

Development of Diachronic Terminology from Japanese Statutory Corpora

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Abstract. This paper reports our ongoing research on the development of diachronic legal terminology, which deals with temporal changes in legal terms. We started by compiling statutory corpora for them. Focusing on articles that define legal terms, we defined a set of regular expression rules. Our experimental result showed that we successfully extracted legal terms, their explanations, and their relations. Our terminology consists of 26,661 terms and 35,201 relations, in which the precision of the relations was 88.0% with 100 samples chosen at random. Graphical output will enrich our understanding of the dynamics of legal terms.

Keywords: legal text processing, legal terms, Japanese statutes, terminology

1. Introduction

In this paper, we report our ongoing research on the development of Japanese legal terminology. In general, important terms in statutes are explicitly defined prior to use. We focus on the legal terms defined in a provision, each of which consists of a tuple of a legal term and its explanation. The provision for the definition of terms is typically placed in Article 2, following the act's purpose. In other words, the legal terms in a provision are regarded as governing the whole act.

Legal statutes are not only established but also often amended by changes in social situations. In some cases, legal terms are also revised, added, and deleted, depending on the scale of the amendment. Therefore, an amendment to provisions for legal terms implies a drastic change of the entire act. The terminology for legal terms must deal with such temporal changes that are dependent on amendment acts.

Our purpose in this paper is to construct diachronic legal terminology that consists of legal terms, their explanations, and their relations. Our approach to automatic extraction is based on a rule-based method. This study, which deals with the dynamics of legal terms, contributes to FALM in the following two ways. One, this terminology provides practical use; since the law at the time is applied due to the non-retroactivity principle, the terminology should be able to deal with

terms at any given point in time. The other is that this terminology will be employed by LegiViewJP (Kawachi et al., 2015), which is a portal site of Japanese legislation that releases outlines of newly promulgated statutes.

We can recognize the study of the diachronic evolution of terminology as a set. Such a study deals with the narrative of the historical origins of a domain’s terminology and its actual historical evolution to the present state (Kageura, 2002). Applied to the legal domain, this is realizable with an exhaustive number of legal terms from all the acts in the statutory corpora.

This thorough study makes it possible to deal with synchronic similarities in legal terms to find the hidden relations among acts. For example, the submission of bills is often motivated by such changes in social situations as economical and political issues, wars, and natural disasters during which multiple acts are simultaneously enacted. Although similar terms are often defined in different acts with explanations that resemble each other, identifying such relations is difficult without knowledge. The natural language processing technique makes it possible to calculate the similarity between terms and explanations. Therefore, diachronic legal terminology provides legal scholars a method for analyzing the dynamics of legal changes.

This paper is organized as follows. In Section 2, we introduce the key issue of the construction of diachronic legal terminology. In Section 3, we explain how to create corpora to deal with the dynamics of legal terms. In Section 4, we propose a method for extracting the hyponymy relations among the terms of our corpora. Our terminology is evaluated in Section 5. Finally, we conclude this paper in Section 6.

2. Target Issue

In this section, we introduce our target issue and provide some examples. In Section 2.1, we explain the diachronic changes in legal terms, and Section 2.2 shows actual changes in definitions.

2.1. DIACHRONIC CHANGES IN LEGAL TERMS

We cite the Gas Business Act (Act No.51 of 1954) as an example to explain diachronic changes in legal terms. As of September 2015, this act has been amended 36 times, six of which include the revision of

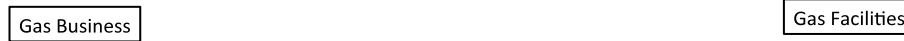


Figure 1a. Legal terms and relations in Gas Business Act (Act No. 51 of 1954)

