Subject and Object of Forensic Electrical Engineering in Proceedings Electricity Theft

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The purpose of this article is to summarize the results of electrical engineering expert research (in particular, performed at National Scientific Center «Hon. Prof. M. S. Bokarius Forensic Science Institute» of the Ministry of Justice of Ukraine) and a complex of general scientific and special methods (in particular, formal-logical, comparison, analysis and synthesis) to determine the place of examination on the facts of theft of electricity in the forensic electrical examination, to formulate the concept of the subject and object of such examination, to compile a list of its types .Prospects for the development of forensic electrotechnical expertise are outlined. The results of forensic electrotechnical researches in proceedings on the theft of electricity are summarized. Continuity of the general tasks of the forensic electrotechnical examination has been proven by these studies. On the basis of the considered separate trends of species genesis in forensic examination, an opinion is expressed about the further development of forensic electrical engineering. The structure of areas of forensic research on unaccounted electricity use was considered and their place in the system of forensic electrical technical examinations was determined. The principles of formation of typical lists of questions in forensic electrotechnical examination on the facts of electricity in accordance with the method of committing a criminal offense are laid down. According to provisions of the general theory of forensic examinations, the subject and object of the

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forensic electrical engineering on the facts of electricity theft are defined. Typical questions to forensic expert in proceedings about electricity theft due to the influence of electromagnetic radiation on the metering device are formulated. On the example of this list, the principles of forming typical lists of questions for other areas of research into the facts of electricity theft, depending on the method of committing the criminal offense, are considered.

Keywords: *object, topic, task, issues of electrical engineering on facts of theft electricity; electricity theft; electricity metering device.*

Research Problem Formulation

Ukrainian legislators criminalized electricity theft in mid-2005: Criminal Code of Ukraine [1] supplemented Art. 188 [1] *"Electricity theft or heat through its unauthorized use"* [2]. At the same time, theoretical issues of forensic electrical engineering (hereinafter referred to as FEE) in electricity theft proceedings have not been sufficiently developed to date for a number of reasons, among that in our opinion, the following should be highlighted.

Firstly, before the amendment of Criminal Code of Ukraine Art. 188 [1], criminal liability in the field of energy resources came only in case of theft of electric power equipment (and not electricity) *"by dismantling and other means of electrical networks, cable communication lines and their equipment"* (Art. 188 of Criminal Code of Ukraine) [3], i.e., over time, there was a change in the topic of a criminal offense.

Secondly, the Ukrainian legislation (in particular, the Rules of Retail Electricity Market [4] (hereinafter referred to as RREM), Code of Commercial Accounting of Electric Energy, etc. [5]), which determines the legal, economic and organizational principles of functioning of the electricity market and regulates relations related to production, transmission, distribution, purchase and sale of electricity to ensure its reliable and safe supply to

1 Кримінальний кодекс України від 05.04.2001 р. № 2341-III (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/2341-14#Text (date accessed: 07.03.2024).

2 Про внесення змін до деяких законодавчих актів України щодо відповідальності за порушення в галузі електроенергетики : Закон України від 31.05.2005 р. № 2598-IV (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/2598-15#Text (date accessed: 07.03.2024).

3 E.g., Кримінальний кодекс ... (станом до 07.05.2008 р.). URL: https://zakon.rada.gov.ua/laws/show/2341-14/ed20071001#Text (date accessed: 07.03.2024). Законом України від 15.04.2008 р. № 270-VI «Про внесення змін до Кримінального та Кримінально-процесуального кодексів України щодо гуманізації кримінальної відповідальності» (зі змін. та допов.) ст. 188 виключено з ККУ. URL: https://zakon.rada.gov.ua/laws/show/270-17#Text (date accessed: 07.03.2024).

4 Правила роздрібного ринку електричної енергії : затв. постанов. НКРЕКП від 14.03.2018 р. № 312 (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/v0312874-18#Text (date accessed: 07.03.2024).

5 Кодекс комерційного обліку електричної енергії : затв. постанов. НКРЕКП від 14.03.2018 р. № 311 (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/v0311874-18#Text (date accessed: 07.03.2024).

consumers, does not contain a clear interpretation of *electricity theft* definition. If we are talking about the amount of electricity that is not taken into account by the calculation means of commercial accounting or incorrectly calculated, used by consumer or transferred in transit to the power grids that belong to other owners, then in the regulatory and legal documents related to the electric power industry, the term: *unaccounted for electricity* is used.

The above led to the insufficient development of both practical (lack of detailed forensic characteristics of criminal offense of electricity theft, lack of detailed forensic methodology for its investigation) and theoretical issues of FEE based on the facts of electricity theft. In the context of forensic expert provision of the evidence base (for the qualification of a criminal act provided for in Article 188[1] of Criminal Code of Ukraine [6]) and determination of the amount of theft (for use by pre-trial investigation bodies or the court of the necessary part of Article 185: the *Theft,* of Criminal Code of Ukraine[7]) in the FEE based on the facts of theft of electricity to today, development of theoretical questions and the formulation of tasks, the definition of the topic and subject of such forensic examination and its place in general structure of FEE remain relevant.

Analysis of Essential Researches and Publications

Scientists and practitioners have actively investigated various energy issues that have arisen in recent years: for example, V. Myslyvyi: criminal and illegal encroachments on oil and gas[8]; Ye. Diedov [9] and V. Skrypnyk [10]: essence of offenses related to illegal use of electricity; M. Toporkova [11] and O. Avdieiev [12]: norms of current legislation in the field of heat and electricity, respectively. T. Chumachenko [13] differentiated the theft

6 Кримінальний кодекс ... . URL: https://zakon.rada.gov.ua/laws/show/2341-14#Text (date accessed: 07.03.2024).

7 Ibidem.

8 Мисливий В. А. Кримінально-правова охорона енергоносіїв. *Вісник Національного технічного університету України «Київський політехнічний інститут імені Ігоря Сікорського». Політологія. Соціологія. Право.* 2018. Вип. 4 (40). С. 151—154. DOI: 10.20535/2308-5053.2018.4(40).194387 (date accessed: 07.03.2024).

