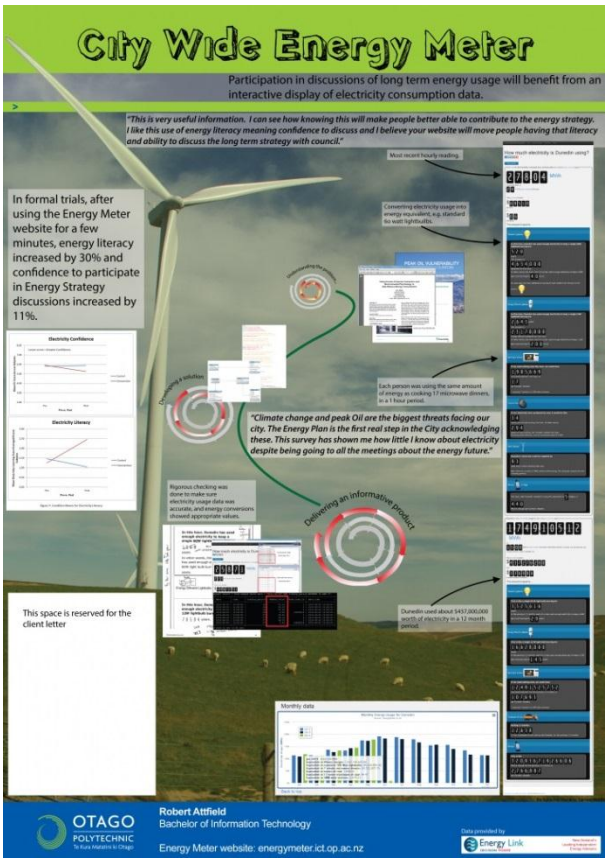
City-Wide Energy Meter

Robert Attfield
Bachelor of Information Technology
Otago Polytechnic

Paul Admiraal, Samuel Mann
College of Enterprise and Development
Otago Polytechnic
paul.admiraal@op.ac.nz, samuel.mann@op.ac.nz

ABSTRACT

This paper describes the processes of developing the City Wide Energy Meter for the city of Dunedin (NZ) – an interactive web- based application, which displays statistics about electricity consumption. The ultimate goal of the City Wide Energy Meter is to help foster discussions of long-term energy usage – affecting Dunedin's long-term energy strategy. The project's development process was based on the Agile Development Framework – a flexible and robust structure for project development, which encourages the concept of 'embracing change'. Development of the City Wide Energy Meter involved several aspects of Information Technology. This included negotiations with data providers, documentation, and various web-related technologies. The web application was built upon a L.A.M.P stack – this consists of a Debian operating system, Apache web server, MySQL relational database, and the primary programming language - PHP.



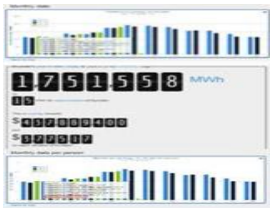
The City-Wide Energy Meter has increased Dunedin's citizens' confidence to participate in discussions of long term energy usage, through an interactive display of aggregate electricity consumption data.

The system is a web-based application – which displays electricity usage statics on a semi real-time basis. This application can be viewed from any device. The web application retrieves and stores electricity data from an external source, has the necessary calculations performed on it, then is displayed on the browser.

Functional Requirement

The system shall allow users to view current and previous electricity usage statistics of Dunedin

The system shall allow users to see the financial costs of the energy consumed.

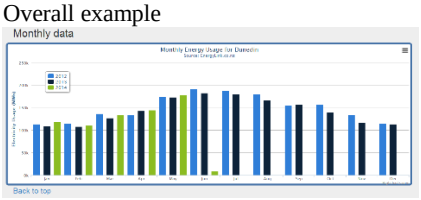


The system shall allow the users to see the energy usage as the equivalent of how many trees/coal/candles etcetera are being used.

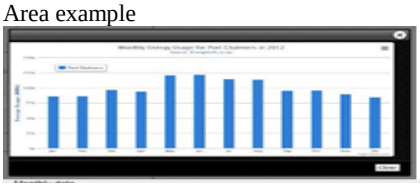
This poster paper appeared at ITX 2014, incorporating the 5th annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2014) and the 27th Annual Conference of the National Advisory Committee on Computing Qualifications, Auckland, New Zealand, October 8-10, 2014. Mike Lopez and Michael Verhaart, (Eds).

