Háskólinn á Akureyri

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ESC

- Energy Saving Calculations -

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the award of the degree BSc.

I hereby declare that this final report is all my own work, except as indicated in the text:

Signature _____

Date _____/_____/_____

Abstract

The document describes the work on the development of an online Energy Calculation System. The system was developed from an idea from Bjarni P. Hjarðar and in cooperation with Orkusetur, the Energy Agency in Iceland. The system is an interface to a database and a calculation engine. It provides means for users to compare calculated energy usage of their house against their actual use of energy. This energy is used to warm up houses that do not have access to geothermal energy. If users exceed the calculated energy need they are advised on how to improve the energy usage.

Hopefully this project will be used by Orkusetur in the future to make people more conscious about their use of energy.

Acknowledgments

I would like to express my gratitude to Dr. Nicola J. Whitehead, of the University of Akureyri for her help, guidance, reading, corrections and support through the project. I would also like to thank Bjarni P. Hjarðar, of the University of Akureyri for his initial idea about this project. As well I could not have done this project without the help of Sigurður Friðleifsson at Orkusetur, the Energy Agency in Iceland and Benedikt Guðmundsson at Orkustofnun, the Icelandic National Energy Authority.

Finally, I would like to thank my girlfriend Sigrún Björk for her patience and support.

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Introduction

Project Description

The project is about making people that live on areas without geothermal energy more conscious about their energy usage. The system created is an online system that allows people to dynamically select their home using a map of Iceland. The system then calculates the needed energy to warm up their houses. These calculations are done with formulas from the Energy Agency in Iceland by utilizing weather and detailed house information. People can then compare their actual energy usage against the calculated need and if the usage exceeds the calculated need the users are shown different ways to improve their energy usage. This material is provided by the Energy Agency and will be available at their web.

Project Objectives

The aim of the project is to make people in areas that have no geothermal energy more conscious about the energy that they spend. The reasons are twofold; first that is one of the aims of Orkusetur:

> *TO PROMOTE RATIONAL USE OF ENERGY FOR SPACE HEATING AND PLACE EMPHASIS ON AREAS WHERE GEOTHERMAL ENERGY IS LIMITED.*

And secondly because the government subsidized a big portion of that energy and if people could be made more conscious and shown how to save energy. The people and the government could possibly save a lot of energy and money. That founding could then possible be used in other places like the educational system.

Motivation for the Work

When starting to think about a final year project I was approached by Bjarni Hjarðar, a lecturer in the University of Akureyri. He was very interested in energy saving equipment and asked if I would be interested. Since I had no big plans for a project and the idea included saving the government money that could be used for the school system, I agreed.

When we first met he had been working on a project with Orkustofnun, the National Energy Authority. His project was an implementation on an air warming device in areas where geothermal energy is not available. This device uses an electronically driven mechanism to heat up the building. It creates warm air in a cheaper way than using the common method of heating up water that is lead through the house, therefore it saves energy.

His idea was that I could help him by creating a program that could be an aid to his work by representing manufacturers' data and his own measurement in a visual manner. By using this data it could be proven to people that implementing such a mechanism could save them money.

There are many different ways possible in order to lower the household energy usage and Orkustofnun and Orkusetur especially sponsor a lot of different projects in this field. This project was originally set up to show one type of energy saving method and by implementing it how it could save the government and households around Iceland money.

After my initial meeting with Benedikt Guðmundsson at Orkustofnun, (in charge of the electricity subsidies) and numerous meetings with Sigurður Friðleifsson (CEO of Orkusetur) the focus changed. Instead of creating something that could only be used to display this one special energy saving method why not to try to create a base system. This base system could then be used to display different methods of saving household energy.

The idea of having a system like this was very appealing to Orkusetur. They see this as a tool that they can use for different types of projects connected to household energy usage. Therefore I agreed to change the project and head in this direction, not though without talking it over with the supervisor of the project Dr. Nicola Whitehead.

When agreeing to change the project it meant also to include Orkusetur and Sigurður Friðleifsson in all ideas and designs in the project. He has proven to be a very capable person with good ideas and vision about the project and how it should evolve. This has been very valuable and made the project a lot more realistic since he has been in the role of a customer.

Target Group

With this project in mind it was decided to target a specific group of people with this project. The group that was selected was the farmers in Iceland. Reason for this is that the farmers are very conscious about how much energy they are using and they are always willing to commit time and money in projects that can save them even more money on the long run. This is not always the case with people that live in towns. Maybe because there are more chances that they will not stay as long in the same house or just that their regular day to day time is spent differently.

Related Work

The system utilizes ides from other GIS (geographical information systems) such as Google Earth, by implementing a map for users to start their navigation for data. After that resembles end and the rest of the system is a selection of data and display of data and calculations.

Project Overview

The remaining of the document is structured as follows:

Background Reading: Here is a background reading about the geothermal energy and how it has been used in Iceland. It goes as well over the numbers showing the governmental cost of the subsidizing of energy to people with no access the geothermal energy.

System Design: The original design of the system is detailed from database design to calculations and client interface.

System Implementation: The system implementation is discussed in details, the process of acquiring data and technologies are reviewed and explained. The architecture and design changes of the system are reviewed, finally the flow of the system and implementation issues are reviewed.

Evaluation: Why should the system be tested and how was it done? There were two types of testing done for the system, these were a usability test and a functionality and browser test. The results are shown and summarized.

Conclusion: Project objectives are reviewed, my work and further work is detailed, finally project conclusions and my personal reflections on the project.

Background Readings

Geothermal Energy and Subsidizing

Since the year 1930 Icelanders have used geothermal energy to warm up their houses. They started to drill for warm water in the year 1928 and two years later they connected the first house by a 3km long pipe[1].

If looked at Figure 1, it can be seen that in large areas around Iceland there is availability of geothermal energy.

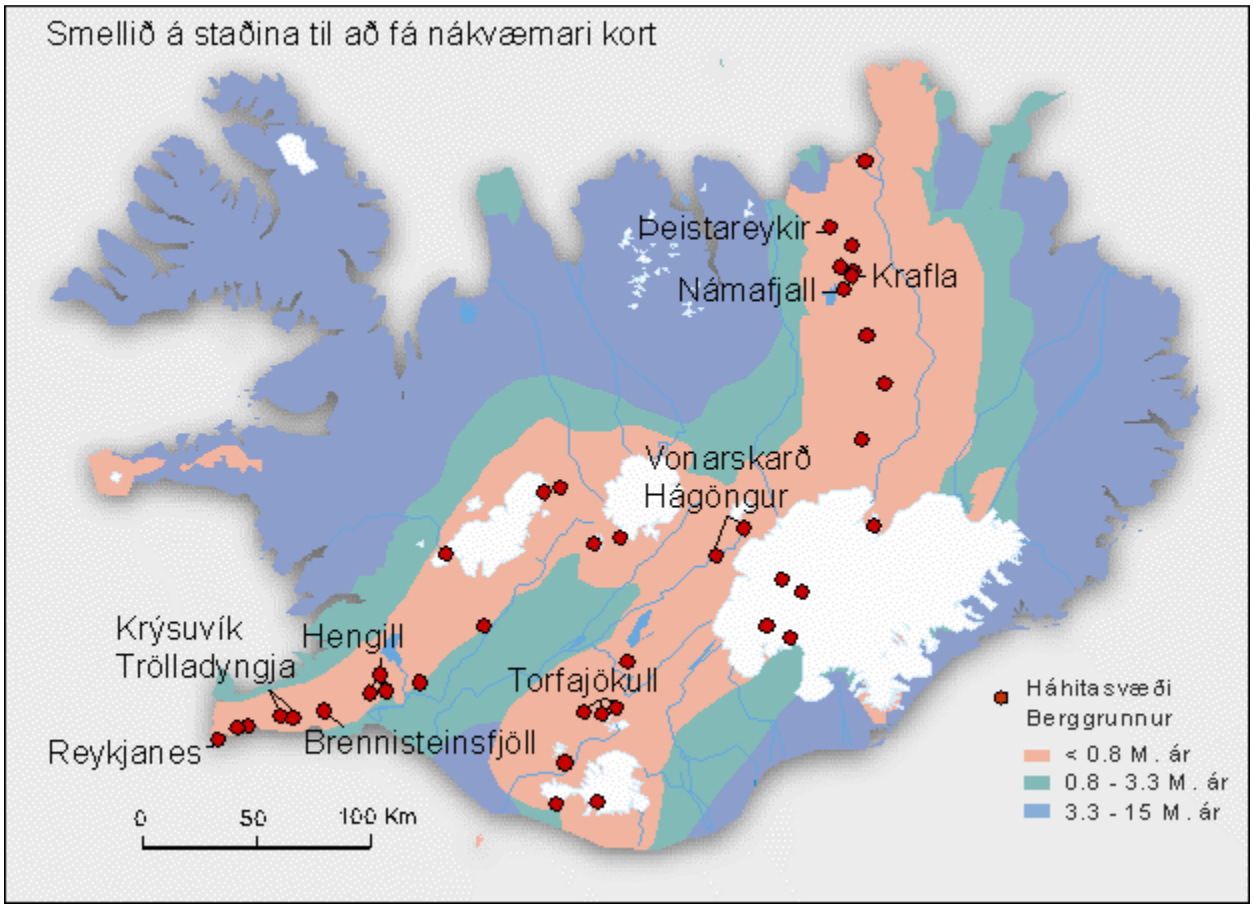

Figure 1: Geothermal energy in Iceland[2]

This usage of the geothermal energy grew and by the year 1985 around 85% of Icelandic population used warm water from geothermal areas to keep their houses warm[3].

[1] < http://www.orkutolur.is/mm/hitaveitur/ >

[2] < http://www.os.is/soloweb/myndir/1628 >

[3] < http://www.orkutolur.is/mm/hitaveitur/ >

Even though the Icelanders have been very committed in creating "Hot Water Distribution" companies that use pipelines to distribute warm water, there are still areas in Iceland that do not have access to it. These areas are commonly known as "Cold" areas. In these areas alternative methods are used to warm up houses. These methods are such as electric heaters or electricity heated water systems[4].

Area of Iceland	Total Population	Population w/ Regulated Hot Water Distributors	Population w/ None-regulated Hot Water Distributors	Population w/ Electricity/Oil Heated Hot Water Distributors	Population w/ Electricity Heating
Reykjavík & Reykjanes	205.004	203.531	17		1.456
Vesturland	14.863	9.928	800		4.135
Vestfirðir	7.546	491	38	3.565	3.452
Norðurland vestra	8.878	6.079	130		2.669
Norðurland eystra	27.000	23.286	545		3.169
Austurland	13.710	2.566	6	2.000	9.138
Suðurland	22.403	13.238	1.717	3.600	3.848
Total	299.404	259.119	3.253	9.165	27.867
Ratio	100%	86,50%	1,10%	3,10%	9,30%

Table 1*: The number of Icelanders that have access to geothermal house eating

Where ever there is no access to geothermal energy the government subsidizes the electricity cost. This has been done after certain rules since the year 1983. This has been done in order to give people in Cold areas an equally priced energy. This was finally legislated in May 2002[567].

As can be seen in Benedikts Guðmundsson's report from 2005[8] the government cost for this subsidy has steadily been increasing from the year 1992 with an exception of last two years (This is due to new legislation in an open market for Hot Water Distributors in Iceland). And in the year 2006 the cost will reach new heights as it reaches for the first time 1,000 million ISK.

With the laws set in the year 2002 and later changed in 2004 it was also made clear how this money could be divided between pure subsidizing 80% and other projects 20% in fields such as searching for geothermal energy in Cold areas and introducing new ways in saving energy.

[4] < http://www.orkutolur.is/mm/hitaveitur/hushitun.html >

∗ This is an abstract version of the table from 1st December 2005, original can be found in Appendix B

[5] < http://www.orkutolur.is/mm/nidurgreidslur/ >

[6] < http://www.althingi.is/lagas/128b/2002078.html >

[7] < http://www.althingi.is/altext/130/s/1886.html >

[8] Orkustofnun, c2005, pp. 2-9

The amount of subsidized energy changes from year to year. For the year 2006 it has been set at 40,000 kWh[9]. This means that on average each home is paying 27,000 kWh fully priced[10]. And since the average subsidizing is around 3 ISK / kWh (see Table 2) the household is paying 81,000 ISK more for the energy above the limit. This shows that there is money to be saved for these households, and if energy usage is lowered below the 40,000 kWh the government will start saving as well.

Hot Wated Distributors	Subsidizing ISK/kWh
Area of Hitaveita Suðurnesja	3.13 ISK/kWh
Area of Orkubú Vestfjarða í dreifbýli	3.42 ISK/kWh
Area of Orkubú Vestfjarða í þéttbýli	2.51 ISK/kWh
Area of Rafveita Reyðarfjarðar	2.57 ISK/kWh
Area of Rafmagnsveitu ríkisins í dreifbýli	3.20 ISK/kWh
Area of Rafmagnsveitu ríkisins í þéttbýli	2.72 ISK/kWh
Area of Norðurorka	3.11 ISK/kWh
Area of Orkuveita Reykjavíkur	3.37 ISK/kWh
Average Per Hot Water Distributor in ISK/kWh	**3.01 ISK/kWh**

Table 2*: Subsidizing cost per hot water distributor in ISK[11]

Summary

This chapter has shown how the geothermal energy is vital for sustaining population in some areas of Iceland. It is so vital that the government has issued laws that people without access to geothermal energy should get the energy needed to heat up the houses subsidized. The amount differs between areas but in on average around 3 ISK/kWh. This sums up to be over 1 billion ISK per year. These numbers show that by making people more conscious about their energy usage a lot of money can be saved.

Next chapter covers the original design ideas behind the system.

[9] < http://www.orkutolur.is/mm/nidurgreidslur/upplysingar.html >

[10] Þórarinsson, Egger Þröstur & Pálsson, Ólafur Pétur & Marteinsson, Björn, 2006

[*] The table has been changed and calculations added to the bottom of it. See original in Appendix B

[11] < http://www.orkutolur.is/mm/nidurgreidslur/upplysingar.html >

System Design

Database

Pool of Variables

After going through the data that will be acquired for the project this list of variables has been created. Each variable has been given a descriptive name, next to each variable is a detailed description of it.

Variable Name	Description of Variable
FMR_ID	A unique number for each house in Iceland.
HEAT_AREA	Iceland is divided into 9 different geographical areas.
LOCATION_ON_MAP	Location on the map of Iceland.
NAME	Name of the house.
SIZE_M2	Size in m2.
AGE	Age of the house.
SHAPE	Is the house on one or more floors.
AREA_CODE	Postal area code.
COUNTY	The county where the house is.
SUBSIDIZED_RATIO	Is there one or more families living in the house.
AVE_TEMP_MONTH1	Average temperature for each month of the year in specific heat area.
...	Average temperature for each month of the year in specific heat area.
AVE_TEMP_MONTH12	Average temperature for each month of the year in specific heat area.
MAX_SUB	The maximum amount of subsidized energy.
AVE_ENERGY	Average energy used per m3
EXT_ID	ID of the extension.
EXT_NAME	Name of the extension.
EXT_DESC	Description of extension.
EXT_FILE	File name of extension.

Table 3: Descriptive list of all database variables

Building Tables

When building a good database it must at least comply with the first three normal forms. However it will be implemented and even though it is small and looks simple the process of going through these three steps can and will ensure that the buildup of it is of best possible manner.

Here is a small layman description of each one of the three steps[12]:

1st Normal Form (1NF):

Each table has to have a primary key

There are no groups of values that are included in many tables.

[12] Elmasri, R &Navathe, c 2003, pp. 312-324

No variable contains multiple values.

2nd Normal Form (2NF):

The database must comply with 1NF.

Variables that appear in multiple tables are moved to a specific table.

3rd Normal Form (3NF):

The database must comply with 2NF.

Variables that depend on other than the primary key are moved to a specific table.

After arranging the entire table of variables from according to the first three normal forms this is the result:

Nr	Table Name	Table Variables			
1.	HEAT_MAP	FMR_ID (uq)	*Heat_Area (5)*	Location_On_Map	
2.	HOUSE_DETAILS	FMR_ID (uq)	SizeM2	Age	Shape
3.	ENERGY	FMR_ID (uq)	Subsidize_Ratio		
4.	ADDRESS	FMR_ID (uq)	Name	Area_Code	County
5.	HEAT_INFO	*Heat_Area (1)*	Ave_Temp_Month1	...	Ave_Temp_Month12
6.	MISC_VAR	Max_Sub	Ave_Energy		
7.	EXTENSIONS	Ext_ID(uq)	Ext_Name	Ext_Desc	Ext_File

Underlined : Primary Key (uq) : Unique Value
Italic : Foreign Key

Table 4: List of tables and their properties

If this list of tables and their variables is looked at closely it can be seen that they all except table nr 6 comply with the first three normal forms. That table is used to store variables for the calculation formulas.

The FMR_ID is a unique value not only in this database but in the Icelandic property registry as well.

ER Diagram

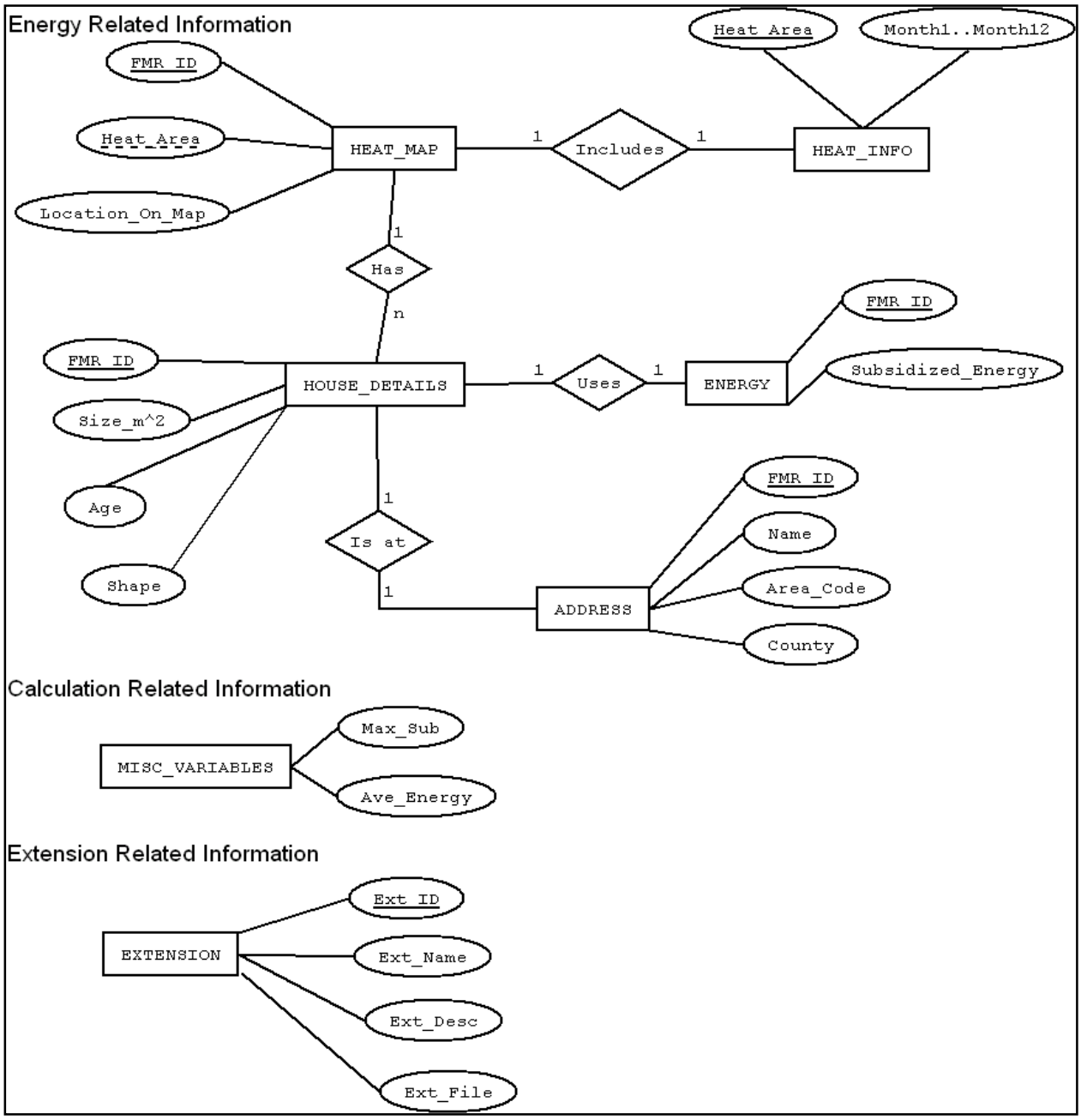

Figure 2: An ER diagram of the database

The ER diagram is a very good way to see the structure of the tables as well as the connections and the keys. In this ER diagram the underlined variables are the primary keys, the dotted lines indicate a foreign key.

There are two tables MISC_VARIABLES and EXTENSION that are not connected to the main information. These tables are called look-up tables and hold variables that are connected to calculation formulas and the extensions that the system can use.

Calculations

Area Calculations

To calculate the average heat of the area all the months of each measurement stations is summed together and divided with the number of months. This calculation is then summarized for each measurement station and divided with the number of stations.

$$\frac{\sum_{i=1}^{n}\left(\frac{\sum_{j=1}^{m} X_j}{m}\right)_i}{n}$$

Equation 1: Average heat calculation for each area.

In equation 1, n is the number of weather measurement stations, m is the number of months, 1 is mapped to January and etc. X is the given average value for the month from the weather station.

To find the average size in square meters, SM or m^2 is the size of houses in the area, the size of all the houses is summarized and divided with the number of houses.

$$\frac{\sum_{i=1}^{n} \mathrm{SM}_i}{n}$$

Equation 2: Average m^2 size of houses in the area

In equation 2, n is the number of houses and SM is the registered size in square meters, m^2 of each house.

When calculating the average m^3 size of the houses equation 2 is used and multiplied with 2,5m which is the minimum height measured from floor to ceiling in regular housing[13].

$$\frac{\sum_{i=1}^{n} SM_i * M}{n}$$

Equation 3: Average m^3 size of houses in the area

In equation 3 the n is the number of houses, SM is the size of house in square meters or m^2 and M is the regulated minimum height which is 2,5m[14] according to governmental standards.

There are many factors the affect how much electricity is used to warm up a house. The average value is around 72 kWh/m^3 [15]. This number doesn't apply to very big houses or very small ones but is fair enough to be used for average calculations such as these.

[13] Byggingarreglugerð 441/1998, 74th section.

