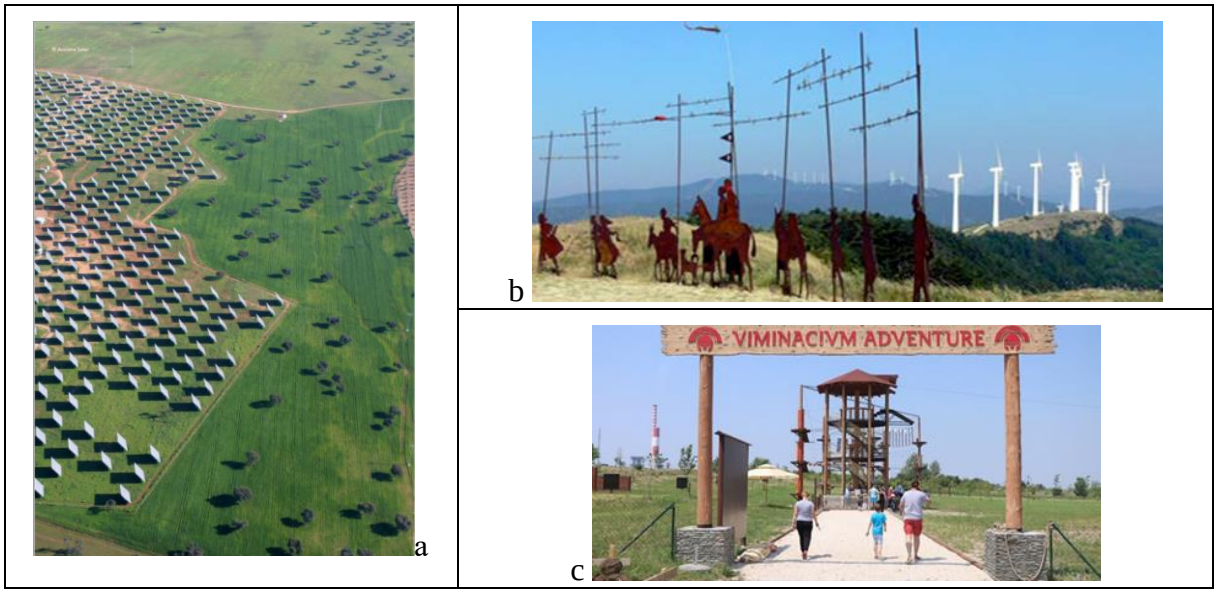

Fig. 2: a- Integration of renewable energy sources into the landscape, © Acciona Solar, [21]; b - St. James Road near Navarre, Spain, with a wind farm in the background [5]; c -Viminacium and TPP Kostolac in the same visual plan [22]

3 Subtilitas explicandi

The conversion of the symbolic capital of a cultural heritage into the category of energy power, as recent studies on renewable energy show [3], is visually demonstrated at the Reichstag Building in Berlin, where the installed solar panels create a different visibility, without altering the dominant symbolic capital of an object with significant historical symbolic capital.

Fig. 4: Solar panels at the Reichstag building in Berlin [3]

Installation of solar panels on the Reichstag building shows how significant the eugenic aspect [eugenics in ancient Greek: ευ = good, γενοσ = the one who produces], as a parameter that does not relate to the quality of production in technical and technological sense, but in terms of precision the production of symbolic content. An intervention in a space that enhances the functioning of an object in some aspect of its reference state (in this case energetic), or that creates a whole new functioning, that is, opens up the possibility for a new aspect that was previously lacking, while striving for a minimum of visuality, would be a function of acceptability of a renewable energy implemented in the cultural heritage space.

When it comes to interpreting the stratigraphy of archaeological sites and linking them to possible renewable energy sources within the sites themselves in the case of geothermal springs (wells and reservoirs), it should be borne in mind that in many sites the stratigraphies are mixed over time

and that the interpretations of the building layers proceed according to findings of movable cultural heritage [23], so archeological expertise is needed regarding the idea of using existing capacities for the eventual application of renewable energy sources for covered sites.

