STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

OPEN REPORT
SCK•CEN-BLG-1105

Codebook for frame analysis of nuclear fusion

Scoping study for the sociological research programme for EURO Fusion,
Grant agreement No 633053

Tanja Perko, Amelie Maussen, Siemen Dhooghe,
Vincent Van Hemelryck and Mikhail Goussarov

September, 2015

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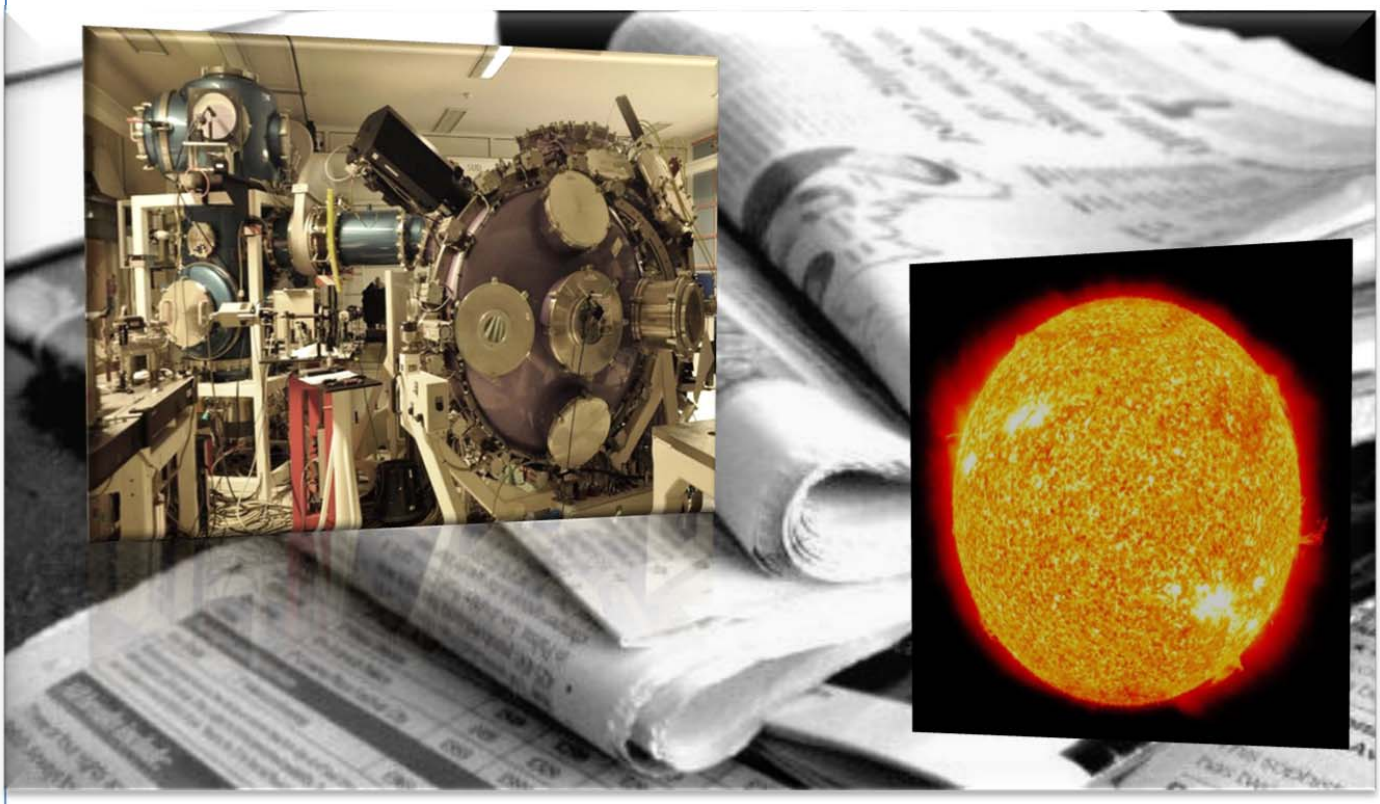