The system shall provide users access to area and overall city stats.

Overall example

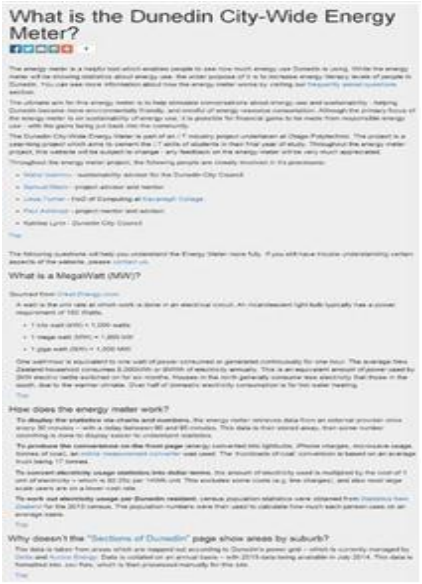


Area example



The system shall provide users access to past and present energy usage

The system shall provide users a F.A.Q/help section.



Proven Value

To make sure the project had proven value, a survey was created and administered. The aim of this survey was to measure Energy Confidence (EC) and Energy Literacy (EL), see if there is a correlating relationship between them, and seeing how information presented on the energy meter website affected both.

A pre- and post-test intervention was used with random allocation into control and treatment groups. Participants were recruited using social media and asked to 'test our Energy Literacy tool'. They were given the context for the work: *The Dunedin City Council is in the process of developing a Long Term Energy Strategy for the city as a whole.*

Respondents were first asked to rank ten potential activities according to their likelihood of doing them in the next year. Four of these statements identified the respondent's confidence in participating in discussions of EL at home or in contributing to local government processes. Four more statements were designed to help position along a continuum of likelihood to participate in civic engagement. We refer to this measure in shorthand as EC.

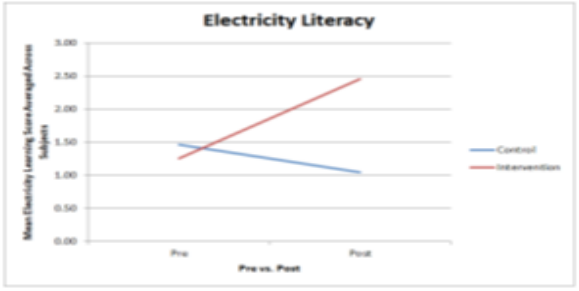
The rankings given for each of the energy statements were used to create a confidence scale for each respondent. This scale ranged from 2 (confident) to 8 (not confident).

To assess energy literacy, two sets of questions were used (pre: EL1, and post: EL2). These questions were designed to provide a measure of respondents' understanding of electricity consumption measures and principles. Each question was one that might be reasonably created with a small amount of knowledge about electricity, and determining the correct solution requires a general understanding of electricity consumption and logic, not knowledge of specific facts.

For both the EC and EL measures, a two-way mixed-model ANOVA was performed, with one between-subjects independent variable (training condition) and one within-subjects independent variable (pre- vs. post-test).

For the EC measure, neither the main effect of training condition ($F=1.779$; $p=.189$) nor the main effect of pre vs. post ($F=2.942$; $p=.094$) were significant. However, the training condition by pre vs post interaction was significant ($F=4.927$; $p=.032$). As illustrated in the figure below, the increase in EC from pre-test to post-test was larger for the Intervention group than for the Control group.

For the EL measure, the main effect of pre- vs. post-test was not significant ($F=3.085$; $p=.086$). There was a significant main effect of training condition ($F=7.156$; $p=.011$) and a significant training condition by pre vs. post interaction ($F=13.155$; $p=.001$). As illustrated in the figure below, the Intervention group showed a substantial increase in EL scores between pre- and post-test (1.25 to 2.45), while the Control group showed a small decrease (1.46 to 1.04). The most likely explanation for the exhibited decrease in EL for the Control group is random variation, given that the metric is based on only four multiple questions.



The City Wide Energy Meter project played a significant role with increasing confidence and energy literacy levels.