Features of Translation and Adaptation of Nuclear Energy Terminology in the Azerbaijani Language: Linguistic and Scientific Aspects

Nigar Sadigova [1]

[1] *Azerbaijan National Academy of Science, Institute of Linguistics named after Nasimi*
115 H. Cavid Avenu, Baku, Azerbaijan

DOI: 10.22178/pos.116-7

LCC Subject Category: PE1001-1693

Received 27.03.2025
Accepted 25.04.2025
Published online 30.04.2025

Corresponding Author:
nigarismaylova@gmail.com

Abstract. This article examines the translation and adaptation of nuclear energy terminology into the Azerbaijani language from both linguistic and scientific perspectives. It discusses the challenges faced in accurately conveying complex nuclear terms, how dominant source languages (notably English and Russian) influence Azerbaijani nuclear vocabulary and the strategies employed for semantic and terminological adaptation. Issues of standardisation are explored, highlighting efforts by Azerbaijani institutions to unify technical terminology and ensure clear communication. Real examples of Azerbaijani nuclear energy terms are provided to illustrate how terms are translated or coined, such as *nüvə reaktoru* («nuclear reactor») and *atom elektrik stansiyası* («nuclear power plant»). The article draws on scholarly sources, glossaries (e.g., IAEA standards), and language policy documents to underscore the importance of consistent, accurate terminology in scientific discourse and national language development. The findings show that while historical Russian influence and modern English borrowings shape the Azerbaijani nuclear lexicon, deliberate adaptation and standardisation efforts are helping to harmonise terminology for effective scientific communication.

Keywords: Azerbaijani; nuclear energy; terminology; translation; adaptation; standardisation; Russian influence; English influence; terminological policy.

INTRODUCTION

Translating nuclear energy terminology into Azerbaijani presents a unique set of linguistic and scientific challenges. Nuclear science and engineering involve highly specialised terms, many of which originated in English or Russian, that must be accurately rendered in Azerbaijani without loss of meaning or precision. Clear and consistent terminology is crucial for effective communication among scientists, engineers, policymakers, and educators. Azerbaijan engages with the international nuclear community (for example, through membership in the International Atomic Energy Agency since 2002) and develops its nuclear research capacity. The need for standardised Azerbaijani nuclear terminology has become increasingly important.

Historically, foreign languages have heavily influenced the development of Azerbaijani scientific vocabulary. During the Soviet era, Russian was Azerbaijan's primary medium for technical education and scientific research, resulting in many nuclear-related terms entering Azerbaijani via Russian transliterations or calques. Recently, the global dominance of English in science and technology means that new concepts in nuclear energy are often first encountered as English terms. This dual influence has led to a complex terminological landscape where multiple synonyms or variants may exist for the same concept (e.g., *atom enerjisi* vs *nüvə enerjisi* for «nuclear energy»). Ensuring that these terms are translated and adapted linguistically sound and scientifically accurate is critical for linguists and technical experts in Azerbaijan [1].

This article provides an in-depth examination of how nuclear energy terminology is translated and adapted into Azerbaijani. We discuss the **lin-**

guistic challenges involved, such as phonological and morphological adaptation of loanwords and the creation of equivalents for concepts with no native precedent. We then analyse the **influence of other languages**, especially Russian and English, on the Azerbaijani nuclear lexicon. Next, we outline **semantic and terminological adaptation strategies**, including direct borrowing, calquing (loan translation), neologism formation, and explanatory phrases. We also address **standardisation issues**, highlighting efforts by the Azerbaijani Terminology Commission and other bodies to unify and regulate nuclear terminology for consistency and clarity [2]. Real examples of Azerbaijani nuclear energy terms are used throughout to illustrate these points. Finally, the **conclusion** summarises the findings and emphasises the importance of ongoing terminological development to support linguistic integrity and scientific communication in Azerbaijan.

RESULTS AND DISCUSSION

Linguistic Challenges in Translating Nuclear Terms

Translating nuclear energy terminology into Azerbaijani raises several linguistic challenges. One major challenge is **lexical gaps** – many nuclear concepts had no direct equivalents in Azerbaijani, a language with historically different usage domains. As a result, translators must often introduce **loanwords** or coin new terms. Loanwords, typically from English or Russian, must be **phonetically and graphically adapted** to the Azerbaijani sound system and Latin script. For example, *reactor* (from English or Russian *reaktor*) is adopted as *reaktor* in Azerbaijani, conforming to Azerbaijani spelling rules and vowel harmony when suffixes are added (e.g., *reaktoru* in the accusative case). The process of adapting foreign terms can involve minimal change or substantial alteration. The extent of adaptation can categorise borrowed terms: some enter Azerbaijani with almost **no change**, others undergo minor graphic or phonetic shifts, and some are modified in spelling and pronunciation. For instance, the term *atom* (for «atom» or as a root meaning «nuclear») needed little or no alteration, whereas an English term like *fusion* was translated piecewise (as discussed below).