Contents

Introduction

In the framework of the Socio-Economic Studies Project implemented under the EURO-Fusion Consortium one of the focus points for the sociological research to be carried out within the 2014-2018 timeframe concerns media reporting about fusion. The aim of this research is to gain more insight into the public understanding of fusion by studying the media frames of this nuclear technology in classic news media, such as newspapers, press releases or magazines. Furthermore, the project's deliverables will include some 'communication tools' which are of practical use, in order to contribute to the quality of the public debate on fusion technologies. As with any debate, also here the quality of the communication on nuclear technologies may be improved in at least two ways. First, through a better understanding of fusion technologies, or how they work and what their characteristics are. Second, through a more nuanced debate on the benefits and risks of these technologies, which implies going beyond a simple 'yes - no game' of 'feasible' or 'not feasible'.

This document is a **Codebook for frame analysis of nuclear fusion**. The coding method will follow explicit rules of coding and will enable large quantities of data to be categorized. While producing the news, the media present it within a frame that guides the public on how this news should be understood. For the purpose of our research a frame is "*to select specific aspects of perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation*" (Entman, 1993, p. 52). In this analysis a qualitative interpretive form of content analysis is used to reconstruct a number of figuratively used frames and counter-frames in the news media that are used to give meaning to 'fusion technologies'. A period of 15 years (from 1st of July 2000 until 30th of June 2015) is taken into account. This gives us the opportunity to look for 'frame attention cycles' (Miller & Riechert, 2001), that is, the sequence of different frames. This sequence can be influenced by so-called 'key events'. In addition to Belgian print media in Dutch and French language also print media from Portugal, Spain and Germany will be analysed according to this Codebook.

The coding in each language will be performed by two independent coders plus a master coder that will decide in case of disagreements in the coding of the same media news. The inter-coder reliability will be calculated and reported. The original files contain the coding from the two coders will be preserved, and the final (consensual) coding will be stored in a separate file (i.e. there will be 3 Excel data files for each language).

Identification of frames used in mass media reporting about fusion

"*To frame is to select some aspects of a perceived reality and make them more salient (noticeable) in a communicating text in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation for the item described*" R.M. Entman (1993). By this research we intend to identify nuclear fusion frames used in press releases and news stories used in last 15 years in Belgium.

For identification of media frames about fusion energy we have used the following steps:

1. We identified repeated patterns in news coverage, using various techniques. We read some selected news coverage about fusion and looked for broad forms of emphasis or selection, such as headlines, what is put first and what left for later in a story, placement of stories in the news (front page vs. page 20; top of the newscast vs. bottom).
2. We looked for master narratives and themes. We identified what stories or aspects of stories are covered and what not, what is assumed to be the source of conflict, looked for stylistic clues such as: Language choices (for instance accidents or disasters), Modes of reference ("Expert" vs. "Einstein"); Use of quotes and attribution ("search for something that may not exist "; "so-called holy grail").
3. We looked at other ways the relevant facts about fusion could be turned into stories. Looked at news coming from a different point of view (e.g., a new budget for ITER accepted and presented in a context of all EU investments in R&D; Scientific challenge reached; Energy needs of nowadays society; Greenpeace etc).
4. We identified the importance of what these frames implied (e.g., Success in research and development) and what these frames took for granted. (e.g., If the success of nuclear fusion, for energy production it is good for the society).
5. We identified what those frames excluded from discussion (e.g. investment, time needed for research or development).
6. We identified which worlds' perspectives those frames are reinforcing (e.g. Climate change or progress of a society).

