UDC 811.111'25
DOI https://doi.org/10.28925/2412-2491.2026.2620

DISTINCTIVE FEATURES OF RENDERING ENGLISH SOLAR PHOTOVOLTAIC TERMS INTO UKRAINIAN

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The article presents research on structural models and techniques of translating solar photovoltaic (PV) terms in modern English scientific and technical discourse into Ukrainian necessitated by the rising significance of photovoltaic applications in the current Ukrainian context due to their efficiency and sustainability across various spheres of life. The article is aimed at discovering the distinctive features of rendering solar photovoltaic terms into Ukrainian by investigating their lexical and grammatical characteristics. The object of the research is English solar photovoltaic terms and their Ukrainian equivalents. The subject of the study is the techniques of rendering English photovoltaic terms into Ukrainian. The linguistic and extralinguistic peculiarities of scientific and technical texts have been clarified. The notion of 'term' in modern scientific and technical discourse has been elucidated. The works on translation of English terminology connected with environmental sustainability in the sphere of energy efficiency, alternative energy and biogas production have been analyzed. It was discovered that the English solar photovoltaic terms have not been the object of a separate investigation in translation studies yet. The findings of the study of the photovoltaic terms in a scientific and technical article on recent advancement in solar photovoltaic technology present the variety of the structural models of solar photovoltaic terms with the prevalent one that consists of an adjective and a noun. The application of the techniques of loan translation, addition, structural transposition and practical transcription turned out to be the distinctive features of rendering English solar photovoltaic terms into Ukrainian.

Key words*: solar photovoltaic technologies, solar photovoltaic terms, structural model, loan translation, addition, structural transposition, practical transcription.*

Тищенко Т. В. Особливості перекладу англійських термінів з галузі сонячної фотовольтаїки українською мовою. *У статті представлено результати дослідження структурних моделей та прийомів перекладу термінів з галузі сонячної фотовольтаїки (PV) сучасного англійського науково-технічного дискурсу на українську мову. Актуальність дослідження зумовлена все більш важливим значенням фотовольтаїчних технологій у сучасному українському контексті*

завдяки їхній ефективності та екологічності в різних сферах життя. Мета статті – виявити особливості перекладу термінів з галузі сонячної фотовольтаїки на українську мову шляхом дослідження їхніх лексичних та граматичних характеристик. Об'єктом дослідження є англійські терміни з галузі сонячної фотовольтаїки та їхні українські еквіваленти. Предметом дослідження є методи перекладу англійських фотовольтаїчних термінів на українську мову. З'ясовано лінгвістичні та позалінгвістичні особливості науково-технічних текстів. Роз'яснено поняття «термін» у сучасному науково-технічному дискурсі. Проаналізувавши праці з перекладу англійської термінології, пов'язаної з екологічною стійкістю у сфері енергоефективності, альтернативної енергетики та виробництва біогазу, було встановлено, що англійські терміни з галузі сонячної фотоелектричної енергетики ще не були предметом окремого дослідження в перекладознавстві. Результати дослідження фотоелектричних термінів у науково-технічній статті про останні досягнення у сфері сонячної фотоелектричної технології свідчать про різноманітність структурних моделей сонячних фотоелектричних термінів, серед яких переважає модель, що складається з прикметника та іменника. Застосування прийомів кальковування, додавання, структурної транспозиції та практичної транскрипції виявилося характерною особливістю перекладу англійських термінів з сонячної фотовольтаїки українською мовою.

Ключові слова: *сонячні фотоелектричні технології, терміни у сфері сонячної фотоелектрики, структурна модель, калькування, додавання, структурна транспозиція, практична транскрипція.*

Introduction

The 21st century is characterized by rapid technological advancement and humanity's drive for energy efficiency. Maximizing output while minimizing energy consumption is crucial for environmental sustainability and economic growth. Modern solar photovoltaic (PV) technologies ensure the reduction of energy demand and carbon emissions. These sustainable technologies of converting sunlight directly into electricity through the photovoltaic effect are gaining traction all over the world. In Ukraine amid infrastructure damage using photovoltaic technologies has become the need of the hour.