[14] Byggingarreglugerð 441/1998, 74th section.

$$\sum_{i=1}^{n} SM_i * M * Z$$

Equation 4: The total calculated energy need houses in the area.

$$\frac{\sum_{i=1}^{n} SM_i * M * Z}{n}$$

Equation 5: Average calculated energy need by a house in the area

In equation 4 and 5 n is the number of houses, SM is the size of the house in square meter or m^2, M is the regulated minimum height which is 2,5m and Z is the calculated average energy.

The average age of the houses is found by subtracting the year when the house was built from current year, this is then divided by the number of houses.

$$\frac{\sum_{i=1}^{n} (cy - by)_i}{n}$$

Equation 6: Average age of house in the area

In equation 6, n is the number of houses, 'cy' is the current year and 'by' is the year when the house was built.

$$\sum_{i=1}^{n} Sr_i * M$$

Equation 7: The maximum subsidized energy for the area.

In equation 7, n is the number of houses, 'Sr' is the ratio of subsidy that the house has rights to and M is the currently decided amount of subsidized electricity.

[15] Þórarinsson, Egger Þröstur & Pálsson, Ólafur Pétur & Marteinsson, Björn, 2006

House Calculations

The things that need to be calculated for individual houses have all been calculated for the area before. The difference is that they do not have to be summarized for all and then divided.

$$SM * M$$

Equation 8: Size of house in m^3

$$SM * M * Z$$

Equation 9: Calculated energy need for a house

In equation 8 and 9 SM is the size of the house in square meters, M is the regulated minimum height which is 2,5m and Z is the calculated average energy.

To calculate the age of the house the built year is subtracted from current year.

$$cy - by$$

Equation 10: Age of a house calculated.

In equation 10, 'cy' is the current year and 'by' is the year when the house was built.

Storyboards

When designing the interface there are things to have in mind. These things will make the user experience much better and hopefully will he be able to achieve his goals without having to spend much time learning how to use the system.

Accessibility to previous screens and information is a key element in a visual program like this one. Therefore an indicator is needed, to show what has been selected and an easy way to switch to other parts. This will be a key element in all the interface design. There will always something that indicates where the user is and how he can travel between selections.

The base of the system is divided into three screens or in storyboards for now. From these three the user should be able to select location on a map of Iceland[16]. Select a house on a more detailed map and then view the information about the house as well as to have interaction about its energy usage.

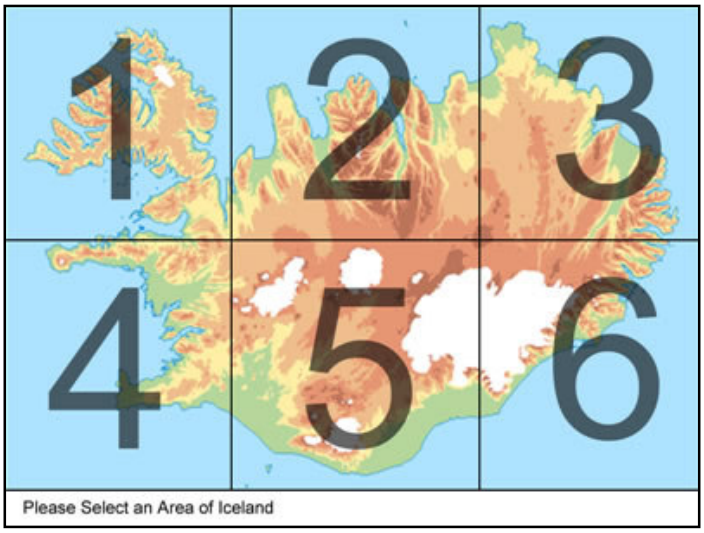

Figure 3: Storyboard 1, Select an Area of Iceland

This screen couldn't be simpler. The user is presented with a map of Iceland. He is then required to select his area with a mouse click. When he does he is moved to storyboard 2.

[16] < http://www.lmi.is/landsurvey.nsf/pages/index.html >

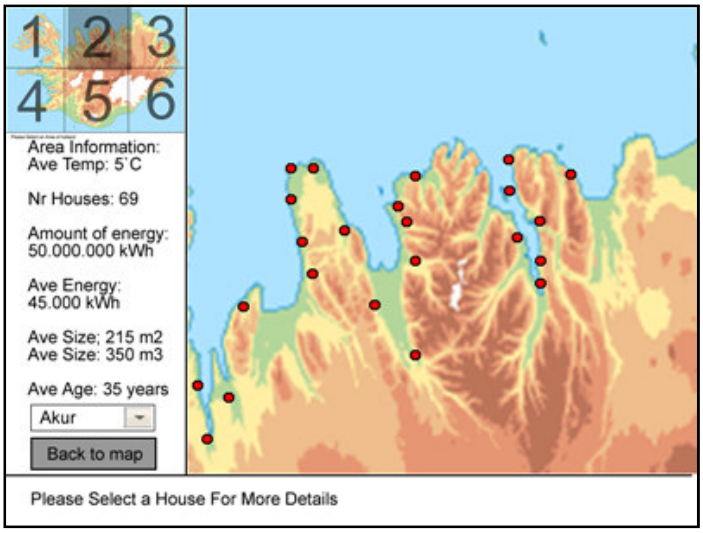

Figure 4: Storyboard 2, Information about Selected Area and Houses

This storyboard shows the selected area. The user is also presented with an overview map up in the left corner. There he can see what the current area is and he can click on that image to go to different area. If the user doesn't realize that option he can use the "Back to map" button and is then presented with screen 1.

In this area the user is presented with information about the area. The average temperature, the number of houses, the total amount of calculated energy, average calculated energy, average sizes for m^2 and m^3 and average age.

On the right side there is a map of all the houses in the area. The user can then click on the house or select the house from a drop down list. He is then taken to storyboard 3.

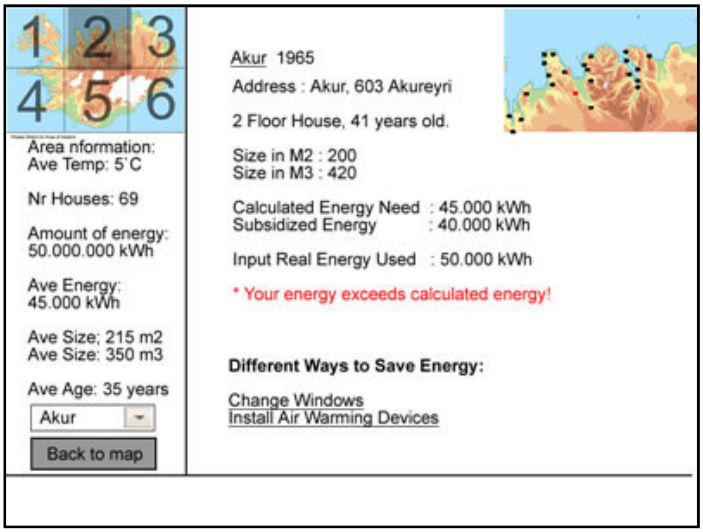

Figure 5: Storyboard 3, Detailed Information about the Selected House

This is the details storyboard. It has the information provided by storyboard 2 as well as the functionality to switch between areas and houses by using context displays in top corners.

In addition this storyboard displays all details about the selected house. And if energy spent exceeds the calculated energy the user is notified. At the bottom of the screen all the different extensions are listed. They can be clicked and then the functionality of that extension will take over.

This is version two of this storyboard. In the first design the top right corner information was not included. Then when making overviews it was clear that it was missing a connection to storyboard 2 and the context was not as good as in storyboard 2. Therefore the right top information window was added. It displays the selected house and allows the user to quickly move back to storyboard 2 in order to select a new house.

Summary

This chapter shows the original design of the system. It goes over the database design, showing how the database was split to tables using the normal forms. It shows all the formulas that were thought to be needed for the calculations and how the interface was designed. It shows the complete system as it was thought to be made before any implementation started.

Next chapter will go over the acquiring and manipulation of data, technologies used, system architecture and implementation issues. It finally goes over how the flow of the system and how the final design has changed from the original one.

System Implementation

Data Acquiring & Processing

The heart of a system like this one is the data that it possesses. Without the data there is no need for a database, engine or a client. Therefore the first thing that was to start collection data. Data from five different institution or companies was needed and some of the data proved hard to get. Here is a complete list, detailing what institute or company provided which data and how it was used.

The Icelandic Meteorological Office has a good website at www.vedur.is. That website provided some of the data as well as email addresses to people that were very helpful in providing the data that was needed. They provided a complete list of readings from various weather stations around Iceland. This list consisted of a station id, name and average heat for each month of the year 2006. Then on the webpage was a map that showed the location of each weather station. The average heat for the year at the station was then calculated and by using the map a mapping of the stations to each of the 9 different portions of Iceland was achieved.

The Icelandic National Energy Authority or **Orkustofnun** has a detailed database where they list all the houses in Iceland that get subsidized energy. They provided access to that database that gave a complete list of all the farms around Iceland. The list had over 7000 entries and included the name of the farm, zip code, house id and information that was not needed. By retrieving the correct information from this data a list of houses with house id was provided for FMR.

The Energy Agency in Iceland or **Orkusetur** is doing various research projects on how energy can be saved and how it is utilized today. They provided formulas and constants for energy calculations. These provided means to make good assumptions on how much energy a house of certain age, size and shape needs in order to sustain a desired temperature inside. Some of the constants were inserted into the database but others along with formulas were codified into the engine.

The Land Registry of Iceland or **FMR** has the means to provide details about each one of the houses. They have still not answered requests about the data. The first person that was contacted promised that this shouldn´t be a problem. But they have recently changed the processing of requests like these and the new process seems to take a long time. Luckily they provide access to their database, called Land Registry Database, at their website www.fmr.is. By utilizing this online access, details about a single house can be retrieved. This made it possible to hand make some sample data, one house at a time. The house size, age and county were handpicked for 80 houses in order to create a sample data for the project.

Iceland Post Inc has a good website at www.postur.is. It provided a detailed map showing the location of each one of the Icelandic zip codes. This provided means to map each house to predefined portion of Iceland.

Technologies

Switching from Java to AJAX

In the beginning of the project it was thought of as a Java applet that would run integrated into a web page at Orkusetur. After some meetings with Orkusetur they expressed their interest of having the system implemented in AJAX. This was because of other project that they are currently running. They thought that if they would have another AJAX system instead of a Java applet it would make their life easier since they are getting custom with that technology and it would make their web more constant. Since the web would not be using such different technologies when showing people different things but just AJAX. This inspired the project to be changed to AJAX and it has been a very successful but time constraining process. Therefore this project moved from a Java applet to an AJAX module that is to be integrated into a larger web at Orkusetur.

AJAX

AJAX stands for Asynchronous Javascript and XML, XML being the data and it can be switched out for any other source of data. It is intended to create more interactive web pages. It makes the user experience more desktop like because it allows the programmer to execute server-side scripts without refreshing the page. Instead of the refreshing it changes the data in some portions or divisions of the page. This makes the use of the web much faster. See comparison on figures 13 and 14.

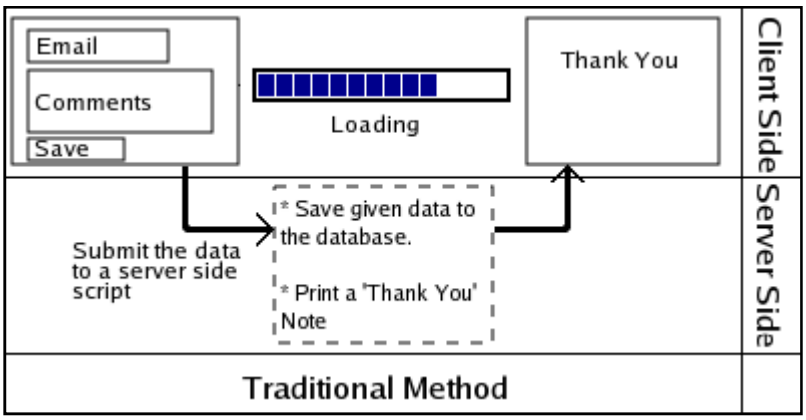

Figure 6: Traditional Method of Processing Data[17]

[17] < http://www.openjs.com/ajax/tutorial/ >

The above figure shows us the traditional method of processing data. The user does some actions on a web page and upon his finish some data is submitted to the server. The server will then process the data and then post some information to the user.

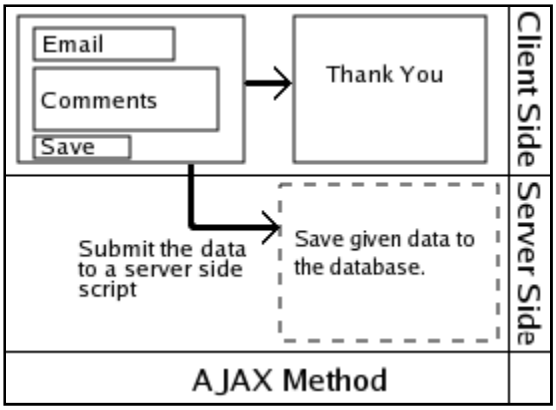

Figure 7: The AJAX Method of Processing Data[18]

The above figure shows how the AJAX method handles data. At the same time as the data is sent to the server to be processed the fields at the original web page are updated without any reload of the page where the user is thanked.

All good things do not come without something bad, at least not to begin with. AJAX is fairly new, the core of it has still existed for few years but people are just recently started to utilize these things to the fullest. Like Jason Cranford Teague points out in his book Visual Quickstart Guide CSS, DHTML & AJAX.

> "There is no such thing as a perfect technology, and using Ajax in your Web site comes with its own set of worries. In fact, many of Ajax's advantages can prove to be a double-edged sword" [19]

The issues that most people seem to have with Ajax is that this is a totally new experience for the user. Applications may get more desktop like but at the same time the same application will most likely lose some of its web like behaviour. This means that normal functionality like the back button doesn't work like it usually does. This is because of the dynamic change of the section of the webpage instead of reloading the page. Also there are some concerns with the response time. That is if the data that is sent for by the web page takes some time to come the user might try to reload but then he will reload the application but not resend for the data that he was actually waiting for.

[18] < http://www.openjs.com/ajax/tutorial/ >

[19] < Jason Cranford Teague, 2007 >

MySQL

MySQL is free. Today it is one of the largest open source databases available. It is multiplatform[20], multithreaded and multi user database, which means it is easy to install and maintain on various platforms. This makes it ideal for web development since majority of servers today run either Windows or Linux. By implementing a database of this quality it is made sure that the system can be installed and maintained at various different setups.

For this project MySQL version 5.0.27 for Windows was installed along with the MySQL GUI tools 5.0.r9a.

PHP

PHP stands for PHP: Hypertext Protocol. [21] It is a widely spread general purpose scripting langue. It takes much of the syntax from languages such as C, Pearl and Java. It then adds to the pool some unique PHP features that cannot be found anywhere else. The main goal of the language is to provide server programmers a tool to dynamically create web pages. It can both be embedded into HTML document as well as it can be used for server side programming only.

For this project PHP version 5.2.1 for Windows was installed.

Apache

Today the Apache web server is a good solution. It is free, secure, and efficient and it provides everything that you need when working on a project similar to this one. It has been the most popular web server since April 1996. And in 2005 it was used for more than 70% of all web sites[22]. Because of this extreme popularity numerous guides have been created on how to install and setup a system like the one that is needed for this project.

For this project Apache Web server version 2.2.4 for Windows was installed.

[20] < http://www.mysql.com/ >

[21] < http://www.php.net >

[22] < http://httpd.apache.org/ >

The System

Architecture

The system is implemented in three tier architecture or as often referred to as multi tier architecture. This is server-client architecture where the clients can be as many as wanted and are not connected but they all talk to the same engine that services them and provides access to the database.

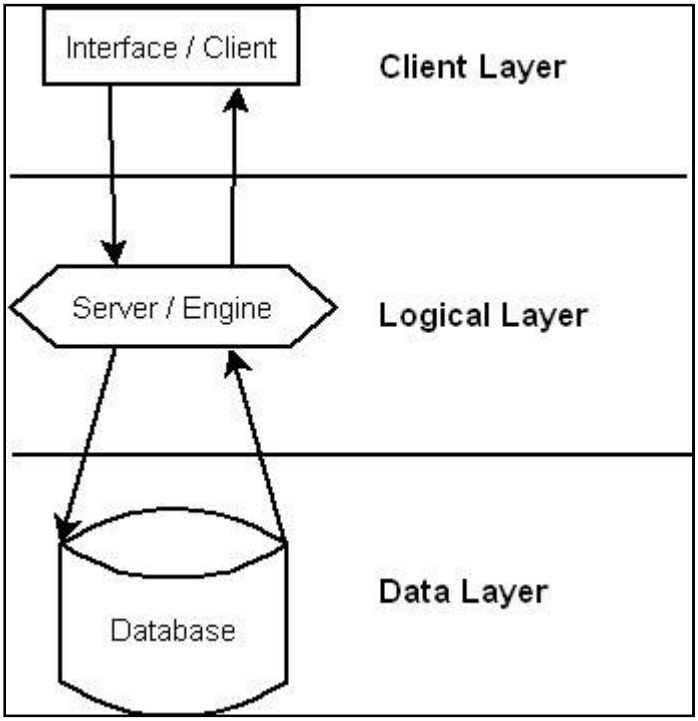

Figure 8: Three Tier Architecture

The client layer is the layer that is presented to the users. They execute the client in their browser and do all their work in the browser. The logical layer then takes care of translating the user actions to database calls, they are then executed. The data layer takes all the calls from the engine and sends back the data that is requested. If there are calculations needed for the data the logical layer takes care of them and formats the data before sending it back to the client layer that displays the data for the user.

Database

There were some changes done when the project started taking off. The table Extensions was removed, it had been thought of as a table storing information about extensions that would be utilized by a Java applet, and since the project was moved to AJAX it became obsolete. The same applies to the Energy table, it was thought to be used for some calculations that later became unnecessary. Then for the Heat Info table, the average heat of each month was changed to average heat of the year. Each station was also given an id called station ID. This id is straight from the Icelandic Meteorological Office, so it is easy

to update the weather information by using this id. The name for the station was added as well. For calculation related information some constant values were added to the misc variables table, these are constant that can change and are set by Orkusetur.

The best way to understand the changes and to see the difference is to look at an EER diagram of the changed database.

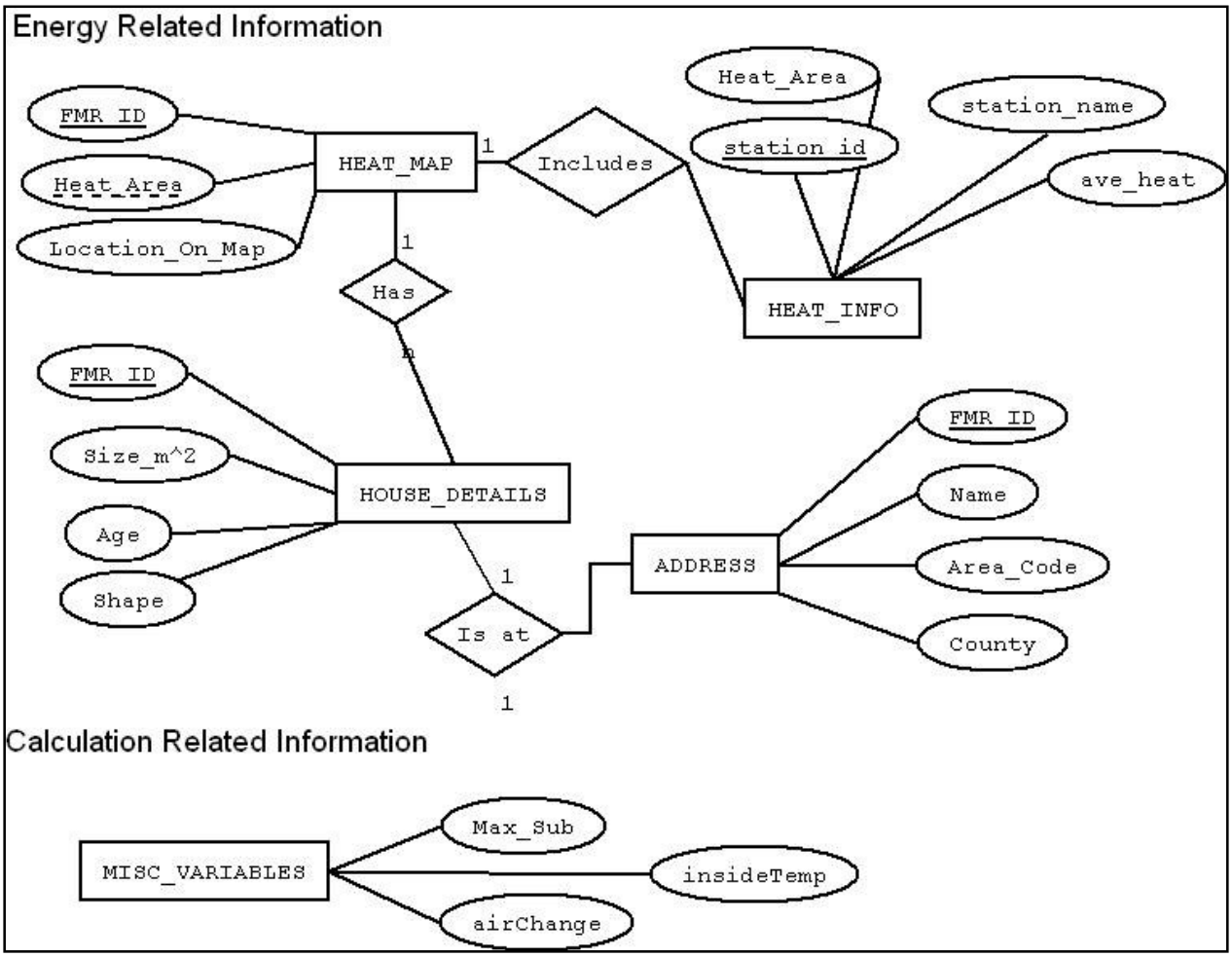

Figure 9: An Updated EER Diagram of the Database

Engine

The engine of the system has to take care of all interaction between the client and the database. That means it has to take care of all database call and then if needed make some calculations using the retrieved data before the data is displayed at the client side.

Formulas and Constants for Calculations

The formulas and constants for calculations all come from Orkusetur (See Appendix E for original document from Orkusetur). These formulas differ a lot from the original ones, so the original formulas have all been discarded and these were implemented. The reasons behind this are changes of the client usage and that the new formulas are new. They were created by another Orkusetur project.

Constants values for U, the energy loss through roof, walls, windows and floor depend on age. The same applies for Ht, the ratios of windows/walls and roof/ground. Here is a table that presents different values for these constants depending on the age.

