



DESIGN REVIEW III

Team: Save Watt

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OUR SPONSORS

- **Jonathan Heitzinger**
Associate Director: Utility Services & member of the Coordinating Committee for Sustainability



- **Truong Nghiem**
Assistant Professor Researching in Cyber-Physical Systems



- Interested in improving sustainability on campus by closely monitoring and analyzing NAU's building operation data.

PROBLEM STATEMENT

Current Process

Collect Data
from Building
Controllers

Store Data in
SQL
Database

Manually Sift
Through
Data

Analyze Data
Using
Outside Tools

- A comprehensive energy dashboard does not exist for NAU.
- Current methods for analyzing data are complicated and time consuming.
- An automated way to export data into mutable file types for analysis does not exist.

SOLUTION OVERVIEW

- A web application, the NAU Energy Dashboard, which retrieves, presents, and exports data automatically.
- Abstract away the complicated process of retrieving, presenting, and exporting data to facilitate analysis.

KEY REQUIREMENTS

Functional

Historical
Data Retrieval

Live Data
Retrieval

Statistical
Analysis

Data
Presentation

Exporting
Data

Performance

Maintainability

Security

Performance

Usability

ARCHITECTURAL OVERVIEW

- Major Components:
 - GUI
 - StaticDataRetriever
 - BackendRetriever
 - Data Cleaning
 - Statistics/Conversions
- Design Concepts
 - Component-Based Development Style
 - Loosely Coupled
 - Work together to make up the system

IMPLEMENTATION OVERVIEW

- Django Web Framework
 - Python-based
 - Object Oriented
- Python
 - Numpy, PANDAS for Statistics and Conversions
 - Django adapts Python to allow dynamic HTML-based templates
- HTML, CSS, & Javascript
 - Create templates
 - Chart.js for dynamic data presentation

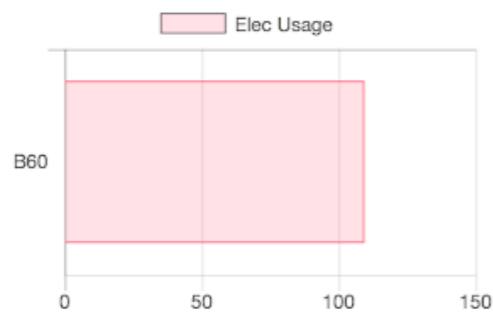
PROTOTYPE REVIEW: HOME



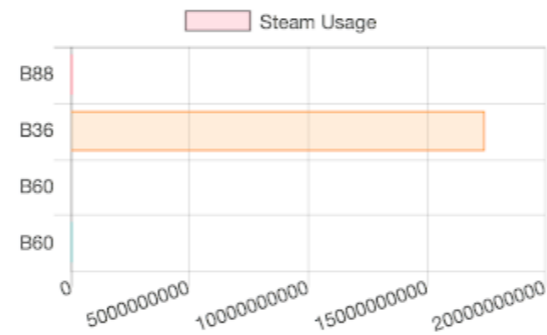
Energy Dashboard

Utility Usage

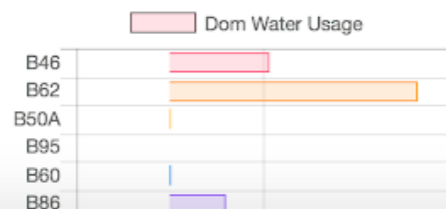
Electricity Usage 109.773 kWh



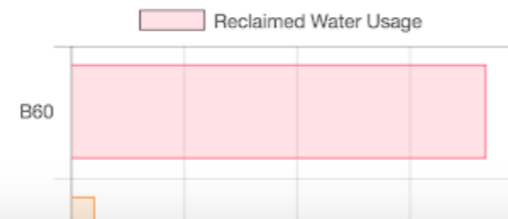
Steam Usage 17648720281.0 KBTU



Dom Water Usage 43719242.0 Gallons



Reclaimed Water Usage 779370.0 Gallons



Current Campus Usage For Monitored Buildings:

