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Comparative analysis of electric power engineering terms in German and English languages

This article deals with the comparative analysis of electric power engineering terms in German and English languages. The paper demonstrates the most typical trends and processes in language development of the thematic group «Smart grids», focuses on etymology of German terms and presents general and specific ways of terms formation.

Key words: comparative analysis; neologism; thematic group; smart-grid related terms; word-building model.

Rapid growth and intensive development of fully-automated and intelligent energy system gives rise to many new concepts and ways of their linguistic expression.

The research is focused on thematic group «Smart grids». As the material of the study serve 104 terms, selected from scientific articles published in Elsevier, Springer, IEEE Xplore, online media sources (online sites of energy companies) and scientific literature [4].

It is necessary to emphasize that most neologisms in the thematic group «Smart grids» do with new equipment, technological advances in the field of renewable energy, as well as IT technologies: e.g. *Blockchain-based IoT (BIoT*), *Peer-to-Peer (P2P) Wireless Sensor Networks (WSNs)*. Thanks to the Internet these new terms are spreading instantaneously at a fast pace and are disseminated fast. The expansion of the terminology is also due to some borrowed words from allied science fields (automatic control, material science, and ecology), systematization of terminological units as well as formation of own highly specialized terms: e.g. *proximal decomposition method*.

The etymological analysis of electric power terminology in the German language, performed on the basis of Duden dictionary, has shown its heterogeneity: along with autochthonous terms it contains borrowings from other languages (see Table 1) [2].

Table 1

Etymology of terms in German language

Terms in English	Terms in German	Etymology of the German terms
current	der Strom	Old and Middle High German (OMHG)
power	die Kraft oder die Leistung	OMHG

voltage	die Spannung	verb spannen (to clamp)
reactive power	die Blindleistung	combination Blind (blind) and Leistung. OMHG
circuit	die Schaltung	from schalten (to switch). OMHG
direct and alternating current	der Gleich-und Wechselstrom	gleich (identical/same), wechseln (to change). OMHG
circuit breaker	der Leistungsschalter	from schalten (to switch). OMHG
conductor	der Stromleiter	Leiter (leader), from leiten (to lead). OMHG
overhead lines	die Freileitung	frei (free) and Leitung. OMHG
resistance	der Widerstand	OMHG
short circuit	der Kurzschluss	kurz (short) and Schluss (an end), schließen (to close). OMHG. Word is jargon.
eddy currents	die Wirbelströme	Wirbel from old word werben previous meaning is turn around (sich drehen). OMHG
capacitor	der Kondensator	from kondensieren (condensed) Latin word
current transformer	der Stromwandler	from word wandeln (to convert). OMHG
AC- or DC-converter	der AC- und DC-Wandler	from word wandeln (to convert). OMHG
wire	der Draht	drāt (to turn). OMHG
coil	die Spule	spuolo (split-off piece of wood). OMHG
torque	das Drehmoment	Dreh from drehen (to turn). OMHG
power plant	Kraftwerk	werk (factory). OMHG

turns ratio	das Übersetzungsverhältnis	Übersetzung (translation) and Verhältnis (ratio). OMHG

Upon the study it was determined that 47 (91%) words come from Middle High German (Mittelhochdeutsch (germ.)) and of Old High German origin (Althochdeutsch (germ.)), 2 words (3%) have a Latin origin. 3 words (6%) terms are the result of semantic evolution of the word presented by the transition of a term from one part of speech to another (conversion) and the process of reverse word formation (reversion – back formation), by cutting off the word-forming element from the prototype unit. *Verb – Noun* scheme is the most typical in the German language. It should be noted that some verbs are not in use anymore, but nouns still have a wide application: e.g. *drāt – der Draht* (germ.).

The comparison of new terms shows that some of them are identical in both languages: e.g. *X-to-Hydrogen-to-X technologies* (see Table 2). Some of German terms are the result of loan-translation, that is, a literal translation (copying): e.g. *Digital twin* – Digitaler Zwilling (germ.). Seven terms in the list are borrowings: they are adopted from one language into another (from English into German): e.g. *Statcom*.

