EC Project 610829

A Decarbonisation Platform for Citizen Empowerment and Translating

Collective Awareness into Behavioural Change

D6.2.1: Earth Hour Report 2014

06 October 2014

Version: 1.0

Version history

Version	Date	Author	Comments
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0.2	11/09/2014	M. Fernandez	Initial versions including advanced analysis section
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Executive Summary

This deliverable summarizes the campaign activities of WWF Switzerland before, during and after the global Earth Hour campaign in 2014 and includes state of the art technology to analyse online media impact of the national and global Earth Hour campaign (cf. Section 4).

For Earth Hour 2014 the campaigning team tried to stay near the light-out symbolism and created action to motivate municipalities to install less, but more energy-efficient street lighting. The public was asked to send e-mails to their municipality and give them nicknames with regard to the energy-efficiency of their street lighting. This toponymy concept and communication was great to stage the dry topic of energy in a humorous and interesting way whilst conveying a serious message with regards to content.

From February 13th to April 8th 181 online and offline media articles concerning the topics street lighting, lights-off, municipality and earth hour were disseminated in Switzerland, including: (i) a short report in TV-news, main edition (about 50% market share in prime time: 19:30 to 20:00), (ii) 1.5 pages in the national, free commuter newspaper "Blick am Abend"[1], (iii) various radio interviews and, (iv) in-depth reports in regional media.

Despite the numerous news-media clippings, mobilisation and engagement of people on WWF Switzerland's website was disappointing compared to earlier campaigns. Only 7.7% (3'261) of people who visited the landing page did send a petitionary letter. Through social media only 381 (Facebook) and 139 (Twitter) citizens were mobilised to send a petitionary letter.

In addition to this initiative we also collected Twitter data around the Global Earth Hour campaign as well as around the national (Swiss) Earth Hour campaign with the final goal of studying engagement. We studied the characteristics of those posts generating higher attention levels as well as those key topics of interests for the users, during and around the time of the campaign.

By analysing more than 35,000 tweets for the Global Earth Hour campaign we observed that, in terms of generating engagement, the content of the tweet is more relevant than the reputation of the user. Posts generating higher attention levels are slightly longer, easier to read, have positive sentiment, mention other users and tend to repeat terms existing in other posts.

[1] http://www.blickamabend.ch/

By analysing the topics of these tweets we observed that, while the main activities and themes of the campaign (super hero, the panda, etc.) did drive most of the social media conversations, the fact that the users engaged in the campaign, did not necessary mean that they also engaged with climate change and sustainability issues. Studying the temporal evolution of these topics we also observed that, while users decrease their engagement towards the topics of the campaign after it finished, these topics still remained, with less intensity, in their conversations one month later.

By analysing @WWF_Schweiz Twitter followers we observed that only 4.7% of these followers did engage in the 2014 Earth Hour campaign. These followers generated around 5,600 posts but 83% of these posts were however not produced by citizens but by WWF, Earth Hour or associated organisations. We eliminated those organisations from our dataset and characterised citizens participating in the campaign. We observed that citizens participating in the Earth Hour campaign are engaged with climate change, wildlife and sustainability issues. They actively participate in social media and they speak multiple languages, predominantly English and German. Users who did not participate in the Earth Hour campaign, in contrast with those ones that did participate, tend to be less identified or engaged with climate change and sustainability issues. They are however identified with topics related with technology, entrepreneurship and journalism (media).

By analysing the popular URLs mentioned in social media during the campaign we also observed that, at national level, when language does not constitute a barrier, international media may influence as much as local media.

By learning how tweets should be written, which are the topics of interest for the users, and how news and other media impact the social media conversations, our analysis aim to provide a step forward enhancing engagement towards the next editions of the Earth Hour campaign.

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1. Introduction

The global movement for the environment called Earth Hour (short: EH) is determined to be the large-scale collective awareness campaign that is analysed in this project. As WWF Switzerland, consortium partner in DecarboNet is a local franchise of WWF International, a special focus of the analysis lies on the EH-campaign activities in Switzerland.

Figure 1: Teaser to join the global Earth Hour movement in 2014.

This document provides:

- Background information on the global and Swiss national Earth Hour movement
- Details and evaluation regarding the national campaign of WWF Switzerland for Earth Hour 2014
- News and Social Media Coverage for the Swiss EH campaign
- Engagement statistics for national and global EH campaigns
- Advanced analysis of social media interactions around EH (global and national)

2. Earth Hour Movement

2.1. Global Earth Hour Campaign

In 2007, WWF initiated Earth Hour, a way of engaging a broad section of society in the environmental issues challenging citizens across the world. WWF embraced the idea of an open sourced campaign that would allow communities and organisations to become part of a global movement to protect our planet.

Every March, Earth Hour celebrates the symbolic “lights off” hour, which has grown from a one city initiative to a mass global event involving more than 162 countries and 7,000 cities and towns.

The movement is collectively supported by millions of individuals, organisations and governments.

Undoubtedly as many sceptics point out, attendance and participation in a social activity, or turning lights out, for an hour on a Saturday night do not necessarily reduce carbon emissions. As Cox [2010, p. 128] previously pointed out in his discussion of the Step It Up campaign, events, citizen mobilization, lobbying need to be part of an integrated strategy that has a clear goal, “mobilization that enables a certain end.” [Sison, 2013]

Therefore each locally supervised campaign today has a so-called Beyond the Hour action that aims to provide long-lasting improvement for the environment.

In 2014, Earth Hour embarked on the most exciting stage of its evolution to be at the forefront of crowdfunding and crowdsourcing for the planet. We call this Earth Hour Blue.[2]

2.2. National Earth Hour Campaign of WWF Switzerland

Switzerland first joined the global Earth Hour campaign in 2009. In 2012 all large Swiss cities participated in the “Lights Out” event. In 2012 also Beyond the Hour, was first introduced and emphasized in Switzerland. The concept was added to the Lights Out idea because WWF Switzerland wanted the message of Earth Hour to become more credible and cities requested broader participation for their own.

[2] http://www.earthhour.org/earth-hour-2014-report

WWF Switzerland decided to create Beyond the Hour actions that are especially aligned to its change maker strategy. Therefore public awareness and the special Earth Hour movement has to be used to change laws or structures to generate long lasting change with benefit for men and environment.

3. Earth Hour 2014 Campaign, WWF Switzerland

For Earth Hour 2014 the campaigning team tried to stay near the light-out symbolism and created action to motivate municipalities to install fewer, but more energy-efficient street lighting.

3.1. Goals and Scope

Participation of WWF Switzerland in EH 2014 was conditioned by our campaign steering group as follows:

- Has to be integrated into our ongoing footprint campaign[3]
- Energy efficiency has to be the topic of the Beyond the Hour Campaign[4]
- EH-Target Audience: computer literate, adult CH population with interest in environmental topics

3.1.1. General campaign goals

During EH 2014 WWF Switzerland will:

- Record and asses current status of public lighting in Switzerland
- Establish contact with cities and municipalities and create a basis for more energy efficiency
- Maximize media impact on the Action Day of EH (29th of March) & notably raise mention of the Beyond the Hour Story
- PR Success/ Media Impact on the Day of EH: Stable amount of clippings (baseline 2013: 200)

3.1.2. Goals for Media releases

[3] Aims to change consumer behaviour, Supply chains and legal structures to support more sustainable lifestyles and consumption patterns

[4] Campaigning Actions that take place before and after the actual lights out action (=Earth Hour)

Media releases had the goal to:

- Mobilize citizens to email their city municipality with:
  - Praise for good public lighting (municipalities with good rating)
  - Encouragement for improvement (municipalities with bad or average rating)
  - Encouragement to fill in questionnaire (municipalities without rating)
- Collect addresses for WWF-Newsletters and call for donations
- Provide data and news for regional offices to actively engage municipalities in the energy efficiency debate

3.2. Action

3.2.1. Municipality Rating

Prior to the public campaign the Swiss Agency for Energy-efficiency (S.A.F.E.)[5] created a questionnaire regarding public lighting based on www.topstreetlight.ch.

This questionnaire was sent out by WWF to all 2'500 Swiss municipalities.

The municipalities that answered the survey were rated based on the environmental impact of their current street lighting.

This rating then was published on the WWF-website and brought to a wide audience in print- and online-media prior to EH 2014.

Deployment of Results:

- News content for media
- Address-collection to use by WWF
- Useful data for regional WWF offices to actively engage municipalities in the energy efficiency debate
- Base for public participation: Mobilize citizens to send an E-mail with pre-generated content according to ZIP codes to their municipality with:
  - praise
  - encouragement for improvement
  - encouragement to fill in the questionnaire

3.2.2. Core Messages and Online&Marketing Concept for public campaign

[5] Swiss Agency for Energy-efficiency (S.A.F.E.): http://www.energieeffizienz.ch/home.html

During EH14 WWF wanted to tell the public that:

- Cities and Municipalities play a crucial role in national and global energy transition.
- Cities and municipalities switch off lights to protect the climate, which is great, but there is so much more that they can do.

Headline: „Do you live in Do-Nothing Ville or in Pioneer City?“

Teaser: “We’ve asked your city how they run their public lightning.
Now you may take a look and encourage them to stay active”

Call-to-action: „Ask Your Municipality for Sustainable Lighting” wwf.ch/earthhour

On wwf.ch/earthhour was the landing page for our mobilisation tool (cf. Figure 2**)**

3.2.3. Toponymy concept

Municipalities get new nicknames based on the rating with regard to their street lighting. For example the City of St. Gallen, which had a great rating got praised with the Nickname “St. Geilen”, which means something like “City of cool people”

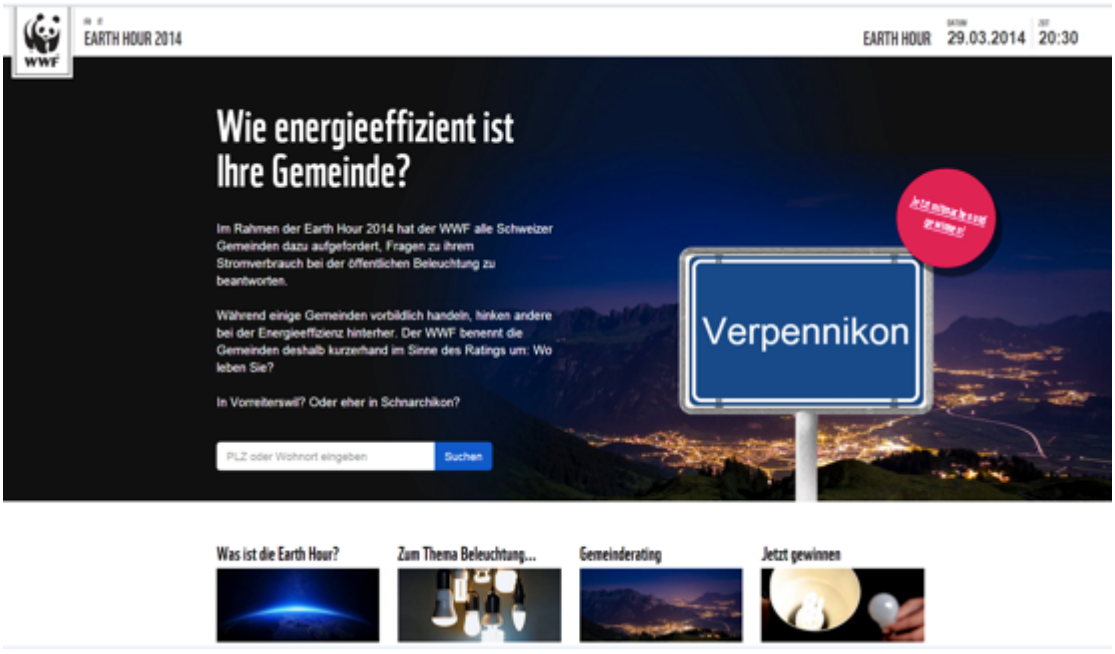

Figure 2: Mobilisation Tool: Landing page with question: “How energy-efficient is your municipality?“

3.2.4. Dramaturgy – 3 Phases

Mobilization: February 25 – March 27
The public gets mobilised through E-mail-newsletters based on the municipality rating.

Prime Time: March, 28 – March 30
Communication focus on "Lights Out"

Follow-up: March 31 - April 28

- Last push E-mail mobilization & rating communication
- Transition into Follow-up phase for participants
- E-mail to municipality leaderships with follow-up offers (SAFE Conference, SAFE guides, Contacts)

3.2.5. Campaign Day offline presence

During EH 2014, WWF was present in all major Swiss cities. WWF Staff offered there a tailored message template which could be sent to the municipality council of passers-by. In return for their signature, participants got a discount offer for LED products, a bag with WWF logo containing the "guidebook for house-lighting" and an offer to participate in a competition for a light changeover at their homes.

3.2.6. Lights Out

Key EH Visual is the extinguishing of cities' landmarks' lights between. 8:30 and 9:30 PM. Call for action mainly goes out to cities and municipalities. Citizens are invited to join.

3.2.7. Dissemination

To reach the public, information based on the toponymy concept was created in German, French and Italian and disseminated in:

- 2 media releases
- 10 posts from WWF_Schweiz on Facebook.
- 6 posts from WWF_Schweiz on Twitter.
- 2 E-Mail Newsletters
- 1 longer article in WWF Switzerland's print-magazine
- Campaign landing page www.wwf.ch/earthhour
- Feature on the cover page of the website: www.wwf.ch

3.2.8. WWF-Website: Landing page / Mobilisation Tool

Deliverable D6.1 describes a typical version of WWF Switzerland's Mobilisation tool.