9 Дєдов Є. В. До питання поняття та сутності правопорушень, пов'язаних із протиправним використанням електричної енергії. *Науковий вісник Ужгородського національного університету. Серія Право.* 2015. Вип. 30. Т. 2. С. 103—106. URL: https://visnyk-juris-uzhnu.com/wp-content/uploads/2020/12/No.30-2.pdf (date accessed: 07.03.2024).

10 Скрипник В. Л. Електроенергія в системі об'єктів цивільних прав. *Публічне право.* 2019. № 4 (36). С. 162—169. DOI: 10.37374/2019-36-18 (date accessed: 07.03.2024).

11 Топоркова М. М. Теплова енергія як об'єкт цивільних прав. *Право і безпека*. 2010. № 5 (37). С. 274—276. URL: http://nbuv.gov.ua/UJRN/Pib_2010_5_66 (date accessed: 07.03.2024).

12 Авдєєв О. О. Кримінально-правова характеристика злочину, передбаченого статтею 188-1 Кримінального кодексу України. *Вісник Кримінологічної асоціації України*. 2014. № 6. С. 25—35. URL: https://dspace.univd.edu.ua/xmlui/bitstream/handle/123456789/665/kriminal_no_pravova_harakteristika_zlochinu_peredbachenogo_statteyu_188_1_kriminal_nogo_kodeksu_ukrayini.pdf?sequence=2&isAllowed=y (date accessed: 07.03.2024).

13 Чумаченко Т. А. Відмежування викрадення електричної або теплової енергії шляхом її самовільного використання від суміжних злочинів. *Вісник Верховного Суду України*. 2007. № 10 (86). С. 41—44. URL: https://www.viaduk.net/clients/vsu/vsu.nsf/7864c99c46598282c2257b4c0037c014/478ff503ebc158f0c22580de0041954a/$FILE/Visnyk_10_2007.pdf (date accessed: 07.03.2024).

of heat and electricity through its arbitrary use from related crimes (Articles 190-192 of the Criminal Code [14]). Ye. Diedov [15] and S. Velmozhnyi [16] devoted their work to operational and investigative work on the theft of electricity. I. Bohdaniuk, S. Rohalin and V. Suprun [17], O. Shmereho [18] studied the effect of an external permanent magnetic field. S. Rohalin, I. Bohdaniuk and A. Lâsâi [19] considered the influence of radio frequency electromagnetic radiation on the compliance of electricity accounting, with further researches [20] to develop the appropriate methods [21]. In the article: *Specific expertise us in criminal proceedings regarding the theft of electric energy* we analyzed separate structural elements of the forensic characteristics of criminal offenses related to the theft of electricity (in particular, tools and methods of committing a criminal offense), as well as traces of a criminal offense (in the broad sense) [22]. We studied the trace pattern of electric power theft carried out by the influence of a permanent magnetic field on metering devices by distorting the volume of electricity consumption by changing the state of the indicators of effect of magnetic field (hereinafter referred to as *IMP*) [23]. In the theft of electricity with the use of technical devices for

14 Кримінальний кодекс ... . URL: https://zakon.rada.gov.ua/laws/show/2341-14#Text (date accessed: 07.03.2024).

15 Дєдов Є. Особливості взаємодії слідчого з оперативними підрозділами під час розслідування правопорушень, пов'язаних із викраденням електричної енергії. *Юридичний вісник*. 2015. № 4. С. 299—304. URL: http://yurvisnyk.in.ua/v4_2015/47.pdf (date accessed: 07.03.2024).

16 Вельможний С. А. Основи методики розслідування викрадень електричної енергії шляхом її самовільного використання : автореф. дис. ... канд. юрид. наук. Харків, 2009. 18 с.

17 Богданюк І. В., Рогалін С. В., Супрун В. С. Дослідження роботи крокового двигуна приладів обліку електричної енергії під впливом дії зовнішнього постійного магнітного поля, утвореного з метою безоблікового споживання електричної енергії. *Теорія та практика судової експертизи і криміналістики*. 2020. Вип. 22. С. 442—460. DOI: 10.32353/khrife.2.2020.36 (date accessed: 07.03.2024).

18 Шмерего О. Б. Особливості проведення судових електротехнічних експертиз приладів обліку спожитої електричної енергії. *Криміналістика і судова експертиза.* 2017. Вип. 62. С. 294—302. URL: https://digest.kndise.gov.ua/wp-content/uploads/2019/03/a2fc25cb69-294-302.pdf (date accessed: 07.03.2024).

19 Rohalin S., Bohdaniuk I., Lâsâi A. Features of performing expert researches on electricity meters that have been exposed to radiofrequency electromagnetic radiation. *Теорія та практика судової експертизи і криміналістики*. 2021. Вип. 23. С. 270—289. DOI: 10.32353/khrife.1.2021.21 (date accessed: 07.03.2024).

20 Рогалін С. В. Теоретичні основи виконання експертних досліджень приладів обліку електричної енергії, які зазнали впливу радіочастотного електромагнітного випромінювання. *Криміналістичний вісник*. 2022. Т. 37. № 1. С. 66—76. DOI: 10.37025/1992-4437/2022-37-1-66 (date accessed: 07.03.2024).

21 Idem. Методика виконання експертних досліджень приладів обліку електричної енергії, які зазнали впливу радіочастотного електромагнітного випромінювання. *Криміналістика і судова експертиза*. 2022. Вип. 67. С. 493—507. DOI: 10.33994/kndise.2022.67.50 (date accessed: 07.03.2024).

22 Idem. Використання спеціальних знань у кримінальних провадженнях щодо викрадення електричної енергії. *Криміналістичний вісник*. 2023. Т. 39. № 1. С. 85—99. DOI: 10.37025/1992-4437/2023-39-1-85 (date accessed: 07.03.2024).