Another important, implicit aspect of the interpretation of the use of renewable energy sources relates to a participation in the concept of defending and consolidating the value of cultural heritage as opposed to the practices of devastating material remains and the cultural and historical network itself as an intangible heritage. Therefore, in the use of renewable energy sources in relation to objects of cultural heritage, there is inevitably a techno-philosophical aspect of the building principles translatable to external actions based on the singularity, which belongs to the anthropological constant of the existence, human nature and traces of the ways of its existence in time. Therefore, for the immediate purpose of designing a renewable energy source appropriate to a particular cultural object, in addition to the historical layers of culture, the engineer must have a symbolic sense of time, which in this task is indisputably substantive in nature, which is why it is necessary to rely in his work, on representative interpretations of diachronic series of cultural values and their value verticals. Here we refer to Hronjec's opinion "... It is precisely the 'readability' of art (as well as the applicability of science) that we must keep in mind, how we create anything ..." [24].

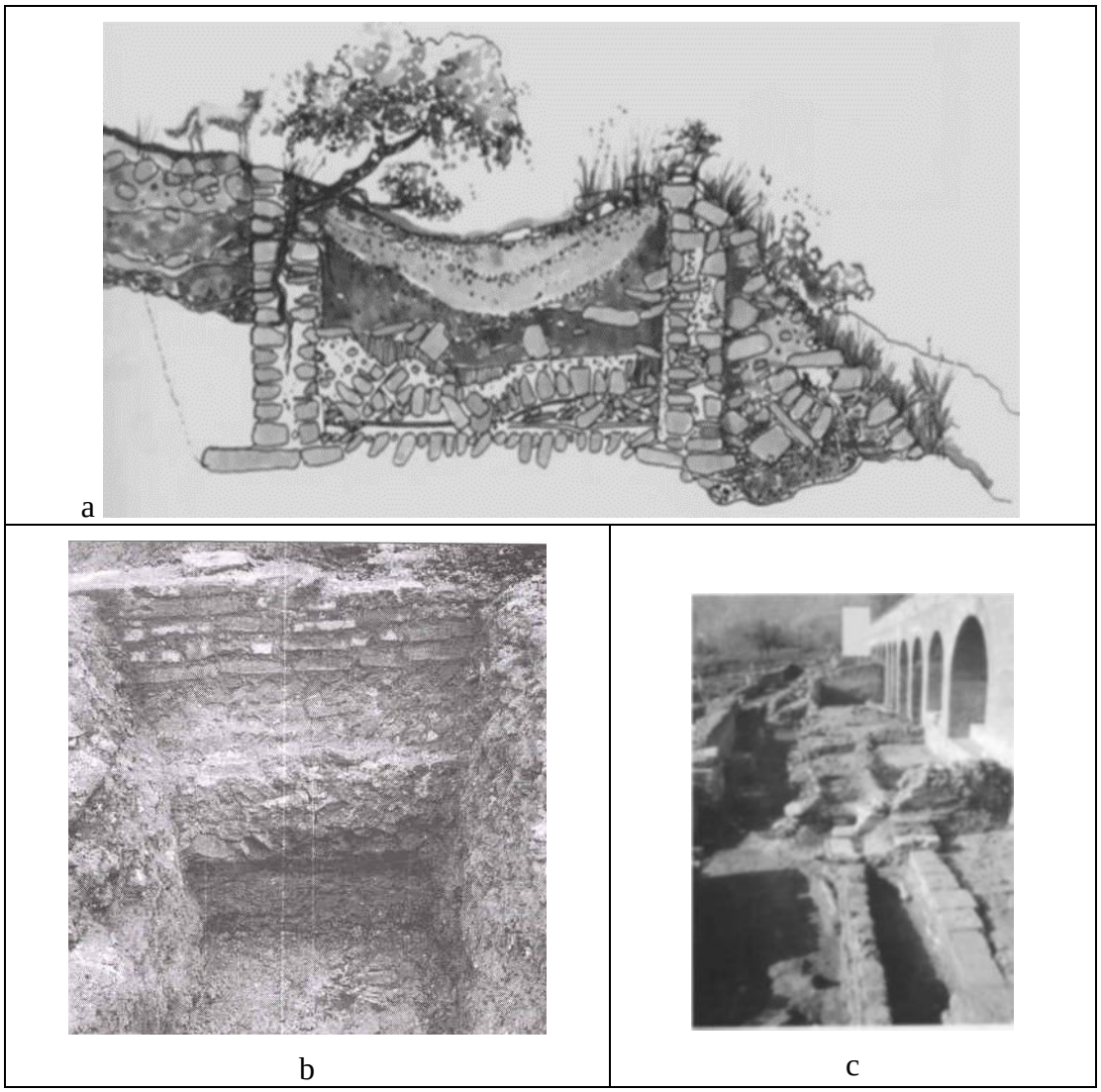

Fig.5: a- Stratigraphy and displacement of layers [25]; b- Stratigraphy - Sirmium [23]; c-Segments of aqueduct at Heraclea Lyncestis Theater Square [26]

At the end of the analysis of the necessary aspects for the implementation of the principle of *subtilitas explicandi*, we also highlight the important question of the autonomy of the author's approach, which marks the engineering design of technical solutions in the field of renewable energy

sources, which is recognized by the methodological consistency of immanent type of analysis, especially on atypical examples of cultural heritage objects, when applying technological principles based on a thorough understanding of the symbolic capital of an object grows into heritological discourse [27]. Technological here is transformed into aesthetic, which requires a normative context, so that the use of technology does not lose out on technologicality, striving for the fulfillment of visual or aesthetic quality.

4 Conclusion

