10. Međunarodna konferencija o obnovljivim izvorima električne energije

10th International Conference on Renewable Electrical Power Sources

Beograd, 17. i 18. oktobar 2022 | Belgrade, October 17 & 18, 2022

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PREDGOVOR

Uslovi koje stvara razvojem tehnologija i u kojima živi savremeni čovek doveli su do kompleksnog i paradoksalnog efekta: da otklanjajući prepreke na putu ka komfornijem, jednostavnijem, bržem i efikasnijem životu i načinu rada čovek ujedno generiše i brojne nedaće, privlačeći tamne oblake pretnji po opstanak planete i čovečanstva. Pitanje koje se tiče svih nas i sve nas pogađa – sve ljude, sva živa bića, sisteme u kojima se odvija život, velike i male, jake i slabe – svodi se na problem negativnog uticaja čoveka na životnu sredinu; ovo pitanje poziva nas na hitno rešavanje kroz sagledavanje uzroka, predlaganje rešenja, njihovu evaluaciju, promene pristupa i načina razmišljanja, kao i izvođenje korektnih zaključaka. Jednostavno rečeno, prilagođavajući prirodu sopstvenim potrebama, čovek je ugrožava i narušava. Zato, zajedničkim naporima svih nas, pojedinaca, organizacija i država, neophodno je preduzeti sve moguće mere za sprečavanje negativnih efekata koji nam predstoje i to odmah.

Značaj obnovljivih izvora električne energije, koje ova međunarodna konferencija stavlja u fokus, primetan je iz dva ugla: prvi – izvesno je da će fosilnih goriva kao resursa nestati i neophodno je pronaći alternativne izvore, drugi – upotreba obnovljivih izvora energije po svojoj suštini podrazumeva ,,čistu" tehnologiju koja značajno doprinosi smanjenju emisije CO_2, a samim tim i ublažavanju klimatskih promena i smanjenju zagađenja, uz podsticanje društvenog i ekonomskog razvoja u svim sferama života.

Jubilarnu, desetu konferenciju o obnovljivim izvorima električne energije organizuje Društvo za obnovljive izvore električne energije pri SMEITS-u, sa suorganizatorima: Institutom za arhitekturu i urbanizam Srbije i Privrednom komorom Srbije, uz podršku Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije. Prijavljeni učesnici svoje radove koncipirali su prema zadatim temama konferencije:

– Energetski izvori i skladištenje energije;
– Energetska efikasnost u kontekstu primene održivih izvora električne energije (OIEE);
– Životna sredina, održivost i politika;
– Aplikacije i usluge.

Eminentni autori – naučnici, nastavnici, stručnjaci iz ove oblasti, poreklom iz devet različitih zemalja: Alžir, Bosna i Hercegovina, Hrvatska, Iran, Nemačka, Srbija, Škotska, Ujedinjeni Arapski Emirati i Ukrajina, dali su svoj doprinos konferenciji kroz trideset sedam radova koji su recenzirani od strane Naučnog odbora Konferencije, te nakon postupka recenzija prihvaćeni za izlaganje na konferenciji i za štampanje u zborniku radova.

Na kraju ovog kratkog obraćanja i na početku zbornika radova, verujem da se sa ponosom može reći da su se na jednom mestu okupili naučnici, istraživači, kreatori politike i stručnjaci iz oblasti industrije, kako bi razmenili iskustva i znanja u cilju promocije naučnih i stručnih ideja i rezultata istraživanja, razvoja i korišćenja OIEE, unapređenja tehnologija za korišćenje OIEE, promovisanja racionalne upotrebe potrošnje električne energije, afirmacije i predlaganja inventivnih rešenja u oblasti održivih izvora električne energije.