17649285597225.086 BTU/HOURS

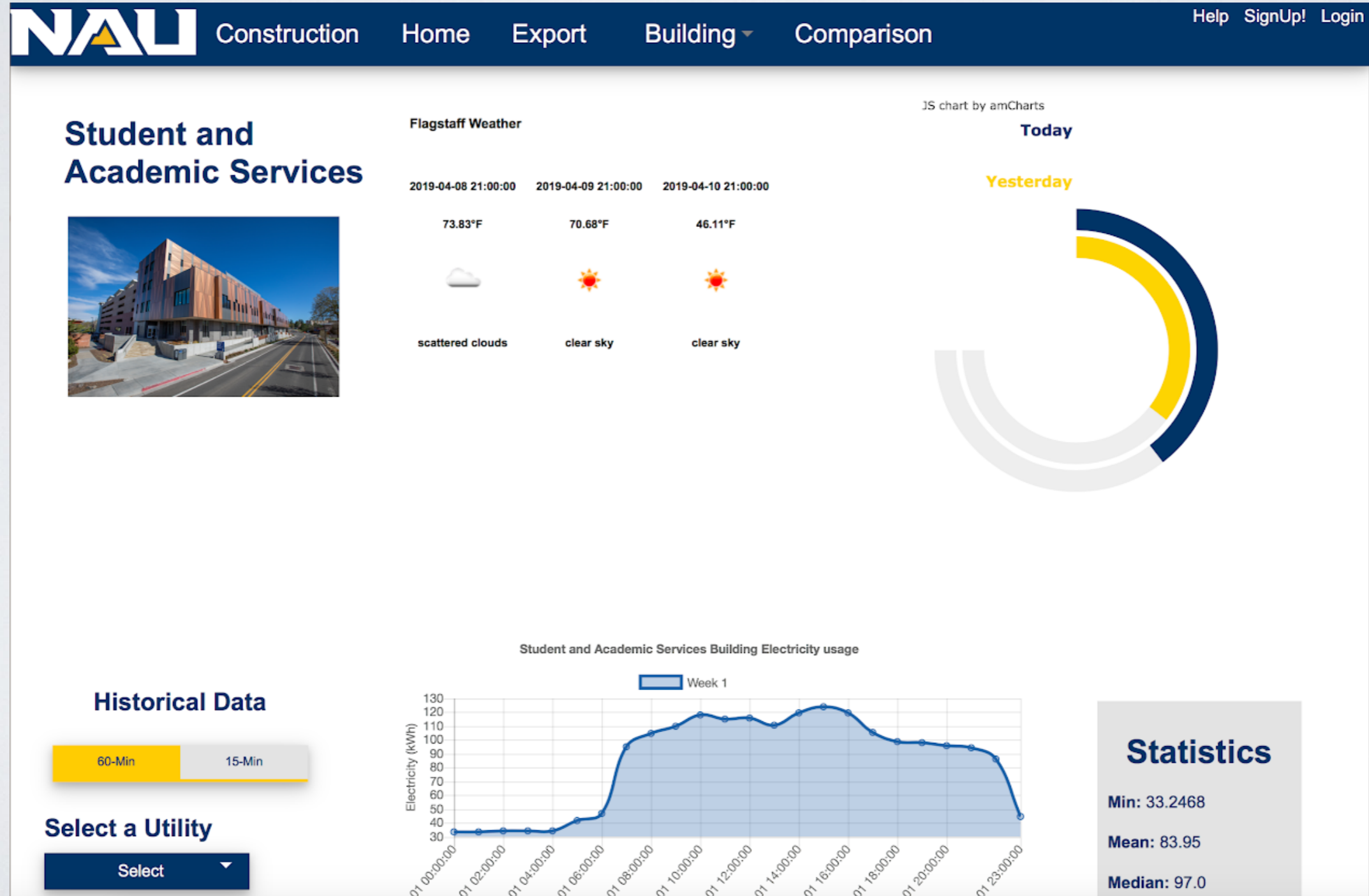


Electricity	374561.0237	BTU/HOURS
Steam	17648720281000.0	BTU/HOURS
Dom Water	555047005.22	BTU/HOURS
Reclaimed Water	9894658.8429	BTU/HOURS