The codebook

DESCRIPTIVES

1) **ID** - Article Identity
2) **Validity** - Level of validity of the article
3) **Title** - Transcribe literally in the original language of the article
4) **TitleEN** - Translation of the original title in English
5) **Date** - Date of appearance in the newspaper
6) **Source** - Name of the newspaper
7) **PGNUM** – Starting page Number
8) **WCOUNT** - Word count of the article
9) **CHCOUNT-** Character count
10) **VISUALS** – Visuals (graph, photo, map…) (yes/no)
11) **Press agency** – Name of the press agency from this article is taken from (if applicable)

For each article, we need some descriptive material that allows us to identify the story. Each article should be assigned a specific **identification number** "*ID*", consisting of 5 digits, from which the first two are the country code (32:Belgium). The last 3 digits will start from 001 for French articles (e.g. 32001, 32002,..) and from 501 for Dutch articles (32501, 32502,..).

The **validity** of the article has three levels: ***level 0*** means the article is not valid at all, therefore it will not be coded. For instance, if the article is about fusion of two business companies will be coded as 0. The articles with the metaphors will be coded as 0 as well. For articles using fusion as a metaphor (validity 0) coder has to fill in the METAPHORS row. If the interpretation of a fusion is wrong the article will be coded as 0 and coder has to fill in WRONG INTERPRETATION line. For the rest of the articles with validity code 0, the coder is asked to indicate the reason for assigning this validity code 0 as a comment in the cell (e.g. The term "nuclear fusion" can also be used in biology, but without any actual link nuclear fusion, thus coded as 0). ***Level 1***(valid) contains the valid articles, article discussing fusion or those articles that contain a part related to fusion. All articles mentioning fusion as a natural process will be coded as 1. For instance “At a certain moment the pressure that presses it together is so large that nuclear fusion occurs and a star is born”. If the article generally describes other subjects than fusion we code only parts of the article related to fusion and simply ignore the rest. ***Level 2*** are articles that are doubled in our database (if any). We keep them in our database, but we don't code them.

After checking the validity, we shall record the original title of the article ("***title***"), the English translation of the title ("***TitleEN***") and the "***date***" of the issue. The **date** will be noted in the form of dd/mm/yyyy.

In the "***source***" of the article we write the name of the newspaper or agency that published the article. To capture the dynamics of media agenda, the **starting page** number is also recorded.

The articles that are covered in newspapers may vary significantly in size. Some cover significant parts of a page, while others consist of fewer than 50 words and are tucked away in a corner. One way of determining the size of an article is by counting the "***words***". We count the number of all words in the article ("**WCOUNT").**

The "***visuals***" category is a binary variable that we shall use to distinguish between articles with or without visuals (photo, graph, map…). (Note: Belgium data basis does not contain any graphical material due to copy rights, thus the category visuals is empty in Belgium).

Finally, we shall record if the article was completely taken from a **press agency** (e.g. Associated Press) or written in collaboration with the agency (these articles are indicated for instance as: "*AFP and De Standaard*")

From this point onward all variables are binary: Yes/No, unless otherwise specified.

TYPE OF THE ARTICLE

100) Type of article

1001 - News

1002 - Interview

1003 - Editorial

1004 - Column

1005 - Letter/personal opinion

1006 - Feature

1007 - Mixed

1008 - Public science article

1009 - Press release

1010 - Other (indicate)

exactly one of these will be coded **1**, the rest: 0

News: Concise report of a news item, usually just a short paragraph which sticks to factual information or a summary of an event, e.g. "*America stops investing in ITER*".

Interview: An article largely based on an interview, which can be preceded by a brief introduction and/or followed by a conclusion. Interviews often tend to represent one point-of-view i.e. that of the people interviewed, unless two or more people have been interviewed. There are different types of interview e.g. studio interview or long statements in article quoted from only one person. It won't necessarily be written in the Q&A style.

Editorial: Editor's viewpoint implies a critical analysis of the news item (subjective opinion supported by facts). The issue is often framed in its broader context. For the Fukushima nuclear accident, this can be the wider context of international information exchange in case of emergency, nuclear safety, energy needs or international (political) discussion on nuclear energy.