For Earth Hour 2014 this tool received small adjustments:

- Engaged people got the option to subscribe for the follow up, which consists of a special E-mail series. Therefore the tool was directly connected to *Inxmai*[6]*l*.

- As it was not necessary to reach a target number of engaged people to write to their municipality, no counter was implemented,

The landing page of the mobilisation tool was shown in Figure 2. When people typed in their zip code, they got the possibility to see the rating for their municipality (cf. Figure 3).

Figure 3: Rating information for user's municipality

Afterwards people were asked to send a petitionary E-mail to their municipality (or just request a coupon). Additionally people could sign up to the WWF newsletter (cf. Figure 4).

[6] Connected E-Mail Marketing: http://www.inxmail.com/

Figure 4: Entry form for petitionary E-mail to municipality

People, who did participate, then were thanked and asked to share their activity with colleagues on Facebook, Twitter or by E-Mail. Additionally they were invited to create creative nicknames for their municipality and share them also (cf. Figure 5).

Figure 5: Invitation to create new nicknames and share engagement in social media

3.3. Data Acquisition (WWF)

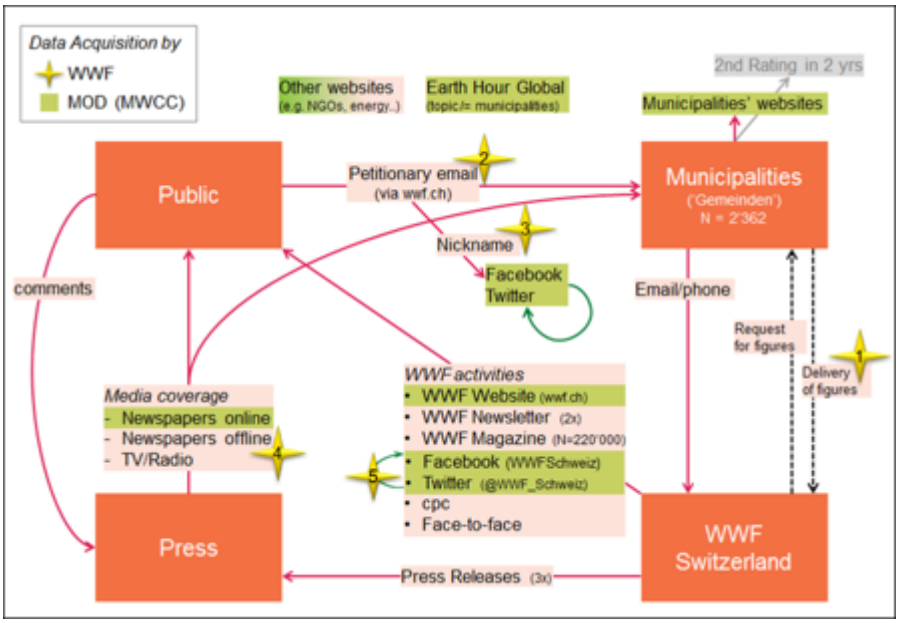

Figure 6: Anticipated data flows caused by Earth Hour Campaign of WWF Switzerland and responsibilities for data collection.

The MOD data collection is described in the Deliverable D2.1.

Engagement measured by WWF Switzerland.

(1) Number of municipalities who took part in the street lighting rating.
(2) The amount of petitionary emails sent to the municipalities.
(3) Number of people who invented a new toponymy/nickname for their municipalities.
(4) The campaigns' news media coverage.
(5) Social media resonance.

3.4. Results& Discussion

3.4.1. Engagement statistics of municipalities for rating

WWF Switzerland called upon all 2.362 Swiss municipalities to take part in the Gemeinderating. 339 (14%) municipalities did so and provided detailed figures of their energy consumption regarding street lighting. Some of them gave additional Feedback: ~50 in German, ~10 in French, ~10 in Italian.

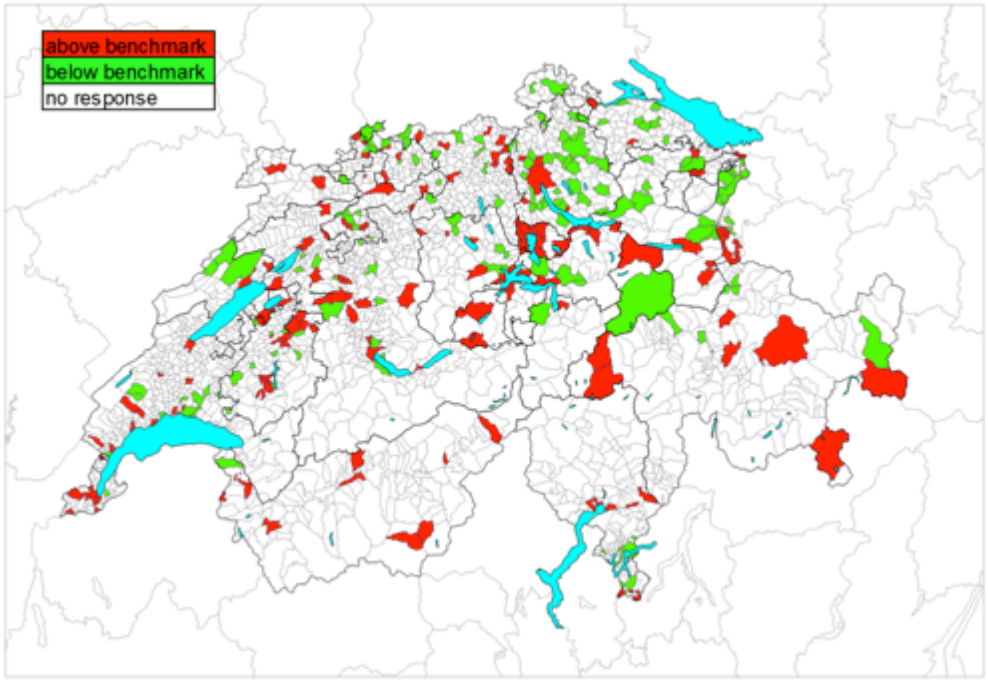

Figure 7: Engagement Statistics of municipalities that filled out the survey on their street lighting.

Comments:

The number of participating municipalities was lower than expected. However, all larger cities participated; therefore about 45% of Switzerland's population was covered.

Feedback of municipalities with regard to the rating was largely negative. As the municipalities took an effort to deliver their rating information voluntarily some understandably felt disappointed when their citizens were blaming them according to a lower rank in the rating.

3.4.2. Engagement statistics "Petitionary E-mails"

From February 27th until April 6th, the website wwf.ch (Earth Hour subpages) received 39.000 visits and 3.261 petitionary E-mails were sent to the various municipalities. In Figure 8 frequency of user engagement is compared with the dissemination activities of WWF Switzerland (cf. top row of Figure 8).

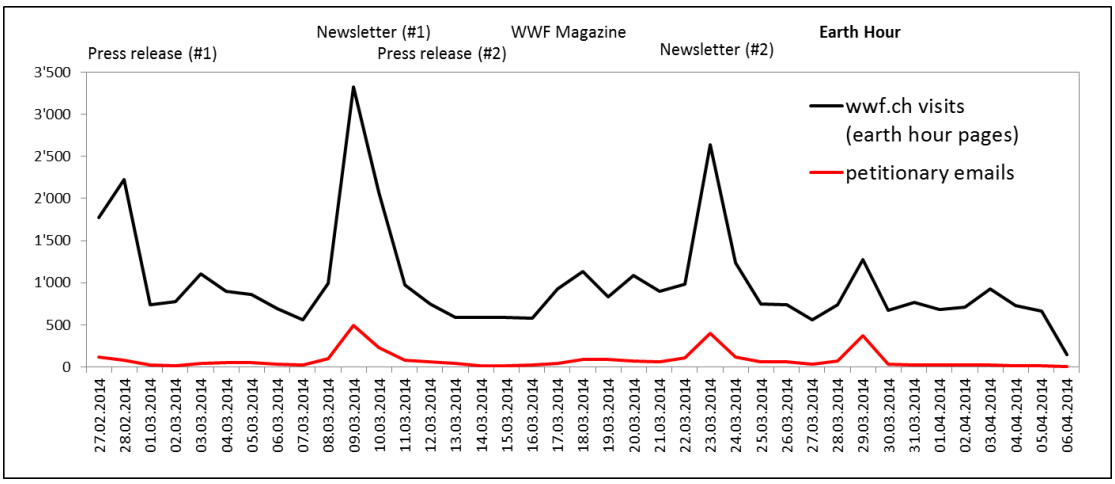

Figure 8: Engagement Statistics for people who visited wwf.ch/earthhour (mobilisation tool) (source: Google Analytics)

7.7% of people who visited the campaign landing page did participate in the campaign. 4.2% of all visiting people signed up for the WWF-newsletter.

Comments:

The above mentioned conversion-rates are much smaller than for WWF Switzerland's autumn campaign where people were asked to estimate their individual footprint. There about 17.4% of visitors did participate in the challenge and 5.75% did sign up for the WWF newsletter.

The results with regard to conversion rate of participation and newsletter-subscriptions must be deemed unsatisfactory.

3.4.3. New toponymy for the municipalities

Once the petition was sent, participants had the option to create positive/negative toponymy for their municipality and to share it via Facebook/twitter. Depicted is the number of people who clicked on the Facebook/twitter button. Whether they actually posted anything could not be measured in the Google Analytics tool. Insights from other tools indicate a number close to zero.

Figure 9: Conversions from invocations over Facebook and twitter (source: Google Analytics)

3.4.4. News media coverage

Two different sources were used to track news media coverage:

The clipping service *Argus* collected 165 online/offline articles (incl. Radio) concerning the topics climate/energy from February 27th to March 6thonly. The service is expensive and therefore was limited to one week.

The social media monitoring tool *Brandwatch* collected 181 online news media articles from February 13th to April 8th, concerning the topics street lighting, lights-off, municipality rating and earth hour.

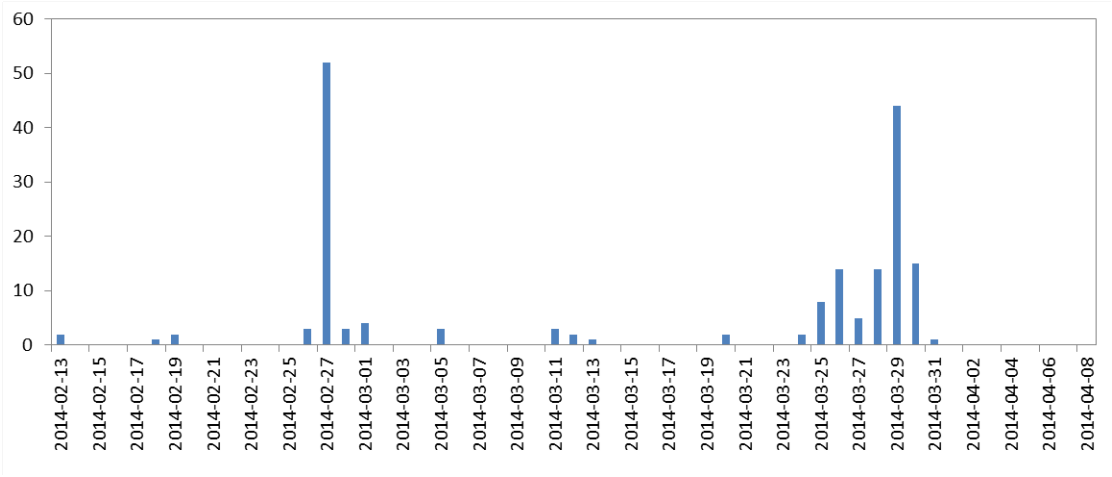

Figure 10: Online news media coverage (source: Brandwatch)

News Media - Highlights:

- 1.5 pages in the national, free commuter newspaper “Blick am Abend”,
- Short report in TV-news, main edition. (about 50% market share in prime time: 19:30 to 20:00)
- Various radio interviews
- In-depth reports in regional media

Comments:
The response was higher than expected and much higher than in 2013.
WWF and its goals were almost always presented in a positive light.

3.4.5. Social media coverage (Twitter)

The social media coverage on Twitterwas tracked with *Brandwatch*

From Feb 13th to April 8th, in Switzerland 179 posts related to Earth Hour were broadcasted on Twitter

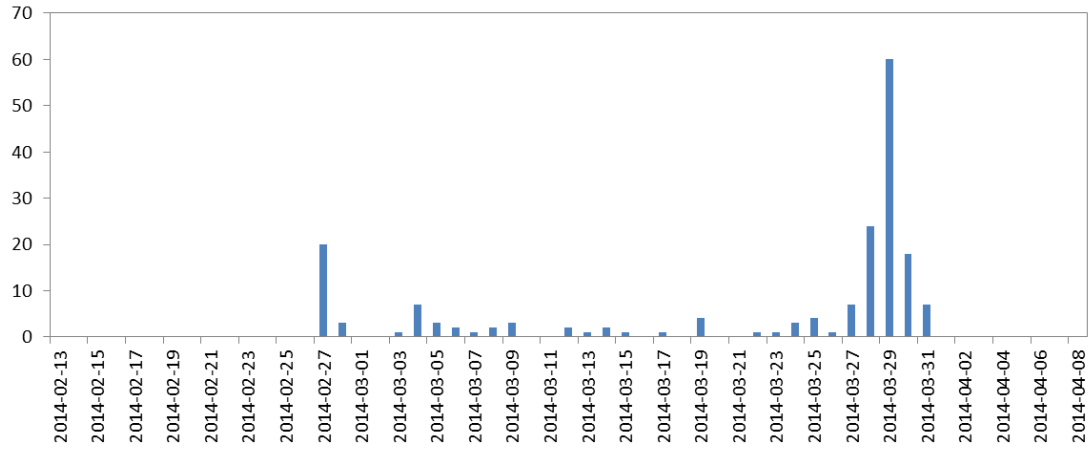

Figure 11: Twitter coverage: Number of Tweets related to Earth Hour Switzerland

3.4.6. Social media coverage (Facebook)

Social media coverage on Facebook was tracked with *Facebook insights.* In total 96'964 views and 1805 likes were counted for 10 created posts between February 27th and March 31st..