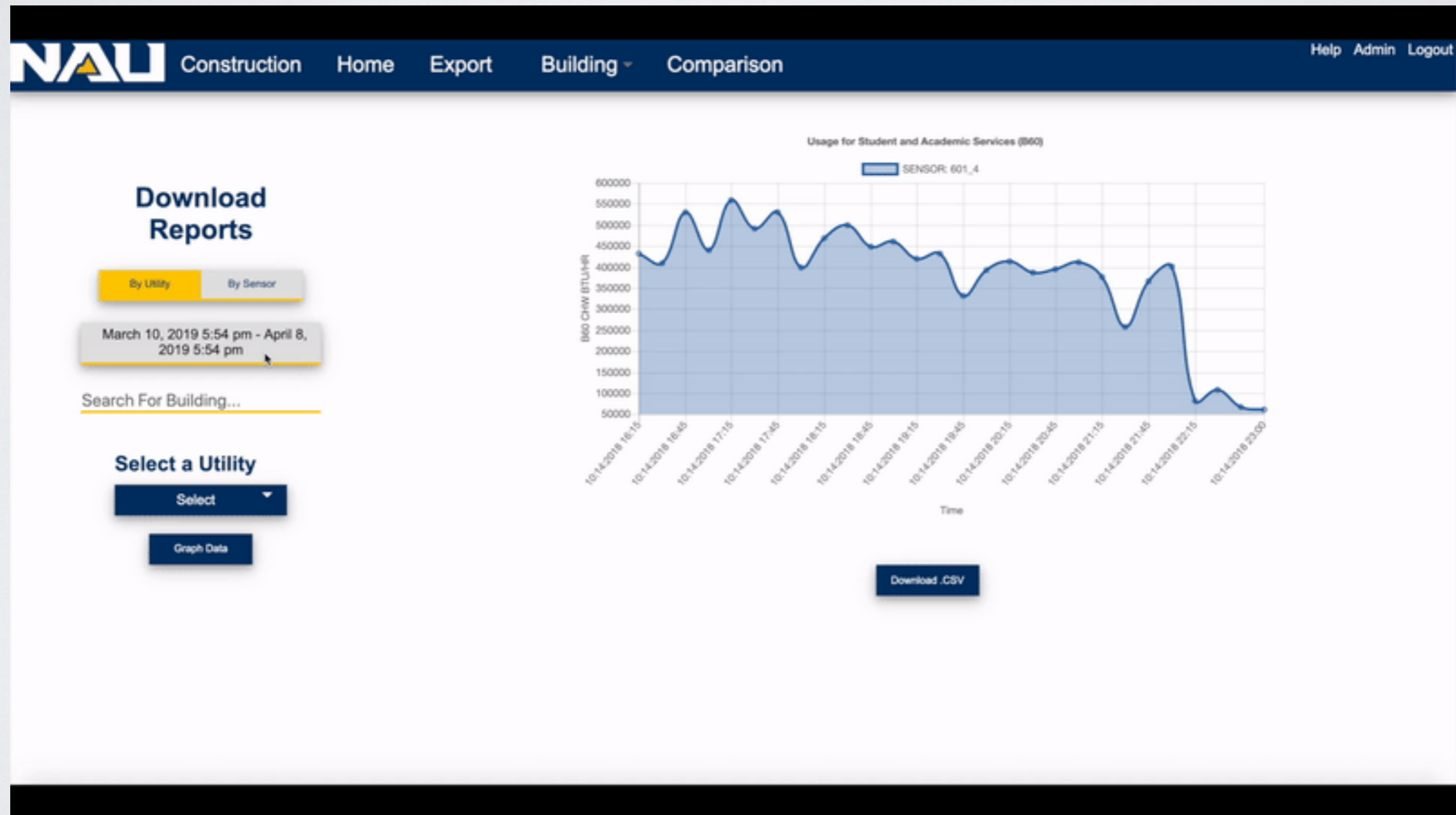
Compare Usage In Equivalent Units:

BTU	kWh	Tons	Gas	Cost
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PROTOTYPE REVIEW: BUILDING PAGE