Column: A regular piece in a publication by the same author providing an opinion or different perspectives on the news item, but not labelled as editorial. A column is always written by an opinion-maker.

Letter: This is a personal opinion from an individual or somebody representing an organisation indicated as a letter (has no direct link with the press agency or newspaper). e.g.: a letter from Greenpeace, a letter to the editor by a concerned citizen, etc.

Feature**:** An in-depth look at what's going on behind the news. This type of article tends to include a detailed description and the analysis of the issue involved and is often accompanied by an interview or quotes from various people. A feature invariably implies full-page articles, with sometimes photos and illustrations, reporting from the field with all possible sources included (e.g. reportage).

Mixed**:** An article with analysis and quotes/ small interview, a one-off article by an expert(s)/well-known personality(ies), a longer analysis article where descriptions or analyses are interspersed with quotes from people referred to in the news item. This category is added to classify articles that do not fall into any of the above categories, but have a common thread running through them – quotes from people. The size of the article can therefore vary from short (a few statements with quotes and therefore not just brief news where there are no quotes), to longer articles (a more detailed description with quotes from people, but not long enough to fall into any of the other categories).

Public science article: These are articles reporting current events from a scientific point of view or summarising general research. It has to be an objective report about the topic. These are rarely written by journalists, they are most likely written by professional writers for a general audience. Although the subject of the article is scientific, the used language is quickly or easily understood by general readers. The author hardly gives full citations for sources. It is written for the general public and tends to be shorter than articles in scientific journals. The definitions or general explanations can also be coded as a public science article; e.g. radioactivity, tritium.

Press release: This is a manuscript written by some institution or organization (PR office) and indicated as press release.

Other: Other publications which do not belong to any of mentioned categories, e. g. comics, cartoons… In this category enter also the articles that are only text below photos e.g. subtitles, announcements, or TV-guides related to fusion. Please indicate the content in few words.

1. THE FRAMES

1a	Fusion is sun on the Earth
1b	Fusion is Pandora's box
2a	Victories in stages
2b	Fusion or illusion
3	Fusion as a social political and/or economical game
4a	Fusion as a natural process in stars
4b	Fusion on Earth

exactly one of these will be coded **1**, the rest: 0

For the frames, please indicate the most dominant one (the one which is in the title, or presented most strongly in the content of the text).

Frame 1a: : **<u>Fusion is sun on Earth</u>**, presents mainly positive aspects of nuclear fusion; for instance cheap, clean, safe, unlimited energy; Fusion as cleaner from conventional nuclear energy. This frame presents fusion as the (alternative) solution of our energy problems. Nuclear accidents are not possible.

e.g.

- "*The big advantage of nuclear fusion over nuclear fission is that it is not dangerous*."
- "*Accidents don't happen. The process of nuclear fusion just extinguishes*."
- "*Moreover there are no radioactive residuals that must be stored for hundreds of years*."
- "*Environmentally friendly form of nuclear energy*."
- "*Nuclear fusion doesn't have the problem of waste which the current nuclear reactors, based on nuclear fission, do have*."

- "*The danger of uncontrollable nuclear reactions doesn't exist*. "
- "*Fusion as a complement to renewables in future energy scenarios*."
- "*According to Meers, nuclear fusion could provide a promising alternative on the long term because of the great potential on energy production*."
- "*It's about a clean, unlimited energy source that can deliver energy for millions of years*."
- "*Fusion energy is been seen as one of the solutions for our energy sources on the long-term*."
- "*Fusion energy as a durable energy source of the future*."

If the article only discusses fusion as a natural process and doesn't mention fusion technology use frame "Fusion as a natural process in stars"(4a).

Frame 1b: **Fusion is Pandora's box** presents mainly negative aspects of fusion such as its dangers, its high expenses and as dirty energy. This frame sees fusion as something that can be used for proliferation, as a source of energy that still produces nuclear waste. Fusion is seen as dangerous due to the possible accidents and as something uncontrollable.

e.g.