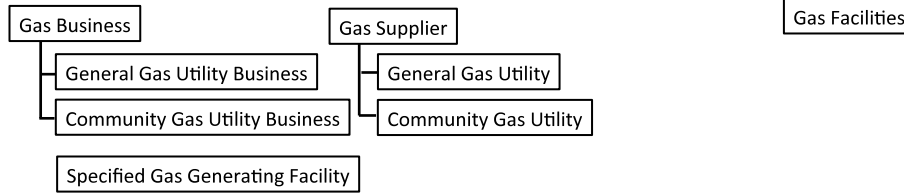


Figure 1b. Legal terms and relations as of enforcement of Act on the Partial Revision of the Gas Business Act (Act No. 18 of 1970)

terms and definitions in Article 2¹. Figures 1a to 1c show the diachronic changes in the terms at three time-points:

- (1) At the new enactment, only two terms “Gas Business” and “Gas Facilities” were defined in the act (Act No.51 of 1954), which came into effect as of April 1, 1954 (Figure 1a).
- (2) The name of “Gas Business” was changed to “General Gas Utility Business,” which became a hyponym of the newly defined term “Gas Business” with newly added term “Community Gas Utility Business,” by the Act on the Partial Revision of the Gas Business Act (Act No.18 of 1970), which came into effect as of October 12, 1970. Note that unlike language changes as a natural phenomenon, the sense of legal terms was forced to change on the enforcement date (Figure 1b).
- (3) Although no enforcement date has been determined yet for the Act on the Partial Revision, etc. of the Electricity Business Act, etc. (Act No. 47 of 2015)², the number of terms defined in the Gas Business Act will be increased to 16 (Figure 1c). In the period between (2) and (3), the terms “General Gas Utility Business,” “Community Gas Utility Business,” “Gas Pipeline Service Business,” “Large-Volume Gas Business,” “Large-Volume Supply,” “General Gas Utility,” “Community Gas Utility,” “Gas Pipeline Service Provider,” “Large-Volume Gas Supplier” and “Wholesale

¹ The Gas Business Act (Act No.51 of 1954) includes another provision for the definitions in Article 39-2 since its enforcement date on the Act on the Partial Revision of the Gas Business Act (Act No. 18 of 1970) in October 12, 1970.

² The said act provides in Supplementary Provisions that Article 2 in this Act shall come into effect as from the date specified by a Cabinet Order, which has not been promulgated yet. Article 39-2 will be deleted at the same time by this amendment.

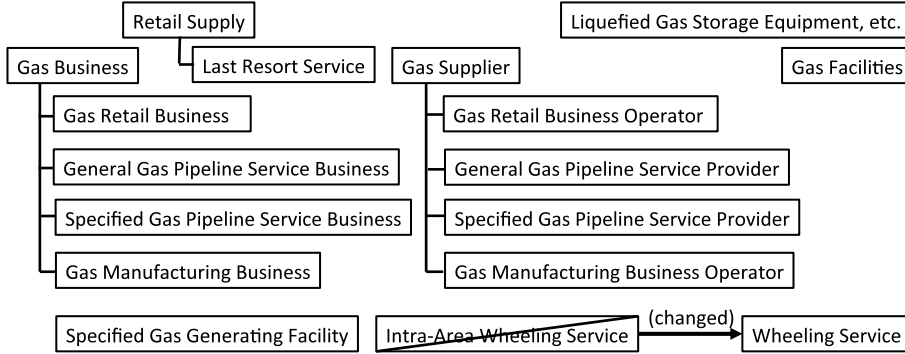


Figure 1c. Legal terms and relations as of enforcement of Act on the Partial Revision, etc. of the Electricity Business Act, etc. (Act No. 47 of 2015)

Supply” were defined but deleted later. In addition, the term “Intra-Area Wheeling Service” was replaced with “Wheeling Service.” They were basically eliminated by social selection.

2.2. AMENDMENT OF LEGAL TERMS

Statutes are written in two types of languages: an object language for new enactments, and metalanguage, which rewrites the description in object language, for amendments, rearrangements, and to repeal acts. While the former describes a law itself, the latter shows how to rewrite it with patch expressions. This amendment method is called *consolidation*.