23 Idem. Особливості виконання експертних досліджень індикаторів магнітного поля як засобів виявлення впливу на прилади обліку зовнішнього магнітного поля, створеного

the impact of high-frequency and pulsed electromagnetic radiation on metering devices, we proposed a classification of the means of committing a criminal offense (according to the video content of YouTube channels) [24]. The directions of application of special knowledge for the investigation of cases of theft of electricity and detailed forensic characteristics of this criminal offense were detailed in the Polish magazine [25]. The above-mentioned scientific developments in the FEE and research paper of I. Bohdaniuk in formation of the tasks of forensic engineering [26] and technical expertise make possible to achieve the goal set in this research paper.

Article Purpose

Determining forensic science place on the facts of electricity theft in FEE system, formulate a definition of the concepts of the topic and object of FEE on the facts of electricity theft; make a list of directions of the network on the facts of electricity theft, characterize in these directions the principles on which basis is possible to formulate typical tasks for this forensic science subspecies.

Research Methods

Generalization (in particular, results of forensic electrical research carried out at National Scientific Center «Hon. Prof. M. S. Bokarius Forensic Science Institute» of the Ministry of Justice of Ukraine (hereinafter referred to as NSC «Hon. Prof. M. S. Bokarius FSI») *and a set of* general scientific and special methods (in particular, formal-logical, comparison, analysis and synthesis).

Main Content Presentation

In the previous research paper[27], we noted the special property nature of electricity. RREM contains the following definition of electricity: "*Electrical energy (active), energy produced at electric power facilities and is a commodity intended for purchase and sale*" [28]. The legal basis for the operation of the electricity market of Ukraine is determined by the Law of Ukraine: *On Electricity Market*, according to which "distribution of electric energy <...>; transportation of electric energy from electric installations of electric energy producers or electric installations of the operator of the transmission network of the operator

з метою необлікованого споживання енергоресурсів. *Криміналістика і судова експертиза*. 2023. Вип. 68. С. 506—523. DOI: 10.33994/kndise.2023.68.51 (date accessed: 07.03.2024).

24 Idem. Дослідження засобів електромагнітного випромінення, що застосовуються з метою необлікованого споживання електричної енергії. *Досвід і проблеми судово-експертної діяльності в умовах воєнного стану в Україні* : мат-ли всеукр. наук.-практ. конф. (Львів — Київ — Одеса; 28.09.2023) : тези доп. Львів, 2023. С. 201—204. URL: http://ndekc.lviv.ua/pdf/a05122023.pdf (date accessed: 07.03.2024).

25 Rohalin S. Criminal Characteristics of Criminal Offenses Related to Electricity Theft. *Krakowskie Studia Małopolskie*. 2023. Nr 4 (40). S. 188—210. URL: https://czasopisma.marszalek.com.pl/images/pliki/ksm/40/ksm4013.pdf (date accessed: 07.03.2024).

26 Богданюк І. В. Загальна система завдань інженерно-технічних судових експертиз. *Теорія та практика судової експертизи і криміналістики*. 2022. Вип. 4 (29). С. 110—123. DOI: 10.32353/khrife.4.2022.05 (date accessed: 07.03.2024).

27 Рогалін С. В. Використання спеціальних знань ... . DOI: 10.37025/1992-4437/2023-39-1-85 (date accessed: 07.03.2024).

28 Правила роздрібного ринку ... . URL: https://zakon.rada.gov.ua/laws/show/v0312874-18#Text (date accessed: 07.03.2024).

of the distribution system, except for the supply of electric energy" [29]. According to RREM, main condition for distribution of *"electric energy <...> to distribution point <...> to electrical installations of consumers in the territory of the relevant system operator" is the conclusion of a consumer contract on the provision of electricity distribution services* [30]. Electricity is used on the basis of a contract for the supply of electricity to the consumer; an agreement between two parties (electricity supplier and the consumer*), "which is a document of a certain form, which provides for the supply of the entire amount of actual consumption of electricity <...> in a certain period of time by one electricity supplier at free prices*" [31]. In other words,, electricity is a specific commodity that is distributed and supplied to the consumer by individual independent operators of the system on the retail electricity market on the basis of relevant contracts. Specificity of electricity as a commodity lies in its special consumer qualities and physical and technical characteristics, due to the simultaneous production and consumption, the impossibility of storage, return, forwarding, etc., which implies the simultaneous existence of contracts on the distribution and supply of electricity. The receipt of electricity (for use by the consumer as a commodity) and the obligations of the parties under the concluded contracts (consumer and operators of the retail electricity market system) are stipulated by Economic and Civil of Ukraine: for example, according to para. 4 h. 4 art. 179 of the Civil Code *"the parties cannot deviate from the content of the standard contract, but they have the right to specify its terms"* [32]. It is worth noting: in the context of the investigated issue, the legislation of Ukraine equates the concept of "goods" with the concept of "property" in relation to electricity. Yes, in Part 1 of Art. 190 of Civil Code states: *"Property as a special object is considered a separate thing, a set of things, as well as property rights and obligations"* [33] and Art. 179 of the Civil Code stipulates the concept of a thing: *Thing is an object of the material world, in respect of which civil rights and obligations* [34] *can arise.* In addition, electricity supply contract is essentially a sales contract. In Art. 655 of the Civil Code provides: *"Under a sales contract, one party (the seller) transfers or undertakes to transfer property (goods) to the ownership of the other party (the buyer), and the buyer accepts or undertakes to accept the property (goods) and pay a certain amount of money"* [35]. The Plenum of Supreme Court of Ukraine in the resolution "On judicial practice in cases of crimes against property" clarifies the following: *"The subject of crimes against property is property that has a certain value and is alien to the guilty person: things (movable and immovable), money, precious metals, securities, etc., as well*