- "*Analysts say North Korea wants to use new atom programs for production of nuclear weapons like uranium enrichment or nuclear fusion*."
- "*Fusion produces nuclear waste as well*!"
- "*Greenpeace wants to have cleaner energy sources than fusion*."
- "*In contrast to nuclear fission, there is no nuclear waste, but for now researchers still put more energy in nuclear fusion than they get out*."

Frame 2a: **Victories in stages** presents the advancement of fusion research and its development towards the future. The technological progress is communicated as it is achieved, in steps. Fusion is a useful research, creating an expectation of evolutionary progress. Investment in fusion is the same as moon conquering. Fusion is innovative and way ahead of its time. Articles that discuss awards, honorary degrees, progress in fundamental research also belong to this frame.

e.g.

- "*The improvements of this superconductor make nuclear fusion energy more reliable. The technological solution of Twente is unique in the world*."
- "*I compare it with the race to the moon in the sixties, this gave an enormous boost to the American technological industry*.";
- "*Amazing fusion technology*"; - "*High-tech in de Provence*"
- "*ITER: 'The most complex machine on earth*."

Frame 2b: **Fusion or illusion** presents fusion as Holy Grail, a Utopia, fantasy and a scientific curiosity, an experiment which does not provide an answer to the real challenge of current energy needs in contemporary societies. It is seen as a distant promise and without transposition to the economy. Fusion energy is a continually postponed project (decades in the future).

e. g.

- "*The method the NIF uses, will not lead directly to a working power plant. For that we will need more time*."
- "*It is not a reality before 2050 and it is a very expensive dream*."
- "*Nuclear fusion the Holy Grail of physics*."
- "*Nuclear fusion stays a distant dream*."

Frame 3: **Fusion as a social political and/or economical game** presents policy behind R&D and tends to include a lot of agreements between different countries. This Frame discusses for example who is going to participate in projects and the location of those, or who is going to lead certain projects. Also the articles that discuss investments in energy sources other than fusion or the price of certain technologies or researches belong to this category.

e. g.

- "*Europe and Japan both want the reactor build on their territory*."
- "*Bart Staes (representative of a green party) calls the rising costs of ITER, in 2006 estimated on 5.9 billion euros and now going to 16 billion, a hold-up on the European tax-payer and the future generations*."

- *"Theoretically nuclear fusion is cheaper, but if the external costs are calculated the price of fusion it is comparable with the electricity out of a "clean" coal central."*
- *"Let's invest in other energy sources instead of fusion."*
- *"The question is where the big experimental reactor is going to be build."*

Frame 4a: **Fusion as a natural process in stars** presents fusion happening as a natural process in stars without any human interaction or mention of it. In addition natural phenomena like lightning bolts also belong to this frame.

e.g.

- *"At a certain moment the pressure that presses it together is so large that nuclear fusion occurs and a star is born."*
- *"Brown stars are not regarded as stars because nuclear fusion cannot be maintained as it is in our sun."*

Use frame 1a if the essence of the article is talking about fusion technology but mentioning fusion as a natural process in stars. Articles mentioning nuclear fusion without talking about ITER or R&D belong to this frame.

e.g.

- *"This evening, lecture about nuclear fusion."*

Frame 4b: **Fusion on Earth**, presents facts and technology in a neutral way by explaining the knowledge behind fusion technology and about ITER.

e.g.

- *"Fusion research is carried out by people all over the world."*

- "*The largest fusion experiment on the world is the Joint European Torus in England*."

THE INDICATORS

We are looking for the frames in more details. Please, indicate as **1** if similar statement (indicator) mentioned in the text and **0** if the similar statement does not appear in the text. Some of these statements are coded as 1 if they are mentioned explicitly or implicitly in the text.

I1 "Fusion energy is unlimited."

I2 "Fusion is a durable energy source."

I3 "Fusion is the solution."