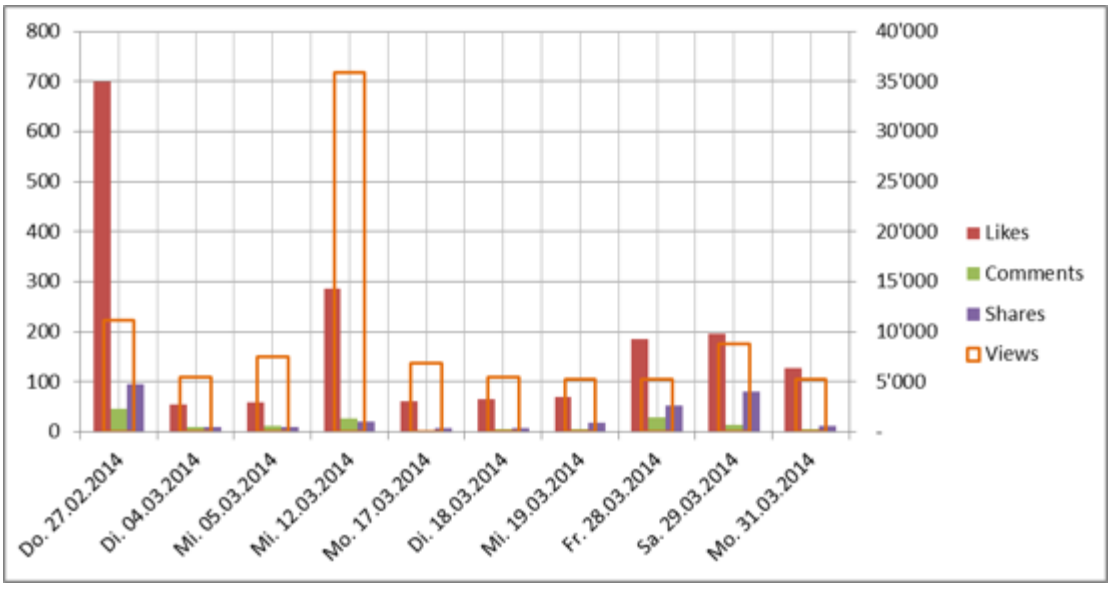

Figure 12: Facebook coverage, Likes, Comments and shares on primary axis, Views on secondary axis (Source: Facebook insights)

Table 1: Facebook posts of WWF_Schweiz on Earth Hour 2014

Post	Date	Views	Likes	Comments	Shares	Clicks

						(total)
EH14 #1: Your City will be renamed, too	27.02.	11136	700	47	95	1354
EH14: Background	04.03.	5508	54	9	10	1436
EH14: Check your municipality!	05.03.	7544	59	11	10	1965
EH14: St. Gallen	12.03.	35920	287	27	21	2208
EH14: Zug	17.03.	6816	61	4	8	2281
EH14: Bern	18.03.	5490	65	6	7	2347
EH14: Name & Shame	19.03.	5308	69	6	18	2453
EH14: Remember: Turn off the lights tomorrow (and write your city council)	28.03.	5232	186	30	53	2533
EH14: Where are you tonight, at 8:30 --> Switch off the lights there!!	29.03.	8776	196	15	80	2799
EH14: Did you switch off the lights? Then write your city council now!	31.03.	5234	128	5	12	2946

Comments: High interest about the launch of the campaign, wide reach for post on the 12th of March, also fostered through commercials (marketing). Bar charts (graphics) on street lighting worked better than expected. Most successful wrt dialoguing was the impudent municipality toponymy «St. Geilen». Most interaction was generated by posts around the time of EH weekend.

3.4.7. Offline action

Campaign Day offline presence

17 of 23 regional WWF sections were present on the street. They engaged 251 people to send out feedback E-mails to their municipalities.

Lights Out

40 municipalities including all large cities, except Bern officially participated.

Comment: More cities participated than ever. Especially small municipalities were acquired through the rating.

3.5. Concept Evaluation and next steps (WWF)

3.5.1. Concept evaluation

Learnings and Concept evaluation for the campaign are summarized in the following tables.

Table 2: Concept of municipality rating

Positive	Negative
Simple; indicators easy to understand for municipalities and public	1st point of contact should have been through a tangible medium (letter)
Rating enables goal oriented cooperation with municipalities (for WWF, SAFE, other partners, e.g. FDE)	Larger cities, not only Canton capitals, should receive phone reminders
Impact: Contact between citizens and city administration, attention for topic of public lighting	Methodical shortcomings of rating: the fact that the form of questionnaire (voluntary self-reporting) would not produce robust results was not anticipated.

Table 3: Concept of "Lights Out!"-event

Positive	Negative
Known concept, cities know what the concept is about	Municipality Rating concept gave no opportunity to municipalities to be part of the dissemination strategy Cities were partners in “Lights Out!”-event and simultaneously „enemies“ in the rating process. → Difficult constellation

Table 4: Toponymy - Concept

Positive	Negative
Coherent concept	Concept of ongoing footprint campaign was not applicable
Funny, humorous, appealing	Difficult to adapt the creative names to French and Italian
Especially cheeky toponymy was popular & generated interactions	Names sometimes difficult to understand
Helpful to generate attention and illustrate the project	Regional limits of humorous names
	Negative names were often too

	aggressive for the administrations of municipalities →complaints Cities reluctant to be renamed without having participated

Table 5: Online concept

Positive	Negative
Design, Visitor flow	E-Mail to municipality was a big step to take for visitors (affords high engagement)
Responsive design→ Content easily accessible on Smartphones and tablets	LED lamps are too expensive, even after discount. → Discount was an unattractive offer
WCMS compatibility/ own microsite.:Allowed for much flexibility	Cumbersome: Technically, texts can‘t be transferred from test environment to live environment automatically

Table 6: Marketing Concept

Positive	Negative
Basic idea of toponymy campaign very interesting (create pictures of town signs with newly created nicknames)	Professionalizing of implementation necessary (storytelling, movies, etc.)
Idea and concept ideal to address a dry topic in a humorous way	Substandard visualization (pictures)
Important support for media work	Feedback from municipality: Inform municipalities (those with positive mention only) about campaign so they can prepare for media interest

3.5.2. Overall Evaluation

- Concept and communication were great to stage the dry topic of energy in a humorous and interesting way whilst conveying a serious message with regards to content

- Again, the results of mobilization with regards to Newsletter-subscriptions were unsatisfactory.

3.5.3. Next steps

For 2015 WWF Switzerland will launch a one year long campaign on climate and energy with focus on heating systems. The rough concept for this is in the making. Earth Hour global 2015 will also focus on the climate change topic.

This is especially important as in December 2015 the United Nations Climate Change Conference, COP21 (also CMP11) will be held in Paris.

The overarching goal of the Convention is to reduce greenhouse gas emissions to limit the global temperature increase to 2 degrees Celsius above current levels.[7]

For environmental causes this is a major milestone because politicians all over the world have the possibility to vote for more stringent climate targets and commitments for their nations.

DecarboNet will support both: the global Earth hour as well as the Swiss national campaign by providing useful information on how to engage more people for WWF's causes not only through social media but also through the various functionalities and initiatives of the DecarboNet platform.

4. Advanced Campaign Analysis

Social media is now commonly used to help communicate messages to the general public. Many organisations have staff dedicated to this task and to improve the connection of the key messages with the wider public through social media. WWF, as an organisation, disseminates messages to the public, on climate change, energy consumption, impact of fossil fuel extraction, conservation of endangered species, and other relevant topics that help to get to a future where people and nature thrive.

[7] "Schedule of Events". United Nations Framework Convention on Climate Change. Retrieved 12 November 2013.

One of the most relevant social media channels to communicate these messages is Twitter. With over 271 million monthly active users and 500 million messages per day[8] Twitter has become a rich resource for organisations to report their messages and to engage with the public.

In this section we explore the use of Twitter as communication channel by WWF during the Earth Hour campaign. Our goal has been to collect relevant data around the campaign and to apply engagement assessment analysis to measure the impact of WWF's social media communications.

Several techniques have been applied to assess this engagement, including: user and content feature analysis, topic analysis and news impact analysis. Specifics about the data collected, the applied analysis methods and the obtained results are reported in the following sections.

4.1. Social Media Data Collection

This section presents a brief overview of the data that has been collected around Earth Hour in Twitter and the architectural solution developed to collect this data. This architectural solution has been developed in collaboration between WP3, WP4 and WP6. Its goal is to obtain fine-grained datasets that can be used to analyse social media engagement around particular topics of interest such as "Earth Hour".

The architectural solution is presented in Figure 13. In a first instance, the data collection mechanisms developed by WP2 are used to filter the Twitter stream in real-time. As specified by Twitter,[9] the public streaming API caps the number of messages sent to a particular client to a small fraction of the total volume of tweets at any given moment.

To enhance these data, we made use of the Twitter user timeline. As specified by Twitter[10] the user timeline API is the definitive source of tweets when seeking completeness. The collection process that we follow is therefore divided in two steps:

- In a first step we use the data collection techniques developed by WP2 to filter the Twitter stream, obtaining posts in real time around a particular topic, in this case "Earth Hour". These posts are pre-processed and stored.

[8]https://about.twitter.com/company
[9]https://dev.twitter.com/docs/faq
[10]https://dev.twitter.com/issues/716

- In a second step, we extract all user IDs from the previously collected data, and use the Twitter user timeline to collect the last 3,200 posts for each user (note that this is a limitation of collection imposed by Twitter[11]). By using this process, we don't only complete our dataset around "Earth Hour" with posts that may have been missing for each individual, but we also collect a historic set of posts around each user. This will help us to better understand the topics of interest, of those users participating in the Earth Hour campaign (see Section 4.3.3).

The architectural diagram of our data collection solution is shown in Figure 13. As we can see the collector extracts data for four main units of information and stores them in a database. These units include: posts, replies/retweets/favourites, tags and users.

- **Posts:** This table contains information regarding the posts, including its own identifier, its author, its text, and the date it was created.
- **Replies/Retweets/Favourites -** This table contains information about the messages that have been retweeted, favourite or replied by other Twitter users. A message with a high number of replies, favourites and retweets indicates that the message is popular and is therefore engaging users in the conversation. These engagement indicators, in particular retweets, will be used later for the analysis presented in section 4.2.
- **Tags -** This table stores information about the set of hashtags mentioned in the tweets. Hashtags provide an indication of the topics that have been posted around the Earth Hour campaign.
- **Users -** This table contains information of those users who participated in the 2014 Earth Hour campaign in Twitter, including their geographical location, their description, their time on the platform, etc.

[11] https://dev.twitter.com/discussions/276

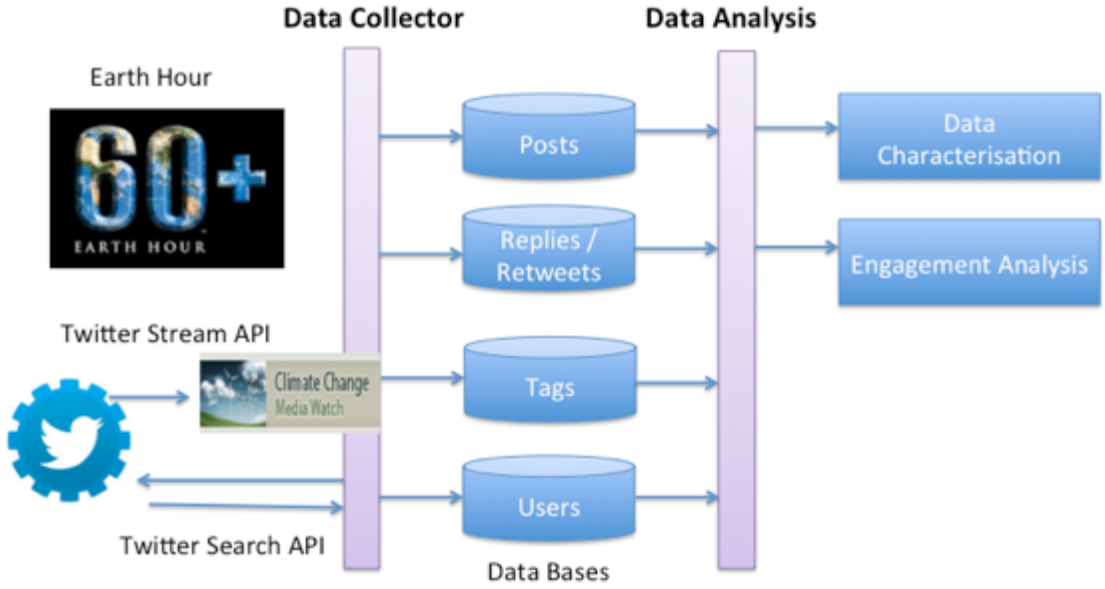

Figure 13: System Architecture

4.1.1.Global English Earth Hour Dataset

The initial dataset collected by using the WP2 streaming mechanisms contained 8,145 tweets generated by 6,195 users. These tweets were posted between 27/01/2014 and 23/06/2014. The collection of these tweets was restricted to the English language.