29 Про ринок електричної енергії : Закон України від 13.04.2017 р. № 2019-VIII (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/2019-19 (date accessed: 23.02.2023).
30 Правила роздрібного ринку ... . URL: https://zakon.rada.gov.ua/laws/show/v0312874-18#Text (date accessed: 07.03.2024).
31 Ibidem.
32 Господарський кодекс України від 16.01.2003 р. № 436-IV (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/436-15#Text (date accessed: 23.02.2023).
33 Цивільний кодекс України від 16.01.2003 р. № 435-IV (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/435-15#Text (date accessed: 23.02.2023).
34 Ibidem.
35 Ibidem.

as the right to property and actions of a property nature, electric and thermal energy" [36]. In the case of proving the fact of theft of electricity (as one of the objects of criminal trespass in crimes against property), Art. 188[1] Criminal Code of Ukraine [37]. Therefore, commercial nature of electricity in the event of its theft determines the fact of criminal and illegal encroachment by, in particular, carrying out FEE. The recent increase in such requests from law enforcement agencies, in turn, requires the structuring of FEE research directions, namely, the separation of FEE based on the facts of electricity theft as an independent subspecies of SETE and its methodical support. Generalization of statistical data on the research carried out at NSC «Hon. Prof. M. S. Bokarius FSI» on the determination of methods of unaccounted electricity consumption allowed us to structure the directions of research into cases of electricity theft in the following way:

"1. Research on <...> cases of theft of <...> electrical energy associated with incorrect use of equipment parameters. <...>

2. Research on cases of electrical energy theft associated with circuit connections;

3. Research on <...> facts of theft <...> of electricity, carried out by interfering with the operation of metering devices using the influence of external physical factors — a constant magnetic field and electromagnetic radiation. <...>

4. Research on <...> cases of theft of <...> electrical energy related to interference with the operation of metering devices through their structural changes" [38].

Role of forensic science in pre-trial investigation of electricity theft is important. Peculiarities of electricity as a subject of a criminal offense determine the preparation, commission and concealment of the criminal offense committed by the offenders, which leads to changes in the objects of research, the formation of new signs and characteristics in them, which the expert determines during the forensic examination, and the expert's conclusion in turn becomes a source of evidence in court. The supply and distribution of electricity, its property nature as a subject of criminal encroachment, analysis of the areas of expertise performed to find out the facts of its theft determine the place of such researches in FEE. The above, of course, indicates the possibility of solving issues that arise during a pre-trial investigation or trial, exclusively on the basis of the special knowledge of a forensic expert. The above gives grounds for asserting the following:

- resolution of issues in criminal proceedings on electricity theft is inextricably linked with the supply, transmission and distribution of electricity, refers to the tasks of forensic engineering and technical expertise, namely: FEE;
- investigation of cases of electricity theft during its supply /transmission/distribution is an independent subspecies of the FEE;

36 Про судову практику у справах про злочини проти власності : постанова Пленуму ВС України від 06.11.2009 р. № 10. URL: https://zakon.rada.gov.ua/laws/show/v0010700-09#Text (date accessed: 23.02.2023).

37 Кримінальний кодекс ... . URL: https://zakon.rada.gov.ua/laws/show/2341-14#Text (date accessed: 07.03.2024) ; Рогалін С. В. Використання спеціальних знань ... . DOI: 10.37025/1992-4437/2023-39-1-85 (date accessed: 07.03.2024).

38 Рогалін С. В. Використання спеціальних знань ... . С. 91—92. DOI: 10.37025/1992-4437/2023-39-1-85 (date accessed: 07.03.2024).

- FEE on the facts of electricity theft according to its praxeological features, determined by the results of the analysis of the studies performed, has its own structure of research areas;
- specific expertise use in research on cases of electricity theft determines the subject of expert research in this subspecies of FEE.

It should be noted that the general theory of forensic examination has numerous examples of species genesis, generated by the emergence of new objects of research, about which, in particular, I. Bohdaniuk writes: "*Foundation of modern types of forensic examinations and new expert specialties is due to the emergence of new objects of research. The spread of UAVs (in particular, the interest in them by representatives of the criminal world) required regulatory and legal regulation of their use, therefore, the engineering and technical assessment of their safety / danger, etc., and this contributed to the formation of a new type of forensic engineering: 10.26 Research of unmanned aerial vehicles (UAVs), which are intended for radio control and interception of mobile communication systems, photo and video control of objects in the area. Another new type of forensic specialization: 10.28 Research of special-purpose robotic systems owes its emergence to this very spread of innovative objects*" [39]. Forensic experts of the Security Service of Ukraine carry out research in forensic specialties 10.26 and 10.28 [40]. A similar example of genesis can be traced not only at the level of a species, but also at the level of a genus, or at a lower level - a subspecies. Forensic science as a science and as the basis of the general theory of forensic examinations is not unchanged, but develops in the same way as the rest of the sciences, which by their purpose serve humanity in the process of knowledge. Therefore, forensic examination, involved (in addition to knowledge) in the process of proving and clarifying the truth in judicial proceedings, also changes and improves along with its genera (species, subspecies). For example, the development of FEE is embodied in the creation of new research methods and the improvement of existing ones, but this development is not limited by its internal boundaries, outlined by research tasks at a certain stage: development takes place both "in-depth" (specification and improvement of existing tasks) and "width" (updating the content of the research subject). New tasks of FEE are not limited only to the emergence of new research objects. One of the examples of this is the investigation of offenses and the judicial review of criminal proceedings regarding the influence of a permanent magnetic field on the accounting of the use of energy resources (electricity, natural gas, hot and cold water) by consumers. Energy distribution companies have installed IMP consumer accounting nodes, and the change in regulatory documents regulating the use of IMP has led to an increase in demand for forensic studies of these IMPs to determine the effect of a permanent magnetic field [41] on them, which indicates the beginning of

39 Богданюк І. В. Загальна система завдань … . С. 116. DOI: 10.32353/khrife.4.2022.05 (date accessed: 07.03.2024).

