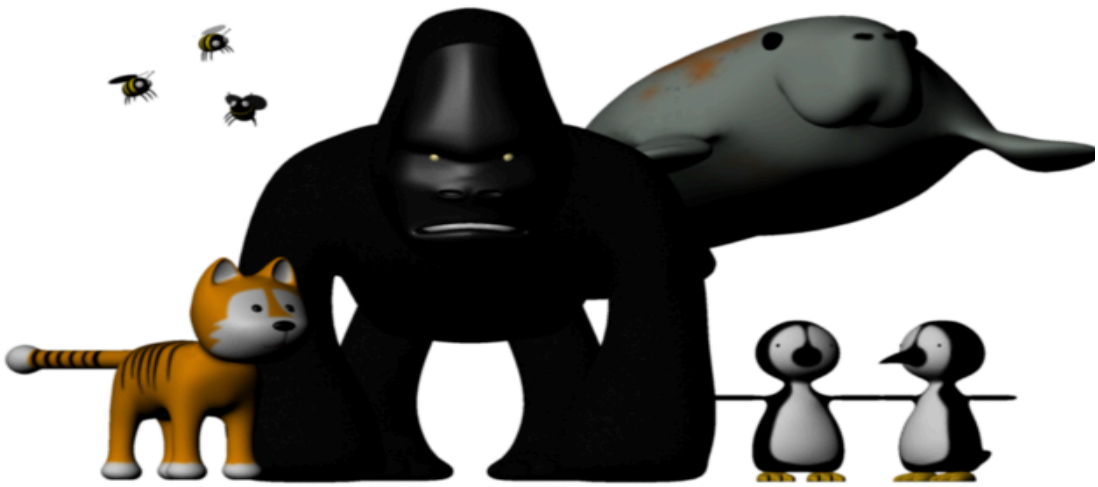
Greenview

Seeing Energy Differently: exploring the impact of a Green ICT initiative at De Montfort University



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July 2012

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Acknowledgements

This project would not have been possible without such a fantastic team. The success of this project is really a testament to the strong working relationship between the IESD and the IOCT, and particularly the strong partnership that has emerged between the development team of Graeme Stuart, Dave Everitt, and Gareth Howell who worked together brilliantly. Martin Rieser brought his useful wisdom and expertise to the project and kept us on the straight and narrow. Our PhD student, Monica Pianosi was a great help at times as were of course, the inimitable sustainability team in DMU, especially Karl Letten, Umakant Pancholi and Claire Connolly. Grateful thanks too go to Amanda at Arup who facilitated the focus group Of course this project would not have been possible without the funding from JISC and the willingness and belief of our trusted project manager, Rob Bristow.

Executive Summary

Greenview followed on and built on the successful DUALL project, funded by phase 1 of JISC's Greening ICT call. DUALL utilised a socio-technical solution to the design of a simple web based information-feedback tool that could report electrical consumption of ICT equipment back to users. Greenview aimed to refine the ICT tool further into a more sophisticated smart phone application that would connect staff and students in De Montfort to the energy consumption of their buildings. We succeeded in developing an iPhone 'app' which was launched in March 2012. The app visualises energy use in buildings on De Montfort University campus. It presents the buildings as habitats for endangered species, providing a fun and engaging way to look at how we can look after our environment. The app provides real-time data through meter readings provided on a half-hourly basis, and with the inclusion of graphical data options, appeals to the range of preferences individuals have for viewing and interpreting data.

The following general conclusions are made:

- Greenview and its predecessor (DUALL) have shown both the need to move beyond linear quantitative approaches to presenting information on energy and sustainability that is fun, creative and engaging.

- Without senior commitment and sincere staff engagement and collaboration mere information provision in the form of dashboards are impotent.

Specifically, for the Greenview app we found:

- Overall the participants found the tool user friendly, fun and visually attractive, however, the need for it be more intuitive and interactive, with the provision of guidance for users to help them behave differently with regard to energy use, were key recommendations.

- Subject to further funding becomes available then we intend to address these valuable observations. This over time will also lead to a gradual shift in attitudes, habits and practices, with a shift towards a more sustainable, energy saving culture in the University.

- There is a need for a web-based as well as (or instead of) smart phone accessibility

- There is a greater need to clearly communicate energy use using colour coding: red, amber and green traffic lights coding and arrows to show whether usage has moved up or down and communicating energy excesses and savings in units that are relevant and easily understandable to the user

- The need for two-way feedback and communications and increased links with social media.

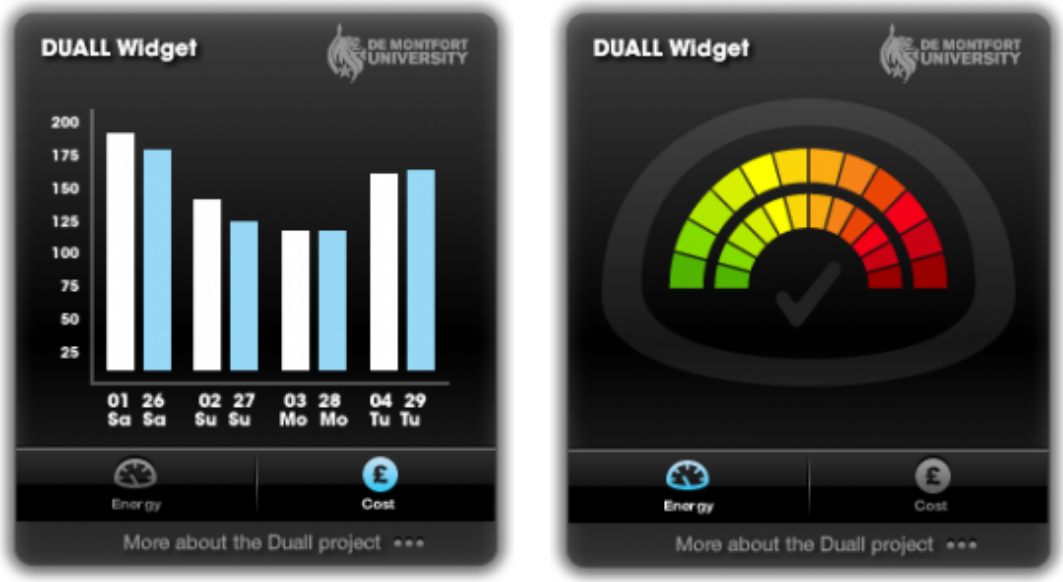
1 Project Summary

Greenview built on the successful DUALL project, funded by phase 1 of JISC's Greening ICT call. DUALL utilised a socio-technical solution to the design of a simple web based information-feedback tool that could report electrical consumption of ICT equipment back to users. Greenview aimed to refine the ICT tool further into a more sophisticated smart phone application that would connect staff and students in De Montfort University (DMU) to the energy consumption of their buildings. We succeeded in developing an iPhone 'app' which was launched in March 2012. The app visualises energy use in buildings on the DMU campus. It presents the buildings as habitats for endangered species, providing a fun and engaging way to look at how we can look after our environment. The app provides real-time data through meter readings provided on a half-hourly basis, and with the inclusion of graphical data options, appeals to the range of preferences individuals have for viewing and interpreting data.

