

Strategies on the English-Chinese Translation of Petroleum Engineering English

Shuyue Wang

Foreign Language School, China University of Petroleum, Qingdao 266400, China

Abstract: Based on Eugene Nida's functional equivalence theory, this article delves into the language features of petroleum engineering English from the three dimensions of vocabulary, syntax and discourse. With practical translation examples for illustration, several translation strategies are developed at each level respectively, such as contextual domestication, ground supplement, unity in form and spirit, transfer from dynamic to static at lexical level; flexibility in form, adjustment of word order and division at syntactical level; recognition and reconstitution in discourse, which have certain referential value for the E-C Translation of petroleum engineering English and the international connectivity of petroleum.

Keywords: Functional equivalence theory, English for petroleum engineering, language features, English-Chinese translation, translation strategies.

1. Introduction

Oil is an important kind of energy to support the global economic development, which is closely related to the national economy and people's livelihood of all countries. Since the outbreak of COVID-19, the supply pattern of the global oil industry has changed greatly, which has prompted the petroleum engineering field to deepen the international cooperation of the whole industry chain. In this process, English translation of petroleum engineering plays an important role as a language bridge. The author took all the journals of CNKI as the data source, and searched them by advanced retrieval method, with the literature classification as "translation" and setting "petroleum Engineering English" as the key word. A total of two journal articles were retrieved: Yuan Sen, Zhao Jing (2019) studied the function of "zero translation" in petroleum engineering term translation; Chen Ke and Xiang Qian (2019) took petroleum engineering English literature as an example to study the phenomenon of "zero translation" of English for Science and technology in the context of big data. It can be seen that in recent years, scholars have studied petroleum engineering English translation, but most of them focus on the micro level such as translation phenomenon description and do not propose targeted translation strategies. Therefore, this paper analyzes the characteristics of petroleum engineering English language and puts forward corresponding translation strategies from both micro and macro perspectives.

2. Functional Equivalence Theory and Feasibility

Influenced by Chomsky's theory of transformational generative grammar (1957), American translator Eugene Nida (1969) pioneered two basic directions of equivalence: formal equivalence and dynamic equivalence. The former requires the translation structure close to the original; the latter indicates that equivalence includes four aspects: vocabulary, syntax, text and style. On the one hand, this theory provides some theoretical guidance for the translation of petroleum engineering English into Chinese in the aspects of

information transmission, cohesion and coherence; on the other hand, it fully considers the consistency between the target language and the source language. This theory was introduced into China in the 1970s and 1980s and received extensive attention from translation scholars, providing an important theoretical support for practical stylistic translation. To sum up, it is feasible to apply this theory to the translation of petroleum engineering English into Chinese.

3. Features of Petroleum Engineering English

Petroleum engineering English mainly involves the exploitation of oil and gas reservoirs and the implementation of a series of engineering and technology on the ground, covering reservoir, drilling, cementing, oil production, refining, gathering, petroleum surface engineering and other aspects. In terms of style, petroleum engineering English belongs to scientific and technological texts. Petroleum engineering English has intensive terminology and strict logic, with distinct lexical, syntactic and textual characteristics. The main forms include research literature, reports for research result, petroleum equipment specifications, agreements and contracts, popular science books, etc.

3.1. Lexical Features

3.1.1. Specification of Common Nouns

Scientific and technological articles require accurate diction and try to avoid ambiguity or polysemy. The sources of scientific and technological vocabulary are divided into three categories. One is to borrow the original words in English and give new meanings. The other is to absorb many words from Latin and Greek. The third category is coined words. Petroleum engineering English vocabulary is usually endowed with special meaning of professional field, and the meaning is accurate and specific to describe objective facts for science. For example, trap has the common meaning of "dilemma" or "capture", etc., but in the field of petroleum engineering, it mostly refers to a place in the rock layer that can prevent the transfer of oil and gas and store oil and gas).

Table 1. Examples of Specialization of Terms in Petroleum Engineering English

Term	Common Meaning	Specific Meaning
envelope	信封	围岩
core	核心	岩心
formation	形成	地层
fault	过失	断层
fraction	部分	馏分
trip	旅行	起下钻
sour	酸的	含硫的
sweet	香甜的	不含硫的

3.1.2. Metaphorization of Concrete Nouns

Conceptual metaphor is a projection process between the source domain and the target domain. Petroleum Engineering

English has a large number of terms that are similar in shape or function to animals, plants, human organs, etc., and has obvious metaphorical characteristics.