40 Перелік видів судових експертиз та експертних спеціальностей, за якими присвоюється кваліфікація судового експерта фахівцям експертних підрозділів Служби безпеки України : дод. 4 до Положення про експертно-кваліфікаційну комісію Служби безпеки України та атестацію судових експертів, затв. наказ. Центр. упр. СБУ від 13.03.2020 р. № 80. URL: https://zakon.rada.gov.ua/laws/show/z0310-20#Text (date accessed: 23.02.2024).

41 Рогалін С. В. Особливості виконання … . DOI: 10.33994/kndise.2023.68.51 (date accessed: 07.03.2024).

a new direction in electrical engineering research, states the development of FEE, records the emergence of new tasks that need to be solved in the process of proving in criminal cases of theft of electric and thermal energy (Article 188 1 of Criminal Code of Ukraine [42]). Thus, in the given example, in essence, the general task of the forensic electrotechnical examination on the study of the magnetic field is concretized in the study of the indicator of the influence of a permanent magnetic field as a separate direction of research, which has its own tasks, subject and object, the appearance of which formed this direction of research, which according to the structural distribution given above, it belongs to the third direction of the system of forensic research on the facts of electricity theft.

The results of the analysis of the examinations conducted in NSC «Hon. Prof. M. S. Bokarius FSI» indicate the use of new methods and means of committing a criminal offense,—the identification of new signs, their typification in the study of the commission of a criminal offense, and this in turn opens up new prospects for the application of special knowledge in the investigation of the facts of electricity theft, which we have already drawn attention to [43], in fact forms a separate and independent subtype of expert research in FEE and needs to concretize (fill in) the concepts of its subject and object. Generalization of the results of expert research and systematization of cases of unaccounted electricity consumption in their structural distribution make it possible to determine the topic and object of this forensic examination.

Concepts of object and topic of research in any science are closely related, but do not coincide. A characteristic difference between these concepts is the fact that the concept of the subject belongs exclusively to a specific science (the object of research can be common to different sciences). The concept of object is broader, it covers the phenomena of the external world, which are subject to the knowledge and practical influence of subjects, persons. Instead, the subject is a specific aspect of the object studied by a certain science, that is, it is the embodiment of the circle of the most essential questions that it studies. To simplify perception: the subject is the goal, the object is the means. In forensic expertise, this relationship in certain types and types of forensic examinations (due to purpose of its appointment / performance) specifies the tasks to be solved in a certain classification group (individual species, subspecies, directions of research), which are characteristic of these investigated phenomena, entities, processes and events. Since in forensic expert activity, the tasks that appear before the forensic expert are formulated in the form of questions for research, the subject of the expertise is indirectly embodied in the questions it resolves. At the same time, analyzing the relationship between the concepts of *subject* / *question* / *task* of the examination, it is necessary to take into account the fact that questions and tasks posed to forensic expert make it possible to determine the subject of the forensic examination, but the subject of forensic examination itself only reflects, and does not determine, the content of the judicial examination examinations So, the cornerstone theoretical concepts of the type and type (subtype) of expertise are the concepts of its subject,

42 Кримінальний кодекс ... . URL: https://zakon.rada.gov.ua/laws/show/2341-14#Text (date accessed: 07.03.2024).

43 Рогалін С. В. Використання спеціальних знань ... . DOI: 10.37025/1992-4437/2023-39-1-85 (date accessed: 07.03.2024).

object and tasks. M. Shcherbakovskyi, researching the scientific and methodical foundations of conducting forensic examinations, notes in relation the subject of forensic examination: *"In this case, it is worth talking about the subject of the field of knowledge forming the scientific basis of the examination of a certain kind, type, and not about the procedural and applied meaning of the subject of examination"* [44]. Considering the subject of forensic examination, this concept should be correlated with the field of scientific knowledge and practical activity. The object of forensic examination is defined as *"material (materialized) sources of information (objects, formations, etc.) that are examined (recognized) by an expert on the basis of the application of special knowledge, within the scope of the subject of expert research by certain methods and means in order to solve tasks (questions), placed by an authorized person (body)"*[45]. Analyzing the current state of the general theory of forensic examinations, we see a direct logical connection between the concepts of subject and object. Obviously, the subject of forensic examination, which is essentially the embodiment of special knowledge, imposes restrictions on the object of forensic examination, which is understood as a fragmentary embodiment of the material environment where a criminal offense took place and where information about the facts and circumstances of this offense is recorded. Logical connection between the concepts of subject and object of forensic examination was studied by many scientists: they were expanded and detailed, their wording was clarified in specific types (subtypes) of forensic examinations, or they were generalized and shortened. However, no one denied the relationship between the subject and the object of research, on the contrary, they emphasized the existence of closer connections between these concepts and the tasks of forensic research.

The general issues of FEE implementation were outlined at the stage of its inception (2008). In the Guidelines for Forensic electrotechnical examinations and expert electrotechnical researches, FEE topic means the actual data and circumstances of the case (events related to the occurrence, development and consequences of abnormal modes in electrical installations or their components; compliance of electrical equipment with regulatory requirements), which are determined on the basis of specific expertise in the relevant areas of electrical engineering [46].

Expert tasks of forensic electrical examination, recorded during the analysis of statistical data at the request of courts and pre-trial investigation bodies, from the time of the beginning of the forensic specialization: 10.18 *Investigation of technical operation of electrical equipment* require updating and streamlining that in turn reveals new directions in research, where there is a need to use special knowledge. In accordance with the purpose of this work,

44 Щербаковский М. Г. Судебные экспертизы: назначение, производство, использование : учеб.-практ. пособ. Харьков, 2005. С. 116. URL: https://dspace.univd.edu.ua/items/5f69adac-7dc2-4ddf-b1ed-b3b60f3b729d (date accessed: 07.03.2024).