The growing interest in solar photovoltaic technologies and demand for using them in Ukraine as well as the requirement to grasp the nuances of photovoltaic effect necessitate the study of the specifics of translating English solar photovoltaic terms into Ukrainian.

The aim of the research is to elucidate the distinctive feature of rendering solar photovoltaic terms of modern English scientific and technical discourse into Ukrainian by investigating their lexical and grammatical characteristics.

Theoretical Background

Scientific texts are characterized by preciseness and accuracy of terminology and concepts, whereas technical texts are focused on transparency of technical specification and practicality. Nowadays, texts tend to combine elements of both scientific and technical texts with the problems that they bring out (Byrne, 2012). While the distinction between the two fields is obvious, "the ways in which they appear in the real world mean that they need to be considered together". Whereas a technical text is created to convey information with utmost clarity and impact, a scientific text is constructed to discuss, analyze and synthesize information with the purpose of clarifying concepts, suggesting new theories or assessing approaches (Byrne, 2012, p. 2).

English scientific and technical literature style is marked by a specific vocabulary, terms and scientific notions, gerundial and participial constructions, abstract nouns formed from verbs and adjectives, strictly logical syntax and sentence ordering, explicitness, objectiveness, impersonality, clarity, accuracy and precision (Bidnenko, 2014).

The extralinguistic features of scientific and technical literature include abstractness and strict logical presentation; informativeness; monological type of speech; objectivity of presentation (argumentation, motivation); focus on logical perception rather than sensory (Prus, 2007).

Scientific and technical texts abound in terminology (general technical, interdisciplinary, narrowly specialised); abbreviations which must be deciphered and given in full when translated; attributive complexes and expanded syntactic structures (Hrechyna, 2011).

Characteristic features of rendering terms in scientific and technical texts have been studied by Karaban V. I., Hrechyna L.B., Kruhlii O. R., Cherniak O. P., Furt D. V., Shvanova O. V., Shvanov O. M., Kutsa O. I., Karanevych M. I., Shtohryn M. V.

The term is characterised as a lexical unit with a limited scope of application within a specific field of science, human activity and production (Kruhlii & Cherniak, 2021, p. 124).

Having scrutinised numorous approaches to the concept ‘term’ Vakulenko M. (Vakulenko, 2014) defined the ‘term’ as "a word or a collocation that refers to a certain concept in a particular field of human endeavour: science, technology, culture, sports, art, etc." with further advancement of the definition of the ‘term’ to "a unit of the lexical level (a word or a collocation) that denominates some concept

of respective domain of human endeavour and forms functional thematic class of the field vocabulary and is a natural (systemic or off-systemic) element of the terminology fund".

Investigated within the framework of text linguistics, ‘the term’ was defined as "a semantically charged linear structure, which names an abstract or a concrete reality studied by a special-subject field" (Collet, 2021). In a special text a term contributes to text coherence and text cohesion. Such contribution "may translate into variability both on the level of its meaning content and of its linear structure, especially if its linear structure is syntactically transparent. This variability may lead to polysemy on the one hand, and signals on the other hand that terms exhibiting syntactic transparency are, in fact, paradigms, i.e. sets of all the possible forms the linear structure can have in a text" (Collet, 2021, p. 109).

The division of terms into scientific and technical suggests that scientific terms indicate the theoretical scientific concepts, while technical terms define tools, artifacts, observations, experiences, and measures (Otman, 1996, p. 15). Scientific and technical terms reflect concepts from specific fields of science or technology and are important components of scientific and technical texts.

Translation of scientific and technical terms pose the following lexical challenges: polysemy of terms which complicates the choice of an adequate equivalent and translation option; the choice of a method for translating terms; interpreting neologisms, abbreviations, homonyms, foreign terms, ethno-national variations of terms, and reproducing proper names (Karaban, 2004, p. 273). Accurate transmission of meaning depends on the word formation of terms, among which simple, derivative (suffixal, prefixal, suffixal-prefixal), compounds and word combinations are distinguished (Karaban, 2004, p. 315).