	Building Year						
	-1929	1930-39	1940-49	1950-59	1960-69	1970-79	1980-
Energy Loss							
Utak = Roof	0,98	1	0,9	0,74	0,48	0,38	0,38
Uvegg = Wall	1	1	0,9	0,75	0,54	0,49	0,4
Uglugg = Window	4,02	3,93	3,83	3,64	3,08	2,96	2,96
Ugolf = Ground	0,78	0,83	0,62	0,65	0,54	0,49	0,49
Ratio Numbers							
Ht1=Utak/Ugolf	1,06	1,06	1,01	1,08	1,01	1,19	1,2
Ht2=Uglugg/Uvegg	0,15	0,15	0,2	0,17	0,27	0,35	0,35

Table 5: Constant Values for Energy Formulas

As can be seen in table 5 there are some differences on how the houses lose their energy or warmth by the year they were built. This is mostly because of different materials and better building methods that are used today.

For the calculations some values are needed from the database. Table 6 shows the variables and explains their meaning. These values are from three tables, the heat info gives the average heat outside, the house details gives the age, ground size and the number of floors. Then there are two constants that are needed from misc variables, these are the inside temperature and the air changes. These constants are used for energy calculations.

Information needed from database:		
Location (weather station)	tm	Used to calculate degree hours (°Ch), G
Building year	Year	
Ground Area of House	Ag	
Number of Floor	Hn	
Desired Inside Temperature	T	Orkusetur wants this to be 21°C
How often air is changed	n	Orkusetur says this should be 0.8

Table 6: Values Needed for Calculations

Table 7 lists all the formulas needed for the calculations of needed energy for warming up the house. These formulas are in most cases very simple. Their goal is to support the last formula which gives the energy needed.

Formulas for calculations		
Degree hours	G	(T-tm)*24*365
Sq. M at ground Level	Agr	Ag/hn
Sq. M of roof	Atak	Agr*Ht1
Brutto Size of Walls	Avbr	Ag
Sq. M of windows	Agl	Avbr*Ht2
Netto sq. M of walls	Avnetto	Avbr-Agl
Heated Cubic Meters	V	Hn*2,6*Agr
Degree Hours Changed	G'	G+(T-20-3)*24*365/1000
		Changed because given energy is 3°C

Table 7: Formulas for Energy Calculations

The smaller formulas are displayed in the above table. Below is the main formula, it utilizes the above constants and the smaller formulas. The result from it is the annual energy need in kWh.

$$Q = \frac{G' * ((Atak * Utak + Avnetto * Uvegg + Agl * Uglugg + agr * Ugolf) + 0{,}36 * n * V)}{1000}$$

Equation 11: Q Equals to the Annual Energy Needed in kWh

Database Calls

There are three main database calls in the system. The first database call is assigned to the navigation map. The map of Iceland is both displayed at the start of the system and as well as a navigation tool in the top right corner throughout the use of the system. This call allocates information about the weather station and farms in the area that was selected. The same functionality and database calls is used for both the large and the small map, the only difference is that the small map indicates with color the selected area. See the below figure.

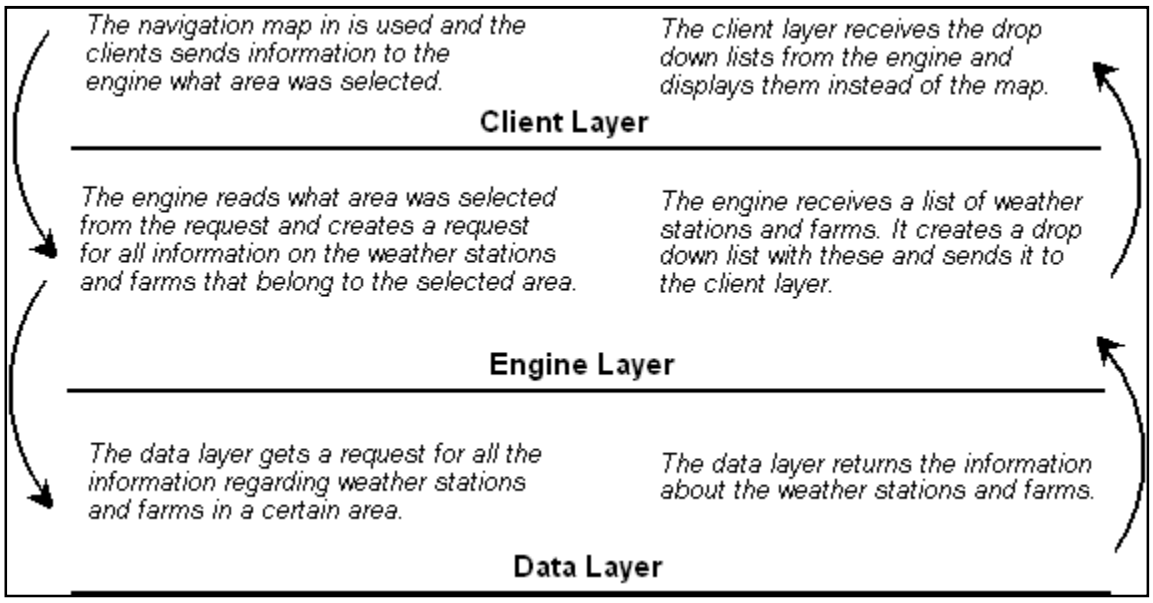

Figure 10: Database Call One, Navigation Map is Utilized

The second database call utilizes the weather station and farm drop down lists that were created using the database call one. When a weather station or a farm is selected from the list, details about them are retrieved from the database and displayed below the selection. See the below figure.

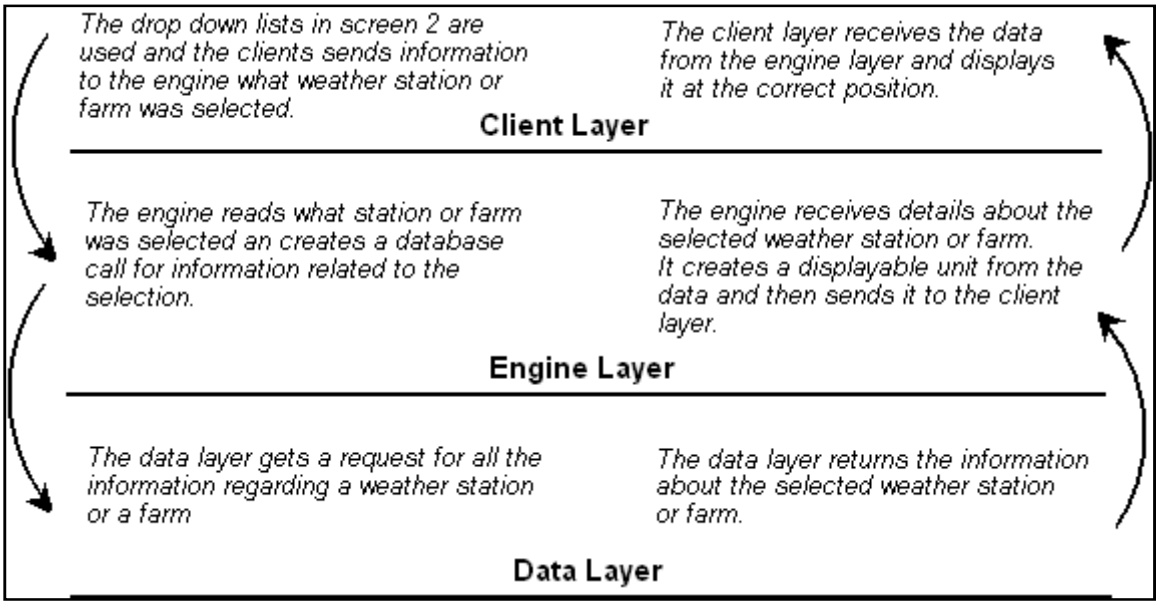

Figure 11: Database Call Two

The third database call utilizes a javascript, when both the weather station and the farm have been selected it will call the information needed about the weather station, details about the house and some calculation constants. This information is then used to calculate the needed energy to warm up the house. See the below figure.

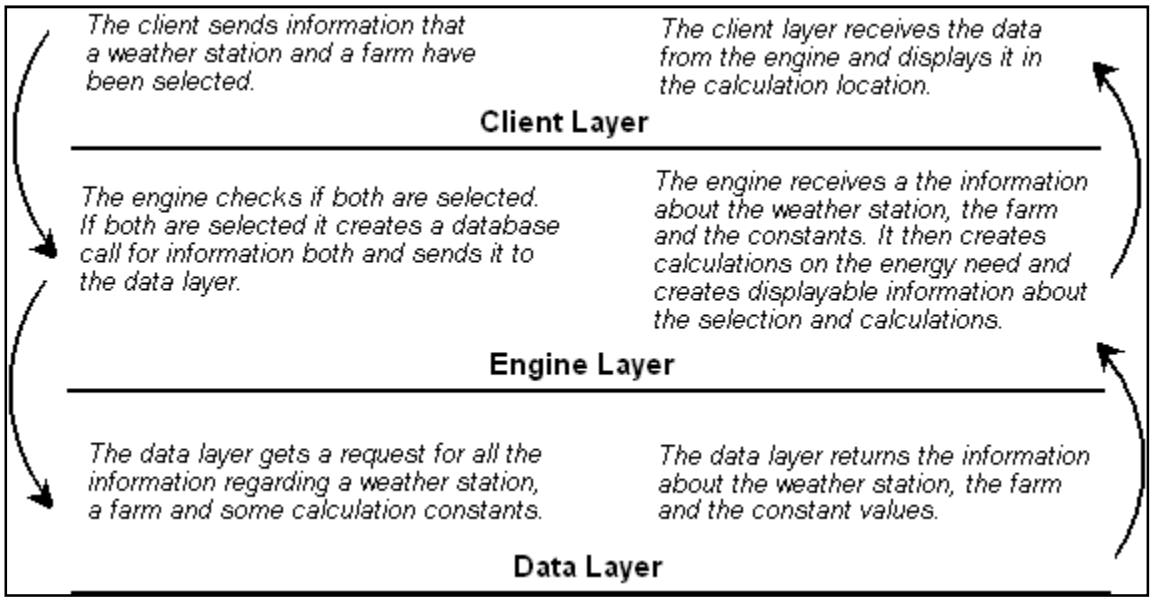

Figure 12: Database Call Three

Client

The client interface is probably the part that has developed the most throughout the project. Here each one of the initial storyboards is shown and compared to the implemented screen with description of the changes.

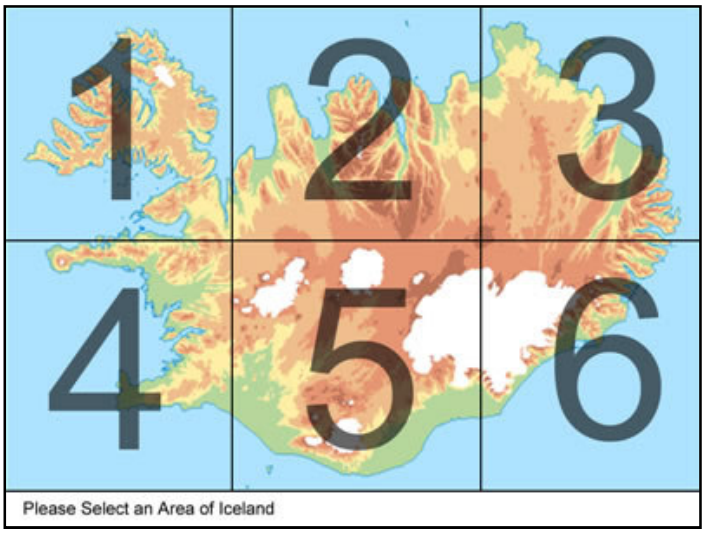

Figure 13: Storyboard 1, Initial Design, Users Start by Selecting Their Area of Iceland

Figure 14: Screen 1, Final Implementation, Users Select Area of Iceland.

The first screen is not that changed from the initial design. The biggest difference is that instead of selecting a numbered area the user is presented with instructions on the left side and will browse over a portion of Iceland. See figure the above figure.

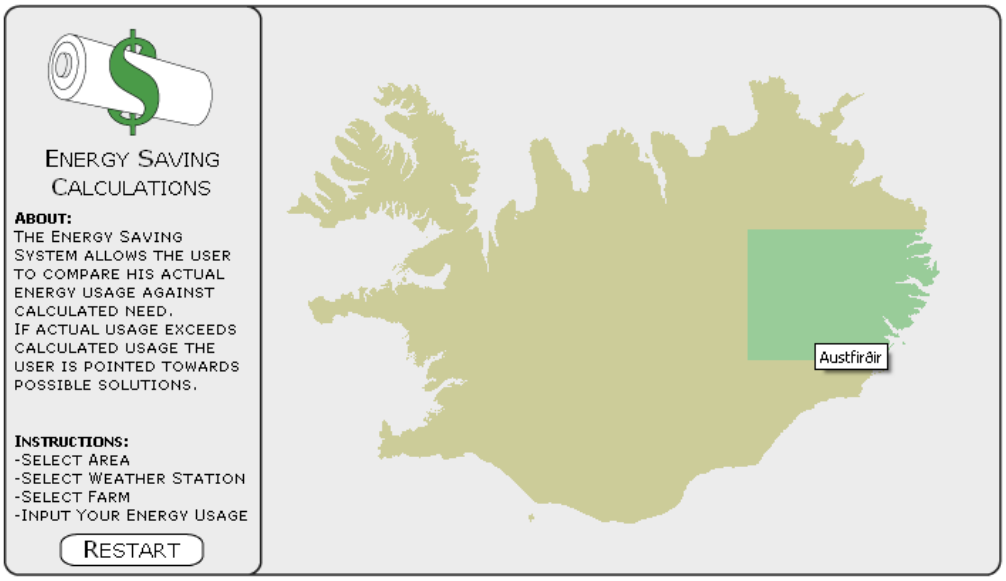

Figure 15: Screen 1, The User is Navigating over Iceland

On the figure above the area that is about to be selected gets highlighted when the user navigates over it. He is also presented with the name of that portion of Iceland.

Storyboard 2 is the screen that was changed the most. That is due to the enormous graphical work it was to draw the dots for each farm. It also meant that each farm would have to get correct global position assigned to it in order to map it correctly on a smaller map. After careful consideration and talks with Tom Barry in his class on Geographical Information Systems this was decided to be changed. See the below figure.

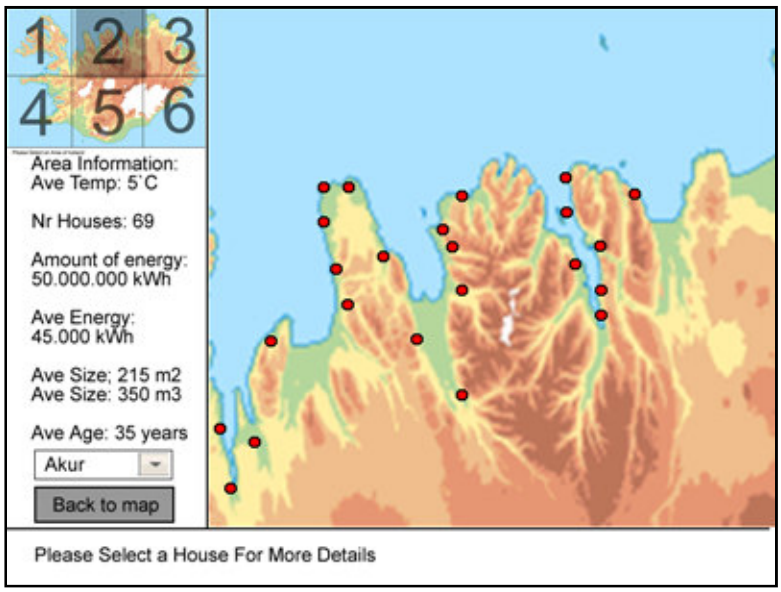

Figure 16: Storyboard 2, Initial Design, User Views Selected Area

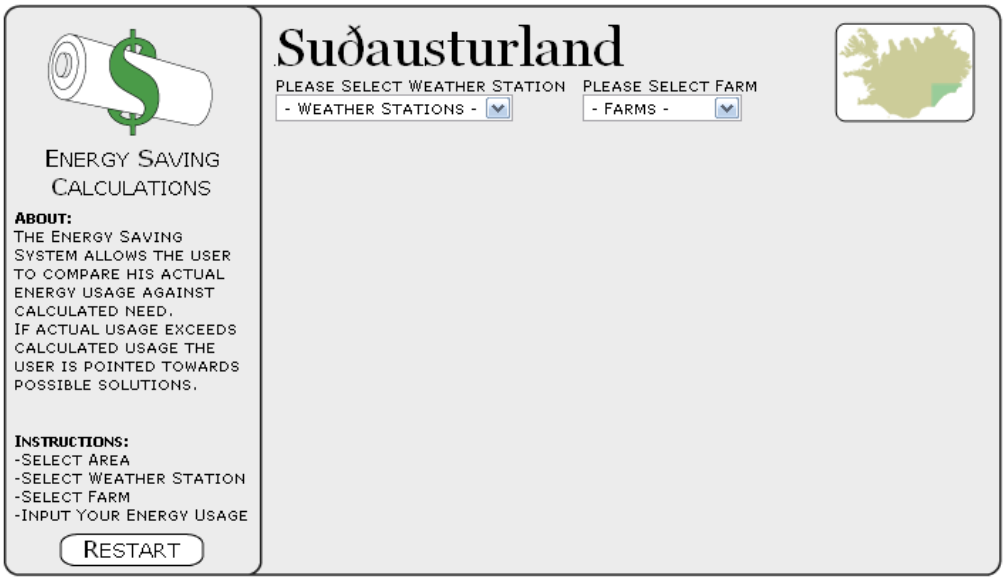

Figure 17: Screen 2, User Is Presented With The Selected Area.

In the top right corner the user is shown what area of Iceland he selected. He is then presented with two drop down menus that allow him to select from all the weather stations that are located in his area. This allows the user to have a better control on what weather station he considers his farm to be closer too.

On the below figure it can be seen where the user is selecting both the weather station and the farm.

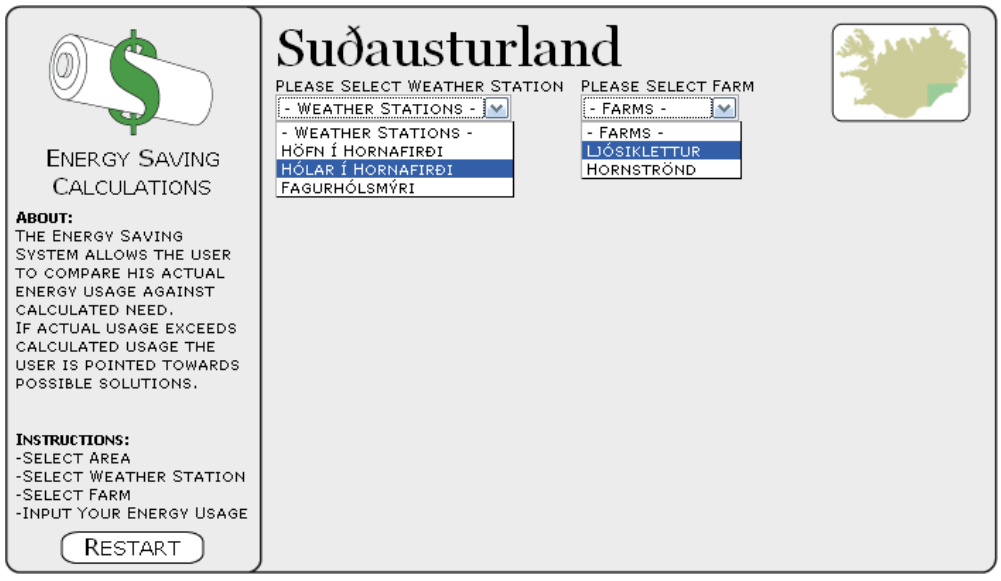

Figure 18: Screen 2, User Selects Both Weather Station and Farm

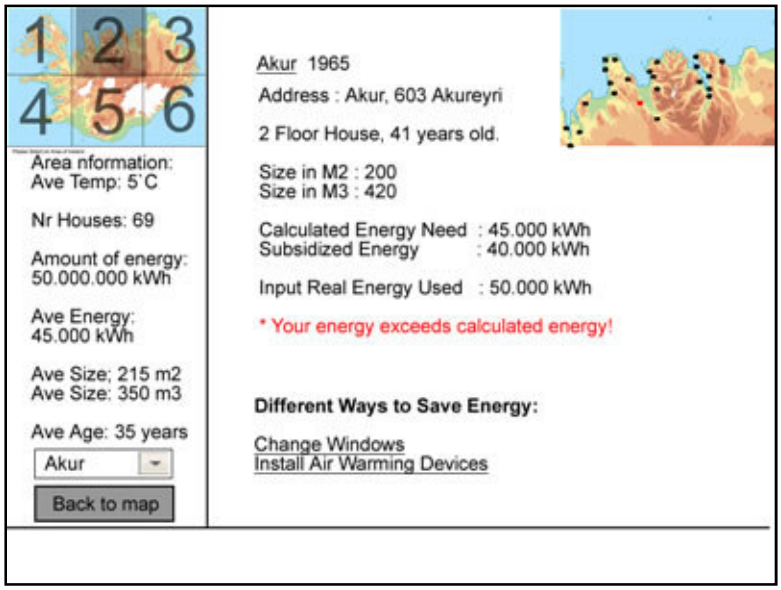

Figure 19: Storyboard 3, Initial Design, Details about Weather Station and Farm

Storyboard 3 was changed a little bit. There the biggest changes are due to the changes made in screen 2. Since that screen was redone the navigation map shown in the top right corner is not available. Instead the user sees his selections on the drop down menu and can change it at any time and the displayed information will automatically be updated.