2 Main Body of Report

Before explaining the Greenview it's necessary to briefly understand the context of DUALL, the precursor to Greenview. DUALL - the 'deliberative user approach to the living lab' (DUALL) tried to recognise the complexity of user perceptions and understandings (Niemeyer, Petts et al. 2005); the importance of combining a bottom-up and top-down approach in order to minimise mixed messages (Owens and Driffill 2008); and the value of public engagement (Burgess and Clark 2009; Ockwell, Whitmarsh et al. 2009). Utilising both face-to-face public engagement as well as the 'writetoreply.org' tool, that enabled stakeholders to comment on documents and strategies at a detailed level; this informed the development and use of the second approach, which is a web-based toolset for users to access their data in context and make decisions about on-going actions. Progress was positive inasmuch as we succeeded in engaging a small group of building users and we developed a simple reporting tool using Yahoo widgets (see figure 1).

Figure 1: The DUALL widget



We also conducted a weekend 'switch off your PC' campaign in the Queens Building that resulted in a 20% reduction in the weekend baseload. The project stimulated a range of activities as part of DMU's 10:10 campaign and we recuited a PhD student undertaking further and more substantial research into effective strategies for engaging building users

using innovative technologies. But the DUALL project was always intended as an 'exploratory' pilot project. Its scope was limited as a result of a tight timeframe and budget. Time taken installing sub-metering, engaging building users and developing the IT capabilities to gather the data has left little time to develop a web-based reporting tool to the standard we hoped. Whilst robust and accurate it presents data in a familiar format of text, numbers and charts. Activities were also limited to just one of DMU's buildings (the Queens Building).

Greenview set out to expand the vision and impact of DUALL, both in terms of its reach across campus – this project attempted to cover every DMU building – but also in terms of an advanced reporting tool to incorporate the latest augmented reality software. The DUALL project aimed to uncover whether involvement in the design of ICT-based user applications can affect behaviour change. Greenview extended the reach of DUALL and specifically aimed to transcend the traditional form of web based representations of energy into something more dynamic and participative, enabling staff and students to not just see the energy performance of every building, but map issues and recommendations pertaining to energy consumption on to the central website. The data would be further interpreted visually onto mobile platforms, as outlined above, using a variety of overlay views including heat maps, electrical grid maps and other visualized forms of readily digestible statistical data etc.

2.1 Project Outputs and Outcomes

The specific aim and objectives are as follows, and directly relate to key themes from the Suste-It project and build on the findings of not just the DUALL project, but the range of research covered by the JISC Greening ICT community.

Aim: To design a leading edge smart phone and web based application enabling building users to understand the energy consumption of the buildings across DMU.

Objectives:

1. To design, implement and launch a campus wide ICT tool connecting building users to the energy consumption of buildings and the ICT infrastructure. This will be open source and available for download by other HEIs.

2. To help the extent building users impact the performance of the environment they are in - and with particular reference to the development of a refurbished building and improving the performance of a building in line with the Energy Performance of Buildings Directive, and UK Regulations.

3. To further understand the potential of augmented reality tools to engage individuals in behaviour change initiatives.

4. To reduce the carbon footprint of DMU's buildings by 10–20%.

5. To engage the creative and developer community at DMU (for example with the Faculty of Technology and the IOCT) in sustainability issues.

2.2 How did you go about achieving your outputs / outcomes?

The project had three key phases: 1) to gather and analyse the energy data in a meaningful way; 2) devise an innovative visualisation tool, 3) launching it!

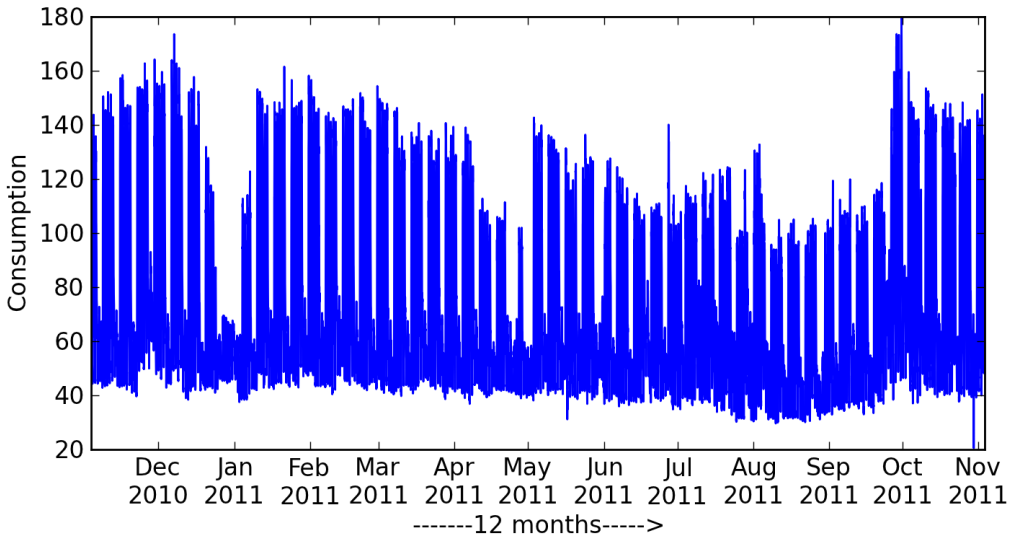
2.2.1 Data modelling and analysis

The first challenge was to ensure the data was presented in a meaningful and accurate way. We needed to develop a tool that provided useful and timely feedback. The key question we had to resolve was how to quantify the energy performance of each building and present meaningful data to the building users. All of DMU's buildings have half-hourly metering for gas, electricity and water. Data are relayed via a low-power radio network to a central receiver, and are then uploaded to a MySQL database server.

We wanted the feedback to reduce the complexity of building energy data to a simple low/neutral/high category. It had been agreed by the team that we would present these states as happy, normal and sad respectively in the final app. The approach needed to be directly calculable from 'live' energy consumption data and buildings must switch between being happy and sad over time. For this, a simple energy consumption model was developed whereby each building has it's own dynamic definition of 'normal' – we would be comparing each building with its own previous consumption. This has many advantages, primarily because it provides positive feedback if improvement is made and negative feedback when performance deteriorates.

Normality for each building was determined as a function of the latest 12 months of consumption. Figure 2 shows an example 12-month dataset of half-hourly electricity consumption.