Using our developed data collection pipeline, we obtained the IDs of the 6,195 users participating in the 2014 Earth Hour campaign in Twitter and collected the latest 3,200 tweets for each of those users. The new collected dataset contains more than 14 million posts. Note that these posts contain data around the 2014 Earth Hour campaign, as well as other topic of interests posted by the users over time.

only in the 2014 ‘Earth Hour’ posts (35,354) for the rest of our analyses.

shows the available posts around “Earth Hour” in our dataset grouped by year. Note that for the 2014 campaign we now have 35,354 posts containing the keywords “earth hour” or “earthhour” or the hashtag “#earthhour”. This is a more complete dataset than the one we originally obtained by filtering the Twitter stream API.

We can notice that the number of posts around “Earth Hour” increases by year. However, it is important to highlight that for most of the users in our

dataset we don't have data for all years. Twitter only allows the collection of the latest 3,200 posts per user. If the user is very active, and posts more than 3,200 posts in a year, we won't have any information for that user in previous years within our dataset. For example, as we can see in the table, for 2,193 users in our dataset their first post belongs to 2014. Considering the incompleteness of data for years previous to 2014 we concentrate only in the 2014 'Earth Hour' posts (35,354) for the rest of our analyses.

Table 7: Earth Hour posts per year

N of posts	Year
23	2008
902	2009
1906	2010
1604	2011
3074	2012
10312	2013
35354	2014

Table 8: Users and year of their first post within our dataset

N of Users	Year of their first post
29	2008
351	2009
363	2010
551	2011
905	2012
1721	2013
2193	2014

Figure 14 and Figure 15 provide some insights about the temporal distribution of the 35,354 tweets around the 2014 Earth Hour campaign.

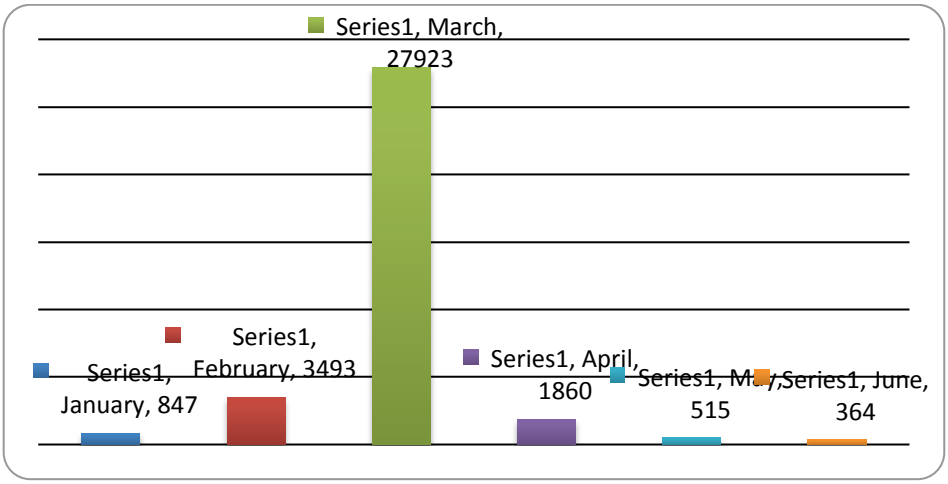

Figure 14: Earth Hour posts per month for the 1st half of 2014

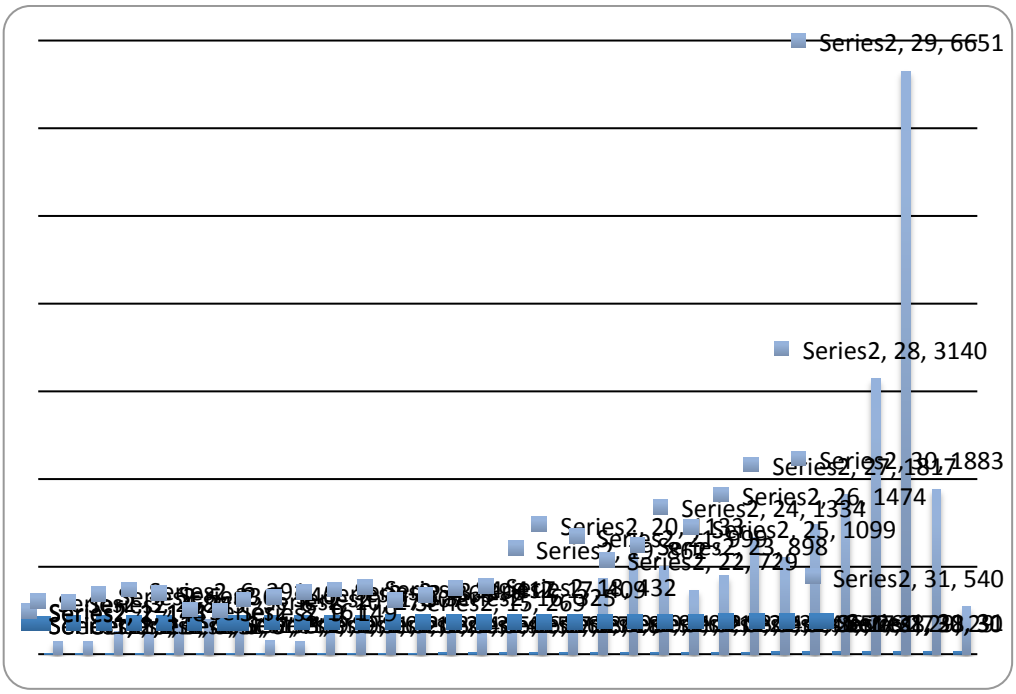

Figure 15: Earth Hour posts for March 2014

As we can see in the figures, March was the month with a higher number of posts, and in particular, 29th of March. Note that Earth Hour was officially celebrated on the 29th of March at 8:30 p.m. in local times all over the world.

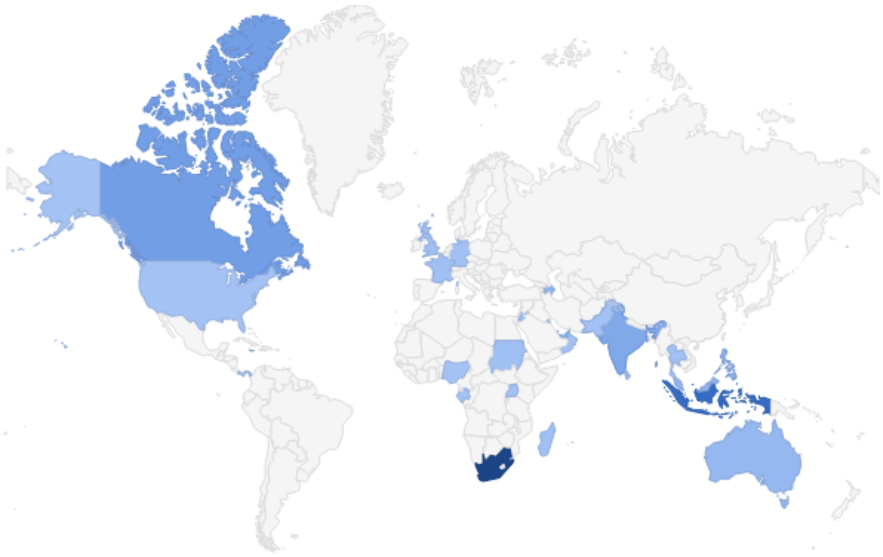

Figure 16: Geographic distribution of the global Earth Hour users

Figure 16 shows the geographic distribution of the posts/users within our dataset. To obtain this geographic distribution we have made use of the "location" property available in the profiles of each user. We geocoded these locations (extracted the latitude and longitude coordinates) by making use of the Google Maps API[12] and accounted the number of tweets for each location by considering the location of the user who posted it. Note that, while tweets sometimes have associated geo coordinates, only 564 tweets in our dataset possess this information.

As we can see in the map, while tweets within our dataset come from all major English-speaking countries, the countries generating a higher number of tweets are South Africa, Indonesia and Pakistan.

4.1.2.WWF_Schweiz Followers Dataset

In addition to the dataset collected around Earth hour, WWF_Schweiz was particularly interested to investigate the engagement of its followers towards the Earth Hour campaign. For this purpose, a data collection process has been performed to analyse this engagement. The set of user IDs have not been filtered this time via the streaming API, but have been collected directly as the user IDs following the @WWF_Schweiz Twitter Account.

Applying our collection process, we collected 6,889,964 posts generated by 12,311 users. There is an additional set of 4,683 followers for whom we could not obtain any data, since they keep their Twitter profiles private. These constitute (27.5%) of the @WWF_Schweiz Twitter followers.

Table 9 shows the number of posts containing the keywords "earth hour" or "earthhour" or the hashtag "#earthhour" per year. As mentioned for the previous dataset, it is important to notice that not for all users we have data for all years. **Table 10** show the number of users and the year of their first post within our dataset. As we did for the previous dataset, we concentrate in the 5,618 tweets around Earth Hour for the rest of our analyses.74% of these tweets are written in English, 10% in German, 6% in French, and the other 10% in several other languages, including Spanish, Italian, Swedish, etc.

Table 9: Earth Hour posts per year

N of posts	Year
14	2008

Table 10: Users and year of their first post within our dataset

N of Users	Year of their first post
116	2008

[12] https://developers.google.com/maps/

203	2009
405	2010
731	2011
1552	2012
4665	2013
5618	2014

1216	2009
1424	2010
1792	2011
2053	2012
3120	2013
2569	2014

4.2. Engagement Analysis

Once the data has been collected, our goal is, first to characterise engagement towards the Earth Hour campaign in Twitter, and second, to study which factors influence engagement. Note that this analysis has been performed over the Global English Earth Hour dataset (see Section 4.1.1)

4.2.1.Expressing engagement in Twitter

In the Twitter platform, retweeting, replying and favouring are actions that require an explicit interaction from a user towards another user. These actions have been repeatedly considered in the literature on social media [3] as engagement indicators. In total, the posts generated around the Earth Hour campaign received 261,487 retweets and 35,961 favourites. For an overview, the following tables show the top 10 retweeted posts and the top 10 favourited posts.

Table 11: Top 10 retweted posts around Earth Hour

Post	Retweets
RT @ArianaGrande: Joining the movement by going dark for #EarthHour on March 29 from 8:30-9:30 pm http://t.co/hR0mUi5JT4 @World_Wildlife yo…	4901
RT @earthhour: Join the world for #EarthHour at 8:30PM local time wherever you are in the world. Use #YourPower at http://t.co/HxefGDqjdL	2721
RT @earthhour: #EarthHour 2014 shows our world is full of Superheroes for the Planet. Join the movement at http://t.co/HxefGDqjdL http://t.…	2316
RT @earthhour: #EarthHour 2014, inspiring a new generation of Superheroes for the Planet. You can mobilise the Power of Youth at http://t.c…	1874
RT @Ennui_Raver: Gucci mane turn off youre blackberry torch. It earth hour. You piece of shit. Yuo fuckin piece of shit turn off your black…	1831
RT @JacksGap: Ralph is the man. Spread the love and #passthepanda ahead of #EarthHour on Sunday 29th March 20:30 @wwf_uk http://t.co/CMQS1l…	1743

RT @earthhour: It's not about what country you're from, it's about what planet you're from. Join the world for #EarthHour http://t.co/v3Q9z…	1686
RT @asonofapeach: Earth Hour? Switch off the ERP gantries island wide for one hour ah.↲↲Cannot right? CB Earth Hour your mother.	1527
RT @earthhour: Go beyond the hour. Back an #EarthHour project for the planet with #YourPower at http://t.co/pJfTb4SWEL http://t.co/t1isxVQg…	1500
RT @stephenfry: Spread the love and #passthepanda ahead of @earthhour #EarthHour 2014 – http://t.co/wVbCjOUJZv	1454

Table 12: Top 10 favourited posts

Post	Favourites
Kola and I for Earth Hour 2014 @wwf_uk #passthepanda http://t.co/1sk9uBRGwi	1287
Use @Instagram and share your #EarthHour with the world this Saturday, 8:30PM wherever you are on the planet http://t.co/YSTBesYl7m	960
It's not about what country you're from, it's about what planet you're from. Join the world for #EarthHour http://t.co/v3Q9z9QD7u	433
'The earth is what we all have in common.' ~ Wendell Berry #earthhour2014 http://t.co/jXmhvZXxCq	350
Earth Hour is making its way across the Atlantic! Next countries to switch off include Brazil, Argentina & Bermuda! http://t.co/sZ3lSmuCO2	346
Happy to be the youngest brand ambassador for WWF's International Earth Hour campaign..↲Love,↲Anirudh http://t.co/DZ4NO1uX8g	332
A great #EarthHour shot from #London - both @TowerBridge and #CityHall switching off! http://t.co/JmtgUQvxDD	285
Andrew Garfield, Emma Stone, @iamjamiefoxx & @marcw on stage at #EarthHour 2014 in #Singapore! Lights out in 15 mins http://t.co/il45Y8XcZA	242
#EarthHour kicks off now in China, Taiwan, Hong Kong, Mongolia, Singapore, Malaysia, Macau, Phillipines and Brunei!	238
Our pandas have made it to Westminster Bridge! Have you spotted any of them in London this morning? #EarthHour http://t.co/wFM6WpyIqw	217
Earth Hour is not just about switching off the lights for the 1 hour... http://t.co/eLB7al8rOC via @IrinaGreenVoice	216

As we can see in Table 11 and Table 12 there is low overlap in the lists of top 10 retweeted and favourite posts. While retweeted posts are more focused on the themes selected for the 2014 campaign (super heroes, going dark, passing the panda), the favourite posts are more focused on the evolution and spread of the campaign across the world. Note that, when retweeting, as opposed to when favouring or replying, users are spreading the voice to their followers, which constitutes a stronger involvement and engagement with the issues posted around the Earth hour campaign. Additionally, while the Twitter

API provides the number of retweets and favourities for each post, it does not provide its number of replies. While we do have in our dataset reply information (since, for each reply the Twitter API provides the parent post) we do not know exactly how many replies each of the tweets in our dataset generated. Considering that the reply information may be incomplete, we have decided to focus on retweets as engagement indicator for the rest of our analysis.