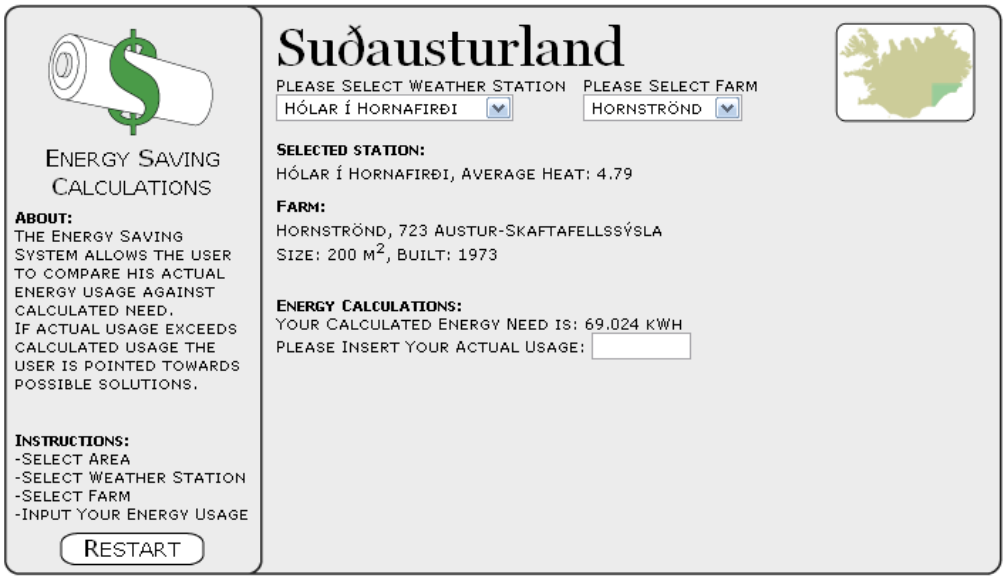

Figure 20: Screen 3, Initial Design, Details about Weather Station and Farm

Below the information about the weather station and the farm are the Energy Calculations. They show the calculated energy need for warming up the house to 21°C according to constants and formulas given by Orkusetur. The user is then presented with the option of inserting the energy that he actually uses.

And if that energy goes over the calculated energy the user is presented with ideas that will be linked into resources from Orkusetur as soon as they set up the system. See the below figure of screen 4.

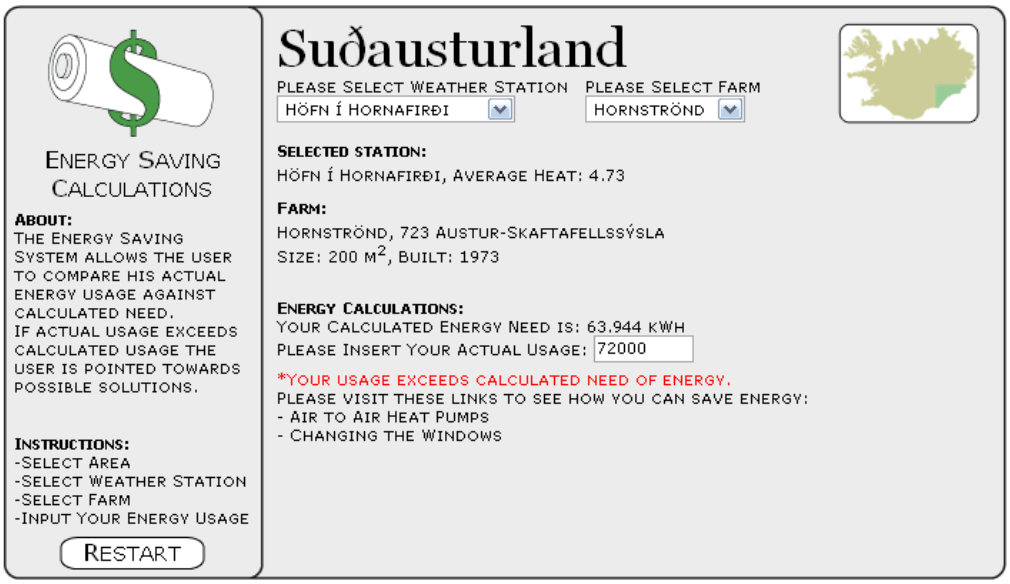

Figure 21: Screen 4, Shows Information Given When Energy Exceeds Calculated Need

On the above figure there are two links shown now. They are actually not working. And they will not be working until Orkusetur has created the material to have behind them. These are just two of the ideas that they want to point people towards.

Analysis of Actions and Flow

The below figure is an explanation of the action and flow chart. It shows all possible actions that the user can perform and the actions that the system performs when the user makes his selections. The action and flow chart shows the start of the client where the index.php is loaded. Next to it is a side process that shows what areas of index.php are loaded or changed. Next to that are the files that are needed in order to perform the update. If any database calls are needed they are listed with the accessed tables.

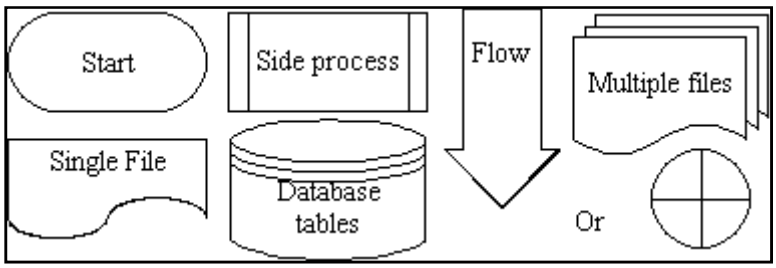

Figure 22: Explanation of Used Icons

Action & Flow Chart

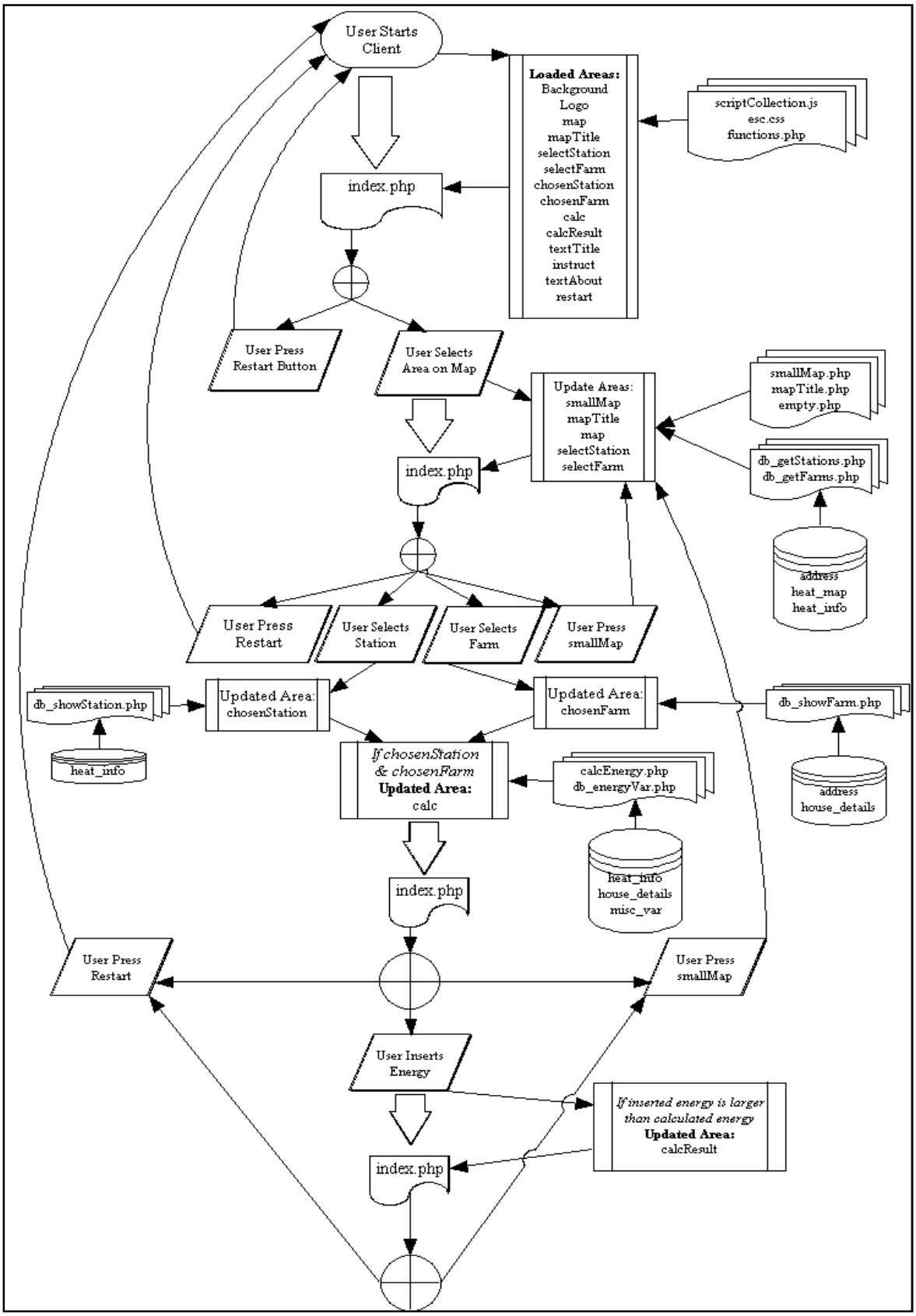

Figure 23: Action and Flow Chart

Implementation Issues

To begin the project it took some time to install all the modules and make them function all together properly. I used a very nice but flawed guide from Edward Tanguay[23]. In his guide Edward goes step by step over how the modules should be set up. Still I found some flaws in his setup and I had to work my way around these, those were mostly minor issues such as the connection the PHP and the MySQL correctly and setting up the Apache web server so it would utilize the PHP and the MySQL database.

After the initial setup bugs things started to go well. The database was up and the data was inserted. Now the system wouldn't display the Icelandic characters. This meant that the system setup needed to be changed and after some research the right parameters for the PHP module were changed.

Now there were some minor issues with the compatibility of the main AJAX function and different browsers. But at the end that was solved with the help of a brilliant function from the book Visual Quickstart Guide CSS, DHTML & AJAX[24]. After that the issues were minor and mainly about how to use different functionalities of PHP, MySQL and Javascript

Summary

This chapter covered what data was needed and how it was acquired and manipulated, it goes over the technologies that were used for the implementation and the reasoning why the project moved from Java to AJAX. It explains each technology and states the version used. It goes over the system architecture and shows how the system changed from the initial design of the database, the engine and the client. It shows how the project developed to the actual work that was done. It as well covers flow of the system and what implementation issues the project came across.

Next chapter will go over the evaluations of the system.

[23] < http://www.tanguay.info/main/welcome.php5 >

[24] < Jason Cranford Teague, 2007 >

Evaluation

Evaluation Purpose

The reason for doing an evaluation is to make sure that the system is robust, find the errors during the process of creation and to avoid that errors will slip through. It is a vital process for any development of software and good testing is in most software development processes a very important thing. For this project it is very vital that people will be able to execute the interface without too much help. Therefore a usability test was done. As well it is vital that the system will run on different browsers. Therefore a functionality and browser test was executed on different browsers.

Testing

For this project two tests were created. The first one was a usability test on the interface of the project. It is an objective test that was laid down for 5 persons that have never used the system before. Afterwards they were asked 15 questions on how they understood and liked the system. The usability test sheet can be found in Appendix F.

The second test was a functionality and browser test. It goes through a routine test that covers all the different functionalities of the client. This test was done using three different browsers, two of the most widely used browsers by February 2007[25], Internet Explorer 6 with 39,8% and Firefox with 31,2% and then one of the new interesting browsers Opera with 1,5%. The functionality and browser test sheet can be found in Appendix F.

Results

The results of the usability test were very positive. Most of the answers show that users find the system very easily understood and people find it easy to use. There were still some issues raised. These were minor things like people tried to use a period when inserting their energy usage. When doing this they get an error message and they found message to be good so that was ok. Also there were suggestions about the text written in the about section. The main thing that people found strange was that there was no response if the energy usage was smaller than the calculated energy. This definitely needs to be addressed. But overall the results from the usability test were very positive.

[25] < http://www.w3schools.com/browsers/browsers_stats.asp >

Question #	Answers	Ratings	Comments
Q1	5 Yes	Excellent	
Q2	4 out of 5 Yes	Very good	Went straigh into using it
Q3	5 Yes	Excellent	
Q4	5 Yes	Excellent	
Q5	5 No	Excellent	
Q6	4 out of 5 Yes	Very good	Was only intersted in 1 place
Q7	5 Yes	Excellent	
Q8	1 No, 4 Yes	Very good	2 suggestions on response if used energy is less.
Q9	3 No, 2 Yes	Very good	Response helped a lot.
Q10	5 No	Excellent	
Q11	5 Yes	Excellent	Said they liked it.
Q12	5 Yes	Excellent	
Q13	9-9-8-9-7.5	Excellent	These are the grades.
Q14	5 Yes	Excellent	Simple and friendly.
Q15	10-9-8-9-9	Excellent	

Table 8: Usability Test Results

The above table shows the results of the usability test. Each question is shown and then the response to it shown and graded. If there were any user comments they are also show. Detailed test log and the usability test sheet can be found in Appendix F.

The results from the functionality and browser test were good. There was no error found, this was expected for Firefox since it was used when developing the system. The fact that there were no errors in the other browser is probably because the browsers are getting more like each other and the competition about users pushes the browsers to stay on their toes and implement the newest and best things. One thing that should be noted was that in Opera the text appeared to be smaller than in the other browsers. See detailed log of each test in Appendix F.

Summary

This chapter went over the reasons why projects should be evaluated and what the gains of good testing are. It states how two different tests were created and how they were executed for the project. It then showed the results of the tests, which were very positive.

The next chapter covers the project conclusion. It starts by the object reflection, goes over my work and further work, the project conclusion as well as my personal reflecions on the project.

Conclusion

Objectives Reflection

The objectives of this project were the following:

- Collect detailed data about houses that get subsidized energy.
- Collect data about the temperature around Iceland.
- Create an online system that combines the above.
- Allow users to dynamically select their home according to location in Iceland.
- Calculate according to standards the assumed energy needed to warm up the selected house.
- Allow users to compare the actual energy used and point out ways to improve energy usage if their usage exceeds calculated need.
- Make people without geothermal energy more conscious about their use of energy.

When the project started its objectives were little vague. That was mainly because of lack of knowledge about the geothermal energy and the energy business in whole, also the fact that the project description was made before the joining up with Orkusetur. After Orkusetur joined this project the project goals became clear and these goals have been met.

My Work

Here is a detailed list of the work that I contributed to the project. It highlights the work that was done over the course of the year in almost time line order.

- ✓ Did background research on the usage and history of geothermal energy in Iceland.
- ✓ Interacted with the Icelandic Meteorological Office.
- ✓ Manipulated the excel data from them and do calculations.
- ✓ Interacted with the Icelandic National Energy Authority, OS.
- ✓ Manipulated the database results from them, mine for the correct data.
- ✓ Interacted with The Land Registry of Iceland, FMR.
- ✓ Sent selected data to FMR from OS in order to get details about houses.
- ✓ Didn´t get requested data from FMR, handpicked details about 80 houses from FMR web.
- ✓ Interact with the Energy Agency in Iceland, EAI.
- ✓ Create and design system in cooperation with the EAI.
- ✓ Codified formulas from constants from EAI.
- ✓ Design a first draft of the system, database, engine and interface.

- ✓ Utilized geographical data to create and divide a map of Iceland to 9 parts.
- ✓ Mapped the weathers stations of Iceland to my map.
- ✓ Used information from the Icelandic Post Inc to map zip codes to my divided map of Iceland.
- ✓ Implemented the three tier architecture for the system.
- ✓ Updated the design of the system, database, engine and interface.
- ✓ Created a relational database after the first three normal forms.
- ✓ Implemented that database design into MySQL and imported all the gathered data.
- ✓ Created an engine that takes care of all interaction between the client and the data.
- ✓ The engine takes care of all database calls and the calculations related to assumed energy need.
- ✓ Implemented this engine in PHP and Javascript.
- ✓ Studied AJAX, learned how to entwine PHP, XHTML, CSS and Javascript.
- ✓ Created user interface and implemented it in AJAX.
- ✓ Performed a usability evaluation on the interface of the client and summarized the results.
- ✓ Performed a functionality & browser test on three different browsers and explained the results.
- ✓ Created over 1500 lines of code in 16 different files.
- ✓ Created 24 different pictures.
- ✓ Used several programs for the development, ArcGIS, ActiveState Komodo, Adobe Photoshop and Mozilla Firefox with the Firebug extension.
- ✓ Finally I wrote a dissertation with over 15.000 words on around 80 pages.

This list shows most of the work that was done. Still it does not include the numerous meetings with my supervisor and the people at Orkusetur and Orkustofnun. These meetings and the input from them made a lot of difference for the development of this project.

Further Work

Like in any project there is always the need of further work. Things that looks so well at some point start to change and when you introduce other people to the project with a usability test or any kind of an objective test it will always bring on many ideas. There were a couple of things that came from the usability test that need to be done. Those are:

- Give feedback if used energy is less then calculated need.
- Change the wording in the about section.

The project will also need to be changed some before it will be implemented into the web of Orkusetur. This work is mostly aimed in the way that house owners that do not live in these areas will be able to

insert their own values, instead of pulling them from a database. This means that the system can be used as a calculator for people interested in living in these areas. The interface also needs to be translated into Icelandic and linked to the educational material that Orkusetur will create.

Then there are the things that I would like to see implemented. These things are for example:

- Automatic update of weather stations and details about houses.
- Change the way Iceland is split to parts. It would be interesting to see the country split into zones according to their temperature instead of just location.
- Houses assigned to areas automatically.
- Admin section that allows change of constant values and to control updates.
- Add calculations regarding how much money people would save by using the recommended energy. That is if the usage exceeds the calculated need.

Project Conclusion

This project is a work in process. A lot has been done and many barriers have been overcome. Still there are things to be done and some will be done in the coming summer. This work will be done in cooperation with Orkusetur. They will soon be ready with material that this system can be linked to, than it will be an excellent aid to their aim of making people more aware of how they spend their energy. When some of the further work has been implemented the system can be used as a calculator on how much energy new houses in these areas will need. Hopefully this system will be an aid to inspire people to save energy and look for alternative methods of warming up their houses.

Personal Reflections

This project was very challenging and rewarding to work at. Mainly because there was somebody in the role of a customer, that gave this project a much more realistic feel and made it more interesting. Also the need of collecting various data from different sources made it challenging because working with real data is much more interesting than making up data that in the sometimes has little or no resemble to reality.

What made this also interesting was that working with AJAX, that is fairly new and very popular and when you know that the things that you are studying will be useful later it makes it a lot more fun and demanding.

Here is a list of things that highlights my personal gain from this project:

- Organization of my work and project.
- Interaction with governmental institutions.
- Project management and overview.
- System design and design implementation.
- Presentation of my ideas and work.
- Working with customers, Orkusetur in this project.
- Finding resources, both for background readings and implementation issues.
- Learned more about dynamic creation of database driven web pages.
- Learned how to use and program in AJAX, PHP, MySQL and CSS.
- Got better at multitasking and working efficiently under pressure.

Hopefully the work with Orkusetur will be continued and the project will be integrated into their web. That will make all this work much more worth it because it would be very nice to see a project that I created, working and in use.