U Beogradu
Oktobar 2022. godine

FOREWORD

The conditions created by the development of technologies and in which modern man lives have led to a complex and paradoxical effect: that by removing obstacles on the way to a more comfortable, simpler, faster and more efficient life and way of working, man also generates numerous misfortunes, attracting dark clouds of threats to the survival of the planet and humanity. The question that concerns all of us and affects us all - all people, all living beings, systems in which life takes place, large and small, strong and weak - boils down to the problem of the negative impact of man on the environment; this issue invites us to an urgent solution by looking at the causes, proposing solutions, evaluating them, changing approaches and ways of thinking, as well as drawing correct conclusions. Simply put, by adapting nature to one's own needs, man threatens and damages it. That is why, with the joint efforts of all of us, individuals, organizations and states, it is necessary to take all possible measures to prevent the negative effects that are ahead of us, and immediately.

The importance of renewable sources of electricity, which this international conference focuses on, is noticeable from two angles: the first - it is certain that fossil fuels as a resource will disappear and it is necessary to find alternative sources, the second - the use of renewable energy sources by its essence implies "clean" technology that significantly contributes to reducing emissions CO_2, and thus mitigating climate change and reducing pollution, while encouraging social and economic development in all spheres of life. The anniversary, tenth Conference on renewable electricity power sources is organized by the Society for Renewable Electrical Power Sources (DOIEE) at SMEITS, with co-organizers: The Institute of Architecture and Urban & Spatial Planning of Serbia (IAUS) and the The Chamber of Commerce and Industry of Serbia, with the support of the Ministry of Education, Science and Technological Development of the Republic of Serbia.

The registered participants designed their papers according to the given conference topics:

- *Energy sources and energy storage;*
- *Energy efficiency in the context of use of renewable energy sources (RES);*
- *Environment, sustainability and policy;*
- *Applications and services.*

Eminent authors - scientists, teachers, experts in this field, originating from nine different countries: Algeria, Bosnia and Herzegovina, Croatia, Iran, Germany, Serbia, Scotland, the United Arab Emirates and Ukraine, contributed to the conference through thirty-seven papers that were reviewed by the Scientific Committee of the Conference, and after the review process were accepted for presentation at the conference and for publication in the proceedings.

At the end of this short message and at the beginning of the proceedings I believe that it can be proudly said that scientists, researchers, policy makers and industry experts gathered in one place, in order to exchange experiences and knowledge with the aim of promoting scientific and professional ideas and results of research, development and use of RES, technology improvement for the use of RES, promoting the rational use of electricity consumption, affirming and proposing inventive solutions in the field of sustainable sources of electricity.

Belgrade,
October 2022.

SADRŽAJ / CONTENTS

Aplikacije i usluge

HERITOLOŠKO-FILOZOFSKE IDEJE U ISTRAŽIVANJU PRIMENE OBNOVLJIVIH IZVORA ENERGIJE

HERITOLOGICAL-PHILOSOPHICAL IDEAS IN THE RESEARCH OF THE RENEWABLE ENERGY SOURCES IMPLEMENTATION

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Uporedo sa razvojem istraživanja obnovljivih izvora energije, poslednjih godina razvija se i moderna energetska paradigma u vezi sa različitim aspektima primene ovih izvora, odnosno energetske tranzicije. Filozofski aspekti odnose se na specifičnosti novih perspektiva posmatranja problema i načina rezonovanja u okviru tehnofilozofske tradicije, kao i u kontekstu savremenih okolnosti primene obnovljivih izvora energije. Heritološku dimenziju daje usmerenost na očuvanje civilizacijskih vrednosti i etičko ponašanje. U ovom radu u fokusu su heritološko-filozofske ideje prisutne u savremenoj akademskoj praksi.

Ključne reči: *obnovljivi izvori energije; tehnofilozofija; heritologija*

Along with the development of renewable energy research, in recent years, develop and a modern energy paradigm in relation to various aspects of the application of these sources, or energy transition. Philosophical aspects relate to the specifics of new perspectives on observation of problems and ways of resonating within the technophilosophical tradition, as well as in the context of the contemporary circumstances of the using renewable sources of energy. Heritological dimension gives focus on the preservation of civilizational values and ethical behavior. In this paper, the focus is a heritological-philosophical idea present in modern academic practice.