In the process of translation of a term from English into Ukrainian a lexical equivalent of a term is mainly looked for by a translator in search of a constant lexical correspondence of the meaning of the word (Furt, 2018). A near equivalent is chosen if an absolute equivalent is inexistant. Other ways of translating terms are the untranslatable adoption of terms, adaptive transcoding (to create a clearly defined term), linguistic calque, explication or descriptive translation (to absolutely convey the meaning of a term), inversion (to change the phrase component order) and substantiation (to substitute an English term for a Ukrainian word with a narrower subject-logical meaning). A simultaneous application of several translation techniques works for translation of non-equivalent terms.

It was found out that while working with terminology the translator has to face the need to deepen knowledge in a particular field, to establish relations between terms and concepts, to consult experts. Translation methods of two-componental terms in the field of energy efficiency have been singled out and described by Kutsa O. I., Karanevych M. I. (Kutsa & Karanevych, 2020). The terms of N+N model were rendered by means of compression, decompression, permutation, transposition, synonymous substitution, compound terms with prepositions, compound terms with abbreviations and replacement of the singular forms with plural ones. To convey the meaning of the terms of Adj+N model loan translation was used.

Upon examining the methods of translation of English alternative energy terminology Shtohryn M. V. revealed the dependence of the choice of a translation method on the number of components in alternative energy terms (Shtohryn, 2024). The most productive method of translating of the analysed terminological phrases turned out to be loan translation, in which the semantic and stylistic features of the source word are preserved in the translation. Combined translation was found out to be another frequent method of rendering alternative energy terms. It included the usage of several translation techniques such as transposition, decompression, compound terms with prepositions primarily for phrases with a multi-component compound term. The descriptive translation method and the selection of equivalents were fairly productive methods of translation. The use of the genitive case, in which changes occur in the order of the units of the source language term combination, appeared to be the least common. Taking into account the rules of Ukrainian grammar this method simplifies the translation of alternative energy terms by reducing the number of definitions that precede the word being defined.

The study of rendering terms in biogas production revealed that such common technical terms consist of two or more nouns; an adjective with a noun or two, more than two nouns; participle I or participle II with a noun; combination of words from different parts of speech, such as an adverb with participle II and a noun, as well as a noun, an adjective and a noun (Shvanova & Shvanov, 2018). Such biogas production terms are mostly translated by loan translation. The typical challenges of translating biogas production terms are abbreviations, synonymous technical collocations, polysemantic commonly used lexemes.

Thus, the existing research of English terminology connected with environmental sustainability concern terms in the sphere of energy efficiency,

alternative energy and biogas production. The English solar photovoltaic terms have not been the object of a separate investigation in translation studies yet.

Methodological notes

The object of the study is solar photovoltaic terms in scientific and technical discourse. The data source is a scientific and technical article on recent advancement in solar photovoaltaic technology and its translation into Ukrainian.

The investigation relies on the following methods. To describe the theoretical foundation of the investigation the theoretical analysis and synthesis were used. The linguo-translation method helped to determine the photovoltaic term translation techniques. By means of the quantitative evaluation method the frequency of translation techniques applied to the English photovoltaic terms was compared. The descriptive method was used to present the results of the study.

Results and Discussions

The study of rendering English solar photovoltaic (PV) terms into Ukrainian revealed the tendency of applying such translation techniques: loan translation, addition, structural transposition and practical transcription.