45 Головченко Л. М., Лозовий А. І., Сімакова-Єфремян Е. Б. та ін. Основи судової експертизи: навчальний посібник для фахівців, які мають намір отримати або підтвердити кваліфікацію судового експерта. Харків, 2016. С. 27. URL: https://expertize-journal.org.ua/attachments/article/924/ose.pdf (date accessed: 07.03.2024).

46 Горбенко В. О., Дмитрієв В. О., Ільченко Б. М., Рогалін С. В. та ін. Методичні рекомендації з проведення судових електротехнічних експертиз та експертних електротехнічних досліджень. Харків, 2011. С. 17.

the above allows to formulate a definition of the subject of forensic electrical examination on the facts of electricity theft.

Therefore***, topic of forensic electric examination on the facts of electric energy theft*** *is to confirm or refute the fact of inappropriate determination of the volume of consumption (distribution, transmission) of electricity and the solution of situational diagnostic tasks regarding the circumstances of violation of regulatory requirements for the arrangement of schemes of electricity metering nodes, the procedure for recording the volume of consumption (distribution, transmission) of electricity according to the actual parameters of the electrical installation, confirmation or refutation of the fact of distortion or blocking of the electricity metering device due to the influence of physical fields, as well as clarifying the presence or absence of structural changes in the investigated means of electricity metering, carried out by interested persons with the aim of stealing electricity by incorrect determination of its volume, distortion of conformity or complete cessation of its accounting*. The given definition is general for all areas of expert research of this subtype of FEE and corresponds to the above structural distribution of investigated cases of electricity theft that we consider comprehensive and appropriate for the formulation of typical tasks and a typical list of questions for this subtype of FEE. As an example, here is a typical list of questions developed by us for proceedings on the theft of electricity due to the influence of electromagnetic radiation on the metering device:

1) "Is electricity metering device provided for research in a working condition?";
2) "What is technical condition (serviceable / faulty) of the electricity metering device provided for research?";
3) "Does electricity metering device under research correspond to electrical load during its operability determination?";
4) "Does the research confirm the fact of exposure to the electromagnetic radiation metering device under study with an electric field intensity of more than 10 V/m and a radiation frequency above the frequency range from 80 to 2000 MHz?";
5) "What sources of electromagnetic radiation in the consumer's electrical installation (at the place of installation of the metering device under study) are capable of generating an electric field with an intensity of more than 10 V/m and a radiation frequency above the limit of the frequency range from 80 to 2000 MHz?";
6) "What type of equipment is the device provided for the study, withdrawn from the consumer during preparation of the act on RREM violation";
7) "To what type of equipment belongs the device provided for research, seized from the consumer during the investigation?";
8) "Does the device provided for research belong to the means of electromagnetic radiation?";
9) "What are nominal parameters and operating mode of the electromagnetic radiation device provided for research?";
10) "Is influence of the provided device on research during its operation on the compliance of electricity metering with metering device confirmed?";
11) "In case of confirmation of the fact of the influence of the device provided on the study on the compliance of the metering of electricity consumed by the metering device, what amount of electricity is not counted in a certain period of time?";
12) "In case of confirmation of the fact of the effect of electromagnetic radiation

on the metering device provided for the study, which sources of electromagnetic radiation affected the violation of electricity metering in the consumer's electricity metering unit?";

13) "Is occurrence of radio frequency interference in the form of electromagnetic radiation, which occurs as a result of the emergency mode of operation of the consumer's electrical installation or an artificial electric discharge that occurs during the performance of electric welding works, confirmed? Has the influence of electric discharges on the compliance of electricity metering during electric welding operations been confirmed?";
14) "Is occurrence of radio frequency interference in the form of electromagnetic radiation, which occurs as a result of a natural electric discharge of lightning, confirmed? Has the effect of a lightning discharge on the compliance of electricity metering been confirmed?".

It is worth noting that the above list was developed for the first time. Until now, lists of typical tasks for each individual research area did not exist, although they are an urgent methodological need. Such lists may contain the same or similar in wording questions (depending on the methods of committing a criminal offense). It is advisable to solve FEE tasks on the facts of electricity theft, depending on the method of committing a criminal offense. In our previous work, we noted the methods of electricity theft carried out by:

1) by replacement (substitution) of equipment parameters;
2) changes in the electrical circuit of the means of commercial electricity metering during connection of electrical installation;
3) impact on operation of electricity metering devices of certain types of force physical fields;
4) by carrying out constructive changes in devices and means of electricity metering [47].

Depending on the method of stealing electricity, the research tasks acquire independence, however, taking into account the commonality of the objects of research, these tasks have common or related definitions that can be formulated in the form of questions to forensic expert (in the investigator's resolution or court decision).

Thus, for the ways of committing a criminal offense No. 1 and 2, the task of FEE on the facts of electricity theft requires a study with calculations to draw up an electricity balance, that involves a study of the compliance of electrical circuits of annexes to the electricity distribution agreement with regulatory requirements using data on the balance of electrical networks, parameters of electrical equipment in consumer's electrical installation, data of the actual circuit arrangement of the electrical installation, applied measuring instruments, in particular metering devices, data of parameterization protocol, etc.

For methods of committing a criminal offense No. 3 and 4, the common task of FEE of cases of electricity theft is to conduct a study to determine the actual technical condition of the metering device under research, determine the compliance of electricity metering with the studied metering device with the value of the electrical load during the determination of its working condition, determine existence / lack of the influence of external equipment or built-in devices on operation of the studied metering devices.

47 Rohalin S. Criminal Characteristics … . S. 197. URL: https://czasopisma.marszalek.com.pl/images/pliki/ksm/40/ksm4013.pdf (date accessed: 07.03.2024).