The application of renewable energy sources in the field of cultural heritage protection requires an integrated perspective that looks at renewable energy sources through the prism of technological mediation of historical heritage values, with demands for environmental conservation and the use of clean energy. The research has shown that a productive attitude towards tradition, precisely on the background of the use of renewable energy sources, requires a new form of social awareness in the synthesis of technological and aesthetic awareness, which is necessary for managing the application of renewable energy sources in the fields of protected cultural heritage, whether about facilities or protected areas. This kind of dynamic adaptation of engineering solutions in the application of renewable energy sources is thus recognized as the complementarity of responses to the changing demands of society in the protection of cultural heritage, articulated by conventions, as well as the complementarity of the development of autonomous methodological approaches in the scientific and technical-technological domain of the application of renewable energy sources in the field of cultural heritage protection.

5 Acknowledgement

The research was funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia, under the projects: TR 34028 and TR 37021, as well as the Ministry of Culture and Information of the Republic of Serbia under the project 633-00-31 / 2019-02.

6 References

[1] ****Policy Document for the Integration of a Sustainable Development Perspective into the Processes of the World Heritage Convention as adopted by the General Assembly of States Parties to the World Heritage Convention at its 20th session,* UNESCO, 2015.
[2] https://www.changeworks.org.uk/sites/default/files/Renewable_Heritage.pdf, retrieved May 2019.
[3] **Morgul, V.** Solar energy systems in the reconstruction of heritage historical buildings of the northern towns (for example Saint-Petersburg), *Journal of Applied Engineering Science 12* (2014) 2, 284, pp. 121-128.
[4] Innovative Energy-Environmental tools for Sustainable Energy Governance in Built Cultural Heritage,http://www.unesco.org/new/en/venice/about-this-office/single-view/news/innovative_energy_environmental_tools_for_sustainable_energy/, retrieved May 2019.
[5] **Chias, P.,** T. Abad, Impact assessment of the renewable energies in the cultural heritage: the case of the way of St. James in Spain, *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences,* Volume XL-5, 2014 ISPRS Technical Commission V Symposium, 23 – 25 June 2014, Riva del Garda, Italy.
[6] https://en.wikipedia.org/wiki/Saint_Petersburg, retrieved May 2019.
[7] https://en.wikipedia.org/wiki/Reichstag_building, retrieved May 2019.
[8] https://en.wikipedia.org/wiki/Edinburgh, retrieved May 2019.
[9] https://en.wikipedia.org/wiki/Ferrara, retrieved May 2019.
[10] https://en.wikipedia.org/wiki/Navarre, retrieved May 2019.