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Appendix A – Code Listing

index.php

```
<?PHP
/**
 *  Created by Hrafn Jóhannesson
 *
 *  The index.php is the main file for ESC
 *  The Energy Saving Calulation System.
 *
 *      The file starts in the head tag by
 *      importing needed javascripts
 *      the style sheet for the web
 *      and the php functions are loaded.
 *
 *      In the body each division is defined.
 *      Some exist only to import things from
 *      the css file.
 *      Others have some functionality and are
 *      explained in more details.
 *
 **/
?>
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN">
<HTML lang="en">
<HEAD>
    <TITLE>ESC - Energy Saving Calculations</TITLE>
    <SCRIPT language="JavaScript" SRC="js/scriptCollection.js"></SCRIPT>
    <link rel="stylesheet" type="text/css" href="esc.css" />
    <?PHP include 'php/functions.php'; ?>
</head>

<body>
    <div id="background">
        <!--
            This exists to create background for the page.
            This uses /pics/big.png as background and is
            defined in esc.css file.
        -->
    </div>
    <div id="logo">
        <!--
            This exists to create logo space on the page.
            This uses /pics/logoTrans.gif as background
            and is defined in esc.css file.
        -->
    </div>
    <div id="map">
        <!--
            This division contains the navigation map for the system.
            It utilizes a javascript to switch pictures when the mouse
            is moved over them.
           Then when the users selects an area the javascript changeData
            function is called numerous time in order to change the
            divisions that need to be updated.

            At the bottom of each area the name of the area is called
```

```
55              with a php function.
56          -->
57          <img src="map/Iceland_whole.gif" alt="Iceland"
58               usemap="#IcelandMap" name="b1" border="0"
59               longdesc="Iceland_whole.gif" width="459"
60               height="350" title="ICELAND"/>
61
62          <map id ="IcelandMap" name="IcelandMap">
63              <area shape ="rect" coords ="0,35,166,143"
64              onMouseOver="mouseOver('map/Iceland_1.gif')"
65              onMouseOut="mouseOut('map/Iceland_whole.gif')"
66              onclick="   changeData('php/smallMap.php','1','smallMap');
67                          changeData('php/mapTitle.php',1,'mapTitle');
68                   changeData('php/db_getStations.php',1,'selectStation');
69                         changeData('php/db_getFarms.php',1,'selectFarm');
70                          changeData('php/empty.php',1,'map');"
71                          nohref ="true" alt='<?PHP echo countryArea(1);
                ?>' title='<?PHP echo countryArea(1);
72                      ?>'/>
73
74              <area shape ="rect" coords ="166,35,315,143"
75              onMouseOver="mouseOver('map/Iceland_2.gif')"
76              onMouseOut="mouseOut('map/Iceland_whole.gif')"
77              onclick="   changeData('php/smallMap.php','2','smallMap');
78                          changeData('php/mapTitle.php',2,'mapTitle');
79                  changeData('php/db_getStations.php',2,'selectStation');
80                         changeData('php/db_getFarms.php',2,'selectFarm');
81                          changeData('php/empty.php',2,'map');"
82              nohref   ="true"   alt='<?PHP   echo   countryArea(2);   ?>'
                title='<?PHP echo countryArea(2);
83                      ?>'/>
84
85              <area shape ="rect" coords ="315,35,450,143"
86              onMouseOver="mouseOver('map/Iceland_3.gif')"
87              onMouseOut="mouseOut('map/Iceland_whole.gif')"
88              onclick="   changeData('php/smallMap.php','3','smallMap');
89                          changeData('php/mapTitle.php',3,'mapTitle');
90                   changeData('php/db_getStations.php',3,'selectStation');
91                         changeData('php/db_getFarms.php',3,'selectFarm');
92                          changeData('php/empty.php',3,'map');"
93              nohref ="true" alt='<?PHP echo countryArea(3); ?>'
                title='<?PHP echo countryArea(3);
94                      ?>'/>
95
96              <area shape ="rect" coords ="0,143,166,235"
97              onMouseOver="mouseOver('map/Iceland_4.gif')"
98              onMouseOut="mouseOut('map/Iceland_whole.gif')"
99              onclick="   changeData('php/smallMap.php','4','smallMap');
100                         changeData('php/mapTitle.php',4,'mapTitle');
101                changeData('php/db_getStations.php',4,'selectStation');
102                changeData('php/db_getFarms.php',4,'selectFarm');
103                         changeData('php/empty.php',4,'map');"
104             nohref   ="true"   alt='<?PHP   echo   countryArea(4);   ?>'
                title='<?PHP echo countryArea(4);
105                     ?>'/>
106
107             <area shape ="rect" coords ="166,143,315,235"
108             onMouseOver="mouseOver('map/Iceland_5.gif')"
109             onMouseOut="mouseOut('map/Iceland_whole.gif')"
```

```
110             onclick="   changeData('php/smallMap.php','5','smallMap');
111                         changeData('php/mapTitle.php',5,'mapTitle');
112                     changeData('php/db_getStations.php',5,'selectStation');
113                     changeData('php/db_getFarms.php',5,'selectFarm');
114                         changeData('php/empty.php',5,'map');"
115             nohref ="true" alt='<?PHP echo countryArea(5); ?>'
                title='<?PHP echo countryArea(5);
116                     ?>'/>
117
118             <area shape ="rect" coords ="315,143,450,235"
119             onMouseOver="mouseOver('map/Iceland_6.gif')"
120             onMouseOut="mouseOut('map/Iceland_whole.gif')"
121             onclick="   changeData('php/smallMap.php','6','smallMap');
122                         changeData('php/mapTitle.php',6,'mapTitle');
123                  changeData('php/db_getStations.php',6,'selectStation');
124                     changeData('php/db_getFarms.php',6,'selectFarm');
125                         changeData('php/empty.php',6,'map');"
126             nohref ="true" alt='<?PHP echo countryArea(6); ?>'
                title='<?PHP echo countryArea(6);
127                     ?>'/>
128
129             <area shape ="rect" coords ="0,235,166,350"
130             onMouseOver="mouseOver('map/Iceland_7.gif')"
131             onMouseOut="mouseOut('map/Iceland_whole.gif')"
132             onclick="   changeData('php/smallMap.php','7','smallMap');
133                         changeData('php/mapTitle.php',7,'mapTitle');
134                  changeData('php/db_getStations.php',7,'selectStation');
135                       changeData('php/db_getFarms.php',7,'selectFarm');
136                         changeData('php/empty.php',7,'map');"
137             nohref ="true" alt='<?PHP echo countryArea(7); ?>'
                title='<?PHP echo countryArea(7);
138                     ?>'/>
139
140             <area shape ="rect" coords ="166,235,315,350"
141             onMouseOver="mouseOver('map/Iceland_8.gif')"
142             onMouseOut="mouseOut('map/Iceland_whole.gif')"
143             onclick="   changeData('php/smallMap.php','8','smallMap');
144                         changeData('php/mapTitle.php',8,'mapTitle');
145                  changeData('php/db_getStations.php',8,'selectStation');
146                        changeData('php/db_getFarms.php',8,'selectFarm');
147                         changeData('php/empty.php',8,'map');"
148             nohref ="true" alt='<?PHP echo countryArea(8); ?>'
                title='<?PHP echo countryArea(8);
149                     ?>'/>
150
151             <area shape ="rect" coords ="315,235,500,305"
152             onMouseOver="mouseOver('map/Iceland_9.gif')"
153             onMouseOut="mouseOut('map/Iceland_whole.gif')"
154             onclick="   changeData('php/smallMap.php','9','smallMap');
155                         changeData('php/mapTitle.php',9,'mapTitle');
156                  changeData('php/db_getStations.php',9,'selectStation');
157                       changeData('php/db_getFarms.php',9,'selectFarm');
158                         changeData('php/empty.php',9,'map');"
159             nohref ="true" alt='<?PHP echo countryArea(9); ?>'
                title='<?PHP echo countryArea(9);
160                     ?>'/>
161         </map>
162     </div>
163     <div id="mapTitle">
```

```
164         <!--
165             Used for the title of the map.
166             Replaced with the name of the selected area.
167         -->
168     </div>
169     <div id="smallMap">
170         <!--
171             This is empty in beginning, is replaced with small
172             navigation map of Iceland from smallMap.php
173         -->
174     </div>
175     <div id="selectStation">
176         <!--
177             This is empty in beginning, replaced with a drop
178             down list with weather stations that belong to
179             the selected area.
180         -->
181     </div>
182     <div id="selectFarm">
183         <!--
184             This is empty in beginning, replaced with a drop
185             down list with weather stations that belong to
186             the selected area.
187         -->
188     </div>
189     <div id="chosenStation">
190         <!--
191             This is empty in beginning, then when the user
192             has selected a weather station the details about
193             the weather station is listed
194         -->
195     </div>
196     <div id="chosenFarm">
197         <!--
198             This is empty in beginning, then when the user
199             has selected a farm the details about
200             the farm is listed
201         -->
202     </div>
203     <div id="calc">
204         <!--
205             This is empty in beginning, then when the user
206             has chosen the station and the farm
207             the calculations are be displayed here.
208         -->
209     </div>
210     <div id="calcResult">
211         <!--
212             This is empty in beginning, then when the user
213             has inserted his actual energy the results
214             are diplayed in this area.
215         -->
216     </div>
217     <div id="textTitle">
218         <p>
219             Energy Saving Calculations
220         </p>
221     </div>
222     <div id="instruct">
```

```
223         <b>Instructions:</b><br />
224             -Select Area<br />
225             -Select Weather Station<br />
226             -Select Farm<br />
227             -Input Your Energy Usage<br />
228     </div>
229     <div id="textAbout">
230         <p>
231             <b>About:</b>
232             <br />
233             The Energy Saving System allows the user to compare his
234             actual energy usage against calculated need.
235             <br />
236             If actual usage exceeds calculated usage the user is
237             pointed towards possible solutions.
238         </p>
239     </div>
240     <div id="restart">
241             <!--
242                 This link is used if system taken off local host.
243                 <a href="index.php">Restart</a>
244             -->
245             <a href="/ESC/" title="Restart the Web?">Restart</a>
246     </div>
247 
248 </BODY>
249 </HTML>
```

esc.css

```
1  /**
2   *  Created by Hrafn Jóhannesson
3   *
4   *  This is the Cascading Style Sheet for ESC
5   *  The Energy Saving Calulation System.
6   *
7   *  The first tags are for redefining existing
8   *  HTML tags.
9   *
10  *  The next tags have # in front of them and
11  *  are used to define the style for different
12  *  divisions of the web page.
13  *
14  **/
15 
16 body {
17     font-size: 1.2em;
18     font-family: Georgia, "Times New Roman", times, serif;
19     color: #000000;
20     background-color: #fff;
21     margin: 8px;
22     }
23 h1 { color: red; }
24 select {
25     font-family:Verdana,Arial,Helvetica,sans-serif;
26     font-size: 11px;
27     font-style:normal;
28     }
29 input {
```

```
30      font-family:Verdana,Arial,Helvetica,sans-serif;
31      font-size: 11px;
32      font-style:normal;
33      }
34  a {
35      color:black;
36      text-decoration:none;
37      }
38  #background{
39      position: absolute;
40      left:200px;
41      top:100px;
42      width:703px;
43      height:402px;
44      background-image: url(pics/background.gif);
45      }
46
47  #logo{
48      position: absolute;
49      left:232px;
50      top:116px;
51      width:116px;
52      height:77px;
53      background-image: url(pics/logoTrans.gif);
54      }
55
56  #map {
57      position: absolute;
58      left:400px;
59      top:115px;
60      font-size: 2.0em;
61      color: red;
62      }
63
64  #mapTitle {
65      position:absolute;
66      left:392px;
67      top:108px;
68      font-size: 2em;
69      color:black;
70      width:500px;
71      height:80px;
72      }
73
74  #smallMap {
75      position: absolute;
76      left:785px;
77      top:112px;
78      width:110px;
79      height:80px;
80      }
81
82  #selectStation {
83      position:absolute;
84      font-family:Verdana,Arial,Helvetica,sans-serif;
85      font-size: 11px;
86      font-variant:small-caps;
87      left:392px;
88      top:150px;
```

```
 89      color:black;
 90      width:210px;
 91      }
 92
 93  #selectFarm {
 94      position:absolute;
 95      font-family:Verdana,Arial,Helvetica,sans-serif;
 96      font-size: 11px;
 97      font-variant:small-caps;
 98      left:608px;
 99      top:150px;
100      color:black;
101      width:190px;
102      }
103
104  #chosenStation {
105      position:absolute;
106      font-family:Verdana,Arial,Helvetica,sans-serif;
107      font-size: 11px;
108      font-variant:small-caps;
109      left:392px;
110      top:195px;
111      color:black;
112      width:450px;
113      }
114
115  #chosenFarm {
116      position:absolute;
117      font-family:Verdana,Arial,Helvetica,sans-serif;
118      font-size: 11px;
119      font-variant:small-caps;
120      left:392px;
121      top:235px;
122      color:black;
123      width:450px;
124  }
125
126  #calc {
127      position:absolute;
128      font-family:Verdana,Arial,Helvetica,sans-serif;
129      font-size: 11px;
130      font-variant:small-caps;
131      left:392px;
132      top:305px;
133      color:black;
134      width:450px;
135      }
136
137  #calcResult {
138      position:absolute;
139      font-family:Verdana,Arial,Helvetica,sans-serif;
140      font-size: 11px;
141      font-variant:small-caps;
142      left:392px;
143      top:355px;
144      color:black;
145      width:450px;
146      }
147
```

```
148 #textTitle {
149     position:absolute;
150     font-family:Verdana,Arial,Helvetica,sans-serif;
151     font-size: 17px;
152     font-variant:small-caps;
153     text-align:center;
154     color:black;
155     left:226px;
156     top:180px;
157     width:130px;
158     height:80px;
159     }
160 
161 #station_Farm {
162     font-family:Verdana,Arial,Helvetica,sans-serif;
163     font-size: 11px;
164     position:absolute;
165     left:0px;
166     top:0px;
167     color:red;
168     width:400px;
169 }
170 
171 #textAbout {
172     position:absolute;
173     font-family:Verdana,Arial,Helvetica,sans-serif;
174     font-size: 11px;
175     font-variant:small-caps;
176     left:208px;
177     top:232px;
178     color:black;
179     width:165px;
180     }
181 
182 #instruct {
183     position:absolute;
184     font-family:Verdana,Arial,Helvetica,sans-serif;
185     font-size: 11px;
186     font-variant:small-caps;
187     left:208px;
188     top:400px;
189     color:black;
190     width:175px;
191     }
192 
193 #restart {
194     position:absolute;
195     font-family:Verdana,Arial,Helvetica,sans-serif;
196     font-size: 17px;
197     font-variant:small-caps;
198     text-align:center;
199     vertical-align:middle;
200     left:240px;
201     top:472px;
202     color:black;
203     height:24px;
204     width:102px;
205     background-image: url(pics/button.gif);
206     }
```

scriptCollection.js

```
/*
 *      Created by Hrafn Jóhannesson
 *
 *  The scriptCollection.js contains the javascripts
 *  for ESC, the Energy Saving Calulation System.
 *
 *  Each function is explained.
 *
*/


   /*
    *   mouseOver and mouseOut
    *   are used to replace the pictures when the
    *   users move the mouse over the navigation maps.
    */
    function mouseOver(pic){
        document.b1.src = pic
    }
    function mouseOut(pic){
        document.b1.src = pic
    }

    /*
     * changeData
     * This is the main function of the system.
     * It is a well known function in the AJAX
     * community. This version of the function
     * comes from the book Visual Quickstart Guide,
     * CSS, DHTML & AJAX, ISBN:0-321-44325-X P: 445
     * It is nice and takes care of the dynamic
     * change of the divisions. It is also very
     * good since it is compatible with different
     * browsers.
     *
    */
    function changeData(url,dataToSend,objectID){
        var pageRequest = false
        if (window.XMLHttpRequest) {
                pageRequest = new XMLHttpRequest()
            }
        else if (window.ActiveXObject){
                try {
                        pageRequest = new ActiveXObject("Msxml2.XMLHTTP")
                }
                catch (e) {
                        try{
                    pageRequest = new ActiveXObject("Microsoft.XMLHTTP")
                        }
                        catch (e){}
                }
             }
        else return false
        pageRequest.onreadystatechange=function() {
                var object = document.getElementById(objectID);
```

```
55                  object.innerHTML = pageRequest.responseText;
56           }
57          if (dataToSend) {
58                  var sendData = 'sendData=' + dataToSend;
59                  pageRequest.open('POST',url,true);
60      pageRequest.setRequestHeader('Content-Type', 'application/x-www-form-
61                                                  urlencoded');
62                  pageRequest.send(sendData);
63              }
64          else {
65                  pageRequest.open('GET',url,true)
66                  pageRequest.send(null)
67              }
68       }
69
70      /*
71       * changeStation
72       * This function reads what station has been selected.
73       * It then calls for the information in the database
74       * and replaces the information about the station.
75      */
76       function changeStation(){
77          var x   = document.getElementById("stations")
78          continueStationFarm()
79
80          changeData('php/empty.php','1','calcResult')
81          changeData('php/db_showStation.php',x.value,'chosenStation')
82       }
83
84      /*
85       * changeFarm
86       * This function reads what farm has been selected.
87       * It then calls for the information in the database
88       * and replaces the information about the farm.
89      */
90       function changeFarm(){
91          var y = document.getElementById("farms")
92          continueStationFarm()
93
94          changeData('php/empty.php','1','calcResult')
95          changeData('php/db_showFarm.php',y.value,'chosenFarm')
96       }
97
98      /*
99       * continueStationFarm
100      * This function reads what station and farm has been
101      * selected. If both have been selected it calls for
102      * energy calculations.
103     */
104      function continueStationFarm(){
105             var x = document.getElementById("stations")
106             var y = document.getElementById("farms")
107
108         if(x.value>0 && y.value>0 ){
109             changeData('php/calcEnergy.php',x.value+"|"+y.value,'calc')
110         }
111         else{
112             if(x.value>0)
113             changeData('php/empty.php',x.value+"|"+y.value,'calc')
```

```
            if(y.value>0)
                changeData('php/empty.php',x.value+"|"+y.value,'calc')
        }
    }

   /*
    * checkEnergy
    * This function checks the input of the energy field.
    * If the input is not legal, contains not only digits
    * error message is produced.
    * If the input is ok and is larger than the calculated
    * need of energy a message is displayed.
   */
    function checkEnergy(calcEnergy){
        var z = document.getElementById("energy")

      if(z.value > 0 && z.value.match(/^\d+$/) && z.value > calcEnergy){
            changeData('php/calcResult.php','1','calcResult')
        }
        else if(z.value > 0 && z.value.match(/^\d+$/)){
            changeData('php/empty.php','1','calcResult')
        }
        else if(!z.value > 0){
            changeData('php/empty.php','1','calcResult')
        }
        else
            changeData('php/calcResult.php','2','calcResult')
    }
```

calcEnergy.php

```
<?php
        /*
        * Created by Hrafn Jóhannesson
        *
        * This is the energy calculation system.
        * It utilizes variables about the house
        * and the weather.
        * Then some constant values are called
        * from the database.
        * The calulation is then performed and
        * a display for the is created at the
        * bottom of the file.
        *
        */

        // call for variables from the database
        // that are needed for the calculations.
        include "db_energyVar.php";

        /* Known/Given Values
        /* Weather Station      */  $station    = $stationHeat;
        /* Age of The House     */  $year       = $farmAge;
        /* Square Meters        */  $ag         = $farmSize;
        /* Number of Floors     */  $hn         = $shape;
        /* Desired Inside Temp  */  $T          = $insideTemp;
        /* Air Switching        */  $AC         = $airChange;


```

```
29          /* Degree Hours formula */  $g          = ($T-$station)*24*365;
30
31          /* Cooling Values Depend on Age
32          /* Cooling through Roof    */  $utak       = "";
33          /* Cooling through Walls   */  $uvegg      = "";
34          /* Cooling through windows */  $uglugg     = "";
35          /* Cooling through floor   */  $ufloor     = "";
36
37          /* Cooling Ratio
38          /* Roof/Floor Ratio        */  $ht1        = "";
39          /* Windows/Wall Ratio      */  $ht2        = "";
40
41          /* Selecting Values Using Age */
42          if($year <= 1929){ // Houses built before 1930.
43              /* Cooling through Roof    */  $utak       = 0.98;
44              /* Cooling through Walls   */  $uvegg      = 1.40;
45              /* Cooling through windows */  $uglugg     = 4.02;
46              /* Cooling through floor   */  $ufloor     = 0.78;
47              /* Roof/Floor Ratio        */  $ht1        = 1.06;
48              /* Windows/Wall Ratio      */  $ht2        = 0.15;
49          }
50          elseif($year >= 1930 & $year <= 1939){
                // Houses built between 1930-1940.
51              /* Cooling through Roof    */  $utak       = 1.00;
52              /* Cooling through Walls   */  $uvegg      = 1.00;
53              /* Cooling through windows */  $uglugg     = 3.93;
54              /* Cooling through floor   */  $ufloor     = 0.83;
55              /* Roof/Floor Ratio        */  $ht1        = 1.06;
56              /* Windows/Wall Ratio      */  $ht2        = 0.15;
57          }
58          elseif($year >= 1940 & $year <= 1949){
                // Houses built between 1940-1950.
59              /* Cooling through Roof    */  $utak       = 0.90;
60              /* Cooling through Walls   */  $uvegg      = 0.90;
61              /* Cooling through windows */  $uglugg     = 3.83;
62              /* Cooling through floor   */  $ufloor     = 0.83;
63              /* Roof/Floor Ratio        */  $ht1        = 1.06;
64              /* Windows/Wall Ratio      */  $ht2        = 0.15;
65          }
66          elseif($year >= 1950 & $year <= 1959){
                // Houses built between 1950-1960.
67              /* Cooling through Roof    */  $utak       = 0.74;
68              /* Cooling through Walls   */  $uvegg      = 0.75;
69              /* Cooling through windows */  $uglugg     = 3.64;
70              /* Cooling through floor   */  $ufloor     = 0.65;
71              /* Roof/Floor Ratio        */  $ht1        = 1.08;
72              /* Windows/Wall Ratio      */  $ht2        = 0.17;
73          }
74          elseif($year >= 1960 & $year <= 1969){
                // Houses built between 1960-1970.
75              /* Cooling through Roof    */  $utak       = 0.48;
76              /* Cooling through Walls   */  $uvegg      = 0.54;
77              /* Cooling through windows */  $uglugg     = 3.08;
78              /* Cooling through floor   */  $ufloor     = 0.65;
79              /* Roof/Floor Ratio        */  $ht1        = 1.01;
80              /* Windows/Wall Ratio      */  $ht2        = 0.27;
81          }
82           elseif($year >= 1970 & $year <= 1979){ // Houses built between
1970-1980.
```

```
            /* Cooling through Roof    */  $utak       = 0.38;
            /* Cooling through Walls   */  $uvegg      = 0.49;
            /* Cooling through windows */  $uglugg     = 3.08;
            /* Cooling through floor   */  $ufloor     = 0.54;
            /* Roof/Floor Ratio        */  $ht1        = 1.01;
            /* Windows/Wall Ratio      */  $ht2        = 0.27;
        }
        elseif($year >= 1980){ // Houses built after 1980.
            /* Cooling through Roof    */  $utak       = 0.38;
            /* Cooling through Walls   */  $uvegg      = 0.40;
            /* Cooling through windows */  $uglugg     = 3.08;
            /* Cooling through floor   */  $ufloor     = 0.54;
            /* Roof/Floor Ratio        */  $ht1        = 1.20;
            /* Windows/Wall Ratio      */  $ht2        = 0.27;
        }

        /* Calculated Values
        /* Sq M on filled soil  */  $agr        = $ag/$hn;
        /* Sq M of roof         */  $atak       = $agr/$ht1;
        /* Brutto Size of Walls */  $avbr       = $ag;
        /* Sq M of Windows      */  $agl        = $avbr*$ht2;
        /* Netto sq M of Walls  */  $avNetto    = $avbr-$agl;
        /* Cubic M of Space     */  $V          = $hn * 2.6 * $agr;

        /*
          Correction of hours that need desired inside temp
          as well as given energy is said to be 3°C
        */
        $gPrime     = $g + ($T - 20 - 3) * 24 * 365 / 1000;

        /* Calculated Need of Energy */
      $Q = $gPrime * (($atak * $utak + $avNetto * $uvegg + $agl *
            $uglugg + $agr * $ufloor) +
             0.36 * $AC * $V) / 1000;

        //$english_format_number = number_format($Q, 2, ',', '.');
        $qReady = number_format($Q, 0, ',', '.');

        // Dispay the calculated need.
        echo "<b>Energy Calculations: </b>";
        echo "<br />";
        echo "Your Calculated Energy Need is: ".$qReady." kWh";
        echo "<br />";
        echo "Please Insert Your Actual Usage: ";
   echo "<input type=\"text\" id=\"energy\" size=\"9\" maxlength=\"8\"
                        value=\"\"
             onkeyup=\"checkEnergy($Q)\"
        />";

?>
```

calcResult.php

```
<?php
/*
 *  Created by Hrafn Jóhannesson
 *
 *  This file creates the results if the use of
 *  energy is higher then the calculated need.
```

```
 7  *
 8  *  It reads the data sent to it and then displays
 9  *  the correct message.
10  *
11  *  1. Only digits and they are higher.
12  *  2. Alpabetic letters are used.
13  */
14     $i = $_POST["sendData"];
15
16     if($i == 1){
17         echo "<font color=\"red\">";
18         echo "*Your usage exceeds calculated need of energy.";
19         echo "</font><br />";
20         echo "Please visit these links to see how you can save energy:";
21         echo "<br/>";
22         echo " - Air to Air Heat Pumps";
23         echo "<br/>";
24         echo " - Changing the Windows";
25     }
26     else if($i == 2){
27         echo "<font color=\"red\">";
28         echo "*Only use digits in the energy field";
29         echo "</font><br />";
30     }
31 ?>
```

db_connection.php

```
 1 <?php
 2 /*
 3 * Created by Hrafn Jóhannesson
 4 *
 5 * This file creates the connection for the database
 6 * it is called by all the scripts that need to
 7 * access the database.
 8 *
 9 * It includes the login settings for the database.
10 *
11 */
12 include 'db_settings.php';
13
14 // This could use a way to handle failed connection;
15 $mysqli = new mysqli($host, $user, $pass, $db) or die("Couldn't connect
                                                        to database");
16
17 /* check connection */
18 if (mysqli_connect_errno()) {
19    printf("Connect failed: %s\n", mysqli_connect_error());
20    exit();
21 }
22
23 ?>
```

