ADAPTIVE ENERGY MANAGEMENT PROGRAM

Market Research

Analytics acc. Further development of PAEN NO

– Complete market analysis according to development of Adaptive Energy Management Program under PAEN – NO. The article documents various topics as well as research containing to the energy management industry.

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Abstract

The following data analytics uses data from Twitter mining in order to map and monitor the energy management industry. Analysis of social media data should be considered of significance to understand changing sentiments of the public, and to gain insight into development trends and identify emerging technologies. In this case the use of connected cluster analysis of terms and hashtags related to Energy Management dating from 2016 – 2022.8.3. Co-occurring topics, trends, and technologies has been examined for the timeline, monitoring the changes of sentiment and reach. Important actors, and businesses has been identified, and given further focus to contribute to our understanding of how technologies and market needs emerge and develop, as well as the technological forecasting and foresight methodology might be of interest in further development of ABB PAENs Adaptive Energy Management Program.

1. Methodology

The steps of the frameworks are as follows:

Stage 1. Hashtag analysis to monitor the emergence of trends and sentiments of the energy management industry.

Step 1 Retrieve data through on topics related to energy management. A python running in docker was used to collect the database from search queries related to the subject of the study (I.e., energy management, #energymanagement, energy management ≡ #fishfarming, etc.). Twint-API was used to download the relevant tweets the open-source python package. This allows an user with Twitter developer access to download tweets of a larger quantity than the limited to 3200 per day. The parameters were set to download a limited set of tweets; max 250 per day, every day ranging from 2015.12.31 to 2022.08.01, limited to tweets with 5 or more likes or retweets (this was done to correct for bots, trolls, and everything in-between). The data collected was then written to a table in .csv formatted to some ~20 rows; including data for; date, username, hashtags, links, geotag, language etc.

Step 2 Preprocessing the obtained data. The data from step 1 needed to be preprocessed. For example, topics such as “energy time management” relating to self-improvement topics was removed. The preprocessed data was anonymized for non-verified users as to be in line with general GDPR rules. Duplicated tweets were deleted according to 95% similarity. Further the preprocessed data was cleaned up and written to a new .csv file.

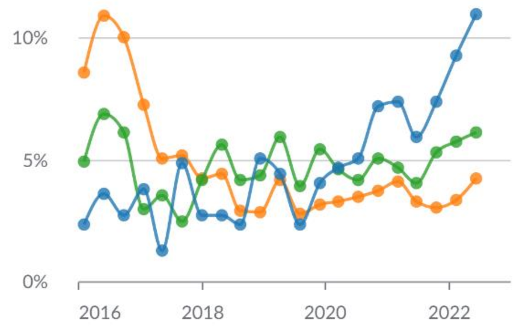
Step 3 Cluster topics with the Lingo algorithm. The Lingo algorithm was applied to cluster the cleaned tweets obtained from Step 2. Lingo algorithm is performed in three steps. First, using a modified version of semantic hierarchical clustering (SHOC) algorithm to discover phrases and single terms. Second, the vector space model (VSM) and singular value decomposition (SVD) were applied to induce cluster labels. Third, classic cosine distance was used to calculate similarity and group in accordance with the Algorithm. These topics were rendered with the carrot2 workbench for visualization, which is an open-source software that includes several text clustering algorithms and integrated a variety of visualization tools. The visualization results can show every topic's connection to other topics, which indicate their correlations. Then these extracted topics were clustered based on their correlations and named by deduction after conversation with domain experts. The new processed data was written to a new .csv file.

Step 4 Constructing sentiment analysis of topics related to energy management. Based on the results of topic clustering obtained in Step 3, a google-API for sentiment analysis was connected to the docker environment, and further used to generate a value-proposition of sentiment (ranging from 0.0 to 1.0, 0.5 being of neutral.). A new row was then added to the table contained to the .csv file, where tweets ranging from 0.0 to 0.35 were labeled as negative -, 0.35 to 0.65 as neutral, and 0.65 to 1.0 as positive. This was further used in graph comparisons in specific domains as demonstrated later in the document. MYSQL, a visualization tool for python was then used to generate the graphs seen in the document.

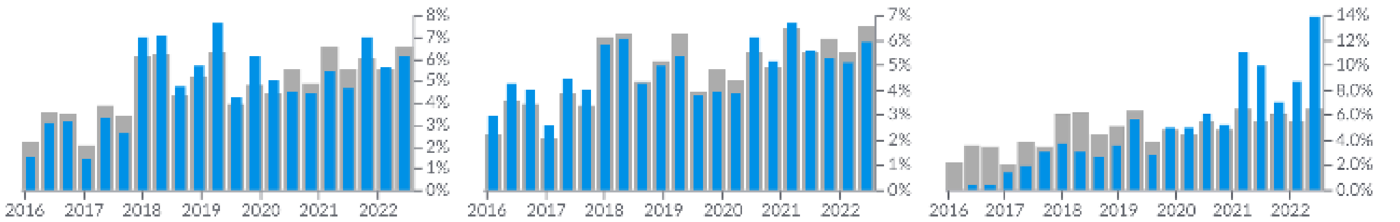
sourced 137 541 tweets with a minimum of 5 likes and 3 retweets. Breaks into four significant clusters.