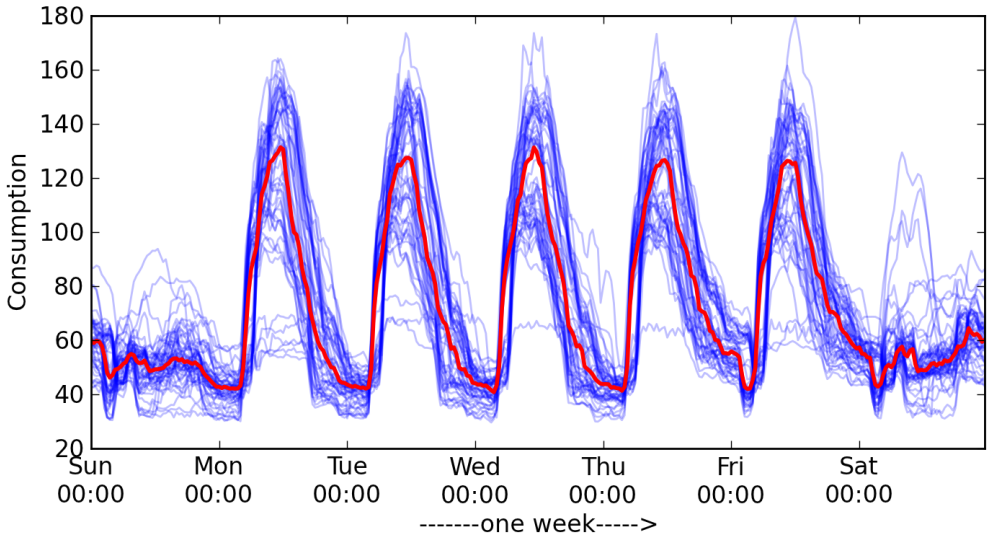
Figure 2: Example of annual electricity consumption



By using a rolling 12-month window the data used to generate the 'normal' model changes over time. As new data are collected, older data are discarded and the definition of normality changes for each building. This means that as the pattern of consumption changes the model will also change and that the baseline model is always up to date. The model itself is based on the weekly pattern. That is, the most significant predictor of electricity consumption in the Greenview buildings is 'time of week'. The daily and weekly occupancy cycles relating to building opening times and weekends determine when the building energy systems are in use. Each building has a unique signature that can be extracted and analysed.

For each of the 336 half-hourly periods in a week, an analysis of the distribution of consumption levels was used to calculate the 'normal' range of consumption values in that period. Figure 3 shows the same data as in Figure 2 with each week overlaid on top of each other. It is clear that the signatures for most individual weeks are similar but each week of data is unique. Also plotted is the median (50th percentile) for each of the 336 half hourly periods.

Figure 3: A weekly period of consumption with 'normal' mapped

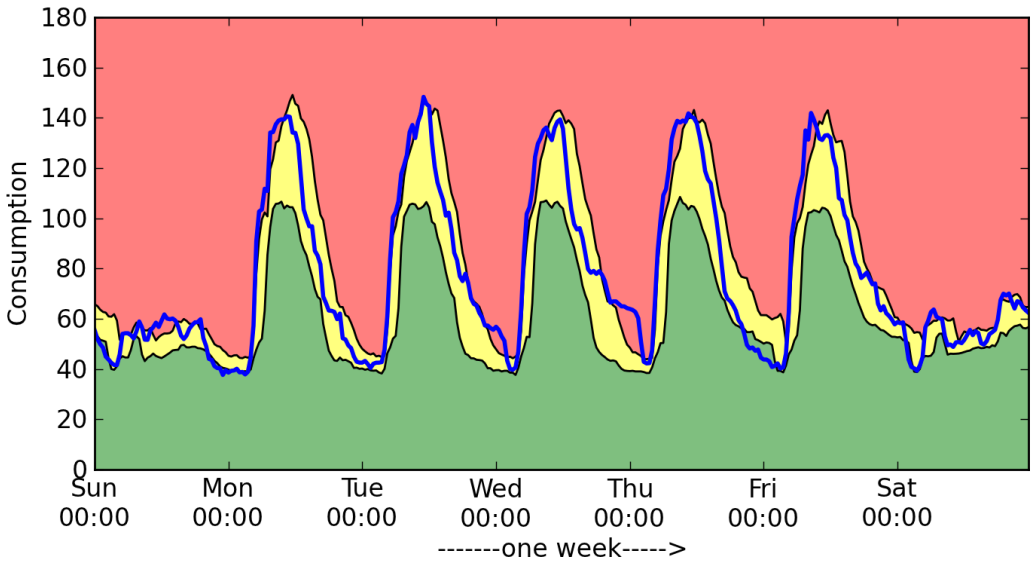


The 25th and 75th percentiles of each period were used to establish the inter-quartile range as the 'normal' range of consumption. By comparing the latest consumption values with the model (in the appropriate time period) it is always possible to categorise a data point accurately. Anything above the inter-quartile range was considered 'high' or 'bad', anything below this was considered 'low' or 'good'.

This approach had many advantages. Importantly, the 'normal' range was achievable by definition, 50% of half-hourly data collected in the last 12 months fell within the normal zone. In addition, each building would regularly switch between the three zones as 50% of the baseline data fell outside of the 'normal' range. Most importantly, no matter what time of day or what day of week the assessment is made, the model adjusts accordingly and gives a sensible threshold.

Figure 4 shows the three zones calculated from the baseline model in red yellow and green plus a blue line showing the latest week of raw data. The neutral zone (inter-quartile range) is very narrow and the building moves between the three zones all the time. This is because the building is relatively predictable and, assuming no persistent changes have occurred, there is a 50% chance of consumption being in the neutral zone. The consumption pattern only needs a small, persistent nudge to change the balance and provide the required feedback. A detailed chart similar to this is available in the app 'behind' the animations of the animals. The animation is selected based on the current state, i.e. the state indicated on the last point of data on the right of the chart. In Figure 4 the current state is at the high end of neutral.

Figure 4: An example week plotted against three consumption 'zones'



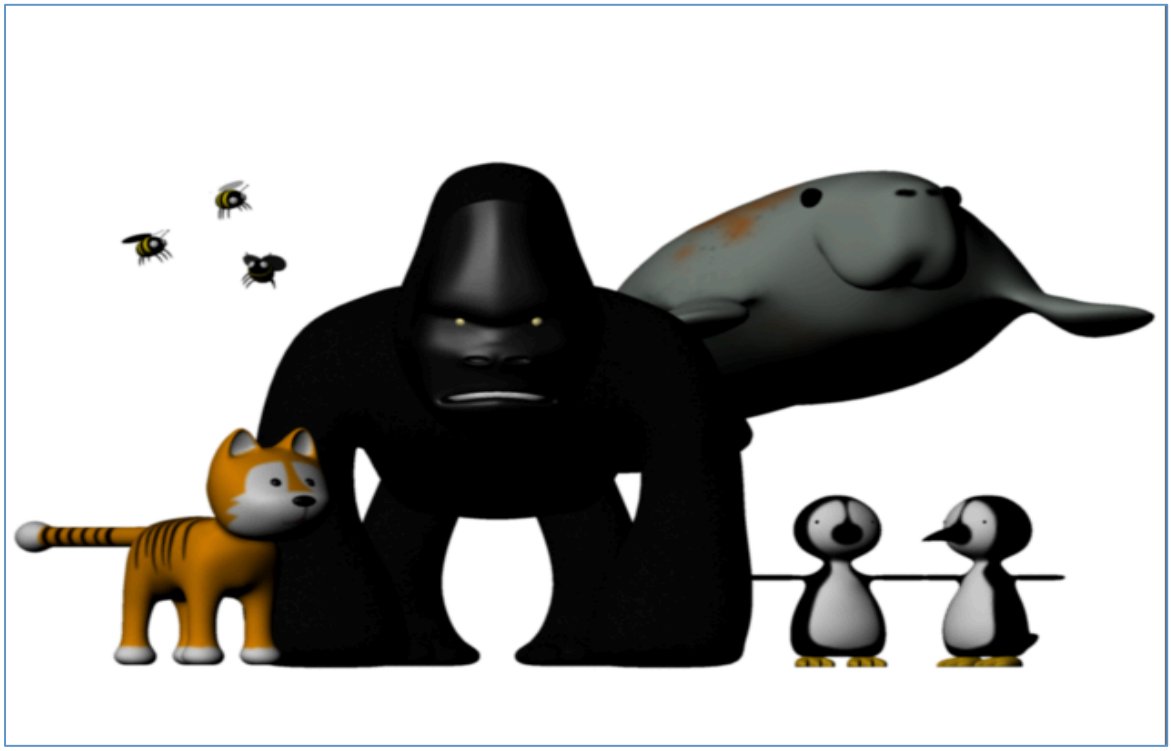
2.2.2 Design of the app

Greenview's primary aim was to explore a fun and creative way of communicating energy efficiency that didn't just show numbers – although these were available. Our team designed bespoke animations of five DMU buildings (Fig 5) 'inhabited' by endangered species (Fig 6).