db_energyVar.php

```
1 <?php
2 /*
3 * Created by Hrafn Jóhannesson
4 *
```

```
 5 * This file connects to the database and gets the
 6 * needed information for the energy calculations.
 7 *
 8 */
 9     $i = $_POST["sendData"];
10     $split = explode ('|', $i);
11
12     include 'db_connection.php';
13
14     $query = "SELECT ave_heat FROM heat_info WHERE station_id =
                  $split[0]";
15     $result = $mysqli->query($query);
16     $row = mysqli_fetch_assoc($result);
17     $stationHeat = $row['ave_heat'];
18
19     $query2  = "SELECT size_M2,age,shape FROM house_details WHERE fmr_id
                    = $split[1]";
20     $result2 = $mysqli->query($query2);
21     $row2    = mysqli_fetch_assoc($result2);
22     $farmSize = $row2['size_M2'];
23     $farmAge  = $row2['age'];
24     $shape    = $row2['shape'];
25
26     $query3  = "SELECT insideTemp,airChange FROM misc_var";
27     $result3 = $mysqli->query($query3);
28     $row3    = mysqli_fetch_assoc($result3);
29     $insideTemp = $row3['insideTemp'];
30     $airChange  = $row3['airChange'];
31 ?>
```

db_getFarms.php

```
 1 <?php
 2 /*
 3 * Created by Hrafn Jóhannesson
 4 *
 5 * This file connects to the database and
 6 * gets information about all the farms
 7 * the belong to the selected area.
 8 *
 9 * It then creates a drop down list for all
10 * the possible farms.
11 */
12     include 'db_connection.php';
13
14     $i = $_POST["sendData"];
15
16     echo "Please Select Farm<br />";
17
18     $query = "SELECT fmr_id,name FROM address WHERE fmr_id IN (SELECT
               fmr_id FROM heat_map
19              WHERE heat_area = $i)";
20     $result = $mysqli->query($query);
21
22     echo "<select id=\"farms\" onChange=\"changeFarm()\">";
23     echo "<option value =''>- Farms -</option>";
24     while ($row = mysqli_fetch_assoc($result))
25     {
26         echo "<option value ={$row['fmr_id']}>{$row['name']}</option>";
```

```
27      }
28      echo "</select>";
29  ?>
```

db_getStations.php

```
 1  <?php
 2  /*
 3  * Created by Hrafn Jóhannesson
 4  *
 5  * This file connects to the database and
 6  * gets information about all the weather
 7  * stations the belong to the selected area.
 8  *
 9  * It then creates a drop down list for all
10  * the possible weather stations.
11  */
12      include 'db_connection.php';
13      $i = $_POST["sendData"];
14
15      echo "Please Select Weather Station<br />";
16
17      $query = "SELECT * FROM heat_info WHERE heat_area = $i";
18      $result = $mysqli->query($query);
19
20      echo "<select id=\"stations\" onChange=\"changeStation()\">";
21      echo "<option value =''>- Weather Stations -</option>";
22
23      while ($row = mysqli_fetch_assoc($result))
24      {
25       echo "<option value
         ={$row['station_id']}>{$row['station_name']}</option>";
26      }
27      echo "</select>";
28  ?>
```

db_settings.php

```
 1  <?php
 2  /*
 3  * Created by Hrafn Jóhannesson
 4  *
 5  * These are the login settings for
 6  * the database.
 7  */
 8
 9  $host = "localhost";
10  $user = "esc";
11  $pass = "esc";
12  $db   = "esc";
13  ?>
```

db_showFarm.php

```
 1  <?php
 2  /*
 3  * Created by Hrafn Jóhannesson
 4  *
 5  * This file connects to the database and
```

```
 6 * gets detailed information about the
 7 * selected farm.
 8 *
 9 * It then creates a display of the
10 * information taken from the database.
11 *
12 * If the farm is then deselected it
13 * gives red error message.
14 */
15     $i = $_POST["sendData"];
16
17     if(strlen($i)>0 ){
18         include 'db_connection.php';
19         $query  = "SELECT name,area_code,county FROM address WHERE
                      fmr_id = $i";
20         $result = $mysqli->query($query);
21         $row    = mysqli_fetch_assoc($result);
22         $farmName       = $row['name'];
23         $farmAreaCode   = $row['area_code'];
24         $farmCounty     = $row['county'];
25
26         $query2  = "SELECT size_M2,age FROM house_details WHERE fmr_id
                       = $i";
27         $result2 = $mysqli->query($query2);
28         $row2    = mysqli_fetch_assoc($result2);
29         $farmSize = $row2['size_M2'];
30         $farmAge  = $row2['age'];
31
32         echo "<b>Farm: </b>";
33         echo "<br /><sup> </sup>";
34         echo $farmName.", ".$farmAreaCode." ".$farmCounty;
35         echo "<br />";
36         echo "Size: ".$farmSize." m<sup>2</sup>";
37         echo ",  ";
38         echo "Built: ".$farmAge;
39
40     }
41     else{
42         echo "<font color=\"red\">";
43         echo "*Please select a farm";
44         echo "</font><br />";
45     }
46 ?>
```

db_showStation.php

```
 1 <?php
 2 /*
 3 * Created by Hrafn Jóhannesson
 4 *
 5 * This file connects to the database and
 6 * gets detailed information about the
 7 * selected weather station.
 8 *
 9 * It then creates a display of the
10 * information taken from the database.
11 *
12 * If the station is deselected red
13 * error message is stated.
```

```
*/
    $i = $_POST["sendData"];

    if(strlen($i)>0 ){
        include 'db_connection.php';
        $query = "SELECT ave_heat,station_name FROM heat_info WHERE
                    station_id = $i";

        $result = $mysqli->query($query);

        $row = mysqli_fetch_assoc($result);
        $stationName = $row['station_name'];
        $stationHeat = $row['ave_heat'];

        echo "<b>Selected station: </b>";
        echo "<br />";
        echo $stationName;
        echo ",  ";
        echo "Average Heat: ";
        echo $stationHeat;
        echo "<sup> </sup>";
    }
    else{
        echo "<font color=\"red\">";
        echo "*Please select a station";
        echo "</font><br />";
    }
?>
```

empty.php

```
<?php
    // This file is used to replace divisions with nothing.
    // Meaning that it will remove all information from
    // selected div.
?>
```

functions.php

```
<?PHP
/*
* Created by Hrafn Jóhannesson
*
* This file has two functions which are used
* when the user selects area.
*
* The first one gives the name of the area
* and the second one is used by the small
* map to show the selected area.
*/
    function countryArea($area){
        switch ($area) {
        case 1:
           $countrySide = "Vestfirðir";
           break;
        case 2:
           $countrySide = "Norðurland";
           break;
        case 3:
```

```
21              $countrySide = "Norðausturland";
22              break;
23          case 4:
24              $countrySide = "Vesturland";
25              break;
26          case 5:
27              $countrySide = "Hálendið";
28              break;
29          case 6:
30              $countrySide = "Austfirðir";
31              break;
32          case 7:
33              $countrySide = "Suðvesturland";
34              break;
35          case 8:
36              $countrySide = "Suðurland";
37              break;
38          case 9:
39              $countrySide = "Suðausturland";
40              break;
41          }
42
43          return $countrySide;
44      }
45
46      function countryAreaMap($area){
47          switch ($area) {
48          case 1:
49              $countrySide = "map/Iceland_small_1.gif";
50              break;
51          case 2:
52              $countrySide = "map/Iceland_small_2.gif";
53              break;
54          case 3:
55              $countrySide = "map/Iceland_small_3.gif";
56              break;
57          case 4:
58              $countrySide = "map/Iceland_small_4.gif";
59              break;
60          case 5:
61              $countrySide = "map/Iceland_small_5.gif";
62              break;
63          case 6:
64              $countrySide = "map/Iceland_small_6.gif";
65              break;
66          case 7:
67              $countrySide = "map/Iceland_small_7.gif";
68              break;
69          case 8:
70              $countrySide = "map/Iceland_small_8.gif";
71              break;
72          case 9:
73              $countrySide = "map/Iceland_small_9.gif";
74              break;
75          }
76          return $countrySide;
77      }
78  ?>
```

mapTitle.php

```php
<?php
/*
* Created by Hrafn Jóhannesson
*
* This is a small wrapper file.
* it is used to display the selected
* area in the heading of screen 2.
*/
    include 'functions.php';
    $i = $_POST["sendData"];
    echo countryArea($i);
?>
```

smallMap.php

```php
    <?PHP
/**
 *  Created by Hrafn Jóhannesson
 *
 *      The smallMap is a navigation tool for
 *      the ESC system. This is the same map
 *      as is used in index.php
 *
 *      The file starts by including
 *      the php functions.
 *
 *      This file contains the navigation map for the system.
 *      It utilizes a javascript to switch pictures when the mouse
 *      is moved over them.
 *      Then when the user selects an area the javascript changeData
 *      function is called numerous time in order to change the
 *      divisions that need to be updated.
 *
 *      At the bottom of each area the name of the area is called
 *      with a php function.
 *
 **/

        include 'functions.php';
        $i = $_POST["sendData"];
        $countryArea = countryArea($i);
        $countryAreaMap = countryAreaMap($i);
    ?>
    <img src="<?PHP echo $countryAreaMap ?>" alt="Iceland"
         usemap="#SmallMap" name="b1" border="0"
        longdesc="map/Iceland_small_whole.gif" width="100" height="71"
        title="ICELAND"/>

    <map id ="SmallMap" name="SmallMap">
        <area shape ="rect" coords ="0,0,28,23"
        onMouseOver="mouseOver('map/Iceland_small_1.gif')"
        onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
        onclick="   changeData('php/smallMap.php','1','smallMap');
                    changeData('php/mapTitle.php',1,'mapTitle');
                changeData('php/db_getStations.php',1,'selectStation');
                    changeData('php/db_getFarms.php',1,'selectFarm');
                    changeData('php/empty.php',1,'chosenStation');
```

```
42                    changeData('php/empty.php',1,'chosenFarm');
43                    changeData('php/empty.php',1,'calc');
44                    changeData('php/empty.php',1,'calcResult');
45                    changeData('php/empty.php',1,'map');"
46                  nohref ="true" alt='<?PHP echo countryArea(1); ?>'
                    title='<?PHP echo countryArea(1); ?>
47                '/>
48
49          <area shape ="rect" coords ="28,0,72,23"
50          onMouseOver="mouseOver('map/Iceland_small_2.gif')"
51          onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
52          onclick="   changeData('php/smallMap.php','2','smallMap');
53                    changeData('php/mapTitle.php',2,'mapTitle');
54                 changeData('php/db_getStations.php',2,'selectStation');
55                    changeData('php/db_getFarms.php',2,'selectFarm');
56                    changeData('php/empty.php',2,'chosenStation');
57                    changeData('php/empty.php',2,'chosenFarm');
58                    changeData('php/empty.php',2,'calc');
59                    changeData('php/empty.php',2,'calcResult');
60                    changeData('php/empty.php',2,'map');"
61                  nohref ="true" alt='<?PHP echo countryArea(2); ?>'
                    title='<?PHP echo countryArea(2); ?>
62                '/>
63
64          <area shape ="rect" coords ="72,0,100,23"
65          onMouseOver="mouseOver('map/Iceland_small_3.gif')"
66          onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
67          onclick="   changeData('php/smallMap.php','3','smallMap');
68                    changeData('php/mapTitle.php',3,'mapTitle');
69                 changeData('php/db_getStations.php',3,'selectStation');
70                    changeData('php/db_getFarms.php',3,'selectFarm');
71                    changeData('php/empty.php',3,'chosenStation');
72                    changeData('php/empty.php',3,'chosenFarm');
73                    changeData('php/empty.php',3,'calc');
74                    changeData('php/empty.php',3,'calcResult');
75                    changeData('php/empty.php',3,'map');"
76                  nohref ="true" alt='<?PHP echo countryArea(3); ?>'
                    title='<?PHP echo countryArea(3); ?>
77                '/>
78
79          <area shape ="rect" coords ="0,23,28,48"
80          onMouseOver="mouseOver('map/Iceland_small_4.gif')"
81          onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
82          onclick="   changeData('php/smallMap.php','4','smallMap');
83                    changeData('php/mapTitle.php',4,'mapTitle');
84                 changeData('php/db_getStations.php',4,'selectStation');
85                    changeData('php/db_getFarms.php',4,'selectFarm');
86                    changeData('php/empty.php',4,'chosenStation');
87                    changeData('php/empty.php',4,'chosenFarm');
88                    changeData('php/empty.php',4,'calc');
89                    changeData('php/empty.php',4,'calcResult');
90                    changeData('php/empty.php',4,'map');"
91                  nohref ="true" alt='<?PHP echo countryArea(4); ?>'
                    title='<?PHP echo countryArea(4); ?>
92                '/>
93
94          <area shape ="rect" coords ="28,23,72,48"
95          onMouseOver="mouseOver('map/Iceland_small_5.gif')"
96          onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
```

```
 97          onclick="   changeData('php/smallMap.php','5','smallMap');
 98                      changeData('php/mapTitle.php',5,'mapTitle');
 99                   changeData('php/db_getStations.php',5,'selectStation');
100                      changeData('php/db_getFarms.php',5,'selectFarm');
101                      changeData('php/empty.php',5,'chosenStation');
102                      changeData('php/empty.php',5,'chosenFarm');
103                      changeData('php/empty.php',5,'calc');
104                      changeData('php/empty.php',5,'calcResult');
105                      changeData('php/empty.php',5,'map');"
106                    nohref ="true" alt='<?PHP echo countryArea(5); ?>'
                       title='<?PHP echo countryArea(5); ?>
107                  '/>
108
109          <area shape ="rect" coords ="72,23,100,48"
110          onMouseOver="mouseOver('map/Iceland_small_6.gif')"
111          onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
112          onclick="   changeData('php/smallMap.php','6','smallMap');
113                      changeData('php/mapTitle.php',6,'mapTitle');
114                   changeData('php/db_getStations.php',6,'selectStation');
115                      changeData('php/db_getFarms.php',6,'selectFarm');
116                      changeData('php/empty.php',6,'chosenStation');
117                      changeData('php/empty.php',6,'chosenFarm');
118                      changeData('php/empty.php',6,'calc');
119                      changeData('php/empty.php',6,'calcResult');
120                      changeData('php/empty.php',6,'map');"
121                    nohref ="true" alt='<?PHP echo countryArea(6); ?>'
                       title='<?PHP echo countryArea(6); ?>
122                  '/>
123
124          <area shape ="rect" coords ="0,48,28,71"
125          onMouseOver="mouseOver('map/Iceland_small_7.gif')"
126          onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
127          onclick="   changeData('php/smallMap.php','7','smallMap');
128                      changeData('php/mapTitle.php',7,'mapTitle');
129                   changeData('php/db_getStations.php',7,'selectStation');
130                      changeData('php/db_getFarms.php',7,'selectFarm');
131                      changeData('php/empty.php',7,'chosenStation');
132                      changeData('php/empty.php',7,'chosenFarm');
133                      changeData('php/empty.php',7,'calc');
134                      changeData('php/empty.php',7,'calcResult');
135                      changeData('php/empty.php',7,'map');"
136                    nohref ="true" alt='<?PHP echo countryArea(7); ?>'
                       title='<?PHP echo countryArea(7); ?>
137                  '/>
138
139          <area shape ="rect" coords ="28,48,72,71"
140          onMouseOver="mouseOver('map/Iceland_small_8.gif')"
141          onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
142          onclick="   changeData('php/smallMap.php','8','smallMap');
143                      changeData('php/mapTitle.php',8,'mapTitle');
144                   changeData('php/db_getStations.php',8,'selectStation');
145                      changeData('php/db_getFarms.php',8,'selectFarm');
146                      changeData('php/empty.php',8,'chosenStation');
147                      changeData('php/empty.php',8,'chosenFarm');
148                      changeData('php/empty.php',8,'calc');
149                      changeData('php/empty.php',8,'calcResult');
150                      changeData('php/empty.php',8,'map');"
151                    nohref ="true" alt='<?PHP echo countryArea(8); ?>'
                       title='<?PHP echo countryArea(8); ?>
```

```
152                 '/>
153
154         <area shape ="rect" coords ="72,48,100,71"
155         onMouseOver="mouseOver('map/Iceland_small_9.gif')"
156         onMouseOut="mouseOut('<?PHP echo $countryAreaMap ?>')"
157         onclick="   changeData('php/smallMap.php','9','smallMap');
158                     changeData('php/mapTitle.php',9,'mapTitle');
159                  changeData('php/db_getStations.php',9,'selectStation');
160                     changeData('php/db_getFarms.php',9,'selectFarm');
161                     changeData('php/empty.php',9,'chosenStation');
162                     changeData('php/empty.php',9,'chosenFarm');
163                     changeData('php/empty.php',9,'calc');
164                     changeData('php/empty.php',9,'calcResult');
165                     changeData('php/empty.php',9,'map');"
166                   nohref ="true" alt='<?PHP echo countryArea(9); ?>'
                      title='<?PHP echo countryArea(9); ?>
167                 '/>
168     </map>
```

ESC.sql

```
 1/*************************************************************\
 2 * Script to create database for ESC                         *
 3 *                                                           *
 4 * AUTHOR : HRAFN JHANNESSON                                 *
 5 * EMAIL  : hrafnjo@gmail.com                                *
 6 * FOR    : ESC, final year project                          *
 7 * DESC   : This script creates the databse needed for       *
 8 *          the ESC project. Detailed description of each    *
 9 *          table is below.                                  *
10 *                                                           *
11 \*************************************************************/
12
13 /*
14  HEAT_INFO
15  This table contains the average temperatures for each area
16  in the country.
17
18  heat_area  : The id of the area containing some average heat.
19  ave_heat   : Each area has its average temperature.
20 */
21 DROP TABLE if exists heat_info;
22 CREATE TABLE heat_info
23 (
24     station_id      int(4) NOT NULL,
25     heat_area   int(1),
26     ave_heat          Float(3,2),
27     station_name    tinytext,
28
29     PRIMARY KEY (station_id),
30     UNIQUE (station_id)
31 );
32
33 /*
34  HOUSE_DETAILS
35  This table contains specific details about each house.
36
37  fmr_id     : Contains a unique id for each house in iceland.
38  size_M2    : Size of the house in M^2 (square meters).
```

```
 age         : The bulding year of the house.
 shape       : The shape of the house, this tells us if the
               house is on two floors and etc.
*/
DROP TABLE if exists house_details;
CREATE TABLE house_details
(
    fmr_id      int(9) NOT NULL,
    size_M2     float,
    age         int(9),
    shape        Tinyint(2),

    PRIMARY KEY (fmr_id),
    UNIQUE (fmr_id)
);


/*
 HEAT_MAP
 This maps each house to the average heat in its area,
 the on_map field is then used to map the house on a map.

 fmr_id    : Unique id of each house in Iceland, this value
             is key-ed to House_Details(fmr_id), meaning that
             there can be no house here that doesn't exist there.
 heat_area : Used to get the heat for area that the house is in.
 on_map    : Contains the location of the house on a map.
*/
DROP TABLE if exists heat_map;
CREATE TABLE heat_map
(
    fmr_id        int(9) NOT NULL,
    heat_area    Varchar(20),

    PRIMARY KEY (fmr_id),
    FOREIGN KEY (fmr_id)    REFERENCES house_details(fmr_id),
    UNIQUE (fmr_id)
);

/*
 ADDRESS
 Contains the postal address of each house.

 fmr_id     : Maps the house to its unique id in house_details.
 name       : Contains the name of the house.
 area_code  : The area or postal code for the house.
 county     : The county where the house is.
*/
DROP TABLE if exists address;
CREATE TABLE address
(
    fmr_id      int(9) NOT NULL,
    name          Tinytext,
    area_code   int(3),
    county      Tinytext,

    PRIMARY KEY (fmr_id),
  FOREIGN KEY (fmr_id)    REFERENCES house_details(fmr_id),
    UNIQUE (fmr_id)
```

```
 98 );
 99
100 /*
101  MISC_VAR
102  Contains different values that do not belong to any other table.
103
104  max_sub : Contains the max subsidized energy that can be paid.
105  insideTemp : This is the desired inside temperature, used for
    energy calculations.
106  airChange : How often people open their windows to change the air,
     used for energy
107  calculations.
108  */
109 DROP TABLE if exists misc_var;
110 CREATE TABLE misc_var
111 (
112     max_sub     int(8) NOT NULL,
113     insideTemp  int(8) NOT NULL,
114     airChange   float NOT NULL
115 );
```