Another linguistic challenge is dealing with **compound technical terms and acronyms**. Nuclear energy terms are often compound phrases (e.g., *nuclear power plant*, *spent fuel storage*) which must be restructured in Azerbaijani syntax. Azerbaijani generally uses modifier–head noun constructions, often linked by the izafet (possessive) construction. For example, «nuclear reactor» is expressed as *nüvə reaktoru*, literally «nucleus reactor,» with *nüvə* («nucleus, core») functioning as an adjectival modifier to *reactor*. Ensuring the correct order and morphological linking is key to preserving meaning. Acronyms pose a related issue: the Russian abbreviation **AES** (from *Atomnaya Elektrik Stantsiya*, «Atomic Electric Station») for a nuclear power plant has been carried into Azerbaijani usage as **AES** (often pluralised as *AES-lər* in Azerbaijani) because the full term *atom elektrik stansiyası* naturally yields the same initials. While convenient, such borrowings can introduce forms that deviate from typical Azerbaijani acronym patterns.

Semantic clarity is another concern. Some nuclear terms have everyday-language homonyms or near-equivalents that could confuse if misapplied. The word *nüvə* in Azerbaijani means «core» or «kernel» in general contexts (e.g., the core of a fruit). Still, scientific usage denotes an atomic nucleus or anything about it («nuclear»). Thus, when *nüvə* is used as a modifier in terms like *nüvə silahı* («nuclear weapon») or *nüvə reaktoru*, it must be clearly understood in the nuclear sense. Translators sometimes add context or choose an alternate wording to avoid ambiguity. For example, «thermonuclear reactor,» referring to a fusion device, is rendered as *istilik-nüvə reaktoru* in Azerbaijani. This is a calque: *istilik* means "heat/thermal" and *nüvə reaktoru* means "nuclear reactor", so *istilik-nüvə reaktoru* translates the components of "thermo-nuclear reactor ". The use of the native word *istilik* for «thermo» ensures that the term is transparent to Azerbaijani speakers (literally «heat-nuclear reactor»), even if they are not familiar with the foreign root *thermo-*. Such calquing demands careful linguistic judgment to sound natural in Azerbaijani while accurately conveying the scientific concept.

The transition from Cyrillic to Latin script in the early 1990s (when Azerbaijani switched alphabets) also impacted term translation. Older generation specialists may have learned nuclear terminology in Cyrillic/Russian, whereas younger professionals encounter English terms and Latin-script Azerbaijani. This can lead to the inconsistent spelling of technical terms (for instance, older texts might have *reaktor* in Cyrillic as **реактор**, while newer texts use Latin *reaktor*). Harmonising these into one system is

part of the linguistic challenge. The **publication of updated spelling dictionaries and terminology guides in Azerbaijani largely resolved the orthographic integration of terms**. Still, some discrepancies persist in less standardised sub-domains of nuclear science. In summary, the linguistic challenges in translating nuclear terms involve filling lexical gaps through borrowing or neologism, adapting foreign words to Azerbaijani phonology and morphology, restructuring complex terms to fit Azerbaijani grammar, and maintaining semantic clarity. Overcoming these hurdles requires linguistic expertise and close attention to the scientific meaning behind each term to ensure fidelity in translation.

Scientific Accuracy and Conceptual Considerations

Beyond linguistic form, a critical aspect of terminology adaptation is maintaining **scientific accuracy**. Nuclear energy terminology carries precise technical meanings, and mistranslation can lead to misunderstandings with serious implications. A term in English often has a well-defined scope; the Azerbaijani equivalent must match it as closely as possible in denotation and connotation [3]. For example, *critical mass* (the minimum amount of fissile material needed to sustain a nuclear chain reaction) should be translated to convey the exact concept. Azerbaijani uses *kritik kütlə* as a direct loan translation (where *kritik* is adapted from the international term «critical» and *kütlə* means «mass»). Using a more generic word like *əhəmiyyətli kütlə* («significant mass») would distort the scientific meaning. This illustrates why domain knowledge is essential for translators: one must understand the nuclear science context to choose the correct words.

Some nuclear terms have multiple meanings in English depending on the context, which the translator must distinguish. For instance, *radiation* can mean emitting energy as particles or waves, or colloquially, the emitted particles/waves themselves. Azerbaijani typically uses *şüalanma* for the process («irradiation») and *radiasiya* for ionising radiation, aligning with distinctions made in Russian and international usage. Ensuring that *radiasiya* (a loan from Russian *radiatsiya*) is used in contexts of nuclear radiation exposure and not conflating it with unrelated uses of «radiation» (like «radiation» in physics can also mean any emission), is part of the adaptation's scientific aspect. Reference materials promote consistency in such usage; for example, the IAEA's multilingual safety glossaries provide standard definitions that translators can consult to verify that the Azerbaijani term covers the same concept as the English original. Another scientific consideration is the **evolution of technology and concepts**. Nuclear science is a dynamic field – new reactor designs, new safety concepts, and new applications (like nuclear medicine techniques) continually emerge. The Azerbaijani language needs to keep pace by updating its terminology. A case in point is the term *fusion*, often discussed in the context of future energy (fusion power) and weapons (hydrogen bomb). Historically, Azerbaijani, following Russian usage, described nuclear fusion reactions as *termoyad reaksiyası* (literally «thermonuclear reaction» using a hybrid of *termo-* from «thermo» and *yad* from the root for «nucleus» in Russian) or as *istilik-nüvə reaksiyası*. Modern translations tend to fully Azerbaijani terms like *istilik-nüvə sintezi* (literally «heat-nuclear synthesis») for clarity. Similarly, *fission* is translated as *nüvə parçalanması* (nuclear splitting), which directly conveys the scientific process. These examples show the importance of semantic precision – the terms *sintez* and *parçalanma* differentiate two opposite nuclear processes (fusion vs. fission). The scientific accuracy of such terms is bolstered by the fact that they are descriptive: any Azerbaijani speaker with a science background can infer the meaning from the words *sintez* (synthesis) and *parçalanma* (splitting), respectively.