4.2.2.Factors that influence engagement in Twitter

In previous works we have identified a series of factors to describe and identify influence in engagement [Rowe at al., 2014; Rowe et al., 2011]. These factors aim to describe the users posting the messages as well as how the posts are written and when they are published. In this section we describe how we have identified, by using these factors, the main characteristics of those users and posts that generated higher levels of attention during the earth hour campaign. The factors considered for this analysis are listed below:

User Features

- *In-degree*: This feature measures the number of incoming connections to the user.
- *Out-degree*: This feature measures the number of outgoing connections from the user.
- *Post Count*: Measures the number of posts that the user has made over her life in the system.
- *User Age*: Measures the length of time that the user has been a member of the Twitter.
- *Post Rate*: Measures the number of posts made by the user per day.

Content Features

- *Post length*: Number of terms in the post.
- Complexity: Cumulative entropy of terms within the posts to gauge the concentration of language and its dispersion across different terms. Let n be the number of unique terms within the post p and fi the frequency of the term t within p. Therefore, complexity is given by:

$$complexity(p) = \frac{1}{n}\sum_{i=1}^{n} f_i(long_n - \log f_i)$$

- *Readability*: This feature gauges how hard the post is to parse by humans. To measure readability we use the Gunning Fox Index[13] using

[13]http://en.wikipedia.org/wiki/Gunning_fog_index

average sentence length (ASL) and the percentage of complex words (PCW).

$$0.4*(ASL+PCW)$$

- *Referral Count*: number of hyperlinks (URLs) present in the posts.
- *Mentions*: number of mentions to other users within the posts.
- *Informativeness*: The novelty of the post's terms with respect to the other posts. We derive this measure using the Term Frequency-Inverse Document Frequency (TF-IDF) measure, which is commonly used in Information Retrieval:

$$\sum_{t \in p} tf_{t,p} \times idf_t$$

- *Polarity*: Average polarity (sentiment) of the post. We are computing sentiment by using SentiStrength,[14] a state of the art method for analysing sentiment in social media data.
- *Time of the day*: Time when the tweet was posted (e.g., 20:00)

As described in Table 13, over the first half of 2014, from 2014-01-01 till 2014-07-31, 22,623 posts (64%) received at least one retweet, indicating a medium-high level of engagement of users in different conversations. We refer to tweets that generate attention (i.e., were retweeted) as *seed posts*.

Table 13: Seeds vs. non seeds posts in Earth Hour Dataset

Dataset	Posts	Seed	Non seed
Earth Hour	35,354	22,623 (64%)	12,731 (36%)

To identify the key characteristics of the posts that are retweeted (generating attention), we perform two different analyses:

- Our first goal is to identify the characteristics of those tweets that are followed by an engagement action (retweet). We call these tweets the seed posts.

- Our second goal is to identify the characteristics of those seed posts that are followed by a high level of engagement (high number of retweets)

[14] http://sentistrength.wlv.ac.uk/

Classification of Tweets

To perform the first task, we train different Machine Learning (ML) classifiers using historical data, and select the one that provides the most accurate classification of seed posts from non-seed posts. This classifier automatically assesses the probability of a tweet to generate attention and engagement, depending on the features of the tweet. To generate the different classifiers we use a balanced dataset of randomly selected 12K seeds vs. non-seed posts and use 10-fold cross validation to test their performance.

Once the optimal classifier is identified (in this case the J48 decision tree), we remove one feature at a time from the classifier, and measure the drop in performance. Those features that generate a higher performance drop are the most discriminative ones, i.e., they are the ones that better distinguish the seed posts (those generating engagement) from the non-seed posts (those that are less likely to be retweeted, replied to, or favoured).

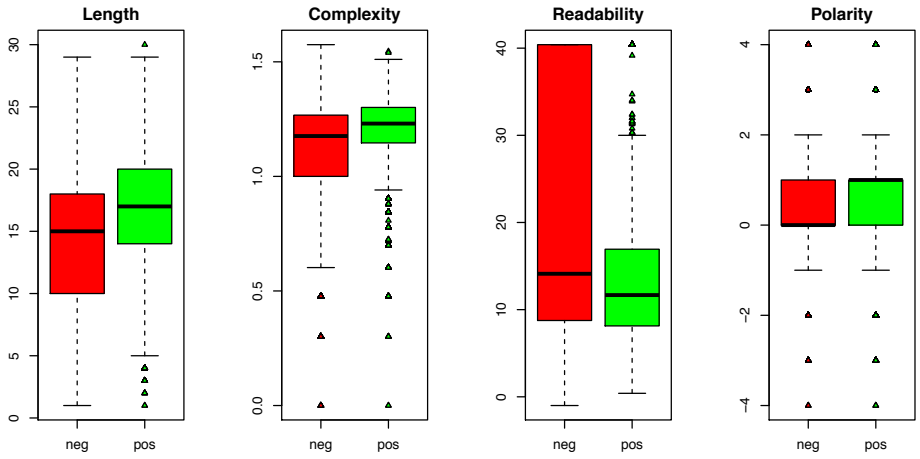

Figure 17: Features with higher influence on engagement levels

Figure 17 shows the result of this analysis. More particularly, the top 4 discriminative features that help distinguishing seed from non-seed posts are: readability, post length, complexity and polarity. **Posts generating attention (i.e., being retweeted) are slightly longer, easier to read, have positive sentiment and tend to repeat terms existing in other posts**. Note that readability is measured using the Gunning Fox Index. This index estimates the years of formal education needed to understand the text on a first reading (i.e., the lower the index level, the easier is for a text to read)

It is important to highlight that the key discriminative features to identify retweets do not include any user features, meaning that, **in terms of**

generating engagement, the content of the tweet is more relevant than the reputation of the user.

Attention Levels

For our second analysis our goal is to determine which are the characteristics of those seed posts that generate higher attention levels (i.e., higher number of retweets). To obtain this information, we created a linear regression model, where the different attributes or factors listed above are used to approximate the number of engagement interactions that a tweet is receiving.

Table 14 presents the results of this analysis. The more significant features are readability, informativeness, polarity, mentions, and outdegree. **Posts receiving higher attention (number of retweets) are easy to read, repeat keywords and themes present in other posts, have positive sentiment and mention other users.**

Table 14: Logistic Regression Coefficients. Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**

Factor	*Regression Coefficient*	*Significance*
length	8.93E-01	
complexity	1.10E+02	**
readability	-1.49E+00	***
referralc	4.81E+00	*
informativeness	-2.25E+00	***
polarity	1.17E+01	***
mentions	2.72E+01	***
timeDay	-8.71E-01	
indegree	1.69E-05	
outdegree	-1.20E-03	**
postcount	1.59E-04	
age	8.48E-04	
postrate	4.57E-01	

4.3. Topic Analysis

The following section aims to analyse the key topics of interest around the Earth Hour campaign, i.e., the topics and themes that kept users more engaged with the campaign. To extract these topics we have followed three main approaches:

- The first approach aims to analyse the hashtags contained within the tweets. Hashtags are keywords preceded by the # symbol that users include in the tweets to express their main themes.

- The second approach uses semantic annotators to process the text of the tweet and to identify the key entities (places / products / companies, etc.) that appear in the tweets under analysis.

- The third approach uses Latent Dirichlet Allocation (LDA) to analyse which topics are discussed by Twitter users before, during and after the Earth Hour campaign.

Note that the topic analyses have been performed over the Global English Earth Hour dataset (see Section 4.1.1)

4.3.1.Hashtag Topic Analysis

The tag cloud displayed in Figure 18 shows the main Hashtags appearing in our Global English Earth Hour dataset. The size of the hashtag is an indication of its frequency within the dataset. The colours are for better visualisation but do not convey any meaning. Note that we have removed the main hashtag (#earthhour) for a better visualisation, since its frequency (13,898 occurrences) is significantly higher than the one of the other hashtags. The second most frequent tag is iniaksiku with 2,080 occurrences. As we can see, the main hashtags of interest during the campaign include:

- iniaksiku is a term used during the campaign in Indonesia. It means 'ini aksiku, mana aksimu' (this is my action, what is ours). It is the Indonesian version of IWIYW (I will if you will)
- Earthhourza (za) is the domain name of South Africa. Tweets with these Hashtag aimed to identified content regarding the Earth Hour South African campaign.
- earthhour2014 is the identifier of the year 2014 Earth Hour camping
- yourpower: This Hashtag represent the campaign slogan “use your power to make change a reality[15]”
- passthepanda[16] is a campaign action in which several teddy panda bears were given to people so that they keep passing them to raise awareness.

[15]http://www.earthhour.org/
[16]http://earthhour.wwf.org.uk/get-involved/pass-the-panda

- Turnofftoturnon, durexsexplorers, getclosergofurther[17]These hashtags are part of the Durex promotion of the Earth Hour campaign. Their goal is to reconnect couples when the lights are switched off.
- spiderman[18] In this year's campaign, Spiderman was selected as ambassador
- bebrilliant. This hashtag also seem to represent a message of the original campaign "Be a part of Earth Hour - the world's biggest celebration for our brilliant planet[19]!"
- welshwish[20] This hashtag is represents the campaign that the Wales rugby stars launched to promote Earth Hour
- momentofdarknes. This hashtag represents the moment of the campaign when the lights are switched off
- earthhouruae. This hashtag represents the campaing of the United Arab Emirates
- tahiti[21] This hashtag represent the campaign conducted in the French Polynesia, and more particularly, the concert taking place in Tahiti.

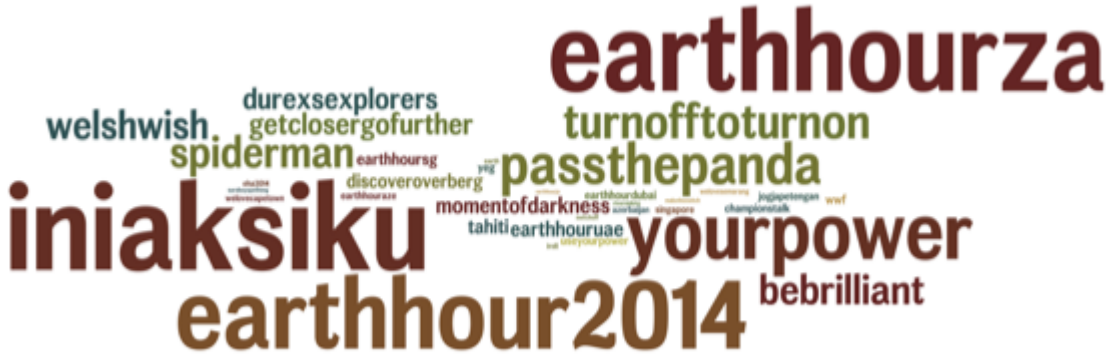

Figure 18: Top hastags within the English Global Earth Hour dataset

This analysis reveals that the top themes of the tweets are the ones promoted by the Earth Hour campaign. However, it is important to notice that a high number of the posts of our dataset do not come from citizens, but from organisations promoting Earth Hour. Figure 19 shows the top contributors to

[17]http://www.thedrum.com/news/2014/03/18/durex-promotes-earth-hour-turnofftoturnon-campaign-spanning-56-markets-worldwide
[18]http://www.earthhour.org/superhero3
[19]https://www.facebook.com/EarthHourUK
[20]http://wales.wwf.org.uk/wwf_articles.cfm?unewsid=7039
[21]http://www.earthhour.org/french-polynesia

the Earth Hour campaign within our dataset. The first column indicates the number of posts they have made for the 2014 campaign, while the second and third columns show their name and description.