Loan translation turned out to be the predominant way of rendering English solar photovoltaic terms into Ukrainian since 57,48 % of the photovoltaic terms were rendered by means of loan translation. The most common structural type of terms rendered by loan translation is two-componental consisting of an adjective and a noun (Adj+N). Such terms constitute 28,34 % of the English photovoltaic terms under consideration: *photovoltaic (PV) installation – фотоелектричні установка; bifacial modules – двосторонні модуль; thin-film cells – тонкоплівкові елементи; photovoltaic (PV) systems – фотоелектричні системи; solar panels – сонячні панелі; solar modules – сонячні модулі, фотоелектричні модулі; solar cell – фотоелемент, фотокомірка, сонячний елемент; solar photovoltaic – сонячна фотовольтаїка; solar array – сонячна батарея, сонячна панель, масив сонячних панелей/ модулів; ecological footprint – екологічний слід; direct current (DC) – постійний струм; altering current (AC) – змінний струм; intelligent tracking – інтелектуальне відстеження; filtered light – фільтроване світло, розсіяне світло; nanostructured patterns – наноструктурний візерунок; plasmonic nanoparticles – плазмонна наночастинка; stray light – розсіяне світло.*

11,02 % of the English photovoltaic two-componental terms with two nouns (N+N) were converted into Ukrainian by loan translation: *silicon panel – кремнієва панель; perovskite cells – перовськітні елементи; semiconductor layers – напівпровідникові шари; crystalline silicon (c-Si) – кристалічний кремній (c-Si); halide ligand – галогенідний ліганд; tandem stacks – тандемні стоси (шари); passivation film – пасиваційна плівка; crystalline wafer – кристалічна пластина, кристалічна підкладка.*

Other structural models are less commonly found among the photovoltaic terms rendered into Ukrainian by loan translation. 4,72% of the photovoltaic terms were word combinations with two adjectives and a noun (Adj+Adj+N): *solar photovoltaic (PV) technology – сонячна фотоелектрична технологія; clean solar power – чиста сонячна енергія; grid-tied solar system – мережева сонячна електростанція; off-grid solar system – автономна сонячна електростанція; solar monitoring system – система моніторингу сонячної електростанції; hybrid solar system – гібридна сонячна електростанція.*

The structural models observed in less than 3 % of the photovoltaic terms rendered by loan translation are Adj+N+N (*single-junction silicon cells – однопереходні кремнієві елементи; photovoltaic (PV) power plant – сонячна електростанція (СЕС), фотоелектрична електростанція),* A+N+prp+N (*levelized cost of electricity (LCOE) – середня вартість електроенергії; seamless pairing with buildings – ідеальне інтегрування в будівлі),* V+A+N (*harness solar rays – використовувати сонячні промені, discard solar panels – утилізувати сонячні панелі*), V+N (*ride the wave – користуватися хвилею; harvest sunlight – збирати сонячне світло*), V+N+N (*lower energy demand – знижувати енергоспоживання*), N+A+N (*perovskite solar cells – перовськітні сонячні елементи*), A+A+N+N *(total renewable electricity capacity – загальна потужність відновлюваної електроенергії*), A (*photovoltaic (PV) – фотовольтаїчний / фотоелектричний*), N+prep+N+A (*efficiency of a solar panel – коефіцієнт корисної дії (ККД) сонячної панелі,* N+N+N (*laboratory perovskite cells – лабораторні перовськітні комірки*), N (p*hotocell – фотокомірка).*

The study discovered that 18, 90 % of the photovoltaic terms had been translated by means of addition. 7,87 % of the terms consisted of an adjective and a noun (Adj+N): *sub-bandgap photons – фотони з енергією нижче ширини забороненої зони, фотони підзабороненої зони; light-trapping structures – структури, що вловлюють світло; silicon-based technologies – технології на*

основі кремнію; life-cycle footprint – екологічний слід життєвого циклу; end-of-life waste – відходи після закінчення терміну експлуатації; organic photovoltaics (OPV) – органічні фотоелектричні елементи, органічні сонячні елементи.