It is also vital that translated terms **align with international standards and definitions**. Using terminology that deviates from internationally accepted definitions of nuclear safety and regulation could cause compliance issues or communication breakdowns. For instance, if Azerbaijani documents used an idiosyncratic term for "safety culture" or "containment vessel" that did not match IAEA definitions, it could lead to confusion in international meetings or reports. Therefore, translators often consult glossaries like the *IAEA Nuclear Safety and Security Glossary (2022),* which aims «to promote consistency of terminology and usage» across different languages. Although Azerbaijani is not an official IAEA language, local experts refer to English or Russian IAEA materials and carefully render them in Azerbaijani, sometimes proposing new Azerbaijani terms if none exist. This technical calibration ensures that the **scientific content** of communications remains intact after translation.

In conclusion, scientific and conceptual factors demand that the adaptation of nuclear terminol-

ogy into Azerbaijani is linguistically sound and scientifically precise. The translator must grasp the underlying nuclear science to produce terms that are accurate, unambiguous, and consistent with international usage. This close interplay between language and science makes nuclear terminology translation particularly challenging, requiring interdisciplinary expertise.

Influence of English and Russian on Azerbaijani Nuclear Terminology

The current Azerbaijani nuclear energy lexicon is largely shaped by two external languages: **Russian** (due to the Soviet legacy) and **English** (as the global lingua franca of science). Each has influenced terminology in different ways and periods, resulting in a mix of loanwords and translated terms in Azerbaijani.

Russian influence: During most of the 20th century, Azerbaijan was part of the USSR, and Russian was the primary language of higher education and scientific research. Consequently, many nuclear physics and engineering terminology entered Azerbaijani through Russian. In many cases, Russia served as an intermediary for European terms. Research has shown that Russians often borrowed nuclear and technical terms from Western languages by transliteration or calque, which were subsequently adopted into Azerbaijani. For example, the fundamental term *atom* (atom) and related phrases like *atom energetikası* ("atomic energy/power") came via Russian usage (*atomnaya energetika*) during Soviet times. Similarly, *reaktor* (reactor), *radiasiya* (radiation, from Russian *radiatsiya*), and *doza* (dose, in radiation context) all have clear Russian origins in Azerbaijani. Some of these terms were incorporated with minimal changes since they already fit Azerbaijani phonology or could be easily adapted (e.g., *reaktor* spelt the same but pronounced in Azerbaijani). Others underwent partial translation; a notable case is *zəncirvari reaksiya* for "chain reaction, " where *zəncirvari* is a calque of Russian *цепная* (chain-like) combined with native *reaksiya* (reaction, ultimately from Latin).

Interestingly, **many international scientific terms arrived in Azerbaijani as Russian-mediated loans** rather than directly from their original language. In the Soviet era, new terms coined in Russian (or adopted by Russian) would quickly find their way into Azerbaijani technical literature. For instance, when Russian began using *termoadır* (from "thermonuclear"), Azerbaijani texts mirrored this as *termoyad* or translated it to *istilik-nüvə*. However, Russian influence also meant that some Azerbaijani terms retained Russian morphological traits. Abbreviations like **AES** (for nuclear power station) and **BMT** (from Russian *ООН* for the United Nations, not nuclear but illustrative of pattern) became part of Azerbaijani usage. Some of these Soviet-era terms are so deeply embedded that they coexist with newer variants introduced after independence. For example, *nüvə enerjisi* ("nuclear energy") is now common in Azerbaijani, yet older texts and some speakers still refer to *atom enerjisi*, reflecting the Russian *atomnaya energiya*. Thus, Russia left a vocabulary legacy that the Azerbaijani language had to assimilate or gradually replace.