np	screen_name	description
1188	WWFSouthAfrica	WWF is a non-profit organisation whose purpose is to stop the degradation of the planet and aims to buil...
899	wwf_uk	So WWF work with pandas and tigers, but cover much more - from rivers to climate change. It's all about...
693	earthhour	Earth Hour 2015, Saturday March 28th at 8:30PM. Be a Superhero for the Planet and use #YourPower
668	EHindonesia	Earth Hour 2014, Sabtu, 29 Maret, Pkl. 20.30 Waktu Setempat. Setelah satu jam, jadikan gaya hidup. Ini A...
630	WWFScotland	The official Twitter account for Scotland's original pandas - WWF Scotland. Follow our director @LangBanks too.
627	EarthHourTahiti	#EarthHour 2014 is on Saturday 29 March at 8:30 PM local time - switch off the lights and celebrate your...
487	WWFCymru	Helpu pobl a natur i ffynnu. Trydar gan Richard a Ruth gan amlaf. | Helping people and nature thrive. Twe...
472	louclarkie	Swansea City Fan living in Cardiff - my views are my own unless they are retweets. Woking for WWF Cymr...
441	EHjogja	Earth Hour 2014: Sabtu, 29 Maret, 20.30 | #YourPower Amplified. Multiplied. Globalised. Ini Aksiku! Mana...
411	EHbdg	Jaringan Komunikasi Bandung Bijak Energi | Setelah 1 Jam, Jadikan Gaya Hidup. #IniAksiku Mana Aksimu?
318	EHSolo	Kampanye yg mengajak publik melakukan aksi kecil utk perubahan besar - Matikan lampu/alat elektronik...
318	EarthHour_AU	Earth Hour has turned from a moment to a movement of Australians united in taking action on climate change.
309	EHTangerang	Official Twitter Account of Earth Hour Tangerang. Setelah satu jam, jadikan gaya hidup. Ini Aksiku! Mana...
286	WWFCanada	Building a future in which people and nature thrive. Pour le français, suivez @WWFCanadaFR
279	EHSurabaya	Mematikan lampu dan alat elektronik yang tidak terpakai selama satu jam baru awal ! Setelah satu jam jad...
268	EHKediri	Earth Hour 2015, Sabtu, 28 Maret, Pkl. 20.30 Waktu Setempat. Setelah satu jam, jadikan gaya hidup. Ini A...
265	EarthHourCanada	Updates on Earth Hour from WWF-Canada. Earth Hour takes place at 8:30pm on March 29th, 2014.
264	EarthHourUAE	Earth Hour is the largest environmental movement in the world. Join us and switch off your lights @ 8:30p...
254	shareenbrown	Work @wwf_uk on #EarthHour - living the panda dream...Tweets are my own.
233	ecospidey	Follow the environmental efforts of The Amazing #SpiderMan 2, the most eco-friendly blockbuster in @So...
215	RiversideBIA	120+ Shops in Toronto's Historic Queen St E Degrassi to the DVP: Award winning Restaurants, Pubs, Sho...
198	EHBogor	Gerakan global #EarthHour @EHindonesia. Cintai Bogor dengan matikan listrik tak terpakai 28 Maret 201...
196	EHAceh	Earth Hour 2014 : Sabtu, 29 Maret pukul 21.00 - 22.00 untuk Banda Aceh. Aceh siap beraksi! Ini Aksiku!...
188	FaiYHoo	Education-Environment-Entrepeneur
174	zoehammonds	Film/Music/Travel Geek. Author of Love, Life & Lemongrass. Editor of YakketyYak Magazine. Energy Expe...
168	KellieRollings	PR Manager at WWF-UK. Having a little tweet every now and then - in a personal capacity.
164	EarthHourAZE	Official channel of Earth Hour Azerbaijan. #EarthHour in Baku, @ 8:30pm, March 29, 2014.
160	DEWA_Official	???? ?????? ????? ??? - ????? ??????? ??? ????? ????? Dubai Electricity & Water Authority - A Sustainable World-C...
159	EHdepok	1 jam mematikan lampu dan peralatan listrik yang tidak dipakai selama #EarthHour hanyalah permulaan!...
159	WWF_ID	WWF-Indonesia adalah organisasi konservasi independen terbesar di Indonesia dan telah memulai kegiata...
159	Dothegreenthing	An inspiration feed using Creativity vs Climate Change to turn sustainable consumption from something...

Figure 19: Top contributors for the English Global Earth Hour Dataset

By following a simple heuristic we have identified those users related to Earth Hour or WWF. This heuristic consists on the identification of all users' names and descriptions containing the keywords "earth hour" "earthhour" "EH" or "WWF". By using this heuristic we have identified a total of 95 official representatives and associates to the Earth Hour campaign, producing a total of 13,138 posts, i.e.,**(37%) of the posts within our dataset**. The list of organisations includes among others: WWF_Australia, earthhour, WWFMy, WWFCanada, EarthHourCanada, EarthHourIL, wwf_uk, EarthHourUAE, EarthHourIndia, WWFSouthAfrica, WWFNewZealand, wwfhk, EHbdg, WWFINDIA, wwfsg, WWF_ID, WWF_Romania, WWF_Philippines, WWF_Colin, EHindonesia, EarthHourBrunei.

We discarded these users from the English Earth Hour Dataset to analyse if there was a high variance within the topics expressed by the official

organisations and the topics expressed by the citizens. For this purpose we eliminate the posts generated by the 95 identified official organisations, and focus our analysis on the rest of the posts. The set of hashtags originated using our new subset of posts is displayed in Figure 20. As we can see the topics of interest remain the same. The key difference is that some topics, such as the ones related to the Durex campaign are now more frequent than before, while others, such as earthhourza or iniaksiku lost relative frequency.

Figure 20: Top hashtags within the English Global Earth Hour dataset after discarding the posts of the 95 identified official organisations

We can therefore conclude with this analysis that **the messages and actions developed by WWF as part of the Earth Hour campaign are the ones driving the social media conversations**.

4.3.2.Semantic Topic Analysis

Additionally to the analysis of Hashtags (which are keywords explicitly expressed by the users) we have processed the posts with a semantic annotator, in this case TexRazor[22] with the purpose of identifying the key entities and concepts extracted from the English Global Earth Hour Dataset. TextRazor offers a text analysis infrastructure. It combines state-of-the-art natural language processing techniques with semantic knowledge bases to extract the key entities and concepts from documents.

As we can see in Figure 21 the top 15 identified entities include: Planet, World_Wide_Fund_for_Nature, Superhero, Durex, Cape_Town, Twitter, Singapore, Indonesia, Climate_change, Wales, Andrew_Garfield, Reef, and Energy. The entity names are similar to the hashtags identified by our

[22]https://www.textrazor.com/

previous analysis or refer to similar topics (e.g., Wales refers to the campaign that the Wales rugby stars lunched to promote Earth Hour, Andrew Garfield is the actor of Spiderman, the super hero selected for 2014 Earth Hour, etc.). The main addition provided by the semantic analysis is that we are now able to identify concrete concepts: locations, organisations, persons, etc., appearing within our dataset.

Figure 21: Top Entities identified for the English Global Earth Hour dataset

For example, among the top organisations driving engagement towards the Gobal Earth hour dataset we can highlight some of the main organisers and contributors, such as the World Wide Fund for Nature, Durex or Twitter; media and entertainment organisations, such as Instagram,THX,YouTube,WWE,Facebook and Verizon_Communications; and international organisations dedicated to the research and development of sustainability, such as ICLEI,York_University,National_Institutes_of_Health, etc.

Key persons/celebrities that help to raise awareness about the campaign in social media include: Andrew_Garfield, Emma_Stone, Jamie_Foxx, Gucci_Mane, Marc_Webb and Sophie_Ellis-Bextor. Andrew Garfield, Emma Stone, Jamie Foxx and Marc Weeb are actors of the Spiderman film (the Earth Hour 2014 super hero). Gucci mane is an American rapper, target of the popular tweet *"Gucci mane turn off your blackberry torch. It earth hour. You piece of shit. Yuo fuckin piece of shit turn off your blackberry".* Sophie Ellies Bextor was one of the celebrities performing for the Earth Hour campaign in London. Among the politicians we can highlight Crhistiana Figueres, Executive Secretary of the UN Framework Convention on Climate Change and David Miller, Canadian former politician and president of WWF-Canada.

The previous analyses reflect the topics/entities that were more popular among users during the Earth Hour campaign. As we have seen, **the activities and messages promoted by the official institutions have been**

the ones driving the social media conversations, reflecting the success and the reach of the messages propagated by the Earth Hour campaign.

To investigate whether the topics and elements used to promote the campaign (the Super hero, Durex, the participation of the Wales rugby stars) stimulate awareness towards topics such as climate change, energy, sustainability, etc., we have performed a correlation analysis between 10 selected entities within our dataset. Correlation is measured considering the distribution of entities per user.

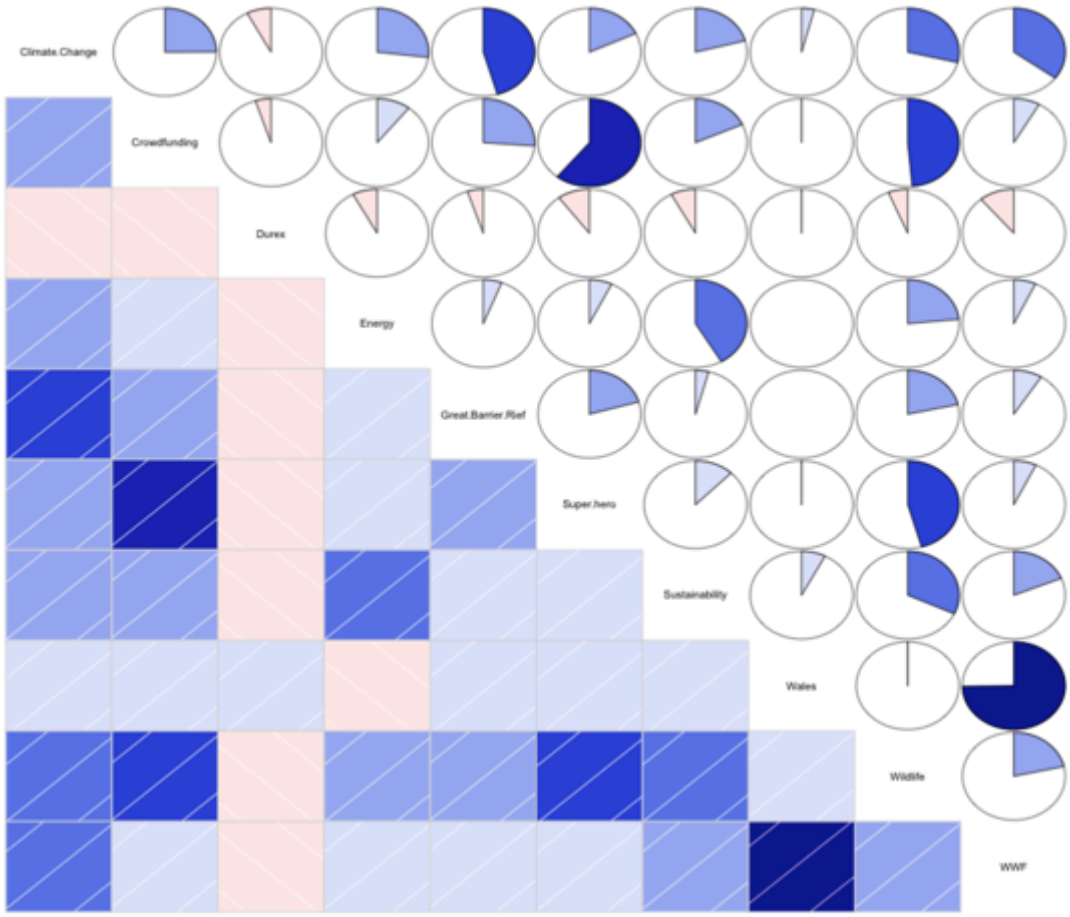

Figure 22: Frequences of co-appearances among the most frequent entities

The results of the performed analysis are displayed in Figure 22. Red means, negative correlation, blue positive correlation. Colour intensity indicates intensity of the correlation. As we can see in this image, there is a low or negative correlation between Durex and any other entity, meaning that **users tweeting about the Durex campaign did not show any particular interest**

about climate change, sustainability, or any other element of the Earth Hour campaign.

Users talking about Climate change also talk about themes around the Great Barrier Reef, wildlife, or WWF. Energy is strongly correlated with sustainability, and sustainability is as well correlated with wildlife. However, these entities have low-medium correlations with the main elements of the campaign such as Crowd funding, Durex, the Super Hero or the Wales rugby stars. This indicates that, **while the main activities and themes of the campaign did drive most of the social media conversations, the fact that the users engaged in the campaign, did not necessary mean that they also engage with climate change and sustainability issues.**

4.3.3.Latent Topics Analysis

Besides the previous analyses, we also derive the latent topics discussed within the two-month period surrounding Earth Hour (1 month before, 1 month after) by applying the Latent Dirichlet Allocation (LDA) algorithm [1] with a number of 50 topics. The goal of such analysis is to analyse how topics besides environment and Earth Hour are discussed by Twitter users and affect the WWF Earth Hour campaign.

LDA generate topics as bag of words where each topic is represented by a distribution of words. In the following figure, we can observe that, within the two months around Earth Hour, topics are mostly discussed equally.