Table 2. Examples of Metaphorization of Concrete Terms in Petroleum Engineering English

Term	Literal Meaning	Metaphorical Meaning
gooseneck	鹅颈	鹅颈管
dogleg	狗腿	水平井开始弯曲的部位
killer well	杀手井	救援井
monkey board	猴台	井架二层工作台
doghouse	犬舍	井场值班房

3.1.3. Generalization of Abbreviations

The abbreviation of abbreviation is one of the common word formation methods in the field of petroleum engineering. Abbreviations of petroleum engineering mostly exist in the names of petroleum institutions or companies, petroleum societies or associations, petroleum equipment and processes, such as CNPC (China National Petroleum Corporation), API (American Petroleum Institute), FPSO (Floating Production

Storage and Offloading), etc.

3.1.4. Nominalization of Words

Vocabulary of petroleum engineering English also has an obvious tendency of nominalization. That is, clauses may be transformed into nominal structures, or verbs and adjectives may be transformed into nominal words, thus effectively avoiding subjects of the sentence to be too abstract. Examples are as follows:

Table 3. Examples of Nominalization of Part of Speech Conversion

Term	Part of Speech	Word meaning	Nominalization	Word Meaning
perforate	动词	射孔	oil well perforation	油井射孔
distill	动词	蒸馏	atmosphere distillation	常压蒸馏
complete	动词	完井	permanent completion	永久完井
viscous	形容词	黏性的	fluid viscosity	流体粘度
porous	形容词	多孔的	reservoir rock porosity	油藏岩石孔隙度

3.2. Syntactic Features

3.2.1. Passive Voice

Petroleum engineering English belongs to the category of English for science and technology, which focuses on objectivity. Passive voice effectively highlights its objectivity to emphasize objective principles or facts. Here is an example:

(1) The drill string is suspended in the derrick by a hook attached to a travelling block.

In this example, the passive voice is used to place the patient drill string in the subject position, emphasizing the objective fact that the drill string is hung on the hook.

3.2.2. Non-Predicate Verbs

Petroleum engineering English often uses non-predicate verbs, whose flexible position and function are often used to describe complex phenomena and principles in petroleum. Here is an example:

(2) When an area appears promising, it is worth making a seismic study. This involves using explosion to generate

seismic waves, which are picked up by an array of sensors.

The three present participles in this example emphasize the necessity and method of seismic exploration in areas with exploration potential, making the sentence logical and compact.

3.2.3. Compound Long Sentences

Due to the fact that petroleum engineering English often needs to add modifiers to describe the principle of facts, and there is a subject-predicate mechanism in English, compound long sentences are widely used in petroleum engineering English.

(3) An exception that is becoming more common is in some offshore fields, where production from subsea wells, or sometimes the commingled production from several wells, may be transported long distances before any phase separation takes place.

The two clauses in this sentence are respectively modified to define exception and offshore fields. Namely, unlike oil, gas and water are mostly transported after separation on the

ground, and the crude oil from offshore oil fields will be transported to onshore treatment plants for separation.

Generally speaking, Chinese emphasize time order and logical order according to time sequence and logical cause and effect. Therefore, from the perspective of temporal order, Chinese generally prefer to express as follows: first old information, then the new information; first partial, then positive; first cause, then effect; first hypothesis, then argument; concession, then inference; condition, then result, etc. In the same information structure, if there is both time and place, time would be expressed before place, because the Chinese expression order is basically: time → place → person → event → way. In comparison, English writing is flexible in time and logical order because of the subject predicate mechanism. If there are statement parts (judgment, conclusion, etc.) and narrative parts in the text, the English language always mentions them first and then narrates them separately. That is, the tendency of pre-supposed statement is more prominent, which is why writing English compositions is generally to write topic sentences first and then give examples or details; Chinese tends to separate statements before summarizing. That is, the tendency of concluding statement is prominent. Therefore, when translating long sentences in English, it is necessary to clarify the relationship between meaning groups. According to the Chinese customs, the following methods can be used: sequential translation, reverse order, segmentation, embedding, and sometimes insertion, splitting, recombination, etc.