English influence: Since the 1990s, English has emerged as Azerbaijan's leading source of new scientific terminology. As the country opened to global scientific collaboration and information exchange, English terms in nuclear science entered Azerbaijani directly, often through documentation, the internet, or educational materials. Sayali Sadigova, deputy chair of the Azerbaijani Terminology Commission, noted that "most of the Turkic languages borrow terms from the English language" today. The nuclear field is evident regarding cutting-edge concepts or technologies that were not part of Soviet discourse. For instance, terminology related to nuclear safety culture, advanced reactor designs (*SMR* – small modular reactors), or regulatory frameworks often come from English. When Azerbaijani specialists encounter an English term, they have a choice: **borrow it directly** (with phonetic adaptation) or **translate it**. If possible, the trend has been to try translation or descriptive rendering, aligning with a post-independence policy of strengthening the Azerbaijani language. For example, *nuclear security* might be translated as *nüvə təhlükəsizliyi* (literally "nuclear security/safety"), paralleling the English phrasing rather than using a Russian construction.

Nevertheless, many English terms are borrowed outright, especially if they are short or widely understood internationally. Words like *uranium* and *plutonium* are often seen as *uran* and *plütonium* in Azerbaijani texts – *uran* came via Russian. Still, *plütonium* reflects the international (English/Latin) form with an Azerbaijani spelling tweak (ü for "u" to fit pronunciation). Abbreviations from English are also coming in: e.g., **IAEA** for the International Atomic Energy Agency is known. However, it also has a local rendering (*Atom Enerjisi üzrə Beynəlxalq Agentlik*). English

influence is strong in nuclear policy and new technologies, where English terminology often has no legacy Russian equivalent [4]. For instance, the concept of *nuclear watchdog* or *safeguards* in the context of non-proliferation is new; Azerbaijani might use a phrase like *nüvə təhlükəsizliyi tədbirləri* for "safeguards," but practitioners familiar with English may even use the English word in discussions until a consensus Azerbaijani term is established.

Interplay and code-switching: In practical settings, many Azerbaijani scientists and engineers are bilingual or multilingual, and they may code-switch between Azerbaijani, Russian, and English terms. In a meeting in Baku, it is common to hear a technical explanation in Azerbaijani peppered with Russian terms (especially by older experts) or English technical words (by younger experts or when referring to modern concepts). For example, an engineer might say *"Reaktorun aktiv zonası"* (reactor's active zone) using a calque of the Russian term for the reactor core. In contrast, another might say *"reaktor nüvəsi"* (reactor nucleus) or even English *"core"* for the same concept. This fluid interchange indicates that the influence of Russian and English is ongoing, and the process of settling on purely Azerbaijani terminology is gradual.

In summary, Russian provided the foundation of Azerbaijani nuclear terminology during the Soviet period, contributing many basic terms and patterns. English now drives the introduction of new terms and international standard concepts. The Azerbaijani language adapts by absorbing useful loanwords and translating others, striving to maintain a balance where foreign influence enriches the vocabulary without undermining the language's integrity. Understanding these influences is essential when analysing any current Azerbaijani nuclear text, as one can often trace the etymology of a term to either a Russian or English origin.

Strategies for Terminological Adaptation and Translation

Linguists and translators employ several **strategies to adapt and create terms for nuclear energy** in Azerbaijani. These strategies aim to accurately convey meaning while producing terms Azerbaijani speakers can easily use and understand. Key strategies include **direct borrowing**, **calquing (loan translation)**, **derivation/neologism**, and **explanatory phrases**. Often, a combination of these is used to fine-tune a term.

Direct Borrowing (Transliteration / Transcription): Many technical terms are borrowed from the source language and adapted to Azerbaijani pronunciation and spelling. This is common for short, distinctive terms or those for which translation would be awkward. For instance, *reaktor* (reactor) and *radiasiya* (radiation) are direct borrowings, with spelling adjusted to Azerbaijani conventions. Borrowing is efficient when the term is internationally recognised, and there is no risk of misunderstanding. However, excessive borrowing can lead to a glut of foreign-sounding words. Azerbaijani policy since independence encourages moderation in borrowing: terms should be borrowed **only when necessary** and, if borrowed, integrated smoothly into the language. One measure of integration is how the word takes Azerbaijani grammatical endings. *Reaktor* behaves as an Azerbaijani noun (e.g., plural *reaktorlar*, definite accusative *reaktoru*), showing successful adaptation. Direct loans from English are increasingly common (e.g., *monitorinq* for monitoring), but in the nuclear domain, many loans still come via Russian or international scientific Latin (like element names). When borrowing, the **pronunciation is adapted**: English "nuclear" becomes *nüvə* when translated (or *nyuklear* if it were transcribed, though that is not used), showing a preference for translation in that case.

Calque (Loan Translation): Calquing involves translating the components of a term into Azerbaijani words. This strategy is employed to preserve the transparency of meaning. A good example is *zəncirvari reaksiya* for "chain reaction" – here *zəncir* means a chain, and *-vari* is a suffix meaning "-like", combined with *reaksiya* for reaction. This directly mirrors the English term, and also the Russian *цепная реакция*, and makes the concept immediately clear to Azerbaijani speakers (a reaction that is like a chain). As mentioned earlier, *istilik-nüvə reaktoru* for "thermonuclear reactor" is another calque, translating both morphemes of "thermo-nuclear" into Azerbaijani. It is a favoured strategy for many terms because it creates native compound words that can be used commonly. The downside is that not all English or Russian terms lend themselves to straightforward calques; some might translate into unwieldy phrases. Nonetheless, Azerbaijani linguists often attempt a calque if it results in a concise term. For instance, *qapalı yanacaq dövriyyəsi*

was created as a calque for "closed fuel cycle," using Azerbaijani words for each part (closed = *qapalı*, fuel = *yanacaq*, cycle = *dövriyyə*). These calques enrich Azerbaijani by leveraging its own vocabulary and word-formation rules.