Figure 2 shows an excerpt from the acts dealing with the changes of the term “Gas Business” from Figure 1a to Figure 1b. The revised act is shown in Figure 3.

3. Corpora for Legal Terms

We developed two kinds of consolidated statutory corpora to extract the dynamics of legal terms: a naive method and another that is done more simply. Each has both advantages and disadvantages. The following subsections explain how to compile them.

3.1. THE JAPANESE STATUTORY CORPUS

We compiled a corpus of all of the Japanese acts, consisting of 9,915 acts enacted up to 2012 since the enforcement of Japan’s new constitution in 1947. The size of the corpus is 252 MBytes. This Japanese act corpus

Gas Business Act (Act No.51 of 1954)

(Definitions)

Article 2 (1) The term “Gas Business” as used in this Act shall mean the business of supplying gas via pipelines to meet general demand.

Act on Partial Revision of the Gas Business Act

(Act No.18 of 1970)

“Gas Business” in Article 2, Paragraph (1) of Gas Business Act shall be deemed to be replaced with “General Gas Utility Business” and “(excluding, however, businesses generating gas at a gas generating facility prescribed in paragraph (3) and supplying such gas via pipelines)” shall be added after the term “general demand”, (*snip*) and the following five paragraphs are added after Article 2, Paragraph (1):

(*snip*)

(3) The term “Community Gas Utility Business” as used in this Act shall mean the business of generating gas at a simplified gas generating facility specified by a Cabinet Order (hereinafter referred to as a “Specified Gas Generating Facility”) and supplying such gas via pipelines to meet general demand at not less than 70 gas service points within one housing complex.

(*snip*)

(5) The term “Gas Business” as used in this Act shall mean a General Gas Utility Business or Community Gas Utility Business.

Figure 2. Excerpt from Gas Business Act (Act No.51 of 1954) and Act on Partial Revision of the Gas Business Act (Act No.18 of 1970)

is based on the articles of legislation in official gazettes. Since most of these acts, especially the older ones, have been digitally scanned, they contain many typographical errors that are not included in the published versions. We need to develop a preprocessor to address these typographical errors.

We also used a database called *Japanese Law Index*, provided by the National Diet Library, Japan³, which stores the history of the statutes in terms of enactments, amendments, repeals, etc. for all acts and ordinances enacted from February, 1886. The number of recorded acts is 13,504 as of June, 2015. We crawled all the history lists for each

³ <http://hourei.ndl.go.jp/SearchSys/index.jsp>

Gas Business Act (Act No.51 of 1954)[As of October 12, 1970]

(Definitions)

Article 2 (1) The term “General Gas Utility Business” as used in this Act shall mean the business of supplying gas via pipelines to meet general demand (excluding, however, businesses generating gas at a gas generating facility prescribed in paragraph (3) and supplying such gas via pipelines). (*snip*)

(3) The term “Community Gas Utility Business” as used in this Act shall mean the business of generating gas at a simplified gas generating facility specified by a Cabinet Order (hereinafter referred to as a “Specified Gas Generating Facility”) and supplying such gas via pipelines to meet general demand at not less than 70 gas service points within one housing complex.

(*snip*)

(5) The term “Gas Business” as used in this Act shall mean a General Gas Utility Business or Community Gas Utility Business.

Figure 3. Excerpt from Gas Business Act (Act No.51 of 1954) as of October 12, 1970

act to consolidate a primitive act with all the amendment acts referring to it.

Furthermore, we need to develop the following tools:

- (1) XML annotation tool
- (2) consolidation tool

The XML annotation tool (1) finds provisions for the definitions of legal terms (Nakamura et al., 2014a). The current version is problematic, especially when processing amendment acts. The consolidation tool (2) extracts diachronic changes in legal terms by consolidation. We can then acquire all the consolidated acts. However, we have faced the following problems:

1. The typographical errors contained in the corpus are too excessive to ignore.
2. Automatic consolidation is more difficult than we expected, even if we limit the region to be processed to the provisions of definitions.