ESC_Data.sql

```
  1/* ********************************************
  2 * Created by Hrafn Jóhannesson                *
  3 *                                             *
  4 * This script inserts the data into the ESC    *
  5 * database.                                   *
  6 *                                             *
  7 **********************************************/
  8
  9 /*  TABLE : HEAT_INFO */
 10 INSERT INTO heat_info(station_id, heat_area, ave_heat, station_name)
 11 VALUES
 12 (1,7,5.08,'Reykjavík'),
 13 (108,4,3.54,'Stafholtsey'),
 14 (167,4,4.64, 'Bláfeldur'),
 15 (178,4,4.30,'Stykkishólmur'),
 16 (195,4,3.71,'Ásgarður'),
 17 (234,1,3.98,'Hólar í- Dýrafirði'),
 18 (252,1,3.65,'Bolungarvík'),
 19 (260,1,3.66,'Æðey'),
 20 (293,1,3.57,'Litla-Árvík'),
 21 (303,4,3.01,'Hlaðhamar'),
 22 (311,4,2.90,'Reykir í Hrútafirði'),
 23 (352,2,3.54,'Hraun á Skaga'),
 24 (361,2,3.46,'Bergstaðir'),
 25 (383,2,3.08,'Dalsmynni'),
 26 (400,2,3.80,'Sauðanesviti'),
 27 (422,2,3.92,'Akureyri'),
 28 (425,2,3.50,'Torfur'),
 29 (448,2,2.54,'Lerkihlíð'),
 30 (462,5,2.04,'Mýri'),
 31 (468,2,2.08,'Reykjahlíð'),
 32 (473,2,2.98,'Staðarhóll'),
 33 (479,2,3.48,'Mánárbakki'),
 34 (490,6,0.83,'Möðrudalur'),
 35 (495,3,1.04,'Grímsstaðir'),
 36 (505,3,2.76,'Raufarhöfn'),
```

```
(515,3,2.73,'Miðfjarðarnes'),
(527,3,3.68,'Skjaldþingasstaðir'),
(565,3,3.43,'Svínafell'),
(620,6,4.07,'Dalatangi'),
(635,6,4.03,'Kollaleira'),
(675,6,4.17,'Teigarhorn'),
(707,9,4.73,'Höfn í Hornafirði'),
(710,9,4.79,'Hólar í Hornafirði'),
(745,9,5.13,'Fagurhólsmýr'),
(772,8,5.14,'Kirkjubæjarklaustur'),
(791,8,4.62,'Norðurhjáleiga'),
(798,8,5.88,'Vík í Mýrdal'),
(802,8,5.59,'Vatnsskarðshólar'),
(815,8,5.40,'Stórhöfði'),
(825,7,4.33,'Önnupartur'),
(907,8,4.13,'Hóll'),
(923,7,3.64,'Eyrarbakki'),
(931,8,3.77,'Hjarðarland'),
(990,7,5.16,'Keflavíkurflugvöllur');

/* TABLE : HOUSE_DETAILS */
INSERT INTO house_details(fmr_id, size_m2, age, shape)
VALUES
(2133319,137.6,1960,1),
(2135202,131.6,1974,1),
(2135028,205.0,1956,1),
(2135162,157.8,1978,1),
(2135499,124.3,1967,1),
(2133212,112.0,1961,1),
(2134536,189.8,2003,1),
(2134787,126.2,1910,1),
(2133614,249.7,1968,1),
(2161514,147.8,1977,1),
(2157325,122.4,1924,1),
(2161336,161.2,1980,1),
(2157754,166.4,1891,1),
(2157117,110.3,1981,1),
(2158822,121.6,1938,1),
(2160826,154.8,1932,1),
(2158791,199.6,1955,1),
(2158614,139.6,1954,1),
(2166554,154.6,1957,1),
(2166464,94.2,1966,1),
(2165735,132.3,1954,1),
(2165943,167.2,1962,1),
(2165684,114.2,1978,1),
(2166395,176.7,1950,1),
(2165898,118.4,1938,1),
(2166547,155.7,1979,1),
(2166532,94.5,1951,1),
(2112936,127.5,1971,1),
(2112585,240.0,1978,1),
(2113360,125.4,1960,1),
(2107599,186.1,1928,1),
(2106292,106.8,1960,1),
(2107432,113.6,1957,1),
(2115527,121.6,1953,1),
(2115606,262.4,1957,1),
(2115411,253.5,1929,1),
```

```
 98 (2141868,152.4,1961,1),
 99 (2141517,122.0,1960,1),
100 (2141098,88.9,1948,1),
101 (2140545,89.7,1951,1),
102 (2142102,171.7,1966,1),
103 (2141676,120.6,1950,1),
104 (2214277,275.2,1982,1),
105 (2140403,93.0,1938,1),
106 (2141524,117.7,1960,1),
107 (2174937,85.2,1937,1),
108 (2173277,247.6,1992,1),
109 (2173919,73.0,1937,1),
110 (2173119,120.8,1966,1),
111 (2176462,125.0,1977,1),
112 (2175275,69.4,1991,1),
113 (2173139,72.3,1936,1),
114 (2172528,128.8,1951,1),
115 (2085494,131.7,1936,1),
116 (2085884,42.6,1978,1),
117 (2085343,130.0,1974,1),
118 (2086193,153.0,1967,1),
119 (2086687,166.0,1972,1),
120 (2234640,324.2,2001,1),
121 (2104858,229.8,1931,1),
122 (2104851,120.0,1956,1),
123 (2104822,98.1,1967,1),
124 (2189612,119.2,1984,1),
125 (2189036,114.0,1955,1),
126 (2190380,150.6,1955,1),
127 (2232778,130.5,1985,1),
128 (2188875,134.2,1966,1),
129 (2189156,135.9,1986,1),
130 (2189632,135.8,1981,1),
131 (2190442,100.4,1963,1),
132 (2182638,432.7,1953,1),
133 (2182175,220.3,1979,1),
134 (2182066,175.0,1949,1),
135 (2245352,165.7,1999,1),
136 (2182305,152.7,1980,1),
137 (2182132,121.8,1956,1),
138 (2218222,205.0,1994,1),
139 (2182129,124.8,1990,1),
140 (2182117,158.1,1966,1),
141 (2182225,165.9,1982,1);
142
145 /* TABLE : HEAT_MAP */
146 INSERT INTO heat_map(fmr_id, heat_area)
147 VALUES  (2133319,1),
148 (2135202,1),
149 (2135028,1),
150 (2135162,1),
151 (2135499,1),
152 (2133212,1),
153 (2134536,1),
154 (2134787,1),
155 (2133614,1),
156 (2161514,2),
157 (2157325,2),
158 (2161336,2),
```

```
159 (2157754,2),
160 (2157117,2),
161 (2158822,2),
162 (2160826,2),
163 (2158791,2),
164 (2158614,2),
165 (2166554,3),
166 (2166464,3),
167 (2165735,3),
168 (2165943,3),
169 (2165684,3),
170 (2166395,3),
171 (2165898,3),
172 (2166547,3),
173 (2166532,3),
174 (2112936,4),
175 (2112585,4),
176 (2113360,4),
177 (2107599,4),
178 (2106292,4),
179 (2107432,4),
180 (2115527,4),
181 (2115606,4),
182 (2115411,4),
183 (2141868,5),
184 (2141517,5),
185 (2141098,5),
186 (2140545,5),
187 (2142102,5),
188 (2141676,5),
189 (2214277,5),
190 (2140403,5),
191 (2141524,5),
192 (2174937,6),
193 (2173277,6),
194 (2173919,6),
195 (2173119,6),
196 (2176462,6),
197 (2175275,6),
198 (2173139,6),
199 (2172528,6),
200 (2085494,7),
201 (2085884,7),
202 (2085343,7),
203 (2086193,7),
204 (2086687,7),
205 (2234640,7),
206 (2104858,7),
207 (2104851,7),
208 (2104822,7),
209 (2189612,8),
210 (2189036,8),
211 (2190380,8),
212 (2232778,8),
213 (2188875,8),
214 (2189156,8),
215 (2189632,8),
216 (2190442,8),
217 (2182638,8),
```

```
218 (2182175,9),
219 (2182066,9),
220 (2245352,9),
221 (2182305,9),
222 (2182132,9),
223 (2218222,9),
224 (2182129,9),
225 (2182117,9),
226 (2182225,9);
227
229 /* TABLE : ADDRESS */
230 INSERT INTO address(fmr_id, name, area_code, county)
231 VALUES
232 (2133319,'Efri-TorfustÖÐum',531,'HÚnaÞing vestra'),
233 (2135202,'Melrakkadal',531,'HÚnaÞing vestra'),
234 (2135028,'ÆgissÍÐu',531,'HÚnaÞing vestra'),
235 (2135162,'GrÖf 2',531,'HÚnaÞing vestra'),
236 (2135499,'ÃžorkelshÃ³li 1',531,'HÚnaÞing vestra'),
237 (2133212,'UppsÖlum',531,'HÚnaÞing vestra'),
238 (2134536,'SyÐri-KÁrastÖÐum',531,'HÚnaÞing vestra'),
239 (2134787,'Kistu',531,'HÚnaÞing vestra'),
240 (2133614,'SkarfshÃ³li',531,'HÚnaÞing vestra'),
241 (2161514,'Reykjum 2',601,'Þingeyjarsveit'),
242 (2157325,'Fornhaga',601,'HÖrgÁrbyggÐ'),
243 (2161336,'HrÍsgerÐi',601,'Þingeyjarsveit'),
244 (2157754,'Ã□slÁksstÖÐum',601,'HÖrgÁrbyggÐ'),
245 (2157117,'SkriÐuland',601,'Arnarneshreppur'),
246 (2158822,'SkÓgarseli',601,'EyjafjarÐarsveit'),
247 (2160826,'LÓmatjÖrn',601,'GrÝtubakkahreppur'),
248 (2158791,'HleiÐargarÐur',601,'EyjafjarÐarsveit'),
249 (2158614,'GilsÁ 2',601,'EyjafjarÐarsveit'),
250 (2166554,'SigurÐarstÖÐum',671,'NorÐurÞing'),
251 (2166464,'NÝhÖfn 2',671,'NorÐurÞing'),
252 (2165735,'Keldunesi 2',671,'NorÐurÞing'),
253 (2165943,'VÍkingavatni 1',671,'NorÐurÞing'),
254 (2165684,'HraunbrÚn',671,'NorÐurÞing'),
255 (2166395,'MiÐtÚni',671,'NorÐurÞing'),
256 (2165898,'SyÐri-Bakka',671,'NorÐurÞing'),
257 (2166547,'SigtÚni',671,'NorÐurÞing'),
258 (2166532,'SandvÍk',671,'NorÐurÞing'),
259 (2112936,'SnorrastÖÐum 2',311,'BorgarbyggÐ'),
260 (2112585,'StaÐarhrauni',311,'BorgarbyggÐ'),
261 (2113360,'Miklaholti 2',311,'Eyja- og Miklaholtshreppur'),
262 (2107599,'HÆl',320,'BorgarbyggÐ'),
263 (2106292,'MÚlastÖÐum',320,'BorgarbyggÐ'),
264 (2107432,'BrÚsholti',320,'BorgarbyggÐ'),
265 (2115527,'KÁrsstÖÐum',340,'Helgafellssveit'),
266 (2115606,'ÞingvÖllum',340,'Helgafellssveit'),
267 (2115411,'GrÍshÓli',340,'Helgafellssveit'),
268 (2141868,'HjaltastaÐahvammi',560,'Akrahreppur'),
269 (2141517,'Stekkjarholti',560,'SkagafjÖrÐur'),
270 (2141098,'HÓli',560,'SkagafjÖrÐur'),
271 (2140545,'Ytri-HÚsabakka',560,'SkagafjÖrÐur'),
272 (2142102,'StekkjarflÖtum',560,'Akrahreppur'),
273 (2141676,'BjarnastÖÐum',560,'Akrahreppur'),
274 (2214277,'HÉraÐsdal 2',560,'SkagafjÖrÐur'),
275 (2140403,'Fjalli',560,'SkagafjÖrÐur'),
276 (2141524,'StÓrhÓli',560,'SkagafjÖrÐur'),
277 (2174937,'ÁsgarÐi',701,'FljÓtsdalshÉraÐ'),
```

```
278 (2173277,'Hafrafelli 3',701,'FljÓtsdalshÉraÐ'),
279 (2173919,'Ekru',701,'FljÓtsdalshÉraÐ'),
280 (2173119,'Melum',701,'FljÓtsdalshreppur'),
281 (2176462,'FinnsstÖÐum 1',701,'FljÓtsdalshÉraÐ'),
282 (2175275,'ÚlfsstÖÐum',701,'FljÓtsdalshÉraÐ'),
283 (2173139,'SturluflÖt',701,'FljÓtsdalshreppur'),
284 (2172528,'BrÚ 1',701,'FljÓtsdalshÉraÐ'),
285 (2085494,'Útkot',116,'ReykjavÍk'),
286 (2085884,'HarÐbala',116,'KjÓsarhreppur'),
287 (2085343,'Melar',116,'ReykjavÍk'),
288 (2086193,'KÁranesi',270,'KjÓsarhreppur'),
289 (2086687,'ValdastÖÐum',270,'KjÓsarhreppur'),
290 (2234640,'Hvassnes',270,'KjÓsarhreppur'),
291 (2104858,'GaltarvÍk',301,'HvalfjarÐarsveit'),
292 (2104851,'GaltarlÆk',301,'HvalfjarÐarsveit'),
293 (2104822,'Fellsenda',301,'HvalfjarÐarsveit'),
294 (2189612,'Hruna 2',880,'SkaftÁrhreppur'),
295 (2189036,'DalshÖfÐa',880,'SkaftÁrhreppur'),
296 (2190380,'SkaftÁrdal 2',880,'SkaftÁrhreppur'),
297 (2232778,'Eystra-Hrauni',880,'SkaftÁrhreppur'),
298 (2188875,'Arnardrangi',880,'SkaftÁrhreppur'),
299 (2189156,'Eystra-Hrauni',880,'SkaftÁrhreppur'),
300 (2189632,'HunkubÖkkum',880,'SkaftÁrhreppur'),
301 (2190442,'SlÉtta',880,'SkaftÁrhreppur '),
302 (2182638,'BÁsaskersbryggja',900,'Vestmannaeyjar'),
303 (2182175,'Hofi Austurh',785,'HornafjÖrÐur'),
304 (2182066,'FagurhÓlsmÝri 1',785,'HornafjÖrÐur'),
305 (2245352,'Litla-hofi',785,'HornafjÖrÐur'),
306 (2182305,'SvÍnafelli',785,'HornafjÖrÐur'),
307 (2182132,'HnappavÖllum 5',785,'HornafjÖrÐur'),
308 (2218222,'SvÍnafelli 1',785,'HornafjÖrÐur'),
309 (2182129,'HnappavÖllum 4',785,'HornafjÖrÐur'),
310 (2182117,'HnappavÖllum 4',785,'HornafjÖrÐur'),
311 (2182225,'Litla-Hofi',785,'HornafjÖrÐur');
312
313
314 INSERT INTO misc_var(max_sub, insideTemp, airChange)
315 VALUES (40000, 21, 0.8);
```

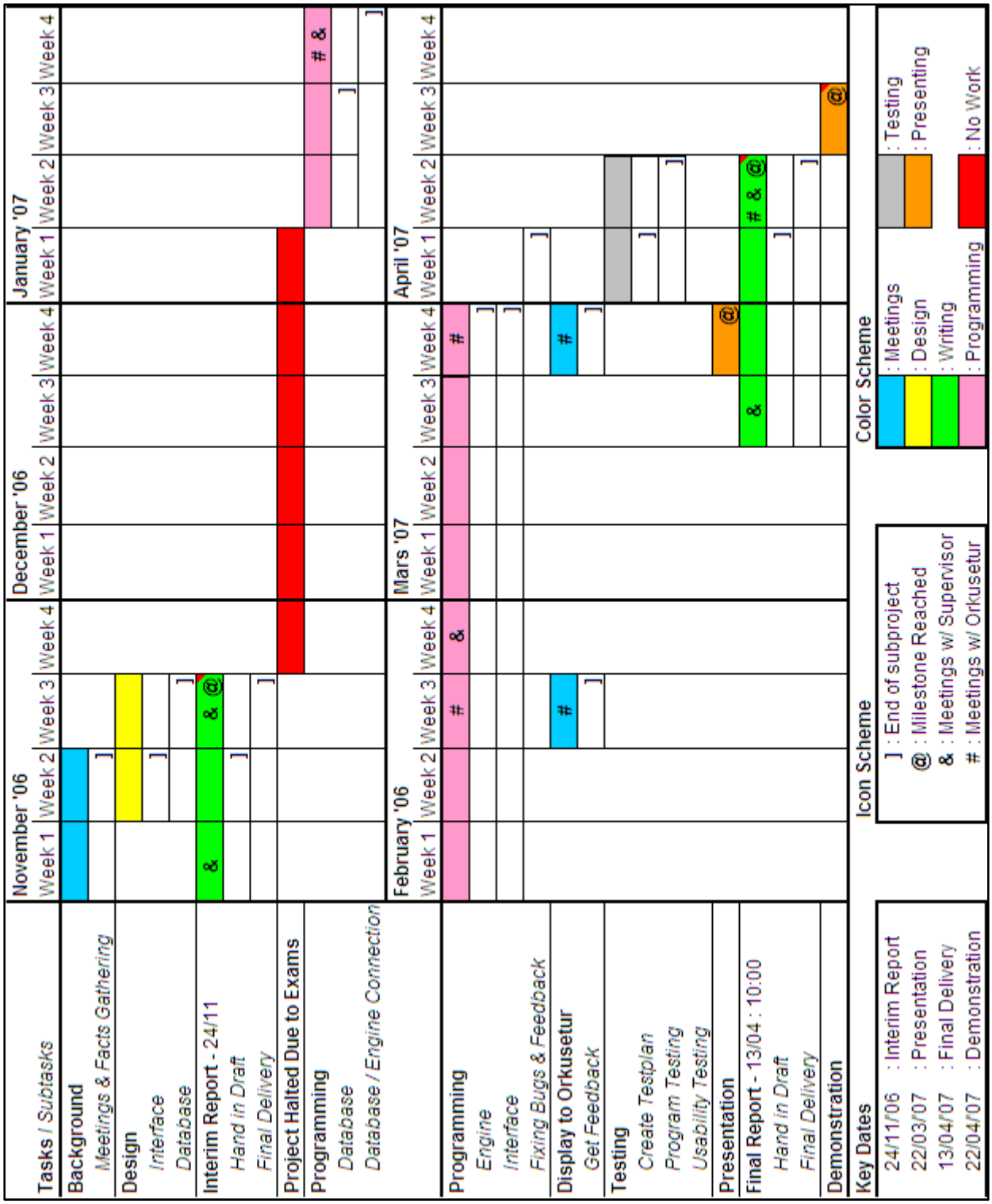
Appendix B – Project Plan

Changes to Time Plan

When dealing with many different institution time is not always on your hands. Increase the number of different institutes that you have to interact with and the time spent will increase dramatically. These constant interactions along with the fact that a programming project will always fulfill the time given make time planning a vital part of any project. The project plan that was created for this project didn't quite hold. But it was mostly delayed, everything was finished like planned in the beginning, but often later than originally planned. Meetings with supervisor and Orkusetur were not like planned but happened more when needed rather than on specific predefined dates.

On the following page is a updated Gantt chart that outlines how the project work was done. It shows the key dates where different parts of the project were finished and when meetings occurred the dates.

Updated Gantt Chart



Appendix C – How to use the System

The system is very simple in use. The interface is mostly self explanatory but there are instructions on the left side of the screen. They should be enough to assist people through the system. The instructions are as follows:

1. Select Area

2. Select Weather Station

3. Select Farm

4. Input Your Energy Usage

The results from the usability test indicate that these instructions seem to be good enough and the simplicity of the user interface makes the system fairly easy to use.

Appendix D – Original Tables

Full Division Table of Icelanders Access to Hot Water Distributors

Kjördæmi	Samt. [Íbúafj.]	Hitav. m. reglugerð [Íbúafj.]	Aðrar hitav. [Íbúafj.]	R/O-veitur [Íbúafj.]	Rafm.h. [Íbúafj.]
Reykjavík og Reykjanes	205.004	203.531	17		1.456
Orkuveita Reykjavíkur		174.616			
Hitaveita Seltjarnarnes		4.459			
Hitaveita Mosfellsbæjar		7.102			
Hitaveita Suðurnesja		17.354			
Veitur			17		
Vesturland	14.863	9.928	800		4.135
Hitaveita Akraness og Borgarfj.		575			
OR - Akranes		5.694			
OR - Borgarnes		1.841			
OR - Norðurárdalur		312			
OR - Munaðarnes		2			
OR - Stykkishólmur		1.153			
Rarik - Dalabyggð		351			
Veitur í Borgarfjarðarsýslu			502		
Veitur í Mýrasýslu			229		
Veitur í Snæfellsnessýslu			59		
Veitur í Dalasýslu			10		
Vestfirðir	7.546	491	38	3.565	3.452
OV - Reykhólar		126			
OV - Suðureyri		289			
Orkubú Vestfjarða				3.565	
Hitaveita Drangsness		76			
Veitur í Barðastrandasýslum			22		
Veitur í Strandasýslu			16		
Norðurland vestra	8.878	6.079	130		2.669
Hitaveita Húnaþings vestra		694			
Rarik - Blönduóss		918			
Skagafjarðarveitur		3.145			
Rarik - Siglufjörður		1.322			
Veitur í Skagafjarðarsýslu			130		
Norðurland eystra	27.000	23.286	545		3.169
Hitaveita Ólafsfjarðar		921			
Hitaveita Dalvíkur		1.701			
Norðurorka - Hrísey		173			
Norðurorka á Akureyri		17.627			
Orkuveita Húsavíkur		2.365			
Hitaveita Reykjahlíðar		338			
Hitaveita Öxarfjarðar hf.		161			
Veitur í Eyjafjarðarsýslu			24		
Veitur í Suður-Þingeyjarsýslu			521		
Austurland	13.710	2.566	6	2.000	9.138
Hitaveita Fjarðabyggðar		288			
Hitaveita Egilsstaða		2.278			
Rarik - Seyðisfjörður				690	
Rarik - Höfn í Hornafirði				1.310	
Veitur í Suður-Múlasýslu			6		
Suðurland	22.403	13.238	1.717	3.600	3.848
OR - Nesjavellir		1			
OR - Rangárvallasýsla		1.802			
Hitaveita Flúða og nágrennis		472			
Biskupstungnaveita		381			
Hitaveita Brautarholts		30			
Hv. Grímsness- og		43			
Selfossveitur bs.		6.407			
OR - Hveragerði		2.019			
OR - Þorlákshöfn		1.473			
OR - Grímsnesveita		43			
OR - Biskupstungur		52			
OR - Austurveita		117			
OR - Ölfusveita		5			
HS - Vestmannaeyjar				3.600	
Veitur í Rangárvallasýslu			142		
Veitur í Árnessýslu			1.576		
Alls	299.404	259.119	3.253	9.165	27.867
Hlutfall	100%	86,50%	1,10%	3,10%	9,30%

Original Table of Hot Water Distributors

veitusvæði Hitaveitu Suðurnesja	3,13 kr./kWst.
veitusvæði Orkubús Vestfjarða í dreifbýli	3,42 kr./kWst.
veitusvæði Orkubús Vestfjarða í þéttbýli	2,51 kr./kWst.
veitusvæði Rafveitu Reyðarfjarðar	2,57 kr./kWst.
veitusvæði Rafmagnsveitna ríkisins í dreifbýli	3,20 kr./kWst.
veitusvæði Rafmagnsveitna ríkisins í þéttbýli	2,72 kr./kWst.
veitusvæði Norðurorku	3,11 kr./kWst.
veitusvæði Orkuveitu Reykjavíkur	3,37 kr./kWst.