Table 2

Comparison of terms in English and German languages

Terms in English	Terms in German
alkaline electrolyzers (AES)	die alkalische Elektrolyseure
proton exchange membrane (PEM)	die Protonen-Austausch-Membran
solid oxide electrolysis cells (SOECs)	die Festoxid-Elektrolyseurzelle
fuel cell vehicle (FCV)	die Brennstoffzellenfahrzeug
green hydrogen	der grüne Wasserstoff
zero-emissions	emissionsfreie
Biomass	die Biomasse
carbon capture, utilization, and storage (CCUS)	die Kohlenstoffabscheidung, -nutzung und -speicherung
X-to-Hydrogen-to-X technologies	X-to-Hydrogen-to-X technologies
Sol Source SFC110 Fuel Cell	Sol Source SFC110 Fuel Cell
Peer-to-Peer (P2P)	Peer-to-Peer (P2P)
Troubleshooting	Troubleshooting
End-to-end digital technologies	End-to-end digital technologies
Static synchronous compensator (Statcom)	*Statcom*

5G communication technology (5-th generation)	die 5G Kommunikationstechnologie
Digital twin	Digitaler Zwilling
Automatic generation control (AGC)	die automatische Erzeugungsssteuerung
Blockchain-based IoT (BIoT)	Blockchain-based IoT (BIoT)
Wireless Sensor Networks (WSNs)	Drahtlose Sensornetzwerke
Insulated Gate Bipolar Transistor (IGBT)	der Bipolartransistor mit isoliertem Gate
Low-Voltage Fault Ride-Through (LVFRT)	*das LVFRT-Kriterium*
Compressed-Air Energy Storage (CAES)	*die Druckluftspeicherung*
Photovoltaic	*die Photovoltaik*
Distributed power generation systems (DPGS)	*das dezentrale Energieerzeugungssystem*

Upon the analysis of the corpus, we identified 3 leading methods that show high word-building potential in both languages: 1) word combination / collocation, 2) compounding / composition, 3) contamination (blending).

1. Word combination / collocation is a multi-component model consisting of separate components: e.g. *alkaline electrolyzers (AES)*, *proton exchange membrane* (*PEM*) *electrolyzer*s. According to the number of components, that present semantically integral combinations [3], the lexical units in the thematic group «Smart grids» are composed of polylexemic words with a quantitative predominance of two component collocations in German language: e.g. *der grüne Wasserstoff* (germ.) and three-component collocations in English: e.g. *oxidation catalytic converter*. Being polylexemic, these units represent separately formed but serve to express a single, but dissected concept and notion [1].

About 80 % of the entire word stock in power engineering [5] field make up terms formed through this model: e.g. *distribution grid, Wireless Sensor Networks, power-to-heat ratio, binary combined-cycle cogeneration plant*. 16% of terms in German are also the result of this word-formation pattern: e.g. *Drahtlose Sensornetzwerke (germ.)*

2. Compounding / composition – one word term formed from two or more morphemes: *e.g. troubleshooting* [1]. This model is observed in both languages, but is more productive in German: e.g. Stromleiter = Strom + Leiter, Wechselstrom = wechseln + Strom, Kommunikationstechnologie = Kommunikation + technologie (germ.).

3. Blending or portmanteau *is defined as an arbitrary portion removed from one word clipped to a whole word or part of it:* e.g. *prosumage = producer + consumer)* [5].

Among other ways of word formation are abbreviation and hybridization. Abbreviation (shortening of polylexemic units) is high-productive model in English and makes up 28%: e.g. *FCV – fuel cell vehicle*. The percentage of abbreviation in German accounts for 4%: e.g *der AC Wandler* (germ.).

Hybridization, that presents formation of words by combining alphabetic and numeric parts, *is found in both languages, but is a low-productive model of word formation*: e.g. *Sol Source SFC110 Fuel Cell.*

Thus, being the language that provides communicative interaction and close cooperation between specialists from different countries, the implementation of international research and annotation of scientific literature, English automatically acts as a lexicalizing language for neogenic structures. Therefore, 24 % of all terms are identical in both languages.

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