[11] **Polić – Radovanović,S., S. Ristić, B. Jegdić, Z. Nikolić**, *Methodological and technical aspects of the application of new techniques in the protection of cultural heritage*, Gosa Institute and Central Conservation Institute, Belgrade, 2010 (in Serbian).
[12] **Polić - Radovanović, S., S. Ristić, M. Kozić, B. Radojković,** Valorisation of the Impact of Thermal Power Complexes on Monumental Cultural Heritage Sites, *Energy, Economics, Ecology*, 5 (2012) 22-29 (in Serbian).
[13] **Polić, S., S. Petronić, B. Milosavljević, A. Ivković, Z. Marković,** Analyzes of modern models of conversion of energy objects in the field of heriotology, *Energy, Economics, Ecology*, 3-4, XIX (2017) p. 305-311 (in Serbian).
[14] **White, H.,** *Tropics of Discourse. Essays in Cultural Criticism*, The Johns Hopkins University Press, Baltimore, London, 1978. p. 50.
[15] **D'Oro, G., J. Connely**, https://plato.stanford.edu/archives/sum2015/entries/collingwood, retrieved May 2015.
[16] **Polić, S.** Il pensiero tecnologico nel XXI secolo e l'eredità della Teoria della Restaurazione di Cesare Brandi**,** A margine della riunione scientifica, Venice 2017., Central institute for conservation, Internazionale Societa 'di etica e la valutazione nelle arti e delle scienze, Belgrade 2017.
[17] **Gaius Plinius Secundus,** *Naturalis Historia,* ed.. Karl Friedrich Theodor Karl Mayhoff, Teubner, Lipsiae, 1897. in Zoja Bojic translation, in: Plinius the Elder, On Arts, Institute for textbooks and Dosije studio, Belgrade, 2011.
[18] **Jenks, C.,** The Language of Post – Modern Architecture, Academy, London, 1977.
[19] ******* First International Congress of Architects and Technicians of Historic Monuments, Athens 1931, https://www.icomos.org/en/167-the-athens-charter-for-the-restoration-of-historic-monuments, retrieved May 2019.
[20] ***Land Convention, (translation of Florence document, 2000), RS Ministry of Infrastructure, RS Ministry of Environment, RS Ministry of Culture, Belgrade 2010.
[21] ***Good Practices, success stories on sustainable and renowable energies in Unesco sites, Renewable Energy Futures for UNESCO Sites, UNESCO, 2013.
[22] https://citymagazine.rs/clanak/viminacium-avantura-park-najbolja-destinacija-za-uzbudljivi-vikend, retrieved May 2019.
[23] **Dautova – Ruševljan, V.,** Cultural Layers of the Building Phases in Commercial and Artisan Quarter in Sirmium, Vestigatio Vetvstatis, Aleksandrini Cermanović – Kuzmanović, University of Belgrade, Faculty of Philosophy, *Centre for Archeological Investigations, Book 20*, Belgrade 2001.
[24] **Hronjec, V.,** Reading of Reading, *Matica Srpska Yearbook, 483,* (2009) 3, Novi Sad, 2009.
[25] **Ashurst, J., A. Shalom,** Excavation and Conservation on Archaeological Sites, *Asi Shalom Archaeology Conservation Centre*, Sede Boker Academy, Negev Region, Israel (in Hebrew).
[26] **Gjorgjievska, A., E. Nasuh,** *Heraclea Lyncestis, Explorations 2008.-2014,* The Institute and Museum Bitola, Bitola, Macedonia, 2016.
[27] **Polić-Radovanović, S**. *On Discourses of Heritological Matter,* [electronic resource], Gosa Institute: Central Institute for Conservation, Belgrade, 2010.