Figure 5: The five university buildings characterised as 3D models

For each of the five chosen buildings, a separate animation was created to illustrate the three possible states (see fig 4) of energy consumption determined by the methods in 2.2.1: 'happy' if lower than the defined 'normal' band, 'neutral' if within the normal range and 'sad' if higher than normal. The same 3 states also drive a more detailed graph, available within the app for those requiring further information. To add to the playfulness of the interface, the same three states also determined which 'top trumps' card was shown—these contained further static information about each building, but are designed to appear more or less 'worn' according to each of the three states.

Figure 6: The five endangered species chosen to represent the buildings



Before construction, a visual storyboard outline and UML-like (Fig 7) diagram was created to clarify the processes within the proposed app and—although the storyboard was changed and some diagrammed functionality was omitted—this provided the basic structure, dividing 'back-end' processes from those required in the user interface and detailing the necessary links between them. The basic structure had four distinct tiers of functionality, two of which reside on web servers, and two within the app itself:

1. the web service generating the raw data (web server 1)

2. 'middleware' that processes the raw data for the app to use and is called by a Linux 'cron' (timed) script at regular 30-minute intervals (web server 2)

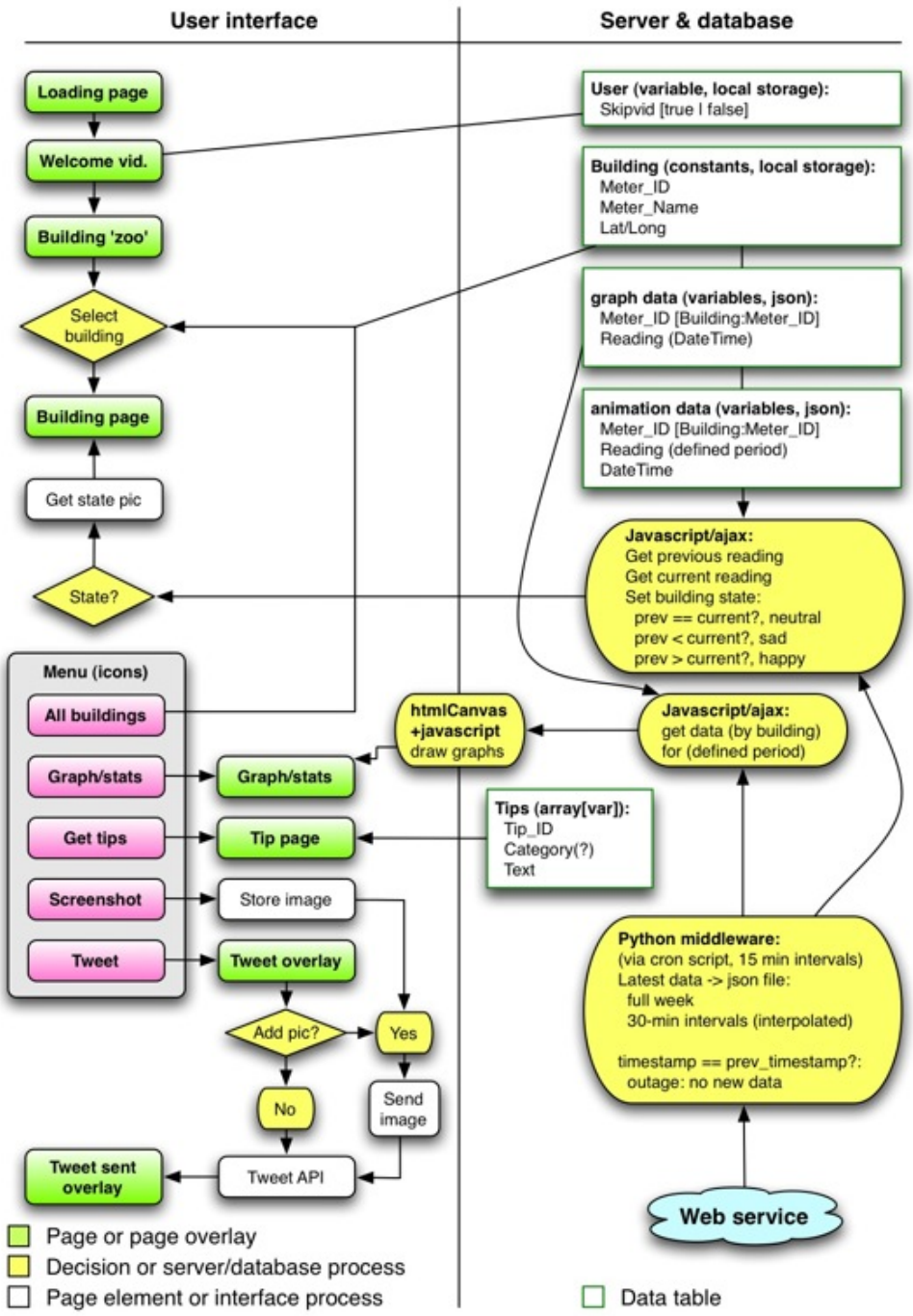
3. Javascript to read in the data and generate both detailed graphs and the three basic states—this does most of the dynamic work necessary for the app's interface to respond to each of the three states (app)

4. The presentation layer that appears to the user (app)

The app was created after some initial functional tests to rough out the basic Javascript code and check the resulting readings (http://greenview.ecoconsulting.co.uk/). Although developed primarily for Apple's iPhone and iPad (and the iOS operating system that these share), with a possible Android version in mind it was decided that using Apple's Objective-C code would be less productive than using web technologies (HTML5, CSS3 and Javascript), so the finished app was 'wrapped' in a 'native' iOS container using PhoneGap, one of the two most popular tools for this process. The result is a native app that utilises the platform's 'web view'—an instance of the system's web browser. While slower than a native app this was not an issue as—once downloaded with all 15 videos (5 buildings x 3 states)—a simple Javascript Ajax call pulls in the latest data. A further advantage of this method is that Greenview can also be made to run in a desktop/laptop browser.