3.3. Pragmatic Features

English, as a hypotactic language, emphasizes the explicit logical connection in the expression of logical relations between sentences in a paragraph. Halliday and Hasan (1976) argued that the means of connection is generally expressed by connecting elements such as and, therefore, however, and in addition, etc. It requires the translator to accurately analyze the logical connection between the sentences, so as to obtain a translation version with a tight structure and clear logic.

Petroleum engineering discourse focuses on logical cohesion and semantic coherence, and has unique structural and non-structural cohesion. The former is embodied in the relationship between information and structure within a sentence, such as thematic structure. The latter is embodied in lexical cohesion and grammatical cohesion. In order to achieve the coherence and smoothness of the text, grammatical cohesion is embodied in five types of cohesive devices such as substitution, reference and anaphora, etc.

Therefore, understanding the original text is the first step in the translation process. In the understanding of the original text, it is often unable to solve all problems simply by limiting to superficial language phenomena. Therefore, in many cases, the grammatical structure and true meaning of an English sentence can not be achieved by grammatical analysis alone. Some sentences can have several different possibilities in terms of grammatical structure and several different interpretations in terms of semantics and pragmatics. At this time, grammatical analysis can only be an auxiliary means to provide translators with several possible understandings. In this case, the translator must comprehensively analyze the linguistic environment, context and relevant relations of sentences.

4. English Translation Strategy for Petroleum Engineering

Based on the above characteristics of petroleum engineering English, the author proposes the following translation strategies at the lexical, syntactic and textual levels.

4.1. Translation Strategy of Vocabulary Equivalence

4.1.1. Specialization of Common Nouns: Contextual Domestication

The translation of petroleum engineering English terms should take into account the external and internal context. The translator should first adapt to the unique terminology system in the field of petroleum engineering, and at the same time specify the exact meaning of terms according to the context. First, it conforms to the unique terminology system in the field of petroleum engineering to achieve equivalence of language functions. For example, the word “power” can be expressed as rate of work, power source and power in physics, electricity and mathematics respectively. In petroleum engineering, it is usually expressed as “transmission”, such as power liquid. Here are some examples of deposit:

(4) Thus, a seismic study is acquired and analyzed for the location of deposit.

translation: 因此, 通过地震勘探并对其分析, 即可确定油气藏的位置。

(5) Firstly, the deposit must be estimated and its parameter must be determined and then be investigated whether it deserves to be developed by considering all the available data.

translation: 首先, 预估储量并确定参数, 根据现有数据研究其是否有开发价值。

(6) If sufficient wash water is not injected, deposits of ammonium chloride can form, causing serious corrosion.

translation: 若注入的洗井液量不足, 可能会形成氯化铵沉淀物, 造成严重腐蚀。

Case five mainly shows that seismic exploration and analysis is an important way to locate oil and gas reservoirs, so it is most appropriate to translate disposition into “oil and gas reservoirs”; Case six emphasizes the conditions such as parameters, so it should be translated as “reserves”. Similarly, in case seven, the component of ammonia chloride after deposit can be determined as “sediment”. Here is another example:

(7) Atmospheric and vacuum distillation are closed processes, and exposures are minimal.

translation: 常压蒸馏和减压蒸馏都是闭式运行工艺, 人员接触有害物的可能性极低。

When translating, we should determine the meaning of words in the context. For example, here exposure should be interpreted into (harmful substances) leakage.

4.1.2. Metaphorization of Figurative Nouns: Ground Supplement

When translating metaphorical terms in petroleum engineering English into Chinese, there may be a cultural gap between the source domain and the target domain. Therefore, appropriate translation can be added to achieve the dynamic equivalence in semantics.

For example, in the field of petroleum engineering, wildcat mostly refers to exploratory wells (in the early days of the oil boom in Texas, many exploratory wells went deep into desert land, and drilling workers often hunted a wild cat and hung its fur on the derrick). If it is translated as “wild cat”, it will

bring readers some obstacles in understanding. If it is translated as “wild cat well”, it can better express its cultural image and function.