- "Fusion is the solution" should be coded as 1 if nuclear fusion energy is presented as the only solution to all energy problems.

I4 Fusion is alternative solution for energy problems.

I5 Fusion is clean(er) energy.

I6 "Fusion is sun on Earth."

I7 "There is almost no radioactive waste."

Whether the similar statement mentioned, code: **1**, if not: **0**

- "There is almost no radioactive waste ": When the article says that nuclear fusion produces almost no nuclear waste, this indicator will be coded as 1. If it's mentioned that it produces no nuclear waste at all, it's coded as 1 too.

I8 There is less radioactive waste.

I9 "Fusion is environmentally friendly."

- This indicator is coded as 1 in different ways: if the article states that fusion technology doesn't produce CO_2 or doesn't release toxic or hazardous substances for the environment, this indicator is also coded as 1.

I10 Fusion is safe.

I11 With fusion there are no nuclear accidents possible.

- If Chernobyl or Fukushima accidents are mentioned in the sense that such accidents are not possible for nuclear fusion, this indicator will be coded as 1 too.

I12 Energy from fusion is cheap.

I13 Fusion is energy source for the future.

I14 Fusion technology is a hi-tech technology.

Whether the similar statement mentioned, code: **1**, if not: **0**

- Hi-tech technology can be mentioned more specifically, e.g. Tokamak, magnetic fields, super conductors etc. This indicator will also be coded as 1 for this terminology.

I15 Fusion technology (or ITER) is unique technology.

I16 Fusion technology development is achieved in steps.

- This indicator will be coded as 1 if the article mentions this indicator explicitly or if breakthroughs or progress in the research are mentioned.

I17 Fusion is the energy power.

- This indicator means that fusion technology creates much more energy than must be put in. If it's mentioned in the article, it's coded as 1.

I18 Investment in fusion technology is high.

I19 Developing fusion technology is related to high-costs.

I20 Costs for fusion energy development are increasing.

Whether the similar statement mentioned, code: **1**, if not: **0**

I21 Fusion is working together (alliances, agreements, negotiations, public debate).

I22 Fusion creates jobs.

I23 Location of R&D is key for the country.

- When discussions about ITER's location are mentioned, this indicator will be coded as 1. This is the same for statements about all the benefits of ITER's location for the country.

I24 Developing fusion technology is developing the technology of the future.

I25 Fusion uses highly energy consuming technology.

I26 For fusion process we need more energy than we get out.

I27 Fusion technology is not as clean as presented.

Whether the similar statement mentioned, code: **1**, if not: **0**

I28 Fusion produces radioactivity.

- This indicator means that either the waste produced by nuclear fusion or the technology like the reactor chamber are radioactive. This indicator should be occurring more explicitly.

I29 Technology used for fusion is dangerous.

I30 Safety of fusion technology is uncertain.

I31 Fusion technology could be used for proliferation.

Whether the similar statement mentioned, code: **1**, if not: **0**

- This indicator is also used for articles that mention the use of nuclear fusion in bombs, such as the H-bomb. If so, this indicator is coded as 1.

I32 Fusion technology is a utopia.

- If nuclear fusion is presented as a 'dream' in a relatively negative sense, this indicator will be coded as 1.

I33 Fusion technology will not be possible to achieve.

- This indicator will also be coded as 1 if the article concludes that specific fusion technologies couldn't possibly be achieved, even if it mentions that ITER does. Examples are sepsis about cold nuclear fusion, acoustic nuclear fusion etc.

I34 Fusion does not provide an answer to the energy needs.

I35 Fusion technology development is a distant promise.

- This indicator will be used when the author presents fusion as a something that is far away. It takes decades to realise it and therefore other alternatives must be used. If so mentioned in the article, this indicator will be coded as 1.

I36 Stars depend on fusion.

- When articles state that a star uses nuclear fusion or that nuclear fusion happens at stars, this indicator will be coded as 1.

I37 Fusion is a natural process.