2.a. **Results**

Cluster 1 [industry, blue]: most co-occurring unique topics; energy efficiency, #Sustainability, #Bigdata data analytics
Cluster 2 [political, orange]: most co-occurring unique topics; #renewable, iso5001. #Green, #climatechange,
Cluster 3 [innovation trends, green]: most co-occurring unique topics; IoT, solar, smart home, smart grid, smart buildings
Cluster 4 [investment & acquisitions, red most co-occurring unique topics; #technology, #innovation, startup, data science, #Forbes, business



Sentiment over time; color indicates as follows; orange is neutral green is positive and blue is negative

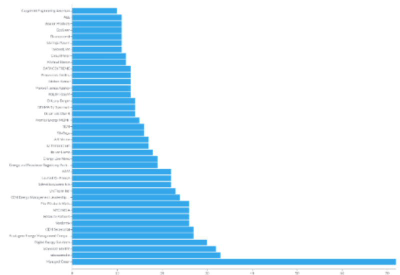


industry specific sentiment over time, read left to right starting with positive, ending with negative. Data is restricted to cluster 1 and cluster 3, related topics I.e.; cluster of relationship to IoT, sustainability, energy transition, energy efficiency, energy industry, business. Sourced from 137 541 tweets total (marked gray), selected cluster consisting of 47.2 % (64 919) (marked blue).

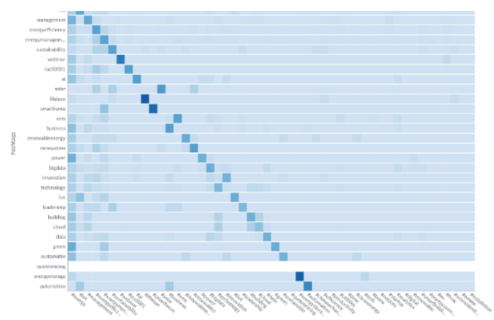
Comments: Generally, it must be stated that negative sentiment means the context of which the data appears could indicate several things. This increase in negative sentiment over time seem to be in relation to the growing concerns of the energy crisis in relation to the COVID-19 pandemic** and the war on Ukraine*

2.b. Possibilities based on current data:

Semantic analysis of specific twitter trends related to different network segmentations. This offers an insight into the most influential users, how they relate to each-other in a broader context and the reach of their posts. This could be interesting to learn from players in the field how to go about SOME-strategies etc. Further we can identify trends and correlations between topics, as well as monitoring them over time. Looking more into cluster 3, 4 might yield insight into funding opportunities, more so could be used to monitor the development of technologies, markets, and the emergence of technologies relating to energy management. **Closing note; have tried to reach out to marketing department whilst on vacation, ongoing initiative



Top 20 profiles in energy management based on number of likes + number of retweets divided by post-count



Co-occuring topics; heat map

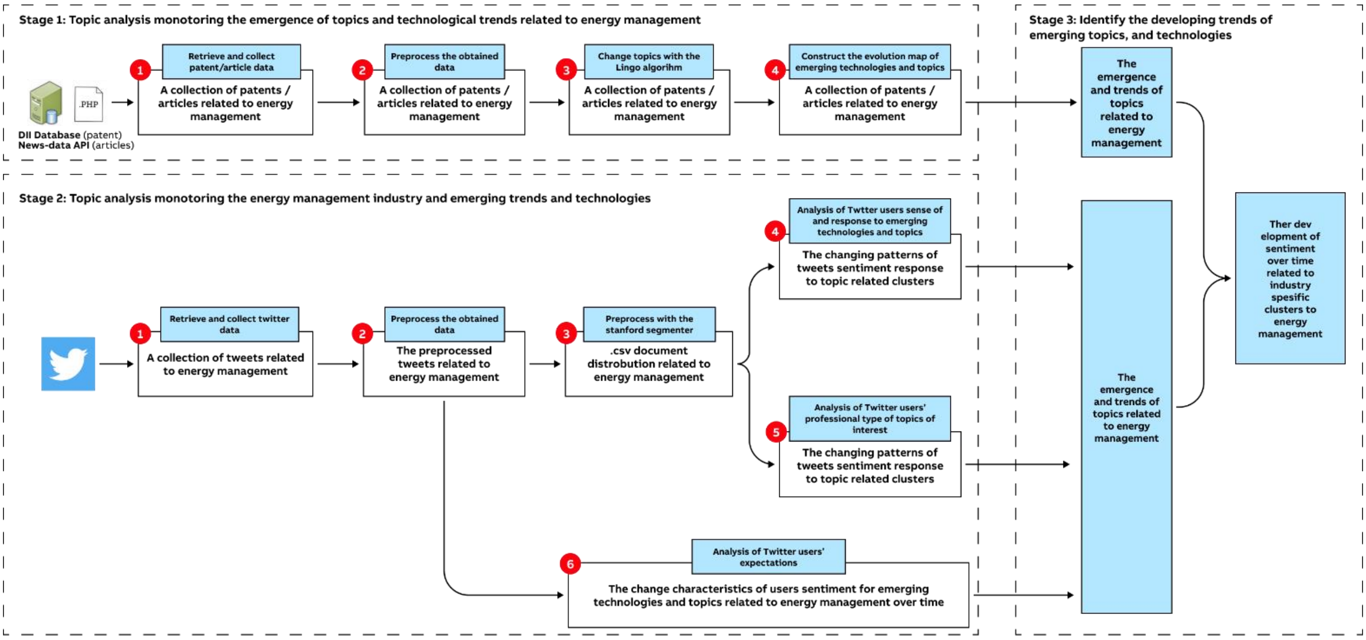


Fig. 6. Framework to identify and for monotoring developing trends of emerging technologies

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2.c. Future development

Framework for real-time monitoring if developing trends and emerging technologies

Why, how does this provide value, to two??

En kunde; equinor; hva snakker de om; Siemens

Tror du ja eller nei:

3. **Europe reconsiders its energy future**

Literature overview / Appendix?

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