4.1.3. Generalization of Abbreviations: Unity in Form and Spirit,

As petroleum engineering covering a wide range and a large interdisciplinary classes, the Chinese translation of English abbreviations in petroleum engineering needs to combine meaning with shape, form and spirit, and context driven to cope with multiple interpretations and avoid mistranslation. For example, the term CCR can refer to both Conradson Carbon Residue and Continuous Catalyst Regeneration. Therefore, it is necessary to figure out the specific reference when translating. At the same time, translators should have their own experience and background knowledge in petroleum engineering translation, and consult the petroleum engineering experts for verification when necessary.

4.1.4. Nominalization of Words: Transfer from Dynamic to Static

When translating nominalized structures into Chinese in petroleum engineering English, it is necessary to add category words appropriately according to the context, such as the category of phenomenon, technology, process and other concepts, so as to specify the nominalized structures with verb potential. For example, well testing, according to the context, which can be translated into “well testing technology” by adding the categorical word “technology”, thus making the target language more appropriate to the context and easy for readers to understand.

4.2. Translation Strategy in Syntactic Equivalence

4.2.1. Using the Passive Voice: Flexibility in Form

The Chinese translation of passive structure in petroleum engineering English requires the translator to identify its deep structure, which is often accompanied by changes in form, such as the treatment of passive sentences into active sentences, non-subject sentences, generic subject sentences, etc. Nida emphasized that sometimes meaning is more important than form. In order to convey sentence meaning accurately, the translation of special sentence patterns shall be flexible. For example, the Chinese translation of parenthesis can retain its original form, treat it as the text, or flexibly adapt it to the structure with bracket, dash, comma, etc. Here are some examples:

(8) Petroleum—shorthand for hydrocarbon oils and gasses as well as solid hydrocarbons such as asphalt deposits—occurs in the pores of rock formation in the earth’s crust.

translation: 石油, 是烃类油气流体以及固态烃(如沥青沉积物)的简称, 蕴藏在地壳岩层的孔隙中。

The original sentence uses dashes as parentheses, and the dashes can be omitted when translating into Chinese; At the same time, appropriate brackets can be added to make the translation clear in meaning.

(9) The multiplicity of carbon compounds is explained by the exceptional ability of carbon atoms to combine with one another to form long continuous chainlike structures containing many carbon atoms.

translation: 碳化合物之所以为数众多, 是因为碳原子互相结合的能力特别强从而能形成包含许多碳原子的一长列连续链状结构。

This sentence has a passive structure on the surface, while its deep structure emphasizes the relationship between the large number of carbon compounds and the strong binding ability of carbon atoms. If it is translated into “interpreted as...”, it is obviously undesirable. When translating into Chinese, it is necessary to identify the deep structure of the source language and translate it into “the reason for...” to accurately express its logical relationship. For another example:

(10) In Europe, both in ancient times and in the Middle Ages, wells were sunk to obtain water and later for prospecting shallow ore lodes.

translation: 在欧洲, 从古代到中世纪, 人们凿井取水, 后来凿井探测浅层矿脉。

Here the passive voice is converted into a general subject sentence under certain circumstances. When the subject is difficult to determine, Chinese often uses generic terms such as “people”, “everyone”, “someone” and others as subjects.

(11) The rotary drilling method, developed in the United States at the end of the 19th century for the exploration and development of oil deposits, was an important step forward.

translation: 美国于19世纪末开发了旋转钻井技术, 用于油藏的勘探和开发, 这是一项重大进步。

The adverbial “in the United States” becomes the subject of “America”. Secondly, the use of the extraneous structure “...this” makes the expression concise and clear. The so-called extrinsic structure refers to the fact that a number of facts or details are stated before, and then this kind of words are used to replace the preceding part.

4.2.2. Using of Non-finite Verb Structure: Adjustment of Word Order

The structure and usage of non-finite verbs are flexible, which can serve as the predicator and adverbial of a sentence. The word order in Chinese translation can be adjusted according to their position and role. Non-finite verb are often used as attributives, either before or after the head word. For the one case, the original form is generally retained. In addition, the translation is either pre-positioned or split into independent clauses. Here are some examples:

(12) The forces acting against migration are the capillary forces and the resistance to flow through rocks with low permeabilities.

translation: 阻碍运移的力包括毛细管力和低渗透率岩石的流动阻力。

The two non-finite verbs in this sentence are both attributives, which should be positioned before the antecedent to adapt to the characteristics of Chinese short attributives.