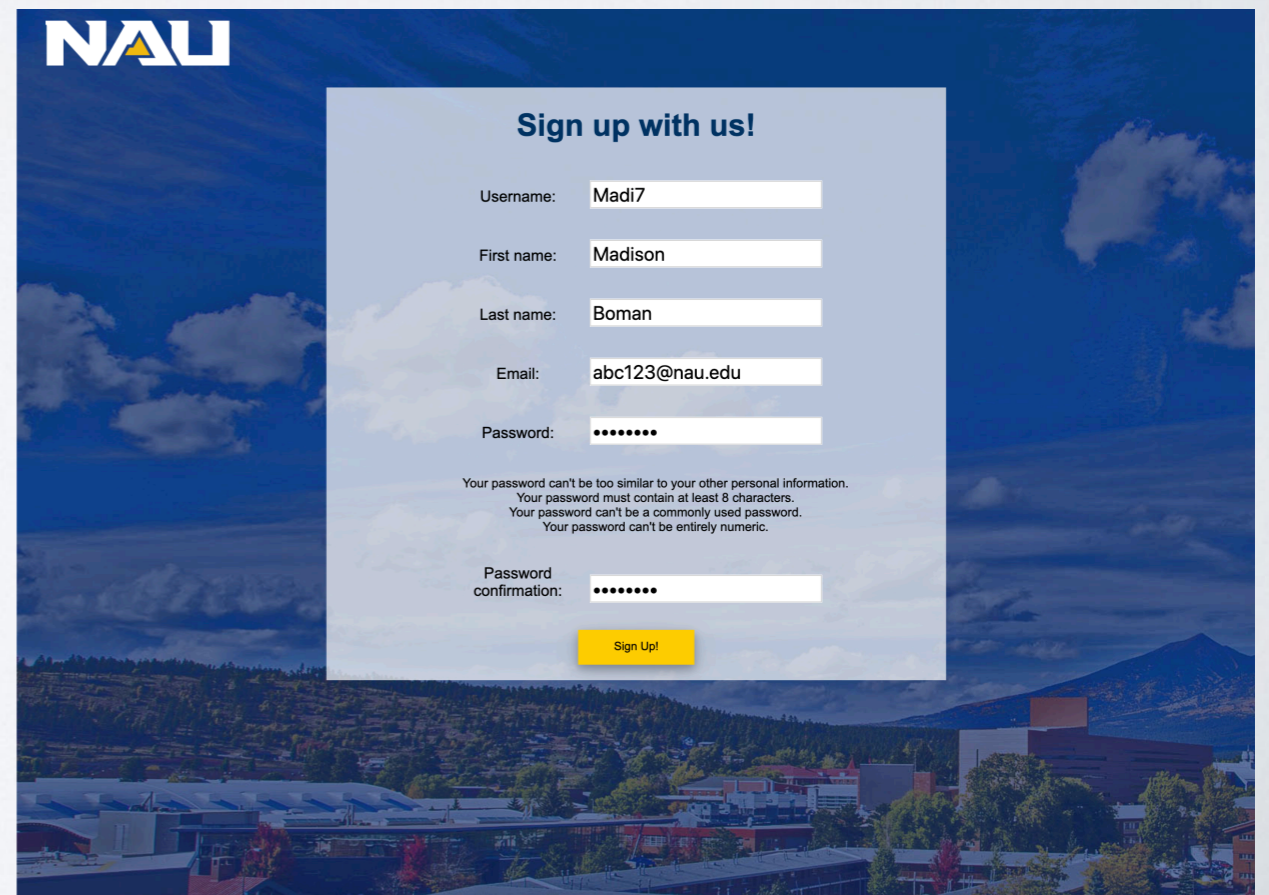
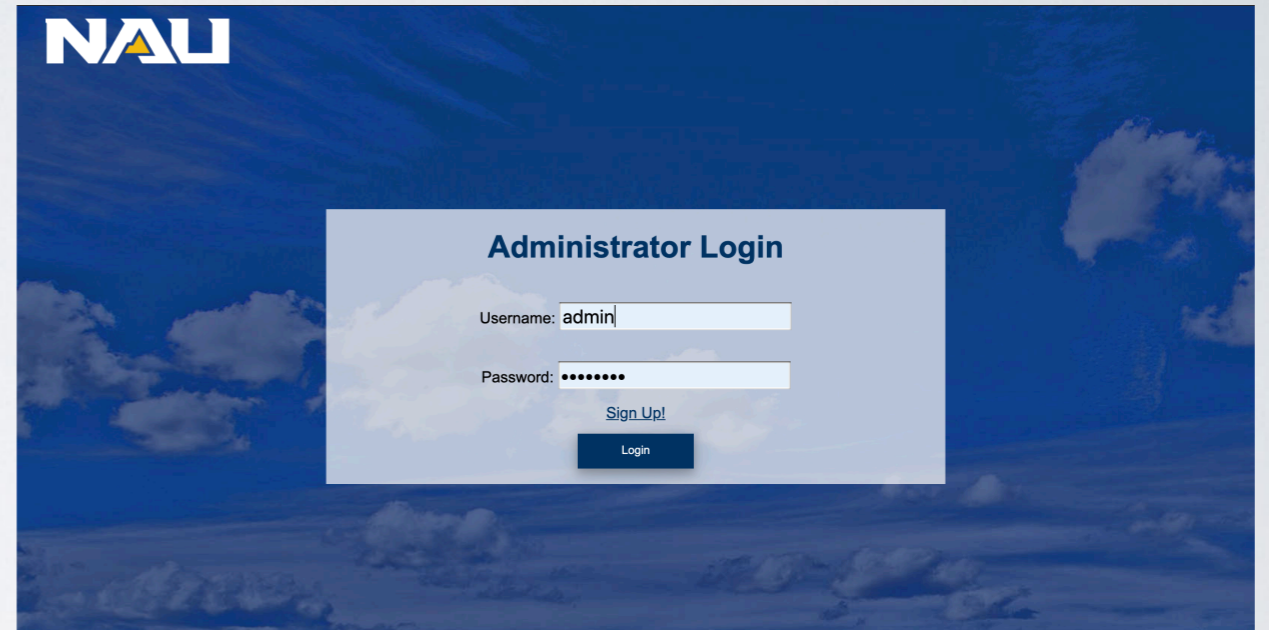