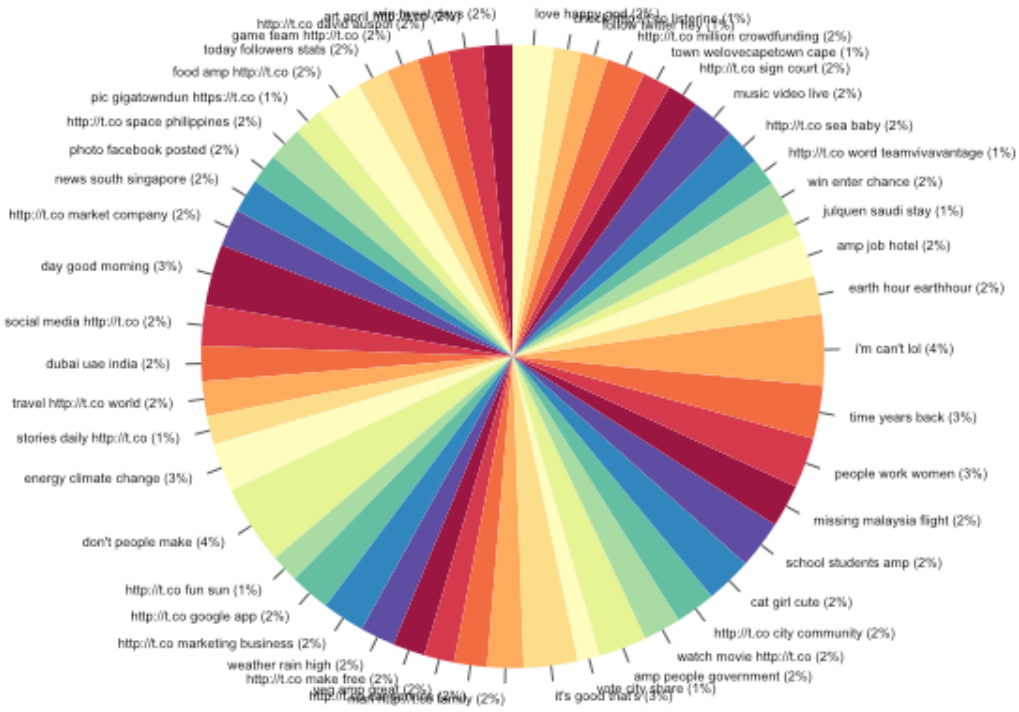

Figure 23: Distribution of Topics

Within the 50 extracted topics, we observe two topics related to climate change (#17) and Earth Hour (#38):

1. win tweet days (2%)
2. art april http://t.co (2%)
3. http://t.co david auspol (2%)
4. game team http://t.co (2%)
5. today followers stats (2%)
6. food amp http://t.co (2%)
7. pic gigatowndun https://t.co (1%)
8. http://t.co space philippines (2%)
9. photo facebook posted (2%)
10. news south singapore (2%)
11. http://t.co market company (2%)
12. day good morning (3%)
13. social media http://t.co (2%)
14. dubai uae india (2%)
15. travel http://t.co world (2%)
16. stories daily http://t.co (1%)
17. **energy climate change (3%)**
18. don't people make (4%)
19. http://t.co fun sun (1%)
20. http://t.co google app (2%)

21. http://t.co marketing business (2%)
22. weather rain high (2%)
23. http://t.co make free (2%)
24. yeg amp great (2%)
25. http://t.co car service (2%)
26. man http://t.co family (2%)
27. it's good that's (3%)
28. vote city share (1%)
29. amp people government (2%)
30. watch movie http://t.co (2%)
31. http://t.co city community (2%)
32. cat girl cute (2%)
33. school students amp (2%)
34. missing malaysia flight (2%)
35. people work women (3%)
36. time years back (3%)
37. i'm can't lol (4%)
38. **earth hour earthhour (2%)**
39. amp job hotel (2%)
40. julquen saudi stay (1%)
41. win enter chance (2%)
42. http://t.co word teamvivavantage (1%)
43. http://t.co sea baby (2%)
44. music video live (2%)
45. http://t.co sign court (2%)
46. town welovecapetown cape (1%)
47. http://t.co million crowdfunding (2%)
48. follow twitter hey (1%)
49. check http://t.co listerine (1%)
50. love happy god (2%)

Earth Hour Topic Similarities over Time

In order to better understand how users discussions are centred around Earth Hour, we compare topic distributions at different points in time against the Earth Hour “reference distribution”. This distribution is computed by considering all the tweets about Earth Hour during the day of the campaign.

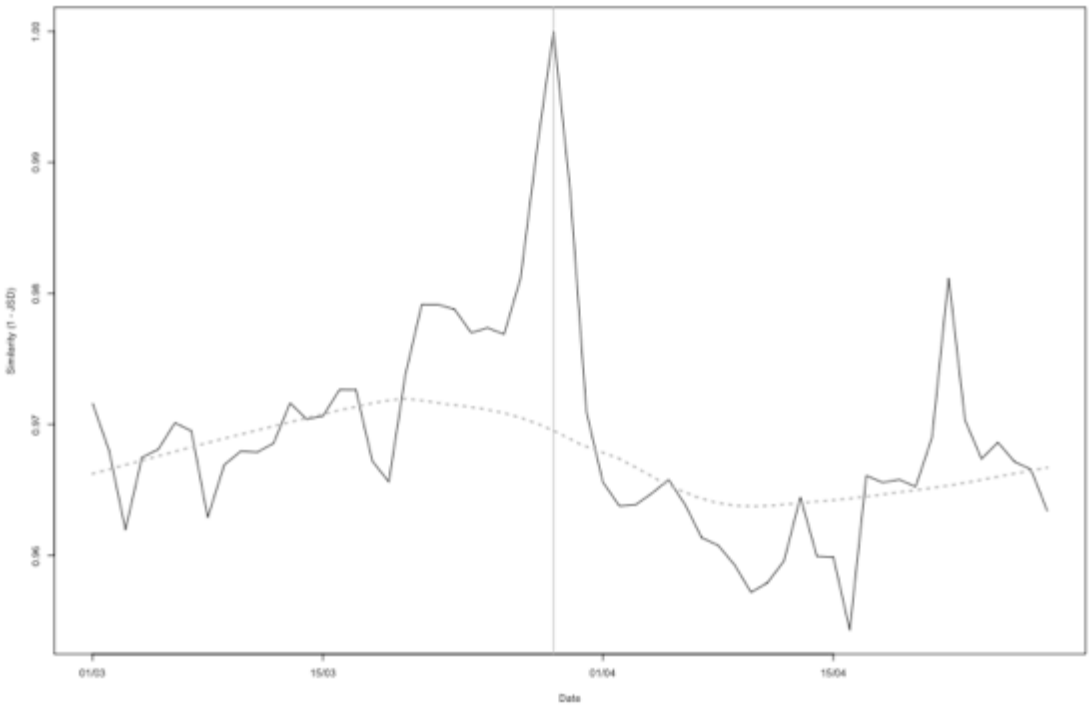

Figure 24: Topic Similarity of topic distributions of different points in time against the Earth Hour reference distribution

It can be observed that **topic distributions get similar to the Earth Hour topic distribution as we get closer to the day of the campaign**. Then topic distributions start fading, as the users come back to their usual conversations. Nevertheless, it appears that topics of discussion maintain some similarity to the topics of Earth Hour, meaning that, **after the camping is finished, users maintain some level of engagement towards the topics of the campaign**.

Topic Transitions

Using the previous results we also calculate topic transitions. The idea is to better understand the relation between topics by analysing what topics are most likely to be discussed after another one. In order to do so, we apply TM-LDA [4] individual user tweets by grouping them into pairs and users.

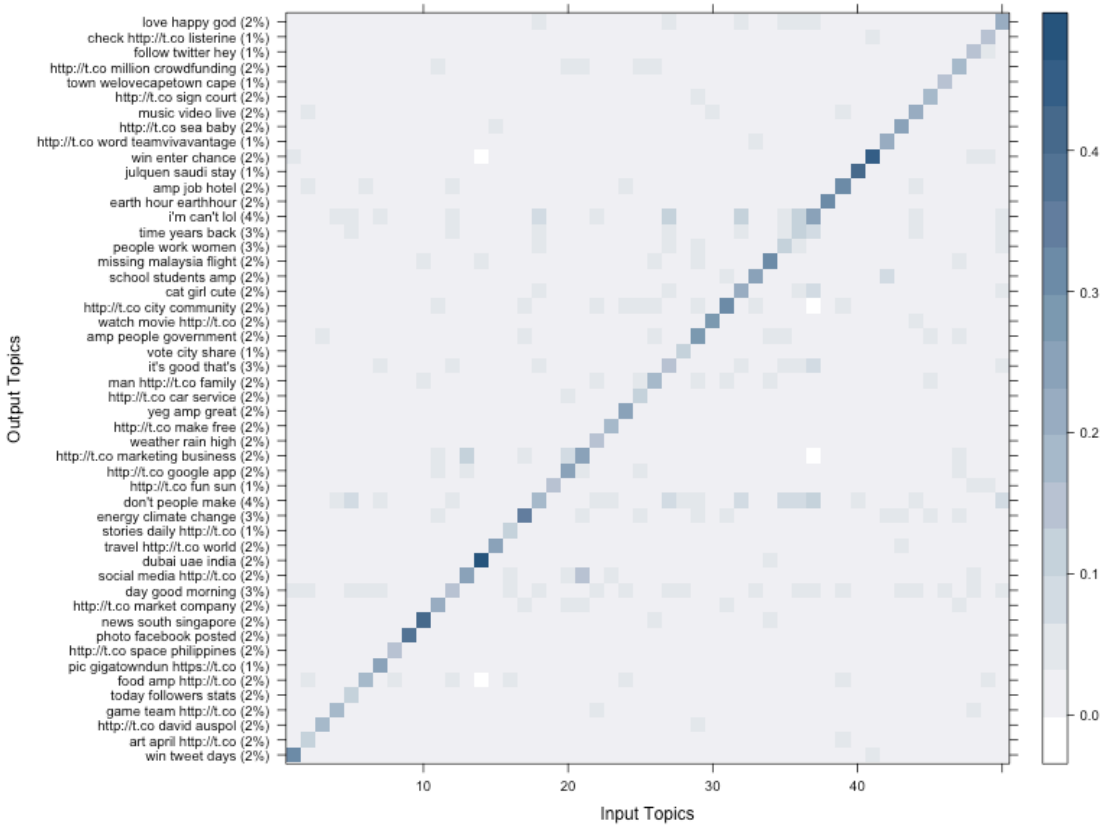

Figure 25: Topic Transistions

It can be seen from the previous figure that most of the time transitions occur within the same topic. For Earth Hour (#38), we cannot see any significant transition. This result means that there is no clear topic that is discussed before or after Earth Hour.

For the climate change topic (#17), we can see some significant transitions. People generally talk about companies (#11), marketing and business (#21), services (#25), people and government (#29), city and communities (#31) and crowdfunding (#47) before talking about climate change.

Topic Impact

We now study how users are affected by the Earth Hour campaign and how their topics change: 1) Before the campaign (IC); 2) After the campaign (PC), and; 3) Overall (OC).

We compute the Jensen–Shannon divergence (JSD) between the topic distributions of Earth Hour previous and after the event, as well as compare their distribution of topics before and after the event. When values are close to

zero, the similarity is high whereas a low similarity generates a JSD of one. We also compute the strength of the association with Earth Hour by comparing with a referential distribution (SC) obtained from Earth Hour posts. In this case, the higher value means a higher similarity.

Although it appears that the campaign had little impact on users' discussions, we have observed the relation between the three different variables for better understanding the impact of the Earth Hour campaign. Ideally, we wish to have a low IC, low OC and high PC as we would like to convert users to environmental issues and maintain their commitment after the event.

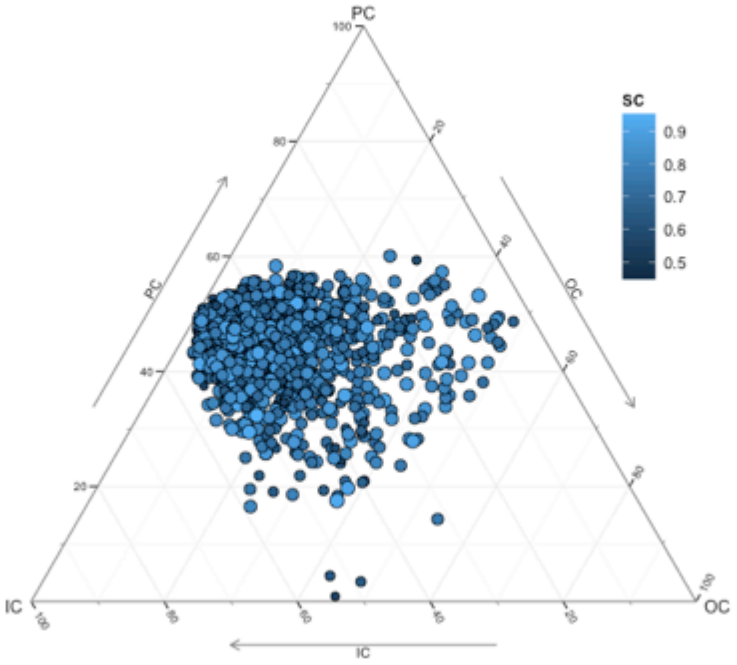

Figure 26: Topic Transistions

In general it can be observed that **users tend to return to their initial discussions after the event**, as OC is around 20%. Except for very few users, most users have a medium IC (45%) and medium PC (50%). This means that users initially change their topic of conversation but rapidly abandon it before returning to their usual topics.

4.4. WWF_Schweiz Followers

In the previous analyses we have observed that the campaign conducted by Earth Hour successfully reached a number of users. A key question that we

need to investigate is why certain users did, however, not get engaged in the campaign.

To investigate this question we have collected an additional dataset from Twitter covering information for the followers of WWFSchweiz (this dataset is described in section 4.1.2). Among their followers, some of them engaged in the 2014 campaign and some not. Considering that these are people already aware of organisations like WWF, it is even more relevant to characterise these users in order to put in place possible engagement strategies to attract them.

Within the WWF_ Schweiz dataset, over the six million posts collected, 5,618 were related to the 2014 Earth Hour campaign. These posts were generated by 338 users. Considering that WWFSchweiz has more than 17,000 followers, this indicates that **only 4.7% of WWF_Schweiz followers were engaged in the 2014 Earth Hour campaign**.

In addition, the higher engagement comes from followers that are also WWF organisations from other parts of the globe. Figure 27 shows a summary of the top contributors for the WWF_ Schweiz dataset. The first column indicates the number of posts around Earth Hour published by the user, the second column shows the name of the user, and the third column shows their description. As we can see, among the top contributors we find organisations such as WWF_UK, Earthhour, WWF_Schotland, WWFCanada, WWFFrance, WWF, EarthHourAZE, etc.

As we did for the Earth Hour Global dataset, we have applied a set of heuristics to identify official organisations. We search for all user' names and descriptions containing the keywords "earth hour" "earthhour" "EH" or "WWF". By using these heuristics we have identified a total of 77 official representatives and associates to the Earth Hour campaign, producing a total of 4,676 posts, i.e., **(83%) of the posts**.