Appendix E – Original Formulas and Constants from Orkusetur

Orkunotkun húsa

U- gildi byggingarhluta verði ákvarðað útfrá viðmiðunartölum, háð aldri húsa, sama gildir um hlutfallstölur varðandi flatarstærðir;

	Byggingartímabil						
	- 1929	1930-39	1940-49	1950-59	1960-69	1970-79	1980-
Kólnunartölur;							
Uþak	0,98	1,00	0,90	0,74	0,48	0,38	
Uvegg	1,00	1,00	0,90	0,75	0,54	0,49	0,40
Uglugg	4,02	3,93	3,83	3,64	3,08	2,96	
Ugólf	0,78	0,83	0,62	0,65	0,54	0,49	
Hlutfallstölur;							
Ht1=Þak/grunnflötur	1,06	1,06	1,01	1,08	1,01	1,19	1,2
Ht2=Gluggar/veggir	0,15	0,15	0,20	0,17	0,27	0,35	

Uppgefið af eiganda;

Staðsetning (veðurstöð); - gefur gráðutímafjölda G (°Ch sbr. áður)

Byggingartímabil; Ár

Gólfflötur húss; Ag

Fjöldi hæða; Hn

Óskhitastig inni; T

Loftræsing - lítil eða meðal/ mikil;

Lítil -> n=0,5 n er fjöldi loftskipta

Annars - > n=0,8

Útfrá ofanskráðu og töflugildum fæst;

Agr = Ag/Hn	flatarmál gólfs á fyllingu
Atak=Agr*Ht1	flatarmál þaks
Avbr= Ag	reiknistærð (brúttóflötur veggja)
Agl= Avbr*Ht2	flatarmál glugga, reiknað frá hlutfallstölu í töflu
Avnetto=Avbr-Agl	nettó flatarmál veggja
V=Hn*2,6*Agr	hitað rúmmál húss
G'=G + (T-20-3)*24*365	gráðutímafjöldi leiðréttur fyrir óskhitastigi, og gert ráð fyrir að "gefins orka" samsvari 3 °C í innihita

Reiknuð orkuþörf til upphitunar, Q

Q= G'*[(Atak*Utak+Avnetto*Uvegg+Agl*Uglugg+Agr*Ugólf)+0,36*n*V]/1000 kWh

Ef reiknuð orkuþörf er verulega frábrugðin raunverulegri keyptri orku þá er ástæða til að skoða slíkt nánar.. frávik þarf að vera ± 10 % til að teljast verulegt

Formula for G was missing so Sigurður from Orkusetur emailed it: G = (ti-tm)*24*365/1000

Appendix F – Test Plans and Results

Usability Test Sheet

Evaluation of Energy Saving Calculation Usability

Q. Did you understand the purpose of this system?

Q. Did you read the about section?

-If not, why?

Q. Did you understand the instructions?

Q. Did you read the instruction?

-If not, why?

Q. When navigating between the screens and the page was never reloaded, did you find it confusing?

-If yes, anything special?

Q. Did you use the small map to change between selected portions of Iceland?

-If not, why? If yes, did you understand that it shows the selected area?

Q. Was it easy to understand that you should make the selections using the drop down menus?

Q. Did you write in the energy field?

-If not why? If yes, did you write a larger number and if so did you like the response?

Q. Did you try to use anything else then numbers?

-If yes, did you like the response?

-If not, why?

Q. Did you to use the browser back button after you had done some selections?

Q. Did you use the restart button?

-If not, why? If yes, did you like how it worked?

Q. Did you find it easy to use the system?

-If not, anything specific?

Q. If you would have to grade the usability of the system using a number 1-10?

Q. Did you like the look and feel of the screens in the system?

Q. If you would have to grade the look and feel using a number 1-10?

Usability Test Log

Person 1

Evaluation of Energy Saving Calculation Usability

Q. Did you understand the purpose of this system?

Yes, the purpose is to compare actual energy usage against calculated usage

Q. Did you read the about section?

Yes

-If not, why?

Q. Did you understand the instructions?

Yes I did, they were very understandable

Q. Did you read the instruction?

Yes

-If not, why?

Q. When data was updated, the page was never reloaded, did you find it confusing?

No I did not

-If yes, anything special?

Q. Did you use the small map to change between selected portions of Iceland?

-If not, why? If yes, did you understand that it shows the selected area?

I did not use it because I was just looking at norðurland

Q. Was it easy to understand that you should make the selections using the drop down menus?

Yes it was very obvious to me

Q. Did you write in the energy field?

-If not why? If yes, did you write a larger number and if so did you like the response?

Yes I wrote in the energy field, when I wrote a larger number the program immediately told me that my usage exceeded the calculated needs but if I put in a smaller number nothing happened.

Q. Did you try to use anything else then numbers?

-If yes, did you like the response?

-If not, why?

No I did not, because I

Q. Did you try to use the browser back button after you had done some selections?

No I did not, I just chose again if I had to change something

Q. Did you use the restart button?

-If not, why? If yes, did you like how it worked?

Yes I used the restart button and it worked fine

Q. Did you find it easy to use the system?

-If not, anything specific?

Yes I found it easy but I found it weird that nothing happened if I put in a smaller number than my calculated need

Q. If you would have to grade the usability of the system using a number 1-10?

It's maybe hard to grade it because I don't have any comparison but it was quite easy and understandable so I will grade it an 8

Q. Did you like the look and feel of the screens in the system?

Yes I liked it, it was cool how the page never reloaded and the colors are very comfortable. Maybe it would be nice to have different colors for different areas on the map.

Q. If you would have to grade the look and feel using a number 1-10?

I would say 8

Person 2

Evaluation of Energy Saving Calculation Usability

Q. Did you understand the purpose of this system?

yes

Q. Did you read the about section?

yes

-If not, why?

Q. Did you understand the instructions?

yes

Q. Did you read the instruction?

yes

-If not, why?

Q. When data was updated, the page was never reloaded, did you find it confusing?

No

-If yes, anything special?

Q. Did you use the small map to change between selected portions of Iceland?

yes

-If not, why? If yes, did you understand that it shows the selected area?

yes

Q. Was it easy to understand that you should make the selections using the drop down menus?

yese

Q. Did you write in the energy field?

no

-If not why? If yes, did you write a larger number and if so did you like the response?

Q. Did you try to use anything else then numbers?

No

-If yes, did you like the response?

-If not, why?

Q. Did you try to use the browser back button after you had done some selections?

no

Q. Did you use the restart button?

yes

-If not, why? If yes, did you like how it worked?

Fine

Q. Did you find it easy to use the system?

Yes very

-If not, anything specific?

Q. If you would have to grade the usability of the system using a number 1-10?

9

Q. Did you like the look and feel of the screens in the system?

Yes – plain and simple helps it isn´t confusing at all

Q. If you would have to grade the look and feel using a number 1-10?

9

Person 3

Evaluation of Energy Saving Calculation Usability

Q. Did you understand the purpose of this system?

Yes

Q. Did you read the about section?

No

-If not, why?

I just went straight to working with the system

Q. Did you understand the instructions?

Yes

Q. Did you read the instruction?

Yes

-If not, why?

Q. When data was updated, the page was never reloaded, did you find it confusing?

No

-If yes, anything special?

Q. Did you use the small map to change between selected portions of Iceland?

Yes

-If not, why? If yes, did you understand that it shows the selected area?

Yes

Q. Was it easy to understand that you should make the selections using the drop down menus?

Yes

Q. Did you write in the energy field?

Yes

-If not why? If yes, did you write a larger number and if so did you like the response?

I did write a bigger number and yes I liked the response. But when I wrote a smaller number I would have wanted some response

Q. Did you try to use anything else then numbers?

Yes

-If yes, did you like the response?

Yes

-If not, why?

Q. Did you try to use the browser back button after you had done some selections?

No

Q. Did you use the restart button?

Yes

-If not, why? If yes, did you like how it worked?

Yes I liked it

Q. Did you find it easy to use the system?

YEs

-If not, anything specific?

Q. If you would have to grade the usability of the system using a number 1-10?

7.5

Q. Did you like the look and feel of the screens in the system?

Yes

Q. If you would have to grade the look and feel using a number 1-10?

8-9

Person 4

Evaluation of Energy Saving Calculation Usability

Q. Did you understand the purpose of this system?

Yes I did

Q. Did you read the about section?

-If not, why? Yes I did

Q. Did you understand the instructions?

Yes

Q. Did you read the instruction?

-If not, why? Yes

Q. When data was updated, the page was never reloaded, did you find it confusing?

-If yes, anything special? No

Q. Did you use the small map to change between selected portions of Iceland?

-If not, why? If yes, did you understand that it shows the selected area?

Yes I used it and understood

Q. Was it easy to understand that you should make the selections using the drop down menus?

No, that´s just like the office programs in wondows

Q. Did you write in the energy field?

yes

-If not why? If yes, did you write a larger number and if so did you like the response?

Q. Did you try to use anything else then numbers?

No I did not but I tried to put a period for the number and the program instructed me to use only numbers, so I did.

-If yes, did you like the response?

-If not, why?

Q. Did you try to use the browser back button after you had done some selections? No just selected restart

Q. Did you use the restart button? Yes

-If not, why? If yes, did you like how it worked?

Q. Did you find it easy to use the system? Yes very easy

-If not, anything specific?

Q. If you would have to grade the usability of the system using a number 1-10? 9

Q. Did you like the look and feel of the screens in the system? Yes very customer friendly

Q. If you would have to grade the look and feel using a number 1-10?10

I would like to add that the about section might be a little bit better worded like :

The Energy Saving System allows the user to compare his actual energy usage with the calculated optimal energy use needed

If actual usage exceeds calculated optimal usage the user is notified and instructed with possible solutions is displayed

Person 5

Evaluation of Energy Saving Calculation Usability

Q. Did you understand the purpose of this system?

Yes, calculate some energy.

Q. Did you read the about section?

-If not, why?

Yes.

Q. Did you understand the instructions?

Yes.

Q. Did you read the instruction?

-If not, why?

Yes I read them.

Q. When data was updated, the page was never reloaded, did you find it confusing?

-If yes, anything special?

No I thought it was cool

Q. Did you use the small map to change between selected portions of Iceland?

-If not, why? If yes, did you understand that it shows the selected area?

Yes I tried it, it woke fine

Q. Was it easy to understand that you should make the selections using the drop down menus?

Yes

Q. Did you write in the energy field?

Yes

-If not why? If yes, did you write a larger number and if so did you like the response?

Yes, the response was simple, the link didn´t work.

Q. Did you try to use anything else then numbers?

-If yes, did you like the response?

-If not, why?

Just didn´t

Q. Did you try to use the browser back button after you had done some selections?

No

Q. Did you use the restart button?

-If not, why? If yes, did you like how it worked?

Yes, it worked fine.

Q. Did you find it easy to use the system?

-If not, anything specific?

Yes, simple

Q. If you would have to grade the usability of the system using a number 1-10?

9

Q. Did you like the look and feel of the screens in the system?

It was ok

Q. If you would have to grade the look and feel using a number 1-10?

9

Usability Test Results

Usability Evaluation Results

Q1. Yes

Q2. 4 Yes, one person went straight into working the system.

Q3. Yes

Q4. Yes

Q5. No

Q6. 4 Yes, 1 person only looked at one portion of Iceland.

Q7. 5 Yes, one joke answer about office.

Q8. 1 No, 4 Yes, 2 persons suggested a response if number was smaller than calculated need.

Q9. 3 No, 2 Yes and they liked the response, so that is ok.

Q10. 5 No, 2 said they just made new selection.

Q11. 5 Yes, liked it.

Q12. 5 Yes, 1 person suggested that smaller energy should give respond.

Q13. Grades were: 9-9-8-9-7.5

Q14. 5 Yes, friendly, simple, one liked the fact that page didn't reload.

Q15. 10-9-8-9-9.

One commented that the text in the about section should be worded differently.

Functionality and Browser Test Sheet

Browser and Functionality Test

Browser: Internet Explorer 6, Firefox 2, Opera 9 – Operating System: Windows XP

Action to Perform	Expected Result	V/X
Start browser, open 'localhost/ESC'	Energy Saving Calculation web opens up	
Left side should contain: Logo, About section, Instruction and a restart button. **Right** side should contain: A map of Iceland	All these things are present. The map is there.	
Move the mouse over the map of Iceland.	The area where the mouse is gets highlighted and the name of the area appears in a tooltip.	
Left click on an area of Iceland.	The map is moved to the right top corner and the area that was selected is highlighted.	
The new screen should contain: Name of the selected area, a navigation map of Iceland and two drop down menus, weather stations and farms.	All these things are present.	
Move the mouse over the navigation map.	The area that the mouse goes over gets highlighted and the name of the area appears in the tooltip.	
Move the mouse away from the map.	The area that is selected is highlighted.	
Click on a new area of Iceland.	The navigation map changes and the title of the area are changed.	
Check the list of weather stations and farms and change a location on the map. Look at these lists again.	The lists are updated with the weather stations and farms that belong to the selected area.	
Select a weather station.	Detailed information about the weather station is shown below.	
Deselect the weather station, select the instruction at the top of the list.	The details are removed and instruction in red are displayed instead, they instruct you to select a weather station.	
Select a farm.	Details about the farm are listed below.	
Deselect the farm.	The details are removed and instruction in red are displayed instead, they instruct you to select a farm.	
Select both weather station and a farm.	Details for both are shown and calculation information about the energy need for the farm is	

	displayed.	
Change a location of Iceland.	The selections are removed along with the calculations.	
Select a weather station and a farm again. Now change the weather station or the farm.	Whenever a weather station or a farm is changed the calculations are updated.	
Try to deselect a station or a farm.	Calculations are removed and user is instructed to make a selection.	
Have both selected and try to write an alphabetic letter in the calculation field.	Instructions saying that you should only use numbers are displayed.	
Try to write a number larger than 9 digits.	You are not able to.	
Write 1 number, 1 alphabetic letter.	You get the same error message.	
Remove the letter.	The error message is removed.	
Write a number larger than the calculated need.	You get a message stating that your usage exceeds the calculated need. You are then given links to different means of energy savings.	
Have the energy message displayed and change the weather station or the farm.	The energy need is recalculated and the input field is cleared.	
Have the energy message displayed and change a location on the map of Iceland.	Everything is cleared and you are only presented with the lists of possible weather stations and farms.	
Firefox and Opera only		
Firefox: Go to View, Page Style and disable the style of the page.	The background and alignment of things are removed.	
Opera: Go to View, Style and select User Mode.	The background and alignment of things are removed.	
Are you able to see everything that you need?	Yes, the map is displayed, the about and the instructions as well.	
Repeat the above functionality test.	Everything works like it should.	

Notes:

Write comments, thoughts that come when doing the test.

Functionality and Browser Test Log

Firefox 2

Browser and Functionality Test

Browser: Internet Explorer 6, Firefox 2, Opera 9 – Operating System: Windows XP

Action to Perform	Expected Result	V/X
Start browser, open 'localhost/ESC'	Energy Saving Calculation web opens up	V
Left side should contain: Logo, About section, Instruction and a restart button. **Right** side should contain: A map of Iceland	All these things are present. The map is there.	V
Move the mouse over the map of Iceland.	The area where the mouse is gets highlighted and the name of the area appears in a tooltip.	V
Left click on an area of Iceland.	The map is moved to the right top corner and the area that was selected is highlighted.	V
The new screen should contain: Name of the selected area, a navigation map of Iceland and two drop down menus, weather stations and farms.	All these things are present.	V
Move the mouse over the navigation map.	The area that the mouse goes over gets highlighted and the name of the area appears in the tooltip.	V
Move the mouse away from the map.	The area that is selected is highlighted.	V
Click on a new area of Iceland.	The navigation map changes and the title of the area are changed.	V
Check the list of weather stations and farms and change a location on the map. Look at these lists again.	The lists are updated with the weather stations and farms that belong to the selected area.	V
Select a weather station.	Detailed information about the weather station is shown below.	V
Deselect the weather station; select the instruction at the top of the list.	The details are removed and instruction in red are displayed instead, they instruct you to select a weather station.	V
Select a farm.	Details about the farm are listed below.	V
Deselect the farm.	The details are removed and instruction in red are displayed instead, they instruct you to select a farm.	V
Select both weather station and a farm.	Details for both are shown and calculation	V

	information about the energy need for the farm is displayed.	
Change a location of Iceland.	The selections are removed along with the calculations.	V
Select a weather station and a farm again. Now change the weather station or the farm.	Whenever a weather station or a farm is changed the calculations are updated.	V
Try to deselect a station or a farm.	Calculations are removed and user is instructed to make a selection.	V
Have both selected and try to write an alphabetic letter in the calculation field.	Instructions saying that you should only use numbers are displayed.	V
Try to write a number larger than 9 digits.	You are not able to.	V
Write 1 number, 1 alphabetic letter.	You get the same error message.	V
Remove the letter.	The error message is removed.	V
Write a number larger than the calculated need.	You get a message stating that your usage exceeds the calculated need. You are then given links to different means of energy savings.	V
Have the energy message displayed and change the weather station or the farm.	The energy need is recalculated and the input field is cleared.	V
Have the energy message displayed and change a location on the map of Iceland.	Everything is cleared and you are only presented with the lists of possible weather stations and farms.	V
Firefox and Opera only		
Firefox: Go to View, Page Style and disable the style of the page.	The background and alignment of things are removed.	V
Opera: Go to View, Style and select User Mode.	The background and alignment of things are removed.	
Are you able to see everything that you need?	Yes, the map is displayed, the about and the instructions as well.	V
Repeat the above functionality test.	Everything works like it should.	V

Notes:

Firefox ran this all without any glitches. That was expected since it was the main browser that was used during the development of the interface.

Internet Explorer 6

Browser and Functionality Test

Browser: Internet Explorer 6, Firefox 2, Opera 9 – Operating System: Windows XP

Action to Perform	Expected Result	V/X
Start browser, open 'localhost/ESC'	Energy Saving Calculation web opens up	V
Left side should contain: Logo, About section, Instruction and a restart button. **Right** side should contain: A map of Iceland	All these things are present. The map is there.	V
Move the mouse over the map of Iceland.	The area where the mouse is gets highlighted and the name of the area appears in a tooltip.	V
Left click on an area of Iceland.	The map is moved to the right top corner and the area that was selected is highlighted.	V
The new screen should contain: Name of the selected area, a navigation map of Iceland and two drop down menus, weather stations and farms.	All these things are present.	V
Move the mouse over the navigation map.	The area that the mouse goes over gets highlighted and the name of the area appears in the tooltip.	V
Move the mouse away from the map.	The area that is selected is highlighted.	V
Click on a new area of Iceland.	The navigation map changes and the title of the area are changed.	V
Check the list of weather stations and farms and change a location on the map. Look at these lists again.	The lists are updated with the weather stations and farms that belong to the selected area.	V
Select a weather station.	Detailed information about the weather station is shown below.	V
Deselect the weather station; select the instruction at the top of the list.	The details are removed and instruction in red are displayed instead, they instruct you to select a weather station.	V
Select a farm.	Details about the farm are listed below.	V
Deselect the farm.	The details are removed and instruction in red are displayed instead, they instruct you to select a farm.	V
Select both weather station and a farm.	Details for both are shown and calculation information about the energy need for the farm is displayed.	V

Change a location of Iceland.	The selections are removed along with the calculations.	V
Select a weather station and a farm again. Now change the weather station or the farm.	Whenever a weather station or a farm is changed the calculations are updated.	V
Try to deselect a station or a farm.	Calculations are removed and user is instructed to make a selection.	V
Have both selected and try to write an alphabetic letter in the calculation field.	Instructions saying that you should only use numbers are displayed.	V
Try to write a number larger than 9 digits.	You are not able to.	V
Write 1 number, 1 alphabetic letter.	You get the same error message.	V
Remove the letter.	The error message is removed.	V
Write a number larger than the calculated need.	You get a message stating that your usage exceeds the calculated need. You are then given links to different means of energy savings.	V
Have the energy message displayed and change the weather station or the farm.	The energy need is recalculated and the input field is cleared.	V
Have the energy message displayed and change a location on the map of Iceland.	Everything is cleared and you are only presented with the lists of possible weather stations and farms.	V
Firefox and Opera only		
Firefox: Go to View, Page Style and disable the style of the page.	The background and alignment of things are removed.	
Opera: Go to View, Style and select User Mode.	The background and alignment of things are removed.	
Are you able to see everything that you need?	Yes, the map is displayed, the about and the instructions as well.	
Repeat the above functionality test.	Everything works like it should.	

Notes:

This test ran smooth, it would be nice to be able to remove the style sheet for this browser as well.

Opera 9

Browser and Functionality Test

Browser: Internet Explorer 6, Firefox 2, Opera 9 – Operating System: Windows XP

Action to Perform	Expected Result	V/X
Start browser, open 'localhost/ESC'	Energy Saving Calculation web opens up	V
Left side should contain: Logo, About section, Instruction and a restart button. **Right** side should contain: A map of Iceland	All these things are present. The map is there.	V
Move the mouse over the map of Iceland.	The area where the mouse is gets highlighted and the name of the area appears in a tooltip.	V
Left click on an area of Iceland.	The map is moved to the right top corner and the area that was selected is highlighted.	V
The new screen should contain: Name of the selected area, a navigation map of Iceland and two drop down menus, weather stations and farms.	All these things are present.	V
Move the mouse over the navigation map.	The area that the mouse goes over gets highlighted and the name of the area appears in the tooltip.	V
Move the mouse away from the map.	The area that is selected is highlighted.	V
Click on a new area of Iceland.	The navigation map changes and the title of the area are changed.	V
Check the list of weather stations and farms and change a location on the map. Look at these lists again.	The lists are updated with the weather stations and farms that belong to the selected area.	V
Select a weather station.	Detailed information about the weather station is shown below.	V
Deselect the weather station; select the instruction at the top of the list.	The details are removed and instruction in red are displayed instead, they instruct you to select a weather station.	V
Select a farm.	Details about the farm are listed below.	V
Deselect the farm.	The details are removed and instruction in red are displayed instead, they instruct you to select a farm.	V
Select both weather station and a farm.	Details for both are shown and calculation information about the energy need for the farm is displayed.	V
Change a location of Iceland.	The selections are removed along with the	V

	calculations.	
Select a weather station and a farm again. Now change the weather station or the farm.	Whenever a weather station or a farm is changed the calculations are updated.	V
Try to deselect a station or a farm.	Calculations are removed and user is instructed to make a selection.	V
Have both selected and try to write an alphabetic letter in the calculation field.	Instructions saying that you should only use numbers are displayed.	V
Try to write a number larger than 9 digits.	You are not able to.	V
Write 1 number, 1 alphabetic letter.	You get the same error message.	V
Remove the letter.	The error message is removed.	V
Write a number larger than the calculated need.	You get a message stating that your usage exceeds the calculated need. You are then given links to different means of energy savings.	V
Have the energy message displayed and change the weather station or the farm.	The energy need is recalculated and the input field is cleared.	V
Have the energy message displayed and change a location on the map of Iceland.	Everything is cleared and you are only presented with the lists of possible weather stations and farms.	V
Firefox and Opera only		
Firefox: Go to View, Page Style and disable the style of the page.	The background and alignment of things are removed.	
Opera: Go to View, Style and select User Mode.	The background and alignment of things are removed.	V
Are you able to see everything that you need?	Yes, the map is displayed, the about and the instructions as well.	V
Repeat the above functionality test.	Everything works like it should.	V

Notes:

When running the client using the style sheet the letters are too small. It gets kind of hard to read them. This should maybe fixed by using em instead of px when selecting the size of letters.

Opera also surprised me by the different styles that it possesses, mainly the debug mode which shows the div areas very well. This could be very useful in other projects.