Let us move on to the concept of the object of research in this subspecies of FEE, which is most often interpreted as a material carrier of information, material evidence that is subject to direct research using the expert's special knowledge. M. Shcherbakovskyi believes that the object of forensic examination is an object of forensic knowledge, and knowledge object is an epistemological category [48]. Investigating the nature of objects of forensic examination, N. Klymenko refers to R. Belkin's statement that *"objects of forensic examination can be material formations (material objects) and processes, which include phenomena, events, actions "* [49]. According to Art. 1 of Law of Ukraine: On Judicial Examination, forensic examination is "research based on special knowledge <...> of objects, phenomena and processes" [50]. That is, supporters of the second approach claim that the objects of expert research can be processes and phenomena (in particular, fragments of a crime event). Despite the needs of the investigation, the expert's knowledge of phenomena and processes as objects of research remains debatable to this day. M. Shcherbakovskyi believes that such authors mix different concepts: *"object of forensic research", physical evidence and document. <...> object of forensic research is not material evidence – it is procedural categories, but objects and documents as material or materialized carriers of information. An object examined by an expert and containing information about a crime may acquire the procedural status of material evidence in accordance with Art. 93 of the Criminal Code of Ukraine, and in the absence of relevant information, it loses its significance in criminal proceedings. But he does not lose the status of the object of examination*" [51]. The question of belonging to the objects of examination of material objects, fragments of the material situation or events or processes is controversial to this day, but decisive in the context of our research.

Currently, in methodological FEE development and in practical forensic expert activity, the following definition is used: *"Objects of forensic electrotechnical expertise (expert electrotechnical research) are material and materialized sources of information that are examined by electrical experts in order to establish the factual data and circumstances of the case (events) belonging to the subject of forensic electrotechnical examination (expert electrotechnical examination): main object of the examination is the electrical installation of the consumer of electric energy and its elements; objects of examination also include those media that contain actual data on the subject of a specific electrical examination; relevant documents of case materials, research objects and documents provided by the customer of the expert examination"* [52]. Separation of forensic researches on the

48 Щербаковський М. Г. Проведення та використання судових експертиз у кримінальному провадженні : монографія. Харків, 2015. С. 107. URL: https://dspace.univd.edu.ua/server/api/core/bitstreams/0dd2821b-1646-4d5c-965f-c20e08dc1479/content (date accessed: 23.02.2023).

49 Клименко Н. І. Природа об'єктів судової експертизи. *Актуальні питання кримінального процесу, криміналістики та судової експертизи* : мат-ли міжвідом. наук-практ. конф. (Київ, 24.11.2017). У 2 ч. Київ, 2017. Ч. 1. С. 309—312.

50 Про судову експертизу : Закон України від 25.02.1994 р. № 4038-XII (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/4038-12#Text (date accessed: 23.02.2023).

51 Щербаковський М. Г. Проведення та використання ... . С. 103—104. URL: https://dspace.univd.edu.ua/server/api/core/bitstreams/0dd2821b-1646-4d5c-965f-c20e08dc1479/content (date accessed: 23.02.2023).

52 Горбенко В. О., Дмитрієв В. О., Ільченко Б. М., Рогалін С. В. та ін. Зазнач. твір.

facts of theft of electricity as an independent FEE subspecies of requires definition of the object concept of the of this forensic examination.

The foregoing makes possible to formulate the following definition: ***object of FEE on the facts of electricity theft*** *are material and materialized sources of information that contain data on inappropriate determination of the amount of electricity consumption (distribution, transmission) and which electrical experts investigate in order to find out the actual data and circumstances of the case (event) that belong to the subject of this examination.*

FEE facilities on facts of electricity theft include:

1) means of commercial electricity metering:
   a) electricity metering devices;
   b) measuring equipment (for example: current measuring transformers and voltage transformers);
2) documents that, on the basis of regulatory requirements, determine the possibility of using means of commercial electricity metering (for example: protocols for parameterization of metering devices, certificates of metrological verification, acts of technical verification of means of commercial electricity metering);
3) annexes to relevant agreements, on the basis and under the terms of which electricity is consumed (transmitted, distributed) (in particular: a single-line scheme of electrical connection with the designation of the parameters of the elements of electrical networks, act of delimitation of the balance ownership of electrical networks, procedure for payments for electricity and provision of relevant services);
4) actual (electrical) device metering arrangement diagrams in the electrical installation under research;
5) documents containing data on violations of RREM (act on violations of RREM, annexes to it: schemes, descriptions of detected violations, descriptions of detections of the facts of influence on the operation of commercial metering equipment, comments of the parties, etc.);
6) materials of photo and video recording of RREM violation detection;
7) devices withdrawn during the drawing up of the act on violation of RREM or during the investigative actions, for which data are provided, which are considered to be the grounds for recording the event of occurrence (existence) of the influence of physical fields, or for which there are doubts about the possibility of their use to influence the compliance of electricity metering with the investigated metering device during their operation;
8) log data of investigated metering device;
9) data of the load profile of metering device under research;
10) documents containing data on the consumer's work schedule and indicators of his activities in the production, manufacture and release of products, provision of services, etc.;
11) calculation of the volume of consumption (distribution, transmission) of electricity, calculation of electricity losses in elements of power networks;
12) devices that have signs of displaying the existence of pulsed or radio-frequency electromagnetic radiation, magnetic field, etc.

Regarding the last point, we should note the following: determining the influence of physical fields on the compliance of electricity accounting requires determining the force characteristics of the field (voltage, induction, as well as the charac-

teristics of changes in these values over time: frequency), and under certain conditions also in retrospect (when the field of electromagnetic radiation or the magnetic field is removed) such characteristics can be found out indirectly; and does the electromagnetic field belong to the research objects? Physics defines electromagnetic field as a special type of matter that is not felt by humans and which is invisible, exists independently of our consciousness, does not require the presence of another type of matter (environment), spreads both continuously and discretely in the form of photons with the speed of light in space, free from substances: vacuum, a certain part of whose physical values (according to the principle of uncertainty) cannot be precisely described (determined) at the current level of science. Feature of the electromagnetic field is the relationship between the electric and magnetic components, under which a changing electric field can create a magnetic field and vice versa. Unlike matter, an electromagnetic field has no rest mass. At the same time, electromagnetic field has energy (similar to matter), is characterized by inert mass, momentum (momentum), and moment of momentum, i.e., those universal properties of matter that obey the general laws of conservation and are due to the indestructibility and indestructibility of matter and its motion. The above proves that the electromagnetic field belongs to the material world, however (as a special type of matter) it is characterized by the complexity of conducting research, therefore, knowledge of a specific electromagnetic field (with certain parameters) in the FEE based on the facts of electricity theft is possible only indirectly through the action on stationary electric charges and moving electric currents by either measurements, or by manifestations of the power characteristics of its individual components: electric and magnetic fields, that is, by the results of the transformation of the energy of the electromagnetic field into other types of energy (in particular, mechanical and thermal) by the traces-reflections of these events on studied objects.