Key words: *Renewable energy sources; technophilosophy; heritology*

1 Introduction

The areas of heritology, philosophy and renewable energy sources, in the multidisciplinary field of research, unite the issue of presence and protection of cultural and civilization values [1]. The wider framework for these researches give complex issues of education and development of technologies, which are reflected in the way of thinking and planning the maintenance of environmental standards, support for society and local communities, as well as the creation of a perspective for sustainable development. It is noticed that the building of critical perspectives is predominantly related to the proper view to issues of environmental justice, related to collective identities and poverty [2], and that very little attention is dedicated to the preservation of culture and civilisation, specifically values of the intangible heritage. Therefore, in this paper, using the method of comparative analysis, we examine the heritological-philosophical ideas of theory and practice contemporary researchers and academic communities, Ideas that build intellectual space and the ways of forming attitudes on important issues of modern use of renewable energy.

Academic practice of energy philosophy in recent years indicates development of specific fields of philosophy: environmental philosophy (ecocentric philosophy of energy) [3], connecting to Intellectual history of Innovation (genealogical history) [4] and exploration of the space in which energy

transition is taking place [5]. Bibliographic reviews indicate that research is based on the narrow circle of traditionally used sources of techno-philosophy, such as: *Philosophy of the Enlightenment* [6], *The Philosophy and Practical Application of Industrial Research* [7], *Technics and civilization*[8], *Philosophy, Technology, and the Arts in the Early Modern Era* [9], *Can technology replace social engineering?* [10], *The concept of energy and its early historical development* [11], *Energy and equity,* [12], *Question concerning technology and other essays* [13] and similar themes. Having that in mind, in this paper, we also propose a view of other significant sources that would enrich academic practice and expand the intellectual basis for the study of renewable energy sources in the context of civilization values.

2 Energy and context of different civilizations

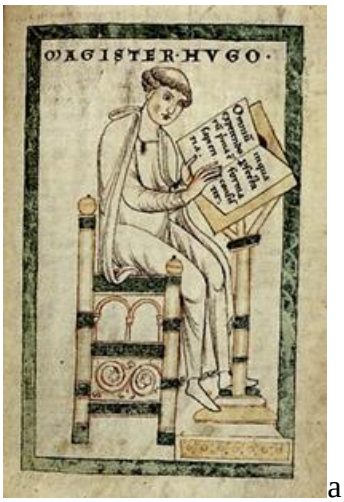
Each systematization of philosophical ideas about energy, in the context of the history of ideas, as a rule starts with Aristotle (Ἀριστοτέλης, 384 b.c. – 322 b.c.) [14]. In addition to the basic concepts of energy (ἐνέργεια) and entelehia (ἐντελέχεια), the concepts were also significant placed in Aristotle's *Categories* (*Κατηγοριαι*), through ontological and logical definitions of movement: genesis (γένεσις), disappearance (φθορά), increase (αύξησις), decrease (μείωσις), modification (άλλοίωσις) and a change in place (κατά τόπον μεταβολή) [15]. The attitude towards Aristotle's intangible heritage, in the history of ideas, is a parameter based on which directions of philosophical thought are interpreted. In this sense, it is possible to compare different lines in connecting intellectual thought about Aristotle and civilization values.

One of the intellectual lines flows through the Middle Ages in which knowledge about Aristotle's doctrine is transmitted through *Liber De Persona Et Duabus Naturis Contra Eutychen Et Nestorium* [16] *(*Boethius Severinus, 480—524), *Dialogus de Grammatico* (Anselm of Canterbury, 1033/4–1109)) [17], *Metalogicon* (John of Salisbury, 1115—1180) (Fig. 1b) [18], *Didascalicon :De studio legendi* (Hugh of Saint Victor, c. 1096 –1141) (Fig. 1a) [19]. Contemporary research shows that many of the medieval instructional methods might prove beneficial to contemporary educators [18].