4,72 % of the terms with two nouns (N+N) were conveyed into Ukrainian by means of addition: *recombination losses – втрати на рекомбінацію; panel output – вихідна потужність панелі, cell formats – типи сонячних елементів; rooftop photovoltaics (PV) – дахова сонячна електростанція, дахова електрична система, сонячні батареї на даху.*

Less common structural models of the terms in question were Adj+Adj+N (*refined light-trapping designs – вдосконалені конструкції для уловлювання світла; dye-sensitized solar cell (DSSC) – сонячно сенсибілізована сонячна батарея),* Adj+Adj (*building-integrated PV (BIPV) – інтегровані в будівлі сонячні модулі, будівельно-інтегровані фотоелектричні системи, фотовольтаїчні матеріали, інтегровані в конструкцію; PV (photovoltaic) – фотоелектричний/ фотовольтаїчний/ фотоелектричний елемент),* Adj+N+N (*overall light capture – загальний коефіцієнт поглинання світла*), N+Adj (*concentrator PV (CPV) – концентраторні фотоелектричні системи (CPV)*, acronym+N (*LiFePO4 battery, LFP battery – літій-залізо-фосфатний акумулятор (ЛЗФ/ LFP).*

It was discovered that 18,11% of the photovoltaic terms had been translated by means of structural transposition. Out of this group the structural models N+N and N+N+N got 4,72 % each: *cadmium telluride (CdTe) – телурид кадмію; surface passivation – пасивація поверхні; moisture ingress – проникнення вологи; Shockley-Queisser limit – межа Шоклі-Квайссера; electron recombination losses – втрати через рекомбінацію електронів; light management strategies – стратегії управління світлом.*

The infrequent structural models in this group of terms are N+N+N+N (*copper indium gallium selenide (CIGS) – селенід міді, індію та галію (CIGS), solar power plant generation – генерація сонячної електростанції),* Adj+N *(PV application – застосування фотоелектричних систем; photovoltaic uptake – поширення сонячних панелей),* Adj+N+N (*active cell layer – активний шар сонячної комірки),* Adj+N+and+Adj+N (*Passivated Emitter and Rear Cell (PERC) – пасивований емітер і задня комірка).*

Practical transcription as a way of translation was characteristic of 5,51% of the photovoltaic terms with the following structures: N (*agrivoltaics –*

агрівольтаїка; thermalization – термалізація, inverter – інвертор, string – стрінг), N+N (*Net Metering – нет-мітерінг, Net Billing – нет-білінг),* MPPT (*tracker – MPPT трекер).*

Conclusions and prospects

The heightened attention to solar photovoltaic technologies due to their increasing efficiency makes it necessary to reveal the distinctive features of rendering English solar photovoltaic terms into Ukrainian.

The findings of the study demonstrate the variety of the structural models of solar photovoltaic terms with the prevalent one that consists of an adjective and a noun.

To faithfully convey the meanings of the solar photovoltaic terms the techniques of loan translation, addition, structural transposition and practical transcription are used. The prevailing translation technique turned out to be loan translation aimed at adopting new concepts while maintaining Ukrainian linguistic structures. The frequent techniques in translation of English solar photovoltaic terms are addition and structural transposition. To ensure clarity and understanding of the nuances of photovoltaic technologies addition was applied in translation of the terms. Structural transposition in rendering the multi-componental photovoltaic terms involved changing the order of words to achieve naturalness and accuracy in Ukrainian. The least common technique of practical transcription integrated the English photovoltaic terms into the Ukrainian language preserving the English pronunciation.

The theoretical value of the research is determined by its thorough analysis of the structural models of the English solar photovoltaic terms in modern scientific and technical discourse as well as the translation techniques utilized to faithfully render their meaning into Ukrainian.

The practical value of the research is that the findings are applicable in the translation of various English scientific and technical texts in solar photovoltaics and development of tutorials in scientific and technical translation.

Potential areas for further study lie in discovering translation techniques of texts in solar photovoltaic technology of different generations and their comparative analysis.

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The author declares no competing interests.

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Publisher: Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine

Publishing history: Received 29.03.2026 ; Accepted 29.04.2026; Published 30.05.2026