It should be noted that the term: *traces-reflections* is one of the main concepts of forensic trace evidence research. According to methodology of trace evidence research: "traces-reflections arise as a result of the interaction of two objects <...>: one object forms a trace (the one that left a trace) – the trace-forming object, the second, perceives changes (on which the trace was formed) – tracker Areas of the surface of objects with which they come into contact during the formation of a trace are called contact surfaces, and the fact of interaction is called trace contact" [53]. However, reflection traces also arise as a result of non-mechanical interaction of objects, as happens with physical fields with certain force characteristics. Complexity of researching physical impact of electromagnetic and magnetic fields on an electricity meter (especially based on an event that took place in the past) requires

53 Шепітько В. Ю., Коновалова В. О., Журавель В. А., Глібко В. М., Дудніков А. Л., Шевчук В. М. Криміналістика : підручник / за ред. В. Ю. Шепітька. 4-те вид., перероб. і допов. Харків, 2008. С. 60. URL: https://law.sspu.edu.ua/files/documents/books/library/17/shepitko.pdf (date accessed: 23.02.2023) ; Копча В. В., Копча Н. В. Криміналістична техніка, тактика і методика : навч. посіб. Одеса, 2022. С. 41 ; Волобуєв А. Ф., Даньшин М. В., Іщенко А. В. та ін. Криміналістика : підручник. У 2 т. Т. 1 / за заг. ред. А. Ф. Волобуєва, Р. Л. Степанюка, В. О. Малярової. Харків, 2018. С. 149. URL: https://dspace.univd.edu.ua/server/api/core/bitstreams/1c71481e-5339-4203-a94d-5fcac8dfee32/content (date accessed: 23.02.2023).

not only the solution of expert tasks for traceable objects, but also the study of the conditions under which these traceable objects acquired fixed signs-reflections of the impact event, that is, it is about the peculiarity of the study of the conditions of existence of electromagnetic and magnetic fields, the conditions of detection of the event of influence of these fields on the research object electricity metering device, which providing for performance of research according to situational tasks. In this case, the object of research also becomes the material situation of committing a criminal offense (electricity theft) with expansion of the above list of researched objects.

Conclusions

The "commodity" essence of electricity as an object of civil rights with the corresponding legal regime of property nature in cases of crimes against property is considered. The results of expert studies in the proceedings on theft of electricity are summarized and the origins of these studies from the general FEE tasks are determined.

The structure of areas of forensic research into unaccounted for electricity use was analyzed and the place of expert research into cases of electricity theft in FEE was determined.

The interrelationship between the subject and the object of research and tasks in forensic examination has been studied. The topic and object of FEE were determined based on the facts of electricity theft.

Typical questions of forensic research on the facts of electricity theft due to the influence of electromagnetic radiation on the electricity metering device are formulated. According to the developed list of typical questions in this area of expert research, the principles of forming typical lists of questions in other areas, depending on the method of committing a criminal offense of electricity theft, are laid down. It is argued that the development of such lists will contribute to the construction of optimal investigative versions and the effective conduct of investigative (search) actions, will speed up the investigation of cases of electricity theft.

Предмет та об'єкт судової електротехнічної експертизи у провадженнях про викрадення електричної енергії

Сергій Рогалін

Мета статті — за допомогою узагальнення результатів електротехнічних експертних досліджень (зокрема, виконаних у Національному науковому центрі «Інститут судових експертиз ім. Засл. проф. М. С. Бокаріуса» Міністерства юстиції України) і комплексу загальнонаукових та спеціальних методів (зокрема, формально-логічних, порівняння, аналізу й синтезу) визначити місце експертизи за фактами викрадення електроенергії в судовій електротехнічній експертизі, сформулювати поняття предмета й об'єкта такої експертизи, скласти перелік її видів. Окреслено перспективи розвитку судової електротехнічної експертизи. Узагальнено результати електротехнічних експертних досліджень у провадженнях про викрадення електроенергії. Доведено наступництво цими дослідженнями загальних завдань судової електротехнічної експертизи. На підставі розглянутих окремих тенденцій видового генезису в судовій експертизі висловлено думку про подальший розвиток судової електротехнічної експертизи. Розглянуто структуру напрямів експертних досліджень необлікованого використання електроенергії та визначено їхнє місце в системі судових електротехнічних експертиз. Закладено принципи формування

типових переліків питань у судовій електротехнічній експертизі за фактами викрадення електроенергії відповідно до способу вчинення кримінального правопорушення. За положеннями загальної теорії судових експертиз визначено предмет та об'єкт судової електротехнічної експертизи за фактами викрадення електроенергії. Сформульовано типові питання до експерта у провадженнях про викрадення електроенергії внаслідок впливу електромагнітного випромінювання на прилад обліку. На прикладі цього переліку розглянуто принципи формування типових переліків питань за іншими напрямами досліджень фактів викрадення електроенергії залежно від способу вчинення кримінального правопорушення.

Ключові слова: *об'єкт, предмет, завдання, питання судової електротехнічної експертизи за фактами викрадення електричної енергії; викрадення електроенергії; прилад обліку електроенергії.*

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Declaration of Competing Interest

Author declare no conflict of interest.

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