▼	screen_name	description
897	wwf_uk	So WWF work with pandas and tigers, but cover much more - from rivers to climate change. It's all
698	earthhour	Earth Hour 2015, Saturday March 28th at 8:30PM. Be a Superhero for the Planet and use #YourPow
630	WWFScotland	The official Twitter account for Scotland's original pandas - WWF Scotland. Follow our director @La
286	WWFCanada	Building a future in which people and nature thrive. Pour le français, suivez @WWFCanadaF
254	WWFFrance	WWF / Pour une planète vivante. Le WWF est la première organisation mondiale de protection de la
202	WWF	Building a #future in which #humans live in harmony with #nature.
164	EarthHourAZE	Official channel of Earth Hour Azerbaijan. #EarthHour in Baku, @ 8:30pm, March 29, 2014.
150	WWF_Australia	For a living planet
117	wnfnederland	Het WNF bouwt, samen met vrijwilligers, donateurs en friends aan een toekomst waarin de mens le
108	Nimrod38	
105	WWF_Deutschland	Unsere Mission: Die Bewahrung der biologischen Vielfalt. Hier twittern @melaniegoemmel und @m
95	World_Wildlife	WWF works to build a future in which human needs are met in harmony with nature. Follow World
87	WWFSverige	Ideell organisation som arbetar för att hejda förstörelsen av jordens naturliga livsmiljöer och bygga
79	ahmadfauzandary	Greater Backpacker, Taste of Analyze. Part Of @EHPalembang @earthhour @WWF_ID . Next Earth H
75	WWFPak	Sustainability, conservation and direct environmental action. Proudly working with communities: pe
72	EarthHour_KO	Jeder kann Klima | WWF Earth Hour Koblenz | 29.März 2014 | 20:30 | News zum Klimaschutz & Infe
69	DermotOz	CEO of WWF-Australia. Passionate about protecting the planet's natural environment.
66	Mr_Hoffmann	Actor, Singer @theaterkoblenz; Environment & Climate Protection Campaigner; Founder of Climate
59	WWFTerraOtranto	Associazione locale WWF
53	Sudscor	obsessive individual, conspiracy theorist, cricket tragic, geek wannabe, global citizen, green collar
53	EarthHourMV	Earth Hour Maldives Official Twitter Feed. Earth Hour in Maldives started officially in 2009.
46	WWF_Kenya	Engage with WWF's Kenya Country Office Conservation work
40	wwfhk	Stay with us for a living planet. ???? Registered Name: ????(??)??? World Wide Fund F
38	LidaPetSoede	hopeful and passionate conservation professional, diver
33	WWF_Jugend	Für alle, denen die Zukunft nicht egal ist! Hier twittert für euch Community Manager @marcelglusc
33	RenevanderKruk	PvdD gem. Utrecht, Dierenwelzijn, Veganist, WNF-Promotor, Risicomanager SNS Bank, Silver bug, H
31	WWFFrance_COM	L'actualité #COM et Campagnes du #WWF #ONG #Panda #SOSVirunga
30	wwf_mada	WWF in the land of lemurs, fossa, baobabs surrounded by the stunning w-indian ocean coral centr
29	WWFColombia	¡Por un planeta vivo! ?Facebook: http://t.co/cMoeoXynmp ?YouTube: http://t.co/65ib4xC0qF
28	WWFINDIA	WWF-India is one of the largest conservation organisations engaged in wildlife and nature conserva
26	WWF_Climat	L'actualité #Climat #Énergie du @WWFFrance #Curation #Veille #Campagnes #Cop21 #ParisClimat2
26	rkarlts	For Peace I MataKaki© I B21OE I Big Fan of Metallica I
25	WWFMy	WWF-Malaysia is a national conservation trust that currently runs a diverse range of environmental
24	blouplanet	@WWF_Jugend member & actionteamer • environmentalist • activist • i have a pet panda 9.10.13 •

Figure 27: Top contributors for the WWFSchweiz Dataset

In order to investigate citizen's engagement we have therefore concentrated our analysis in the 261 remaining users. Figure 28 shows the geographic distribution of these users. Most of them are concentrated in Switzerland and Germany, although some users are also located in several european countries, as well as in in Indonesia, South Africa, Kenya and Costa Rica.

Aiming to identify their topics of intersest we have applied a keyword and semantic analysis to their profile descriptions. Twitter users include in their profiles descriptions of themselves, where they specify their profession, hobbies, etc.

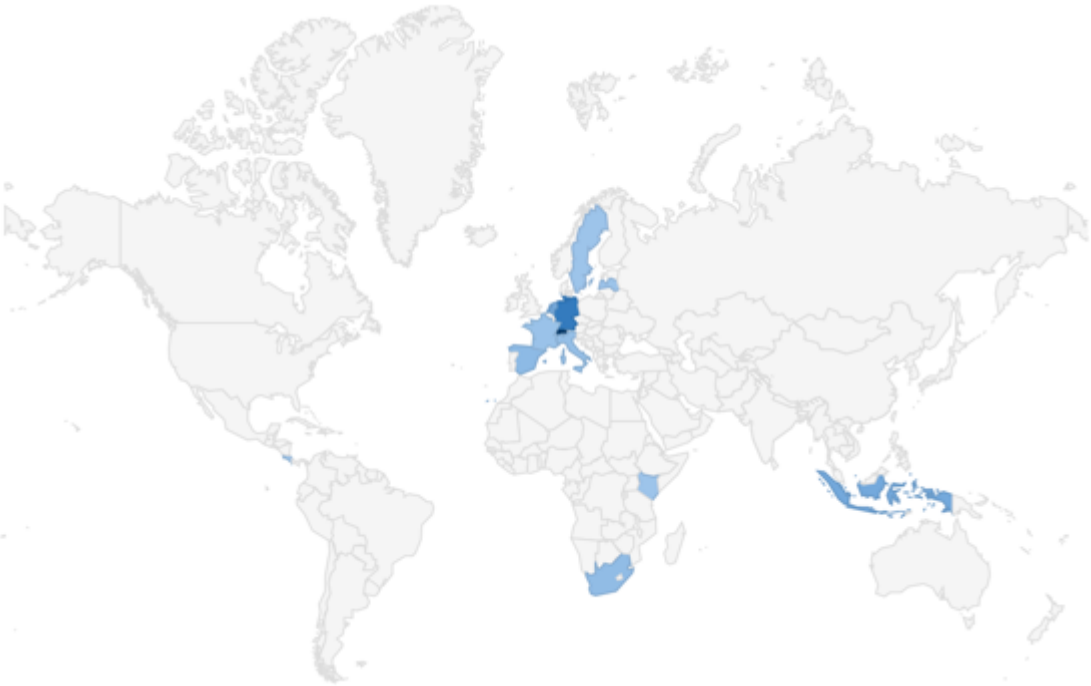

Figure 28: Geograpic distribution of the 261 not institutional followers of WWF_Scheiz

Figure 29 and Figure 30 show the tag clouds corresponding to the keyword and semantic analysis of these users.

To perform the keyword analysis we have extracted all descriptions from the selected 261 users and we have removed German and English stopwords. Note that within these descriptions we can also find other languages such as Spanish or French, but only for 10% of the Tweets. The result of this analysis can be seen in the tagcloud displayed in Figure 29. As we can see in this figure the strongest keyword highlighted in this analysis is climate, followed by environment, green, change, world, sustainability, nature, love, social, news or media. This analysis indicates that WWF_ Schweiz followers engaged in the Earth Hour campaign are users already engaged and concerned about climate change and sustainability.

To investigate a bit deeper specific themes or topics of interest we have performed a semantic analysis over these profiles. We usedTextRazor to extract key entities and concepts of interest for these users. The obtained results can be seen in Figure 30. As we can see the key entity of interest is the location Switzerland, followed by concepts such as climate change, sustainability, social media, energy, renewable_energy, etc. The most popular categories of concepts are Places and Organisations followed by Species and Animals.

Figure 29: Keyword Analysis of the Twitter descriptions for the 261 WWF_Scheiz followers participating in the 2014 Earth Hour campaing

Figure 30: Semantic Analysis (entities extracted by TextRazor) of the Twitter descriptions for the 261 WWF_Scheiz followers participating in the 2014 Earth Hour campaing

As both of this Figures highlight, **WWF followers participating in the Earth Hour campaing are users already engaged with climate change, wildlife and suistainability. They actively participate in social media and they speak multiple languages, predominantly English and German.**

To contrast these results we have randomly selected a subset of 300 users who did not took part in Earth Hour 2014. Note that we selected only 300 to have a balanced sample. Figure 31 and Figure 32 present the keyword and sentimantic analysis of these user descriptions. As we can see in both figures, concepts related to climate change or sustainability have now much less weight. Instead, social media, and other technology related concepts and terms, such as software development, internet, web design, etc. are the most frequent ones. Other relevant terms include fotography, journalisim, enterpreneurship and marketing. Locations such as Switzerland and Germany are the top identified ones.

This analysis indicates that **users who did not participate in the Earth Hour campaign, in contrast to those ones that did, tend to be less identified or engaged with climate change and sustainability issues. They are however identified with topics related to technology, enterpreneurship and journalism (media)**. **The also express particular interest about Switserland and Germany**. Being aware of these users' interests can hep the development of engagement strategies around those topics, so that WWF_followers become more engaged towards the subsequent Earth Hour campaigns.

Figure 31: Keyword Analysis of the Twitter descriptions for the 300 WWF_Scheiz followers randomly selected not participating in the 2014 Earth Hour campaign

Figure 32: Semantic Analysis (entities extracted by TextRazor)of the Twitter descriptions for the 300 WWF_Scheiz followers randomly selected not participating in the 2014 Earth Hour campaign

To conclude our analysis about the engagement of WWF_ Schweiz followers, we have tried to measure the impact of the different media sources. The list below shows the top 10 mentioned URLs within WWF_Schweiz dataset. These URLs include particular information about the Swiss campaign (3) as well as media around the campaigns in UK (1, 6, 8), Canada (4), Germany (5, 7), and Global (2, 10). The list also includes an URL from United Nations (9). This variety of media resources indicates that, **when language does not constitute a barrier, international media may influence as much as local media for these type of campaign.**

1. http://earthhour.wwf.org.uk/
2. http://www.earthhour.org/
3. http://www.wwf.ch/de/aktuell/kampagnen/earth_hour_2014/
4. http://www.wwf.ca/events/earthhour/
5. http://www.wwf.de/eh14-tw
6. http://scotland.wwf.org.uk/how_you_can_help/wwfs_earth_hour/
7. http://klimaschutz.koblenz.de
8. http://earthhour.wwf.org.uk/?show_signup=yes&utm_source=twitter&utm_medium=social&utm_campaign=earth_hour&pc=EHJ001006
9. http://www.un.org/climatechange/take-action/

10. http://www.earthhour.org/spiderman

5. Conclusions

This deliverable reports on the project activities surrounding the Earth Hour 2014 campaign. WWF Schweiz put in place a national campaign with the goal of motivating municipalities to install less, but more energy-efficient street lighting. Despite all the media efforts (TV, Radio, social media, etc.) only 7.7% (3'261) of people who visited the landing page of this campaign did send a petitionary letter. Through social media only 381 (Facebook) and 139 (Twitter) citizens were mobilised to send a petitionary letter.

In addition to this campaign, the DecarboNet team has been collecting and analysing social media data around the Global and National Earth Hour campaigns with the aim of studying engagement. By analysing more than 35,000 tweets for the Global Earth Hour campaign we observed that, in terms of generating engagement, the content of the tweet is more relevant than the reputation of the user. Posts generating higher attention levels are slightly longer, easier to read, have positive sentiment, mention other users and tend to repeat terms existing in other posts.

By analysing the topics of these tweets we observed that, while the main activities and themes of the campaign (super hero, the panda, etc.) did drive most of the social media conversations, the fact that the users engaged in the campaign, did not necessary mean that they also engaged with climate change and sustainability issues. Studying the temporal evolution of these topics we also observed that, while users decrease their engagement towards the topic of the campaign after it finished, these topics still remained in their conversations one month later.

By analysing @WWF_Schweiz Twitter followers we observed that citizens participating in the Earth Hour campaign are engaged with climate change, wildlife and sustainability issues. They actively participate in social media and they speak multiple languages, predominantly English and German. Users who did not participate in the Earth Hour campaign, in contrast with those ones that did participate, tend to be identified with topics related with technology, entrepreneurship and journalism (media).

By learning how tweets should be written or which are the topics of interest for the users our analysis aim to provide a step forward enhancing engagement towards the next editions of the Earth Hour campaign.

A. List of Figures

B. List of Tables

C. List of Abbreviations

Abbreviation	Explanation
CA	Consortium agreement
DoW	Decription of work, i.e. GA - Annex I
EC	European commission
GA	Grant agreement
IP	Intellectual property
IPR	Intellectual property rights
PC	Project coordinator
PMB	Project management board
SC	Scientific Coordinator
PO	Project officer
PSB	Project steering board
DM	Data Manager
AB	Advisory board
WP	Work package

D. References

[1] David M. Blei, Andrew Y. Ng, and Michael I. Jordan. 2003. Latent dirichlet allocation. *J. Mach. Learn. Res.* 3 (March 2003), 993-1022

[2] Yu Wang, Eugene Agichtein, and Michele Benzi. 2012. TM-LDA: efficient online modelling of latent topic transitions in social media. In *Proceedings of the 18th ACM SIGKDD international conference on Knowledge discovery and data mining* (KDD '12). ACM, New York, NY, USA, 123-131.

[3] M Rowe and H Alani. Mining and Comparing Engagement Dynamics Across Multiple Social Media Platforms. In the proceedings of the Web Science Conference 2014. Bloomington, US. (2014)

[4] M rowe, S Angeletou, H. Alani. Anticipating Discussion Activity on Community Forums. The Third IEEE International Conference on Social Computing. Boston, USA. (2011)

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