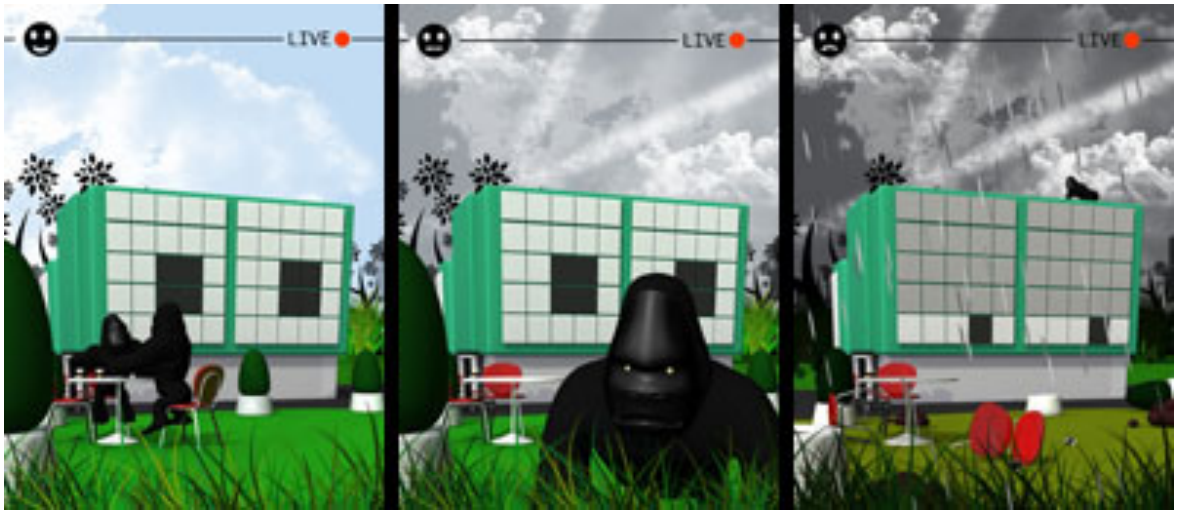
However, it was later discovered that Android's handling of video files is inconsistent and buggy, and this—even with informal input from a specialist—made an Android version using the animation videos so difficult that the option was abandoned. The development process of the main app was captured using the version control software GIT and finally uploaded to a public repository on the GitHub social coding service (https://github.com/DaveEveritt/Greenview-App), although this was not enforced throughout, and 3-4 separate 'frozen' versions of the app still exist outside version control.

Figure 7: UML-like diagram of the proposed app



The overall result enabled users to check the current state of a building at any time of day, and immediately see whether its energy use is average, below or above its usual parameters. The three states for each building pervade the entire app, and are immediately visible on the main screen. Video stills for the three states of one building are shown below (Fig 8). Much care was taken over the animations to ensure that the 'personality' of each building and associated animal had an instant visual and emotional appeal, and this has been a major factor in stimulating public engagement with the app.

Figure 8: Video stills from each of the three states for one building



Since launch the processed data has been continuously available to the app and, although the web service delivering the *raw data* is occasionally offline (outages are monitored using the same script that pulls in the data: the longest period was 14hrs), the code allows for the app to be used at any time with the latest available data—the middleware will pull in the latest data when it becomes available. A small code snippet using HTML5's local storage also ensures that the currently selected building is 'remembered' on the user's device until another is chosen. At the time of writing (June 2012) the app has been downloaded 139 times which equates to approximately 7% of DMU staff.

2.2.3 Launch of the Greenview app

The Greenview app was finally launched in March via twitter and our blog (see figure 9). Tweets were sent along with requests for 'retweets' from top DMU tweeters like the VC and the library. For the first week the blog was updated daily introducing the animals and inviting followers to suggest which one to focus on next (see figure 10). You will see that whilst there was some involvement it landed on a small number of people actively engaging, for example, Sustainable DMU, Alison McNab (head of Kimberlin Library) and Sue Thomas – all active on social media.

Figure 9: Extract from the launch via twitter.