We also follow an interesting intellectual line in Arabian philosophy, where the Avicenna (980-1037) the creator of the School System in the Islamic world and Ibn Rushd (Lat. Averroes, 1126 – 1198) transmit, change and develop Aristotle's philosophy [20]. Abû Nasr al-Fârâbî (870 – 943) helps Islamic understanding of Aristotle's logic [21]. Some of the writings have made it easier for the Christian interpretation of Aristotle: thanks to Ibn Rushd, in Paris we find integral Aristotelism representatives such as Siger Van Brabant, one of the most fascinating figures of the medieval period [22].

In the next civilization step, Gerard of Cremona (Gerardus Cremonensis; c. 1114 – 1187), Italian translator of scientific books from Arabic into Latin, made it possible the Western world meets Aristotle's philosophy. St. Thomas Aquinas, as an innovator manages to express the Christian ideology in synthesis to Aristotelian terms, and wrote several important commentaries on Aristotle's works, (Fig. 1c)[23]. We find the visualization of this civilizational transmission in the picture from the Louvre Museum collection in Paris: Triumph of St Thomas Aquinas, “Doctor Communis”, between Plato and Aristotle, by Benozzo Gozzoli (1471) [24].

These were the beginnings of the journey of Aristotle's ideas through various civilizations. The integral course of all intellectual lines that have then developed to date, transcends the boundaries of this article. However, what we know for sure today, we have not revealed all the intellectual lines that have developed on the basis of Aristotle's work there are questions that are still very discussed [17, 25], not everything is written about the influence of Aristotle on the development of technical sciences, so we continue to search for complete explanations, in all science and geographic meridians [26].



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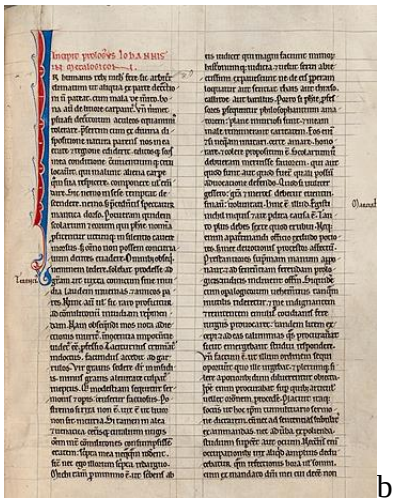
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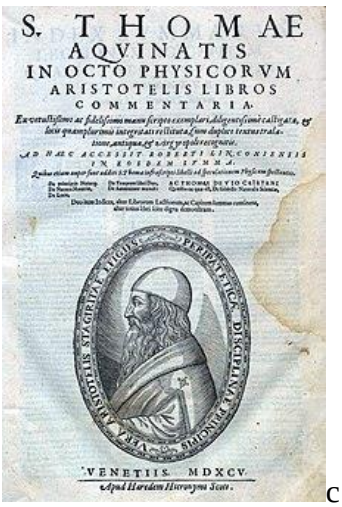

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Fig.1. Different civilization steps in the transmission of Aristotle's ideas: a- Hugh of Saint Victor writing his „Didascalicon". Miniature in the manuscript Leiden, Bibliotheek der Rijksuniversiteit, Vulcanius 45, fol. 130r. (detail) [27]
; b- First page of Metalogicon by John of Salisbury (detail) [28]; c - Super Physicam Aristotelis, 1595 [23]

3 Heritological - philosophical intellectual framework: One civilization line of harmonization

Unlike the previously mentioned sources that thematization of ***space*** (how the ideas are transferred from the spaces of Ancient Greece to Arabic and Latin civilization), in this review, in focus is thematization of the issues of ***time*** (different ways transferring ideas over time, in global civilization). At the same time, we point to the specific higher form of organization of knowledge model (Canon), which enables the heritological transfer of ideas over time. It is again a view of one of the possible intellectual lines.