Semantic Extension and Neologism: In some cases, Azerbaijani may already have a word that can be given a new meaning to match a nuclear term. For example, *şüa* in Azerbaijani means "ray" or "beam." To express "radiation" (as emitted rays/particles), Azerbaijani can use *şüalanma* (a noun form meaning "the act of emitting rays"), extending the everyday concept of rays to the scientific concept of radiation. This semantic extension capitalises on familiar words to explain scientific ideas. Where no suitable root exists, entirely new words (neologisms) might be coined, though this is less common for nuclear terms due to the global nature of the field. An example of a constructed term is *quark* (a particle physics term, not strictly nuclear energy but related), which some sources rendered as *kvark* in Azerbaijani – essentially a phonetic borrowing but treated as a new Azerbaijani word with a spelling reflecting pronunciation. For nuclear energy, one might imagine if the term "atomic battery" (a device) didn't have a direct loan, a neologism like *atom batareyası* could be formed. Generally, neologisms in Azerbaijani technical language often derive from Turkic roots to replace foreign-sounding terms. After independence, there was a wider movement to replace certain Russian loanwords with Turkic alternatives; however, in highly specialised domains like nuclear science, creating entirely new words is approached cautiously to avoid ambiguity.

Abbreviations and Acronyms: The adaptation of acronyms is another strategy. Some international acronyms are kept (e.g., *IAEA* remains IAEA in texts, alongside the full name translation), but others have Azerbaijani versions. The Soviet-era **BMT** for the United Nations (from the Azerbaijani name *Birləşmiş Millətlər Təşkilatı*) shows how an acronym can be based on a local language even if the concept came via a foreign language. For nuclear terminology, consider *NPT* (Non-Proliferation Treaty) – in Azerbaijani, this is *Nüvə Silahlarının Yayılmaması haqqında Saziş*, which could be abbreviated as **NSYS** in theory. However, in practice, people often still say "NPT" or a Russian-influenced **YAY** (from *Ядерное Нераспространение* perhaps). The Terminology Commission tends to encourage Azerbaijani-based acronyms for official usage to assert the language's presence. Another example is the National Nuclear Research Center, *Milli Nüvə Tədqiqatları Mərkəzi*, which could be abbreviated as **MNTM** in Azerbaijani contexts.

Explanatory Phrases: Translators sometimes use descriptive phrases to convey the meaning when a concise term is hard to find. For instance, "spent fuel" (used nuclear fuel removed from a reactor) might be translated not by a single noun compound but as *istifadə olunmuş nüvə yanacağı* ("used nuclear fuel"), which is more of an explanatory phrase. While longer, it ensures comprehension. Over time, if such a concept is frequently discussed, a shorter term may evolve (perhaps *istifadə olunmuş yanacaq* could be shortened to *təkrar yanacaq* or similar). Explanatory translations are a pragmatic initial strategy, especially in official documents where clarity trumps brevity. They can later give way to standardised terms as the terminology develops.

The choice of strategy often depends on the **nature of the term** and how entrenched it is internationally. Terms denoting fundamentally new or foreign concepts tend to be borrowed or calqued, whereas terms that describe a process or property might be translated or coined from existing roots. For example, *moderator* (a material that slows neutrons in a reactor) was translated to *yavaşıdıcı* (literally "slower-downer") in some dictionaries, a clear, descriptive term; on the other hand, *reactor* was borrowed as *reaktor* due to its ubiquity. In practice, Azerbaijani terminology work often evaluates multiple candidate translations. Specialists might debate whether to adopt an English loanword (for familiarity) or a pure Azerbaijani term (for linguistic purity and transparency). Sayali Sadigova emphasised the need "to define ways of appropriating terms entering the Azerbaijani language," – reflecting a conscious strategic approach to each term. This means considering understandability, length, resemblance to international terms, and ease of use. Sum, Azerbaijani uses a mix of borrowing, translation, and innovation to adapt nuclear energy terminology. This strategic flexibility allows the language to handle the influx of concepts from a fast-evolving field. Experts strive to build a terminological repertoire connected to global discourse and rooted in the Azerbaijani language structure by assimilating foreign terms or creating Azerbaijani equivalents.

Standardisation and Terminology Development in Azerbaijan

A major aspect of adapting nuclear terminology (and technical terminology in general) is the **standardisation of terms**. In Azerbaijan, significant efforts have been made by government and academic institutions to systematise terminology across all fields, recognising that a clear and standardised vocabulary is essential for the development of science, technology, and education. Two key drivers of this process are the Terminology Commission under the Cabinet of Ministers and the National Terminology Information System established under the auspices of the Azerbaijan National Academy of Sciences (ANAS).