3.2. THE D1-LAW.COM DATABASE

Some private companies provide advanced legal databases. The database of Dai-Ichi Hoki Co., Ltd.⁴ serves all the acts and ordinances that are currently effective, precedents, literature, and so on. It stores not only all 2,501 currently effective acts but also their old versions at any time-point. In addition, the history is listed with each article, in which we can designate any two time-points to show a comparison table.

The problem with this database is that old acts are only available for inspection back about 15 years, which is too short to see the dynamics of legal terms. Although we employ this database due to the lack of need for a consolidation process, this is a pilot version. In other words, we need to compile a complement to it from the Japanese Statutory Corpus, overcoming the drawbacks shown in Section 3.1.

We crawled all the provisions for the definitions of legal terms. Since each article in an act typically has an article caption, we extracted articles whose caption includes a particular string denoting definitions with a regular expression (Figure 7(a)). The number of acts that include one or more provisions for the definition of legal terms was 1,033 out of 2,501. If an act includes a number of articles for the definition of legal terms, we consider them separately. Therefore, we deal with 1,081 articles, 540 of which were revised during the last 15 years.

4. Extraction of Legal Terms and Hyponymy Relations from Explanatory Sentences

In this section, we propose the extraction of hyponymy relations from explanatory sentences. We first explain the characteristics of explanatory sentences and then show how to extract the hyponymy relations.

4.1. EXTRACTION OF LEGAL TERMS

What are recognized as legal terms to be collected depends on the purpose (Lame, 2005; Höfler et al., 2011; Winkels and Hoekstra, 2012). In this paper, we define legal terms as those explicitly defined prior to use in a law, each of which consists of a tuple of a legal term in the quotations and its explanation. They are typically placed as the following forms:

- (1) An independent provision
- (2) An inserted statement in parentheses

⁴ <https://www.d1-law.com>

For (1), an article often consists of a number of paragraphs, each of which defines a legal term. They are described with boilerplate expressions including a legal term and its explanatory sentence, which can be extracted with a set of regular expression rules (Figure 8(f)). The underlined phrases in the upper box in Figure 2 match one of the rules. Some paragraphs include items for a list either of conditions for the term defined in the paragraph’s body or of legal terms. A set of regular expression rules distinguishes them (Figure 7(b)). In the former case, the explanatory sentence includes all the items. For the latter, a legal term and its definition can be extracted with a simpler set of regular expression rules (Figure 7(c)).

For (2), a defined term appears in parentheses following a phrase as its explanation in the main text. Abbreviations of terms are often defined in parentheses. An example is shown in Figure 3, where the term “Community Gas Utility Business” and the term in parentheses “Specified Gas Generating Facility” are defined as follows:

Term: Community Gas Utility Business

Definition: The business of generating gas at a simplified gas generating facility specified by a Cabinet Order (hereinafter referred to as a “Specified Gas Generating Facility”) and supplying such gas via pipelines to meet general demand at not less than 70 gas service points within one housing complex.

Term: Specified Gas Generating Facility

Definition: The business of generating gas at a simplified gas generating facility specified by a Cabinet Order.

We extracted the explanation of the latter, the underlined part in Figure 3, from the beginning of the definition to just before the beginning of the parentheses.

Although the definitions in the parentheses often appear in the main text, regardless of the article’s content, we deal with those in the article for the definition of legal terms. This is because legal terms can have a relation that shares the term defined in the parentheses in their explanatory sentences.

4.2. EXTRACTION OF HYPONYMY RELATIONS

In this paper, a hyponymy relation denotes a kind of IS-A relation between terms. The extraction of legal terms and their hyponymy relations leads to the construction of a legal ontology. Surface pattern rules can extract both hyponymy relations and legal terms. For example, the

Gas Business Act (Act No. 51 of 1954)[As of April 1, 2004]

Article 2 (10) The term “Gas Business” as used in this Act shall mean a General Gas Utility Business, Community Gas Utility Business, Gas Pipeline Service Business or Large-Volume Gas Business.