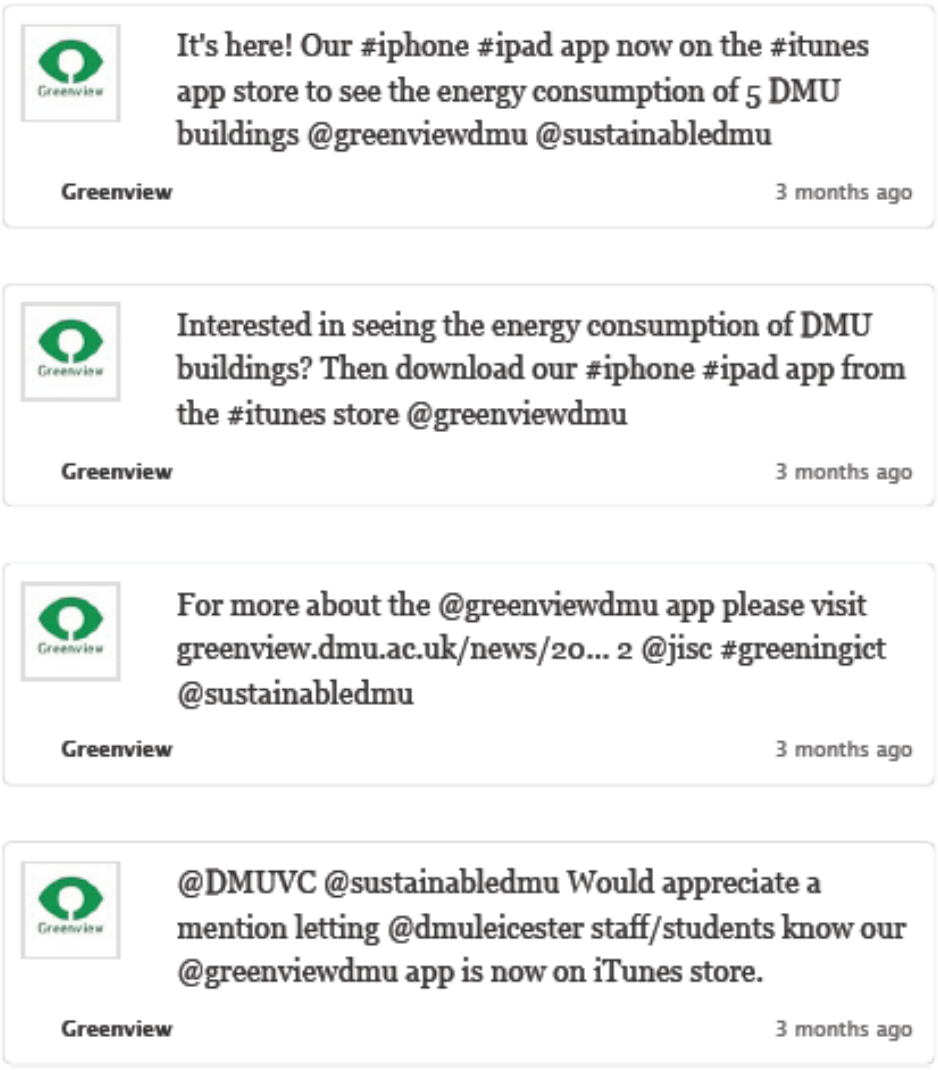
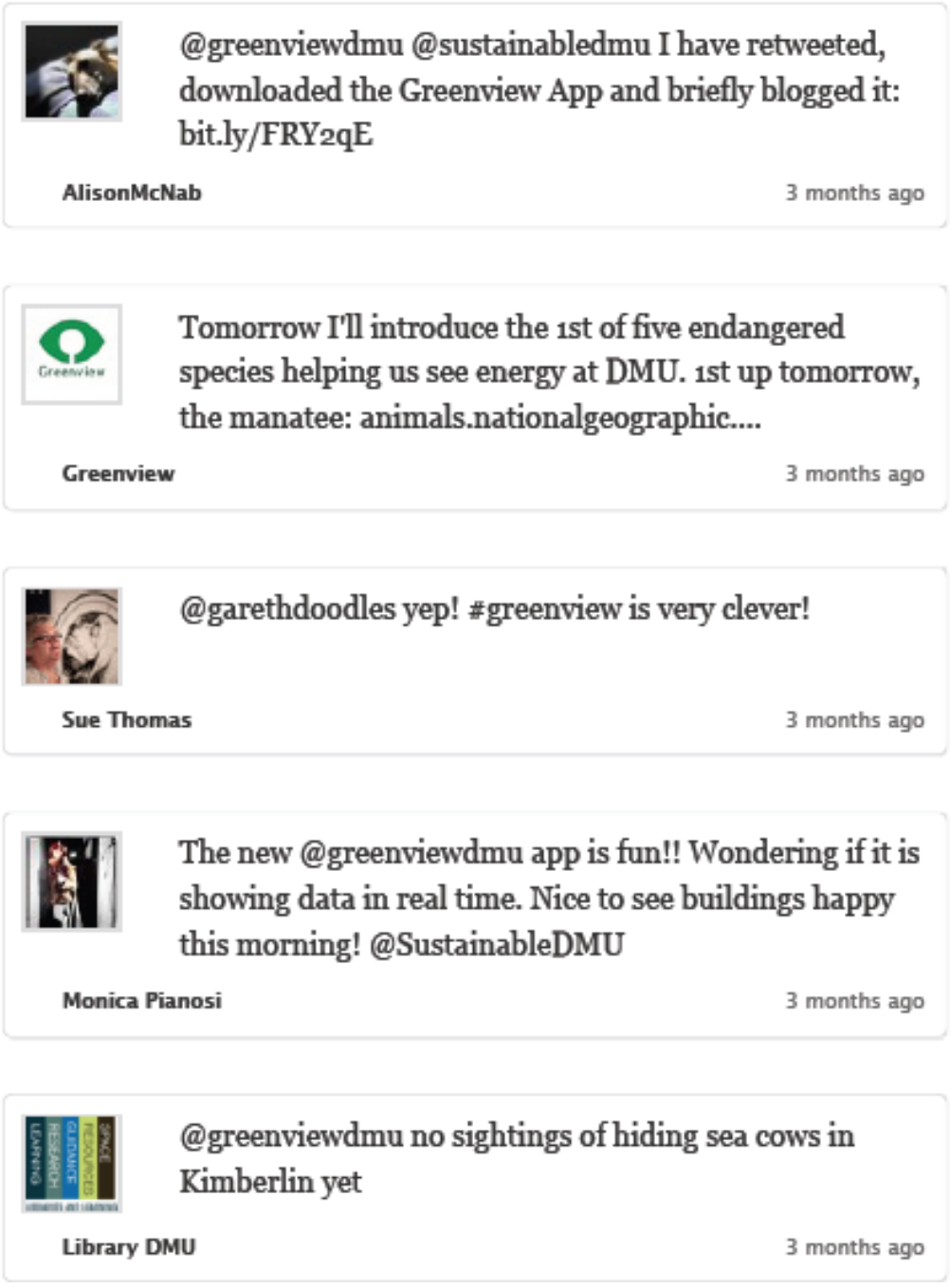


Figure 10: Extract from twitter conversation around the launch



2.2.4 Evaluation

To evaluate the user-opinions on the Greenview app it was decided to organise a focus group because of both methodological choices and practical constraints. Due to time constraints this was viewed as a better use of time than trying to organise multiple interviews and then subsequent transcription and analysis. But methodologically focus groups are seen by many as an extension of the interviewing process (Bryman 2001; Robson 2002), focus groups allow greater exploration of why people feel the way they do about a particular issue. Moreover, participants have greater control to express their viewpoint. Finally, they provide

an interesting opportunity to witness how "individuals collectively make sense of a phenomenon and construct meanings around it" (Bryman, 2001: 348).

The focus group was designed and facilitated by a neutral Chartered Occupational Psychologist from Arup, with assistance from DMU. This approach would ensure a 'neutral' presence and lead, encouraging maximum engagement and output from participants, with co-facilitation from Dr Richard Bull of the University's Institute of Energy and Sustainable Development and Principal Investigator of Greenview.

The focus group was held on Wednesday 28th March 2012, in the Queens Building at De Montfort University. The two-hour session was held in the afternoon, preceded by a welcoming lunch and networking opportunity for all participants. In total, 11 participants attended the session. This included seven staff and students from DMU, including environmental champions (staff from across the faculties and buildings) and a Masters student. Four members of Leicester City Council were also invited as the one of the aims of the focus group was to learn lessons from Greenview that could feed into recommendations for our participation in the SMARTSPACES project.[1]. It was considered that the range of stakeholders in attendance provided a sufficiently representative sample of participants to provide a valid review of the Greenview app and input SMARTSPACES.

Following the initial welcome activities and energiser activity, participants were presented with an overview of the Greenview App, including background and context for its development, and an overview of key features. Participants were also provided with a 'walk-through' of the app using two ipads and an iphone. This enabled all participants to engage and interact with the app and ensured that all participants had a full and shared understanding of the app's features and functions. Participants were then provided with an overview of key behavioural influencing factors, gained from psychological research into the area of 'Green behaviours', to enable participants to begin to consider how the Greenview app currently may influence the behaviour of users. Various key themes for exploration, together with key 'prompt' questions, were then presented to the participants for their consideration. The key themes and prompt questions are provided below:

- Usability: How easy is it to use? Is the information easy to understand? How convenient is it to use? What are the barriers to use (if any)?

- Design: What design elements work well/not so well? How could the design be improved (style, layout, format)?

- Functionality: Does the app provide all that it should do in terms of functions? What can or can't it do? What else should/could it do?

- Content: How could the content be improved? What other information should the app provide? Does the content/information help prompt you to save energy? Does it help you understand HOW to save energy? What other information/feedback should be included?

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[1] *Smartspaces is an EU CiP project (EU/297273) enabling public authorities across Europe to improve the management of energy in their buildings by exploiting ICT. DMU is responsible for the evaluation of the project alongside being a 'pilot site' with Leicester City Council. This means designing an implementing an energy visualisation tool across a range of public buildings in the local authority and the university. For further details see: http://www.smartspaces.eu/index.php?id=629*

- Attitudes: How do you view the app? What are your perceptions? Does the current app help you to change your views and behaviours relating to energy saving? Does it tap into your feelings and emotions? How could this be improved? Would you encourage others to use it?

- Other: What else can we capture about what the app? What other positive things? What else do we need to consider in improving the app? Are people changing any aspect of their behaviour? Are people uploading information and engaging with the energy management team as a result of the tool?