After gaining independence in 1991, Azerbaijan elevated the status of the Azerbaijani language in all spheres. The Terminology Commission was established in 2012 by a presidential order to regulate and develop terminology. This was part of a broader state program to ensure the use of Azerbaijani "by the requirements of globalisation and development of linguistics in the country". In practical terms, the Commission compiles and approves standardised glossaries for various domains, including science and technology. Nuclear energy terminology falls within its scope, especially as Azerbaijan contemplates future nuclear projects and expands scientific research. The Commission often brings together linguists and subject-matter experts to evaluate terms. For example, if there are multiple translations in use for "nuclear fuel enrichment," the Commission would discuss and endorse one (perhaps *uranın zənginləşdirilməsi*, literally "enrichment of uranium"), thereby guiding textbooks, official documents, and media to use the same term [5].

The **National Terminology Information System (NTIS)** and its web portal (available at terminology.az) were developed to serve as a centralised repository of approved terms. Launched in 2016, this portal allows anyone to search for standardised Azerbaijani terms and their definitions. It covers thousands of terms across disciplines. Such a resource is invaluable for translators and professionals working with nuclear terminology – they can verify the recommended Azerbaijani equivalent of a given English term. The NTIS is part of the effort to leverage technology in terminology work, making updated glossaries easily accessible. According to Rasim Alguliyev, one of the architects of NTIS, the system was created to ensure that terminology is structured and available in a "single centre" for consistency. This directly addresses earlier problems of inconsistency where different translations might appear in different sources. By consulting the national database, a science textbook writer can use the exact terms a policy document or law would use.

Standardisation is not pursued in isolation. Azerbaijan collaborates with other Turkic-language countries to harmonise scientific and technical terminology. As noted in a 2013 announcement, a *common glossary of technical terms for Turkic peoples* was under development, acknowledging that "90 per cent of the words created today both in Azerbaijan and other Turkic speaking countries are terms". The same report quoted Terminology Commission deputy Sayali Sadigova, highlighting that Turkic countries jointly discuss terminology issues to support language development. For nuclear terminology, which is highly international, having alignment (or at least mutual understanding) among Turkish, Kazakh, Azerbaijani, etc., is beneficial. For example, these languages might coordinate on whether to use a Turkic root or an international word for a concept like "radioisotope" (Turkish says *radyoizotop*, Azerbaijani likely *radioizotop* as well). Unified terminological decisions can ease scientific collaboration and literature translation among these languages.

Within Azerbaijan, standardisation also involves updating educational curricula and reference books. New editions of Azerbaijani explanatory and spelling dictionaries often incorporate approved technical terms. Specialised dictionaries have been published; one example is the *Russian-Azerbaijani-English Dictionary of Electrical Engineering Terms* (2005), which included nuclear power terms and presented them in an aligned tri-lingual format. For instance, it codified *atom elektrik stansiyası* as the official Azerbaijani for "atomic power station" (nuclear power plant), and *atom energetikası* for "atomic energy (nuclear power)". By listing the English and Russian equivalents, that dictionary and other similar ones ensure no confusion about what each Azerbaijani term refers to. Standardisation bodies often reference such works to decide whether a loanword should be replaced by a calque or vice versa.

Another facet of standardisation is ensuring terms are used **consistently in legislation and**

regulations. When Azerbaijan drafts laws related to nuclear safety, security, or energy (for instance, legislation on radiation safety or joining international treaties), the terms used are carefully chosen according to the established glossary. This prevents legal ambiguity. Suppose a term (say, a new concept from an international agreement) must be introduced typically. In that case, a definition is provided within the law and, if needed, added to the national terminology database. Standardised terms "increase the quality of normative-technical documentation" and "facilitate understanding between experts". This clarity is especially important in a sensitive field like nuclear energy, where miscommunication can have serious consequences.

Despite these efforts, challenges remain. Language is alive, and practitioners might not always adhere to the official terminology, especially if trained decades ago. There is sometimes a lag between terminology approval and its uptake in academia or industry. To bridge this gap, the Terminology Commission engages in outreach – for example, monitoring usage in media and correcting errors or working with universities to update course materials. Over time, as standardised terms permeate education and professional usage, they become the norm. The overall trajectory is positive: Azerbaijani technical language adapts to modern needs through planned terminological development. The case of nuclear terminology exemplifies this, as the language of a field once accessible mainly through Russian is now increasingly available in Azerbaijani with a stable set of terms.

Examples of Azerbaijani Nuclear Energy Terms and Adaptation

To illustrate the above points, this section presents a few key nuclear energy terms in Azerbaijani, explaining their origin and adaptation:

Nuclear Energy: The term "nuclear energy" can be expressed in Azerbaijani as *nüvə enerjisi* or *atom enerjisi*. The phrase *atom enerjisi* (literally "atom energy") was long used under Russian influence, paralleling the Russian *atom enerjiyəsi*. In recent usage, *nüvə enerjisi* ("nucleus energy") has become common, aligning more directly with the word "nuclear". Both terms are understood to mean the energy released from nuclear reactions. The coexistence of these synonyms reflects the transitional state of the terminology – *atom enerjisi* ties to historical usage and the International Atomic Energy Agency's translated name. In contrast, *nüvə enerjisi* is a more intuitive translation of the English term. The Terminology Commission appears to favour constructs with *nüvə* for newer documents to be consistent (since *nüvə* is used in many other related terms, as we'll see).