Figure 4. Example of definition by enumeration of hyponyms

following expression, “ y is a (kind of) x ,” in which both x and y are noun phrases, implies that x is a hypernym of y as well as “such x as y ” (Miller et al., 1990; Hearst, 1992). This approach is also applicable to Japanese, for example, see Ando et al. (Ando et al., 2004), who proposed a set of Japanese surface patterns. These studies suggest that legal ontologies can be automatically constructed from legal texts containing boilerplate expressions.

While a previous study (Nakamura et al., 2014b) extracted hyponymy relations with general terms, in this study, we deal with the relations between legal terms. A legal term is defined with an explanatory sentence, which can include other legal terms. Figure 4 shows an example of a definition by the enumeration of hyponyms, implying that the term “General Gas Utility Business” is a “Gas Business” and so on. The point is that explanatory sentences end with a legal term following preceding term(s) connected with a comma(,), ‘and’ or ‘or’. We made a set of rules for extracting legal terms from such explanatory sentences (Figure 7(d)).

When the explanatory sentence of a term starts from another legal term⁵, it is probably a hypernym of the defined term. Figure 5 shows an example of an explanatory sentence with another legal term as a hypernym, in which the term “personal information” is a hypernym of the term “personal data.” We made a rule for extracting legal terms from such explanatory sentences (Figure 7(e)).

We defined a subsume relation as a relation other than either a hyponym or a hypernym relation. For example, the terms “Community Gas Utility Business” and “Specified Gas Generating Facility” in Figure 3 have a subsume relation since the former refers to the latter.

⁵ In Japanese, it corresponds to the end of the explanatory sentence.

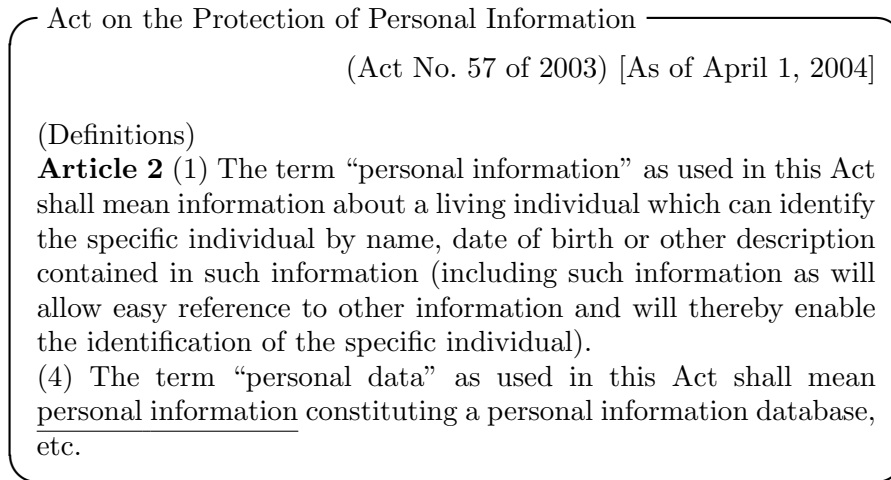


Figure 5. Example of definition with another legal term as a hypernym

5. Evaluation

The purpose of the experiment is to confirm our automatically extracted terminology. We successfully extracted legal terms with our developed rules. The number of tokens was 26,661, and the number of types was 5,465. The ratio, which implies a term is defined about five times on average, reflects the fact that many terms are preserved beyond amendments, and some acts share identical terms with different definitions. As mentioned in Section 3.2, almost half of all acts (540/1,081) have been revised in the corpus.

We found relations between 35,201 terms, out of which hypernyms and hyponyms in the explanatory sentences are 1,705 and 2,291, respectively.