In order to ensure that all participants were given the opportunity to 'voice' their ideas, they were all given post-it notes to capture personal thoughts and ideas throughout the presentation of the key themes and prompt questions, and were given a short period of time (15 minutes) to capture their individual thoughts and 'map' these onto themed flip-chart sheets provided around the room. Following a brief facilitated exploration of the ideas posted on the walls, the participants were then asked to work in three mixed stakeholder groups (two groups of four and one group of three), to further develop their ideas and to capture key ideas and develop recommendations for improvement for the app. The outputs and recommendations are provided in section 2.3 below.

2.3 Evaluation

Respondents in the focus group evaluated and commented on the Greenview app from three perspectives: usability, design and content and functionality.

2.3.1 Usability

Through the discussions, the need to maximise engagement and making the app as easy as possible to use emerged as key considerations. Participants felt that in order to ensure users engage with and continue to be interested in the app and its content, the animations need a clearer explanation and to be easier to interpret. Making the app more interactive, for example through making the animals interactive, would also help maintain interest and engagement. Participants felt that the graphs ideally need to be easier to interpret, and to clearly show that the information presented is 'live'. The data needs to be intuitive and self-explanatory if such information were to be displayed on a public display screen. Several participants commented on the need for the app to be available in either a web-based or PC format, to increase the accessibility to a wider range of stakeholders. In addition, the need to consider what would prompt staff to view the information was mentioned. Having the data available through a link on the DMU staff portal, providing prompts when starting up computers, or having the data as a screen saver/wallpaper were all seen as potential ways to make the data more easily and readily accessible to staff. Finally, participants felt that there needed to be more contextual information provided within the app (and also provided on display screens if used) to explain the possible reasons why energy usage levels are showing as high/low. This rationale would help users to understand what they could potentially do to positively influence energy usage levels, what is within and indeed outside of their control, and would also help them to gain greater understanding of the 'bigger picture' of energy use, in specific buildings and across the campus.

2.3.2 Design and Content

Providing comparative data emerged as a key recommendation. Providing energy usage data for individual departments within buildings (where possible, depending on metering capabilities), with the ability for users to select their own buildings to focus on within the app, would increase the relevance that users would feel the information had for them (since they would be able to see how their own department was performing), and would also enable users to compare their own department's or building's performance with that of others, thus

creating a positive level of competition to help motivate users and promote behaviour change in relation to energy use. Comparative data would also allow monitoring of energy performance, within groups and between groups, over weeks or months as appropriate. This competition element could also possibly include 'league tables' to communicate how groups are performing, with rewards and recognition for those who are performing the best in comparison to either previous building energy levels, or compared to other groups.

Enabling the app to send 'alert' messages to users, which would prompt the user to go into the app, would increase engagement. In addition, if users were able to select which buildings they want to receive alerts about (as above), the alerts could be tailored to the specific buildings selected, and this would further increase perceived relevance to the user. Participants felt that, currently, the link between the app's content and how to save energy is not clear. Providing hints and tips to encourage users to question their behaviour (e.g. "Have you switched off your monitor?") would also equip users with the procedural information to take action to influence energy use. Furthermore, the ability to send prompts or alert messages would also be useful for security staff, to help monitor potentially 'abnormal' energy use overnight within DMU buildings.

Participants shared various views on whether the use of the endangered species was the most effective way to communicate the importance of the energy use messages to users. Participants mentioned that the animals may be perceived as too childish and would perhaps only appeal to children or younger people. The idea of using animated people, with happy, sad and neutral facial expressions, or showing them as ranging from healthy and happy to unhealthy and sad, were all ideas worth further consideration. The use of emotion and facial expression was seen as very powerful and something which should be enhanced within the app to increase the power of energy use messages.

2.3.3 Functionality

Having a 'map' of the Campus and buildings as the 'front page' display was suggested, with the emoticons (smiley faces) also featuring on this screen to give an immediate overview of energy use levels across the campus, with this clearly labelled or shown as 'live' data. From this front page it would then be possible to select buildings to look at in more detail. In relation to the functionality of the app, clarity of information being presented again was a key recommendation. Participants commented on the need for both the graphs and the animals being easier to understand, with the possible inclusion of a tutorial or guidance information to assist users in navigating through the app effectively. The need for more animation and interactive functionality was reiterated here too; being able to interact with the data, graphs and animated features would promote engagement and understanding of the data presented. It was also felt that the graphs could benefit from showing data in smaller time increments, such that users could opt to view specific times of energy use (e.g. during a particular day), to be able to pin-point potential reasons for 'spikes' in the data.

In considering attitudes towards the app, a key question raised by the focus group participants was "Will the app engage the unengaged?" One key way of enhancing engagement was thought to be the inclusion of more (or ideally) all the main campus buildings. In addition, providing feedback (e.g. of amount of energy saved) was considered likely to be more effective if the value of the saving was communicated in units that users would be able to relate to (such as monetary value, or the number of books that could be bought for the library, for example). Providing the ability for users to be able to give feedback (e.g. using a forum, an active twitter link and feed, guidance on where to ask questions, who to phone or email), were also seen as ways of positively influencing users' attitudes towards the app, through increasing individuals' knowledge and understanding of the information presented and what they can do to respond to it.

In addition, if the app were expanded to include additional university campus buildings, it could help promote behavioural change with regard to energy use, and this was seen by participants as especially valuable for those areas or buildings where other initiatives focused on energy saving have not been successful in the past. The provision of procedural information (i.e. what individuals can do to influence energy saving) was also seen as a way to positively influence individuals' attitudes towards the app and towards energy saving, since this guidance would prompt people to act and to begin to establish new patterns and practices. Similarly, the inclusion of key messages being fed through the app from senior management (e.g. through an email link), demonstrating top level commitment to addressing energy use in the buildings would also be a welcome addition to the app for influencing how individuals view energy saving within DMU.

2.4 Impact

The Greenview project has had a significant impact on DMU and its approach to energy management and visualisation as well as staff and student engagement. There is a general increased awareness of energy efficiency across the whole campus: the app has been downloaded by 139 staff and students across the campus and our twitter account attracted 131 followers, for a sample of the conversation on twitter see figure 5).