- If nuclear fusion is mentioned as something natural, or if nuclear fusion is mentioned when it has nothing to do with stars, for example nuclear fusion as a cause of lightning bolts, this indicator will be coded as 1.

I38 Stars get energy from fusion.

I39 Fusion is melting atoms.

I40 Extreme temperatures are involved.

I41 Fusion occurs at the core of stars.

Whether the similar statement mentioned, code: **1**, if not: **0**

- When nuclear fusion is mentioned as happening in the core, heart, or inner-part of a star, this indicator will be used.

2. NUCLEAR FUSION AS A METAPHOR

A figure of speech in which a term 'fusion' or phrase related to fusion is applied to something to which it is not literally applicable in order to suggest a resemblance, as in the following examples.

The validity of this article is 0. Write a full sentence where the metaphor is used.

"*The nuclear fusion between the writers delivers the energy of this poetry book*."

"*We propose doing something, not because we would like that but to evade a nuclear fusion that would represent for Europe a bankruptcy of Greece*."

Please write a full sentence where the metaphor is used first in the original language and then translate it. Note that the validity of these articles is coded as 0.

WRONG INTERPRETATIONS

If you think there is something wrong in use of nuclear fusion in the article, explanation or conceptualisation this could be wrong interpretation. Please, write the most important sentence of wrong interpretation according to your opinion as exact wording and then translate it in English.

E.g.

- *"Fukushima: The radiation was simply too strong. The meaning of the usual undertaking is to cool fission material that is threatening to undergo fusion. "*

Note that the validity of these articles is coded as 0.

The validity of this article is 0. Write the most important sentence of wrong interpretation.

SIGNIFICANCE OF 'FUSION' IN THE ARTICLE

Lastly the significance of the '*fusion*' in the articles will be analysed by using statistics and computer program. While some articles are very relevant to fusion, for example in depth looks on how fusion works or a report about ITER, other articles might just be only mentioning fusion, for example an article about a mining company that says one of its resources can be used for fusion.

Equation in excel will automatically calculate the values.

S1: Frequency of the word 'Fusion' in the article.

S2: Average of the frequency of the word 'Fusion' comparing to all the words in the article.

S3: Scaled significance of the word 'Fusion' in the article comparing to all the articles in the data base.

Frequency of the word Fusion in the article

One can expect that a media article or press release about nuclear fusion contains the word 'fusion' many times. We count the word fusion in an article including in titles and subtitles. This variable reports an absolute use of the word and its interpretation is biased by the size of the article (There is a difference if the work fusion appeared three times in a short article or in a long article.)

f_d denotes the frequency of the word "fusion" in an article d.

Average of the word Fusion in the article comparing to all words

Relative appearance of the word fusion will be calculated by taking into account all the words in the document. By this way a division by the total amount of words is done.

tot_d denotes the total amount of words in a document d. The average term frequency μ_d for a document d is given by

$$\mu_d = \frac{f_d}{tot_d}.$$

Significance of the nuclear fusion topic in the article

Comparing this latest number to all the other articles in the data base indicates significance of the nuclear fusion topic in the article. In other words, it expresses how important nuclear fusion is in the article comparing to other topics discussed in the article and other articles in our databases. It is a statistical value that represents the value of an aggregate fusion topic in comparison with a reference number for other articles.

This new number is calculated by rescaling the previous numbers using the 'average frequency' numbers from the other articles. This rescaling is done by using the mean of the 'average frequencies' over all the documents.
Denote D the set of all your documents. Define:

$$m = \mathrm{E}(\mu_d \mid d \in D).$$

The 'scaled frequency term' is then calculated following the equation:

$$S_d = \frac{\mu_d}{m}.$$

The value is interpreted as following.

The value is between 0 and 1: the article is less significant than the average article.

The value is 1: this represents the average article.

The value is greater than 1: the article is more significant on nuclear fusion than the average article. The higher the number, the more significant.