We examined the relations between terms that were obtained with the regular expression rules. Although finding terms in an explanatory sentence is easy, identifying the relation between the terms defined in the quotations and those in the explanatory sentence is difficult. We randomly chose 100 sample terms to examine whether all of the relations were correctly obtained for all the terms in the explanatory sentence. The precision was $88/100 = 88.0\%$. Our error analysis revealed that the regular expression rules for the legal terms in parentheses often lead to a failure to extract explanatory sentences.

Figures 6a, 6b and 6c show graphical outputs. The vertices are yellow or white depending on whether the terms are defined or not defined in the statute as of the date of the enforcement of the amendment act. Edges are directed and colored red, blue, or gray. Red edges denote

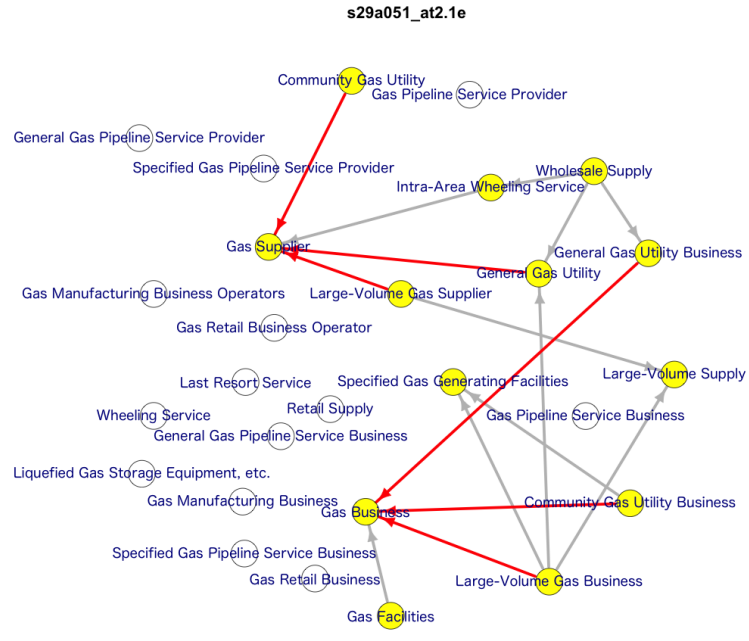


Figure 6a. Legal terms and relations in Gas Business Act (Act No. 51 of 1954) as of enforcement of Act on the Arrangement of Related Acts that Accompany the Enforcement of Acts that Revise Parts of the Commercial Code, etc. (Act No. 91 of 2000)

the hyponymy relations from the hyponyms in the definition and to a hypernym as a term. Blue edge denotes a relation where a hypernym appears in a term’s definition. The gray edges show subsume relations, where the source term is defined with the target term.

These vertices and edges are extracted from the provisions for the definitions of terms. For example, the vertex labeled “Gas Business” in Figure 6b corresponds to that in Figure 4, which is connected with four vertices with a red edge. Figure 6c corresponds to Figure 1c. Since the statutory corpus only covers all the effective acts for over 15 years, no output corresponds to Figures 1a and 1b. Nevertheless, we can see the drastic change of the terms between Figures 6b and 6c that took place due to the enforcement of the Act on the Partial Revision, etc. of the Electricity Business Act, etc. (Act No. 47 of 2015).