Serbian-American Inventor, Physicist, Engineer, and Futurist, Nikola Tesla (1856–1943) [29], wrote about transporting natural processes in technological processes, in his philosophical treatise *The Problem of Increasing Human Energy - With Special Reference to the Harnessing of the Sun's Energy* [30], (Fig 2a). He emphasized that "[…]windmills, solar machines and machines were initiated by natural heat have limits available for the amount of power…". Visionary he was considering the possibility that electricity was obtained directly from the Sun, connecting it with Maxwell's theory („[…] This might be the case if the Maxwellian theory is true…"), according to which electrical vibration of all speeds should come from the Sun. He also anticipated the finding of new ways to obtain energy from the Sun, in accordance with its philosophy about the time in which an invention occurs, when a new situation occurs, i.e. some new principle for that.

The history of ideas also belongs to Mihajlo Petrović Alas (1868 –1943), Serbian mathematician and an academician, who leaning towards Platonism and who tried to constitute mathematical phenomenology (*Elements of Mathematical Phenomenology*, 1941), (Fig 2b), as a universal science that would cover a issues wide range of natural, technical, humanities and social sciences, linguistics and art. He thought that one of the most significant analogies exists among the phenomena of the electric current, heat transfer and the flow of fluids: „[…] It is so complete that these three types of phenomena, with their multiple and diverse variations, represent from an analytical point of view, one of the same problem, the solution of which only needs to be interpreted in three different ways." [31].

In its capital book *A Climate. a philosophical study* (drafted 1929; redrafted 1931; revised 1935.) [32], Japanese philosopher Watsuji Tetsurō (1889-1960) has connected culture and civilization with Climate phenomenon. Carter and McCarthy writing in *Stanford Encyclopedia of Philosophy*, that Watsuji Tetsurō considered that each nation is shaped by its climate, specific geography, history and culture. His methodology of calling to awareness of the interconnectedness of all things, resulted to watching a human as an unified structure of the past, present and future. Also, Watsuji thought ethics was as a pattern of proper and effective social interactions: „[…] ethics is the study of the ways

in which men and women, adults and children, the rulers and those ruled, have come to deal with each other in their specific climatic conditions." [33]

Fig 1: a- The edition of The Century Illustrated Monthly Magazine in which Tesla published an article The Problem of Increasing Human Energy - With Special Reference to the Harnessing of the Sun's Energy, 1900. [30]; b- Elements of Mathematical Phenomenology by Mihailo Petrović Alas, 1911. [31]; c- A Climate: A Philosophical Study, 1961.[32]

In the same time, about the climate, Milutin Milanković writes in his paper, *Kanon der Erdbestrahlung und Seine Anwendung auf das Eiszeitenproblem* published in 1941 in Belgrade (Fig 2a) [35] and the first translation in to English (*Canon of Insolation and the Ice-Age Problem*) was published in 1969 in Jerusalem [36]. His research about the distribution of solar radiation at the Earth's surface, a few decades later, still inspires contemporary research. For example, in a study *A long-term numerical solution for the insolation quantities of the Earth* [37], Jacques Laskar, astronomer and member of the French Academy of Sciences, with coauthors from *Astronomie et Systèmes Dynamiques* and *University of Santiago*, emphasizes that: "[…] The first computations of the variations of the obliquity (angle between the equator and orbital plane) due to the secular variations of the orbital plane of the Earth are due to Pilgrim (1904), and were later used by Milanković (1941) to establish his theory of the Earth's insolation parameters. Since then, the understanding of the climate response to the orbital forcing has evolved, but all the necessary ingredients for the insolation computations were present in Milanković's work."