(13) Increasingly, natural gas transmission lines deliver directly to large end users...bypassing LDCs.

translation: 不过, 新的趋势是, 输气公司绕开配气公司, 直接将天然气输送给终端大客户.....

Bypassing is an adjunct to deliver, but the two actions have some causal relationship in logic. The Chinese expression order is because the first result comes after the second, so bypassing is put in front; Second, two verbs are processed in parallel.

(14) They purchase natural gas and then provide transportation of the natural gas to residential, commercial, and industrial consumers, charging one fee for the service and the natural gas.

translation: 配气公司购买天然气, 然后输送到居民区和工商业客户, 收取气费和服务费。

In this sentence, charging one fee for the service and the natural gas is the accompanying adverbial. In the translation version, the non-predicate verb and the predicate verb are used as coordinate predicates.

(15) Very large amounts of fossil fuels are stored in organic rich mudstones or shales that havenot been buried deeply enough for the organic matter to be converted to petroleum.

translation: 大量化石燃料储存在富含有机物的泥岩或页岩中, 这些泥岩或页岩埋藏不够深, 所以有机物不能转化为石油。

Here, “for+n.+to do” is a compound structure of infinitives, expressing the result in this sentence. Therefore, the causality of the original sentence should be highlighted when translating.

4.2.3. Using Compound Long Sentences: Sentence Division

In petroleum engineering English, long sentences are often divided into several small sentences, and the word order is adjusted according to the language features of the target language. Here are some examples:

(16) Petroleum production involves two distinct but intimately connected general systems: the reservoir, which is a porous medium with unique storage and flow characteristics; and the artificial structures, which include the well, bottom hole, and wellhead assemblies, as well as the surface gathering, separation, and storage facilities.

translation: 油气生产包括油气藏和人工装置两套系统, 两者相对独立又密切相关。前者是具有独特储存与流动特征的多孔介质, 后者则包括油气井、井底和井口装置以及地面油气集输、分离和储存设施。

When translating this sentence, it is necessary to separate the two attributive clauses from their antecedents, and then use “the former” and “the latter” to express the core meaning first, and then add explanations.

(17) Controlling the second hazard-leakage into a shallow aquifer behind the well casing-requires use of best practice in well design and well construction, particularly during the cementing process, to ensure a proper seal is in place, systematic verification of the quality of the seal and ensuring the seal does not deteriorate through the life of a well.

translation: 第二大风险是套管渗漏, 污染附近含水层。为控制该风险, 需优化气井设计和施工, 尤其是注水泥阶段, 以确保固井质量优良; 还需系统地检验固井的质量, 并确保在气井的生产期内注水泥层段完好无损。

(18) Heated crude oil is physically separated into various fractions, or straight-run cuts, differentiated by specific boiling-point ranges and classified, in order of decreasing volatility, as gases, light distillates, middle distillates, gas oils and residuum.

translation: 原油加热后按照不同沸程以物理方法分离成各种馏分(又称为直馏馏分), 这些馏分按照挥发性由高到低, 分为气体、轻质馏分、中间馏分、瓦斯油和渣油。

The translation makes the first post attributive adverbial and collocates it with “physically”, and the second attribute forms a sentence independently by repeating the antecedent.

4.3. Translation Strategy of Text Equivalence: Recognition and Reconstruction

When translating petroleum engineering texts into Chinese, attention should be paid to the differences between English and Chinese in hypotaxis and parataxis. It is necessary to identify and highlight the pronoun, analyze the cohesion of

the original text and transform the explicit cohesion into implicit cohesion. Here are some examples:

(19) Boreholes compete with mining methods as a means of prospecting for and producing raw material, and are in many cases, superior to them for operational viewpoints. Deep drilling is therefore becoming increasingly important with the development of deposits and reservoirs that lie ever deeper and in inhospitable regions.

translation: 勘探开采地下矿物时, 钻井法与坑道法均可行。从作业分析, 钻井法在很多情况下优于坑道法。随着埋深越来越大的储层和恶劣条件地区的开发, 深井钻井法变得愈加重要。

When translating them into Chinese in the original sentence, it is necessary to identify their meaning as mining methods to avoid mistranslation. In the second sentence, there is an explicit cohesion, which turns into an implicit cohesion in Chinese translation, and achieves the effect of textual cohesion.