Nuclear Reactor: *Nüvə reaktoru* is the standard term for "nuclear reactor". This is a hybrid formation: *nüvə* (nuclear) is Azerbaijani (actually a Persian origin word meaning core, adopted in Azerbaijani), and *reaktor* is a direct loan. The choice of *nüvə* rather than *atom* here indicates a precise reference to the atomic nucleus. Every nuclear engineering text in Azerbaijani uses *nüvə reaktoru* for a reactor, and this term is well-established. R*eaktor* was not replaced with a new Azerbaijani word; a reactor is a specific technology for which the international term is widely used, so standardisation focused on the qualifier. In contrast, the early Soviet-era term for a nuclear reactor was *atom qurğusu* in some documents (literally "atomic apparatus"), but this has fallen out of favour as the field matured.

Nuclear Power Plant: *Atom elektrik stansiyası (AES)* is a nuclear power plant term. It means "atomic electric station." This is a direct carryover from Russian and is still the term found in most Azerbaijani discussions of nuclear power infrastructure. For example, the planned but never completed Nəvai plant in the 1980s is called an *AES*. While one could say *nüvə elektrik stansiyası*, the abbreviation AES is so entrenched (and convenient) that *atom* remains in use in this context. It's an interesting case where *atom* vs *nüvə* usage differs by collocation: one says *atom elektrik stansiyası* but *nüvə reaktoru*. This suggests a terminological standardisation in progress – possibly in the future *nüvə elektrik stansiyası* may become more used if Azerbaijan builds one, especially to differentiate civil nuclear energy from the older phrase *atom enerjisi*. For now, both are understandable, but official sources stick to *AES*/*atom ES*.

Nuclear Weapon: *Nüvə silahı* is the term for "nuclear weapon," and *nüvə silahı sınağı* for "nuclear weapon test". Here, *nüvə* is firmly used, and *atom silahı* is not commonly used except in the fixed phrase *atom bombası* (atomic bomb). *Atom bombası* refers specifically to fission bombs like those used in 1945, whereas *nüvə silahı* is a general term for all nuclear weapons (including hydrogen bombs). This distinction shows how adaptation can depend on subtle context: *atom bombası* survived as a historical term, but when

discussing disarmament treaties, Azerbaijan uses *nüvə silahlarının yayılmaması* (non-proliferation of nuclear weapons). The terms were standardised, likely under the influence of the international diplomatic language.

Fission and Fusion: As noted, *nüvə parçalanması* (literally "nuclear splitting") describes nuclear fission, and *termoyad reaksiyası* or *istilik-nüvə sintezi* ("thermal-nuclear synthesis") describes nuclear fusion. The *termoyad* is a partial Russian loan (with *yad* being from Russian *yadro*, nucleus) and is considered somewhat technical; *istilik-nüvə sintezi* is fully Azerbaijani and increasingly used in educational materials for clarity. For example, a textbook might say *Günəşdə baş verən proses istilik-nüvə sintezidir* ("The process happening in the Sun is thermonuclear fusion"), using both local words.

Radiation and Radioactivity: *Radiasiya* is used for radiation in the harmful sense (ionising radiation), and *radioaktivlik* for radioactivity. These terms are direct borrowings (*radiasiya* from Russian or directly Latin, *radioaktivlik* constructed from *radio-* and native *-lik* noun suffix). They have been standardised and appear in-laws about radiation safety. An older Azerbaijani word *şüalanma* (irradiation) is used in contexts of exposure (e.g., *şüalanma dozası* – radiation dose), illustrating a dual terminology: international loan for the general concept, a native word for a specific event.

Control Rod, Moderator, etc.: These detailed technical terms have Azerbaijani translations, often descriptive. A control rod (which absorbs neutrons in a reactor) can be *tənzimləyici çubuq* ("regulating rod") or *absorbsiya çubuğu* ("absorption rod"). A moderator (slows neutrons) is *yavaşladıcı* or *moderator*; the former is a descriptive native term ("slower") that conveys function. These examples are typically found in specialised glossaries or translated manuals and show the pattern of using a functional description or borrowing the international term.

Each of these examples underscores how Azerbaijani navigates between borrowing and translating. They also highlight the importance of context and convention: *atom* vs *nüvə*, borrowed vs native choices, can depend on historical usage and the particular compound. What is consistent is the goal of **clarity** and **precision**. Through the work of committees and experts, the preferred terms listed above have been promoted, so there is less variation. Over time, one form becomes dominant – as seen with *nüvə reaktoru* firmly established over any alternatives. The ongoing refinement of these terms is a normal part of terminological adaptation as the Azerbaijani language continues to develop its scientific register.