However, a broader, civilization context of *Kanon der Erdbestrahlung und Seine Anwendung auf das Eiszeitenproblem* provide research in the field of cultural anthropology. Milanković's canon ranked comparative with *Nomocanon* (Code of Law) (Fig. 2b) who had prepared at the beginning of the 13th century by Saint Sava, personality that had a double legitimacy: orthodox monk and founder of the autocephalous Serbian Orthodox Church. St. Sava's *Nomocanon*, the highest church and state legal act in medieval Serbia, and the oldest preserved Serbian legal act, based the *Synopsis of Stephen the Ephesian* (6th century) with the commentaries of Aleksije Aristin (gr. Ἀλέξιος Ἀριστηνός,, b. ? - d. after 1166) [38] and Byzantine *Canonic Syntagma in fourteen titles* (unknown author, 6th century), which he translated and editing from Greek and which he supplemented and Byzantine chronicler and theologian Jovan Zonaras (gr. Ἰωάννης Ζωναράς,12th century) [39]. The part of the Laws related to church law consisted and *Nomocanon of John Scholastica*, Rules of the Holy Apostles, Rules of the Holy Fathers, Decisions of Ecumenical and Local Councils and Mosaic legislation (3rd and 5th books of Moses).

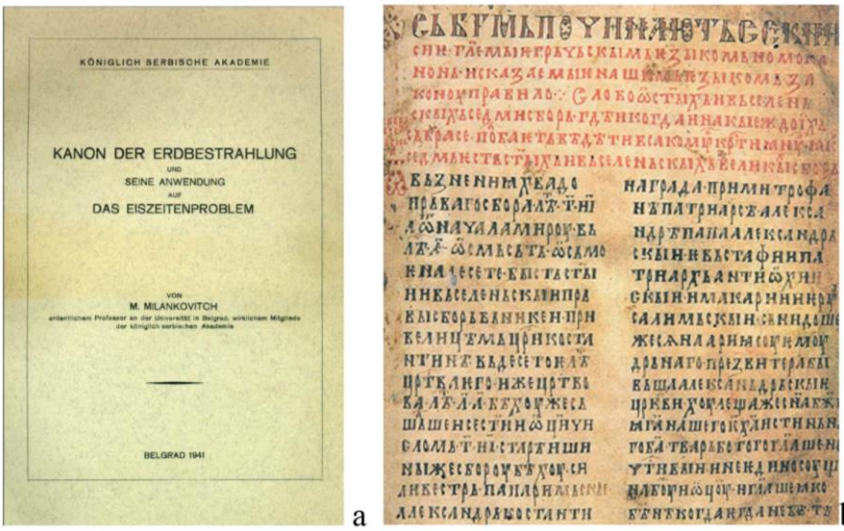

Fig. 2 : a - Kanon der Erdbestrahlung und Seine Anwendung auf das Eiszeitenproblem", 1941, Royal Serbian Academy [35]; b – Nomokanon of St. Sava, Ilovick copy created in 1262 at the monastery of St. Archangel Michael in Ilovica (detail) [40]. Is kept in the Library of the Sciences Academy in Zagreb [41]

St. Sava's *Nomocanon* contains the interpretations and evaluation of the rules, as well as their adaptation and harmonization of the social context of Serbia in a way that enables the transplantation of theory of the symphony in Serbia [40]. As it stands out in the *Hilandar Monastery* web presentation, in the section *Writings and Gospels*, "[…] The part related to Civil Law consisted of: Excerpts from Justinian's Novels (around 550), a legal collection compiled by John Scholastic, *Collectio tripartita*, a collection of laws from Justinian's legislation and Prochiron (City Law) from 879, a collection of Byzantine civil, criminal and procedural law. By transplanting (receiving) Roman-Byzantine law, Serbia became an integral part of European and Christian civilization." St. Sava's *Nomocanon* enacted at the council in the *Žiča monastery* in 1221 [42].