In addition, recasting can also be used for reconstruction to achieve equivalence of discourse.

Recasting is to completely disrupt the order of the original text and recombine the meaning groups according to the habits of the target language, such as the chronological order and causal order of Chinese.

(20) The secret of the moon remained veiled until the latter half of the 20th century due to the lack of a lunar space carrier, for a series of questions concerning fuel, material, safe landing, propelling mechanism and particularly electronic computation etc. were too intricate to solve under the technical conditions early in this century, which have since been undergoing profound change and greatly improving.

translation: 20世纪初, 技术条件尚不成熟, 燃料、材料、安全着陆、推进装置, 特别是电子计算等一系列的问题都过于复杂, 难以解决, 无法制造出登月运载装置。但是随着时间的推移, 技术条件发生了深刻的变化, 有了极大的改进, 到20世纪后半叶, 人类终于揭示了月球的奥秘。

The three time sequences in the original text until the later half of the 20th century, early into the center, since shall be expressed according to the time sequence of Chinese because Chinese language habits generally follow the time sequence.

In short, the English discourse of petroleum engineering describes scientific facts or rigorous prediction. On the one hand, the Chinese translation needs to use formal and rigorous words and pay attention to the logic of the translation, and strive to be appropriate. At the same time, the present tense, especially the general present tense, is often used to express the timeless and general description such as natural phenomena, processes, routines. The present tense is generally used in scientific English to illustrate scientific definitions, explanations of theorems, equations or formulas, and explanation of charts.

The English text of petroleum engineering describes scientific facts or rigorous prediction results. When translating into Chinese, words should be used formally and rigorously, and attention should be paid to rhetorical features and the logic of the translation. It is often used to make objective statements in the general present tense and the writing must conform to the standards of scientific and technological stylistics, so as to achieve dynamic equivalence at the stylistic level.

Generally speaking, scientific English articles are conforming to the thinking logic and expression norms of

English people. Thus the translator should write according to the thinking logic of the original authors, and convey the original authors' intention and ideas in a standard language that conforms to logic. There should be no logical problems such as unclear reference, inconsistency, inversion of order, confusion of unreasonable facts. To achieve this, the translator should not only consider the grammatical relationship between the elements in the sentence, but also pay attention to the logical relationship between the concepts in the sentence, and develop the habit of verifying and checking whether their expressions are reasonable and accurate from both the logical and linguistic perspective.

5. Conclusion

Under the guidance of functional equivalence theory, the author proposes the translation strategies respectively based on the characteristics of vocabulary, syntax and text so as to provide some reference for English translation of petroleum engineering. However, due to the space limitations of the article, this study has not yet conducted a detailed comparative study of the style of petroleum engineering and other style, which need further theoretical discussion in the future.

References

- [1] G. Lakoff and M. Johnson: *Metaphors we live by* (University of Chicago press, U.S., 2008)
- [2] G.N. Leech: *Glossary of English grammar* (Edinburgh University Press, U.K., 2006)
- [3] M.A.K. Halliday and R. Hasan: *Cohesion in English* (Routledge, U.K., 2014)
- [4] E.A. Nida.: *Toward a Science of Translation* (Shanghai Foreign Language Education Press, China, 1964)
- [5] W.D. Ding, Z.L. Wang: *Introduction of Stylistics* (Foreign Language Teaching and Research Press, China, 1987), p.278-286. (In Chinese)
- [6] H.J. Ma: *A Study on Nida's Translation Theory*(Foreign Language Teaching and Research Press, China, 2003)
- [7] M.Q. Liu: *English Varieties and Translation* (China Translation & Publishing House, China, 1986)
- [8] Y. Zou: *Linguistic Features of Petroleum English and its Translation* (Chinese Science & Technology Translators Journal Press, China, 2007), p.10-14. (In Chinese)
- [9] J.Xu, J. Chen, X.Y. Lv: *A Coursebook of E-C Translating of Petroleum Text* (Petroleum Industry Press, China, 2017), p.1-226. (In Chinese)