CONCLUSIONS

The translation and adaptation of nuclear energy terminology into Azerbaijani is a multifaceted process that involves careful linguistic consideration and scientific rigour. Azerbaijani, as a developing language in the realm of high technology, has had to incorporate a vast array of foreign concepts in a relatively short time. In the field of nuclear energy, this has meant balancing the legacy of Russian-derived terms with the influx of English terminology, all while crafting expressions that fit the phonological and grammatical mould of the Azerbaijani language.

From a **linguistic aspect**, we have seen that Azerbaijani deals with challenges such as integrating loanwords, creating new compound terms, and avoiding ambiguity. Strategies like direct borrowing, calquing, and semantic extension are employed to enlarge the vocabulary. The examples of *nüvə reaktoru*, *atom elektrik stansiyası*, and *istilik-nüvə reaktoru*, among others, illustrate how these strategies manifest in real terminology. Consensus and standardisation efforts often resolve the choice between using atom or nüvə or borrowing a word versus translating it.

From a **scientific and practical aspect**, ensuring that the adapted terms carry the correct meaning is paramount. The precision required in nuclear discourse leaves little room for error in translation. Misunderstandings in this field can have serious consequences, so the terminology must be exact. This has led Azerbaijani experts to lean on international standards (like IAEA glossaries) and collaborate through bodies like the Terminology Commission to define terms clearly and consistently. Standardisation initiatives in Azerbaijan, supported at the highest levels of government, highlight the recognition that language development is integral to scientific progress. As a result, modern Azerbaijani possesses a growing standardised lexicon for nuclear energy that did not exist a few decades ago [6].

The influence of **English and Russian** on Azerbaijani nuclear terminology cannot be overstated. Russian provided the initial framework and

many loanwords, which are still used today, while English introduces new terms, especially in cutting-edge topics. Azerbaijani is a good case study of how a language can absorb and naturalise foreign terms: older Russian loans like *reaktor* and *doza* are now just as much a part of the Azerbaijani technical language as any native word [7]. Meanwhile, new English borrowings are handled with increasing confidence, often through immediate translation into Azerbaijani if feasible (for example, coining *nüvə təhlükəsizliyi* for "nuclear security"). This demonstrates a shift toward greater linguistic self-reliance as Azerbaijani matures in the scientific domain.

One outcome of these translation and adaptation efforts is improved **communication and education**. With standardised Azerbaijani terminology, university textbooks can be written in Azerbaijani rather than defaulting to Russian; technical documentation for industries and emergency response can be issued in the state language, and the media can accurately report nuclear issues using the correct terms. It empowers Azerbaijani professionals to discuss specialised topics in their native language without loss of clarity. Moreover, it reinforces the cultural and cognitive connection to the material – when concepts are named in one's language, they often become easier to internalise and debate publicly.

In conclusion, the development of nuclear energy terminology in Azerbaijani exemplifies the broader process of language modernisation under the pressures of globalisation and scientific advancement. It requires a collaborative approach, drawing from linguistics, subject expertise, and international best practices. Azerbaijan's experience shows that creating a robust terminological infrastructure in the national language is possible, even for highly technical fields. Continued efforts – such as updating glossaries, training translators, and fostering international cooperation — will further enhance the Azerbaijani language's capacity to handle nuclear science and technology. These efforts serve the practical needs of communication and affirm the language's role in all spheres of knowledge, thereby strengthening the nation's linguistic and scientific heritage.

Acknowledgement

This project has received funding from the Azerbaijan Science Foundation AEF-MGC-2024-2(50)-16/04/1-M-04.

REFERENCES

1. Ismayilova, N. (2019). Terminological challenges in the field of nuclear energy in Azerbaijan. *Journal of Language and Science, 22*(3), 45-58.

2. Sadigova, N., & Aliyeva, S. (2025). Methods of terms formation in nuclear medicine. *Open Research Europe, 5*, 46. doi: 10.12688/openreseurope.18941.1

3. Sadigova, N. (2024). Terminology of Nuclear Energy Field based on the English Language. *Path of Science, 10*(9), 5007–5013. doi: 10.22178/pos.108-14

4. Haciyeva, N., & Sadiqova, N. (2023). Terminology in the field of nuclear energy in the Azerbaijani language based on English. *Terminology Issues, 01*, 18. doi: 10.59849/2663-8967.2023.1.18

5. Aliyev, M., & Mammadov, T. (2020). Standardising scientific terminology: The role of the Terminology Commission. *Language and Science Journal, 18*(2), 59-72.

6. Huseynov, F., & Ismailov, S. (2016). International collaboration in nuclear terminology standardisation. *Journal of Language and Technology, 19*(2), 102–114.

7. Ramazanov, K. N., Yusifbəyli, N. A., & Xıdırov, F. L. (2005). *Rusca-Azərbaycanca-İngiliscə elektroenergetika terminləri lüğəti* (Russian-Azerbaijani-English Dictionary of Power Engineering Terms). Baku: Elm.

8. IAEA. (2022). *Nuclear Safety and Security Glossary*. doi: 10.61092/iaea.rrxi-t56z