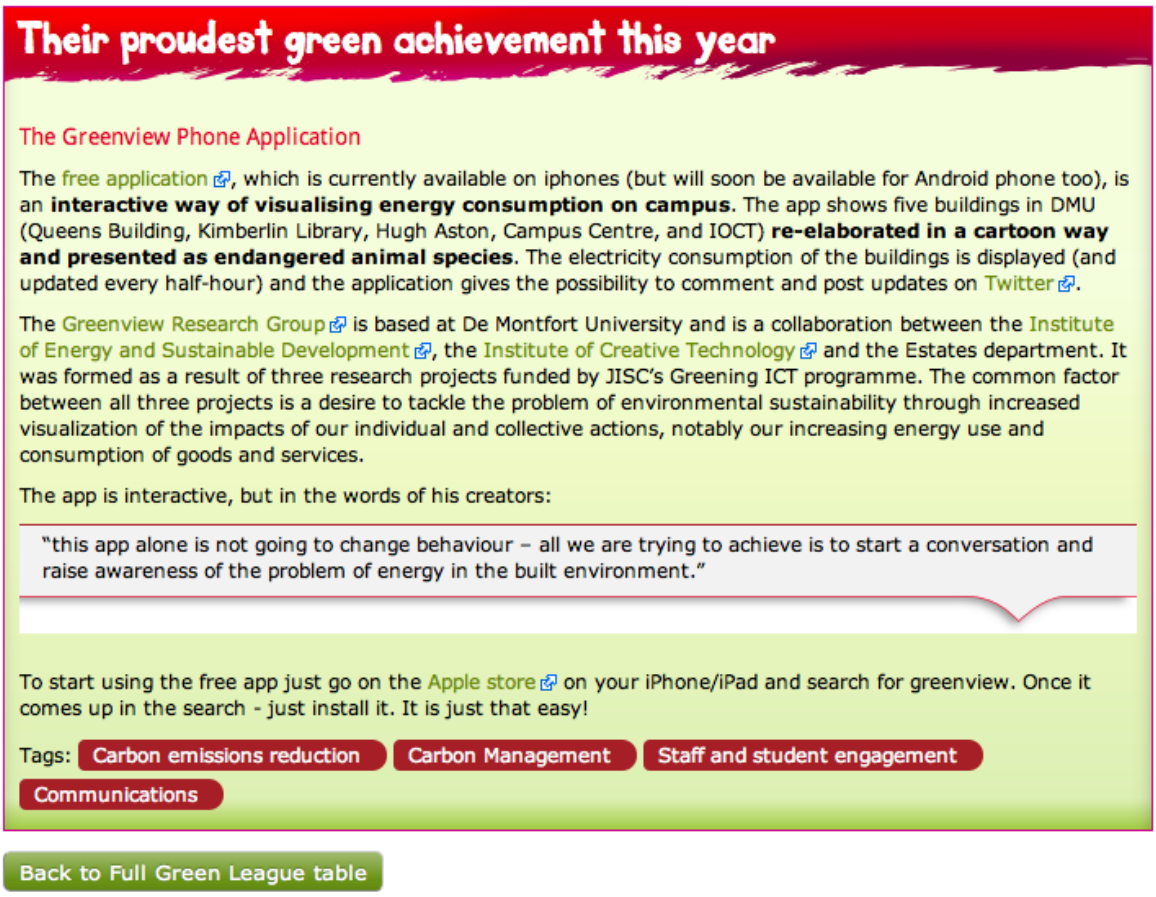
A 'go-green' week was launched in September 2011 to encourage staff and students to reduce energy consumption by up to 25%. The Green view team were invited to design a simple web version of the app to both monitor and communicate the savings to all staff and students. This resulted in a 13% reduction in savings based on the same week the previous year (see Figure 11) and was an excellent opportunity for the team to hone the methodological approach for measuring comparative savings.

Figure 11: Screenshot of the Go Green Week site developed by Greenview

The establishment of this accurate methodology for quantifying actual comparative savings based on sound building science and analysis was central to the success of the project. This ensures that the figures and animations people see are based on real comparative figures and are influenced by the actions of the individuals in the buildings. This methodology and

approach of the two JISC projects (DUALL & Greenview) has formed a key part of the Smartspaces project: an EU CiP project (EU/297273) enabling public authorities across Europe to improve the management of energy in their buildings by exploiting ICT. As a result of this success and impact we were highlighted as a key part of our sustainability strategy leading to a first in the Green League (see figure 12 and (http://peopleandplanet.org/green-league-2012/tables?ggl12profile=8697&test=22373f#casestudy)

Figure 12: Extract from the People and Planet Green League 2012



As a result of this development of a methodology, alongside the innovative design and its take-up in the SMARTSPACES project the impact of this project is going far beyond what we originally imagined. There is increased understanding of the benefits and limits of energy dashboards. Through analysis of the project by Arup – who ran a focus group for us on the usability and impact of the Greenview, along with our own evaluation of Greenview (and DUALL previously) we now that energy dashboards have limited potential for behaviour change when divorced from wider institutional engagement and commitment to sustainable development.

We are now in discussion with Leicester City Council with a view to revise and launce the Greenview app across a range of key buildings and findings on the methodology and approach were presented at the 2011 RCUK Digital Economy conference and results and analysis were presented to the 'West Midlands Regional Sustainability Advisor' event "Sustainability: a different approach" 18th April 2012. Talk entitled: Greenview – understanding consumption of buildings across campus using a smartphone.

3 Conclusions

The non-domestic building sector represents a huge, largely untapped potential for energy savings in the coming years. If national and local governments are serious about tackling increasing carbon dioxide (CO_2) emissions then non-domestic buildings must be targeted. Greenview offers key insight and experience into the barriers, hurdles and opportunities to engaging staff and students using digital economy tools such as smartphones. It is essential we know the best way to engage and motivate people and that we have a realistic understanding of the benefits and limitations of such approaches.

Greenview has shown both the opportunities and limits to using smartphones and more creative visualisation tools. It has an enormous impact beyond DMU, both through the current dissemination activities at the RCUK digital economy conference and JISC sponsored events such West Midlands RSA. Our website and presentations on Slideshare have reached over 1000 views. Initial findings from DUALL are published as peer-reviewed conference proceedings on line at the ECEEE website (Bull, Brown et al. 2011): http://proceedings.eceee.org/visabstrakt.php?doc=8-038-11 .

Greenview and its predecessor (DUALL) have shown both the need to move beyond linear quantitative approaches to presenting information on energy and sustainability that is fun, creative and engaging. And yet we have seen that without senior commitment and sincere staff engagement and collaboration mere information provision in the form of dashboards are impotent. The focus group provided a valuable opportunity to gain a rich and broad range of data from a range of key stakeholders from both DMU and Leicester City Council to inform the design of the Greenview app. Overall the participants found the tool user friendly, fun and visually attractive, however, the need for it be more intuitive and interactive, with the provision of guidance for users to help them behave differently with regard to energy use, were key recommendations. If further funding becomes available then we intend to address these valuable observations. Implementing of these ideas into the design of the Greenview app will certainly help promote engagement with the tool and help promote behavioural change with regard to energy use across DMU. This over time will also lead to a gradual shift in attitudes, habits and practices, with a shift towards a more sustainable, energy saving culture in the University.

The focus group also provided the opportunity to provide initial thoughts and ideas to help shape the SMARTSPACES project in the earliest stages, ensuring user engagement and involvement from the outset, which will help ensure that the resulting design of the SMARTSPACES tool will be user-centred, and thereby maximise its chances of success.

4 Recommendations

The conclusions above cover the more general reflections and recommendations with regards to the wider challenge of reducing end use energy demand through the use of energy dashboards and ICT based tools. The following recommendations emerged out of the focus group and were specific recommendations for how the app could be improved to help the development of the SMARTSPACES tool:

- The need for a web-based as well as (or instead of) smart phone accessibility
- Clearly communicating energy use using colour coding: red, amber and green traffic lights coding and arrows to show whether usage has moved up or down
- Communicating energy excesses and savings in units that are relevant and easily understandable to the user
- Interactive functionality maximised, especially within graphs

- Use of emoticons (smiley faces)
- Two-way feedback and communications, linking with social media

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