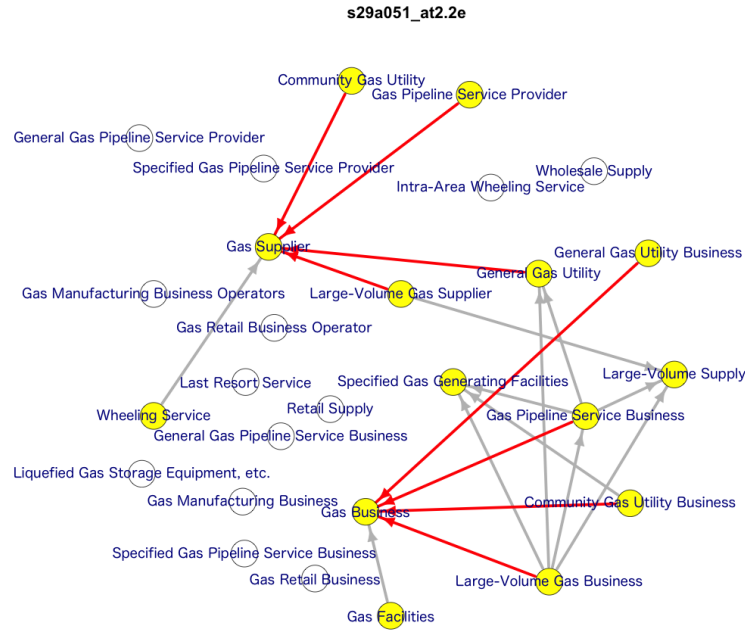


Figure 6b. Legal terms and relations in Gas Business Act (Act No. 51 of 1954) as of enforcement of Act for Partial Revision of the Electricity Business Act and the Gas Business Act (Act No. 92 of 2003)

6. Conclusion

In this paper, we explained the key issue of the construction of diachronic legal terminology. We started by compiling statutory corpora for legal terms. We focused on the articles of the definition of legal terms and defined a set of regular expression rules. Our experimental result showed that we successfully extracted legal terms, their explanations, and their relations. We found 26,661 terms and 35,201 relations. The precision of the relations was 88.0%, which might be improved with additional regular expression rules.

Our next target is to extract synchronic similarity in the legal terms among related acts. Related statutes are defined as ones that directly or indirectly refer to each other. Finding directly related statutes of a target is not difficult; just list all the statutes that refer to and are referred to by the target. On the other hand, finding indirect relations between statutes without explicit references is difficult.

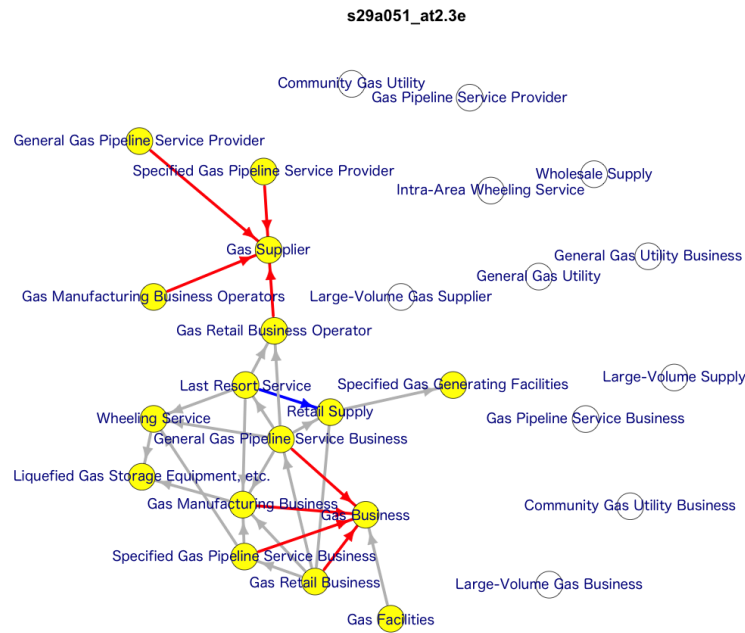


Figure 6c. Legal terms and relations in Gas Business Act (Act No. 51 of 1954) as of enforcement of Act on the Partial Revision, etc. of the Electricity Business Act, etc. (Act No. 47 of 2015)

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Appendix

A. Regular Expression Rules for Extraction and Identification

The regular expression rules used for extraction and identification are shown in Figures 7 and 8. Note that they are written in Japanese. There is no English translation, because they include fragments of Japanese words.