Researching the question of canon, as a heritological form of knowledge transfer, in *Encyclopedia Britanica*, in a determinant of *History of technology*, we find: "[…]The modern philosophy of progress, cannot be read back into the history of technology; for most of its long existence technology has been virtually stagnant, mysterious, and even irrational." [43] However, when it comes to canons, philosopher of science, university professor of cultural anthropology and cultural diplomacy, Aleksandar Petrović emphasizes that there is no canon limitation: both canons, St. Sava's and Milanković's, connect Heaven and Earth. St. Sava this made through Symphony of Church and State, and Milanković through the Heaven Mechanics and chronology of the Earth. In his essay *Perfect Law of Freedom* Petrović explains that "[…] in Interpreting of St. Sava, how much in our power is, we say that through the centuries, the light of the Serbian culture, have the canon nature. This light we can see the best of through the prism of two canons, St. Sava's *Nomocanon* and *Canon* by Milutin Milanković". [44]

This opinion fits into the Serbian intellectual tradition of understanding the culture and civilization of which is one of the most prominent intellectuals of his time, Slobodan Jovanović (1869 – 1958), a Serbian and Yugoslav writer, historian, lawyer, philosopher, literary critic, diplomat and politician. Slobodan Jovanović wrote about valorization of culture of nation and he considered that in cultural observation very important to take into account all the branches of spiritual life: not only his science, but also his faith, literature and art, politics and law, army and economy, customs and entertainment. [45]

If we make a brief overview of the basic ideas that make up the civilization line presented in this paper (Tab. 1), we determine that it is shown to agree with the definition of culture that gives in the early 21st century give *Metzler Lexikon Kultur der Gegenwart*: Culture represents everything that is the sum of "historical, individual and common, practical, aesthetic as well as mythical and religious forms of expression". [46]

Table 1: One of the possible civilization lines

Scientist	Philosophical view	Harmonisation
Nikola Tesla	The Problem of Increasing Human Energy - With Special Reference to the Harnessing of the Sun's Energy	Human energy and Sun's Energy
Mihajlo Petrović Alas	Elements of mathematical phenom-enology	Universal science and particular anal-ogies
Watsuji Tetsurō	A Climate: A philosophical study	Culture and civilization with Climate phenomenon
Milutin Milanković	Kanon der Erdbestrahlung und Seine Anwendung auf das Eiszeitenproblem	Sun and Earth
Saint Sava	Nomocanon	Symphony of Church Law and State

As he emphasized the philosopher, writer and historian of the Middle Ages, Umberto Eco,"[…] In every century, the way that artistic forms are structured reflects the way in which science or contemporary culture views reality. The closed, single conception in a work by a medieval artist reflected the conception of the cosmos as a hierarchy of fixed, preordained orders." [47] How Modern Theorists notice, Umberto Eco agree on the complexity of such a world in the difficult times of the Middle Ages with the Byzantine historian Nicetae Choniatae [48]. They especially considered the indicative quote: "[…] Even Saraceni are merciful and mild compared to these people carrying on the shoulders of Christ's Cross" [49-51]. In the analysis of the methodology, which is still transmitted from the Middle Ages, until today, the historian's opinion also confirm: "[…] repeating of consecrated role models is the feature of the Middle Ages, and foundation on which society sets its own canons, building such a layered image of yourself and the world, made up of many already known images that give the necessary rhythm of the present." [52]

4 Conclusion

Heritological - philosophical ideas on energy, Sun, Earth and climate, are instruments for the development of new methodological directions in the research of the context for the development of new technologies and implementation of renewable energy sources, in framework of civilization values.

Research has shown that reviews of history of ideas can be useful in detecting intellectual lines that connect ideas in space and time, as well as need to be mew reviewed by the paradigm that claims the *Modern Philosophy of Progress, Cannot Be Read Back Into The History of Technology*. On the contrary, contemporary research shows that we are still not sure that we have reached the final interpretations of all the heritological-philosophical ideas about energy, which have so far passed through space and time, until contemporary civilization.

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