Regular Expression Rules

- (a) to extract articles for legal term definitions:
 "^[\\(([^) \\)]*定義 [] \\) 等及]"
- (b) to identify presence of itemization for definitions:
 "用語.+当該各号",
 "規定の解釈.+次の定義",
 "「とは、次に掲げるものとする。\$"
- (c) to extract definitions from an explanatory sentence:
 "とは、(.+)をいう。\$",
 "とは、(.+をいい、.+もの)とする。\$",
 "とは、(.+をいう。.+)\$"
- (d) to identify the legal term as a hypernym of terms in its explanatory sentence:
 "({ [^ { }]+ } (又は|若しくは|及び|並びに))+ { [^ { }]+ } (又は|若しくは|及び|並びに) { [^ { }]+ } \$", "({ [^ { }]+ }、)* { [^ { }]+ } (又は|若しくは|及び|並びに) { [^ { }]+ } \$", "^({ [^ { }]+ }) \$"
- (e) to identify the legal term as a hyponym of the term in its explanatory sentence:
 " { ([^ { }]+) } で(あって)?、", " { ([^ { }]+) } \$"

Figure 7. Regular expression rules (a)-(e)

Regular Expression Rules

- (f) to extract both a legal term and definitions (1: legal term, 2: definition (noun phrase), 3: definition (verb phrase))
- "([[^]「」]+)とは、?(([[^]「」]+)(を、|をいい、))「",
- "([[^]「」]+)とは、?(([[^]「」]+)をいう。)",
- "([[^]「」]+)とは、?(([[^]「」]+をいい、[[^]「」]+)とする。)",
- "([[^]「」]+)とは、?(([[^]「」]+)(をいい|とし)、[[^]「」]+(とみなす|で定める|を含む)。)",
- "([[^]「」]+)には、?(([[^]「」]+)とする。)",
- "([[^]「」]+)とは、?(([[^]「」]+(含むもの|をいうもの))とする。)",
- "([[^]「」]+)とは、?(([[^]「」]+を総称)する。)",
- "([[^]「」]+)又は「.+」とは、?(([[^]「」]+)(を、|をいい、))「",
- "([[^]「」]+)又は「.+」とは、?(([[^]「」]+)をいう。)",
- "([[^]「」]+)、「[[^]「」]+)又は「.+」とは、?(([[^]「」]+)をいう。)",
- "([[^]「」]+)、「[[^]「」]+)又は「.+」とは、?(([[^]「」]+)をいう。)",
- "([[^]「」]+)、「[[^]「」]+)又は「.+」の意義は、?(([[^]「」]+)による。)",
- "「([[^]「」]+)又は「.+」の意義は、?(([[^]「」]+)による。)",
- "「([[^]「」]+)の意義は、?(([[^]「」]+)による。)",
- "([[^]「」]+)とは、?(([[^]「」]+をいい、.+を除く。)",
- "([[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)又は「.+」とは、?(([[^]「」]+)をいう。)",
- "([[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)又は「.+」とは、?(([[^]「」]+)をいう。)",
- "([[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)又は「.+」とは、?(([[^]「」]+)をいう。)",
- "([[^]「」]+)とは、?(([[^]「」]+をいい、[[^]「」]+)とに分ける。)",
- "([[^]「」]+)とは、?(([[^]「」]+)をいい、以下「[[^]「」]+)と略称する。)",
- "((([[^]「」]+))とは、[[^]「」]+をいい、以下「([[^]「」]+)と略称する。)",
- "及び「([[^]「」]+)は、?(([[^]「」]+)とする。)",
- "([[^]「」]+)、「[[^]「」]+)及び「.+」は、?(([[^]「」]+)とする。)",
- "([[^]「」]+)、「[[^]「」]+)及び「.+」は、?(([[^]「」]+)とする。)",
- "([[^]「」]+)、「[[^]「」]+)、「[[^]「」]+)及び「.+」は、?(([[^]「」]+)とする。)",

Figure 8. Regular expression rules (f)