PROTOTYPE REVIEW: EXPORT



PROTOTYPE REVIEW: LOGIN/SIGN UP

- Login system with built-in field checks
- By default the user is set to be a “low-level” user
- Superuser later can go update their permission if needed.



PROTOTYPE REVIEW: ADMIN

The screenshot displays the 'Energy Dashboard Admin' interface. At the top, a dark blue header contains the title 'Energy Dashboard Admin' on the left and the user information 'WELCOME, IAN. [VIEW SITE](#) / [CHANGE PASSWORD](#) / [LOG OUT](#)' on the right. Below the header, the main content area is titled 'Site administration'. It is divided into two sections: 'AUTHENTICATION AND AUTHORIZATION' and 'EDASHBOARD'. The 'AUTHENTICATION AND AUTHORIZATION' section includes links for 'Groups' and 'Users', each with '+ Add' and 'Change' options. The 'EDASHBOARD' section includes links for 'Buildings', 'Sensors', and 'User profiles', also with '+ Add' and 'Change' options. To the right of the site administration is a 'Recent actions' panel. This panel has a sub-section 'My actions' listing various actions with status indicators (red 'x' for failure, green '+' for success, and yellow pencil for edit) and entity names (Building, User, User profile).

Energy Dashboard Admin WELCOME, IAN. [VIEW SITE](#) / [CHANGE PASSWORD](#) / [LOG OUT](#)

Site administration

AUTHENTICATION AND AUTHORIZATION

- Groups** + Add [Change](#)
- Users** + Add [Change](#)

EDASHBOARD

- Buildings** + Add [Change](#)
- Sensors** + Add [Change](#)
- User profiles** + Add [Change](#)

Recent actions

My actions



- ✘ fake building1
Building
- ✎ fake building1
Building
- + fake building1
Building
- ✘ admin7
User
- ✘ admin7
User profile
- ✎ admin
User profile
- ✎ admin
User profile
- ✎ ian7d7
User profile
- ✘ fake building
Building
- ✎ fake building
Building

PROTOTYPE REVIEW: ADMIN FUNCTIONALITY

- Add, Modify, and Delete - Users, Buildings, and Sensors

Home > Edashboard > Sensors > Riles AHU Fan Status

Change sensor

Building: Riles (B15)  




S name: Riles AHU Fan Status

S type: None

S log: 791_5

[Delete](#)

Change user profile

User: admin   

Description: High-Level User

Permission: 3

[Delete](#)

Home > Edashboard > Buildings > RLSS Warehouse (B98F)

Change building

B name: RLSS Warehouse

B num: B98F

B alias: res life warehouse

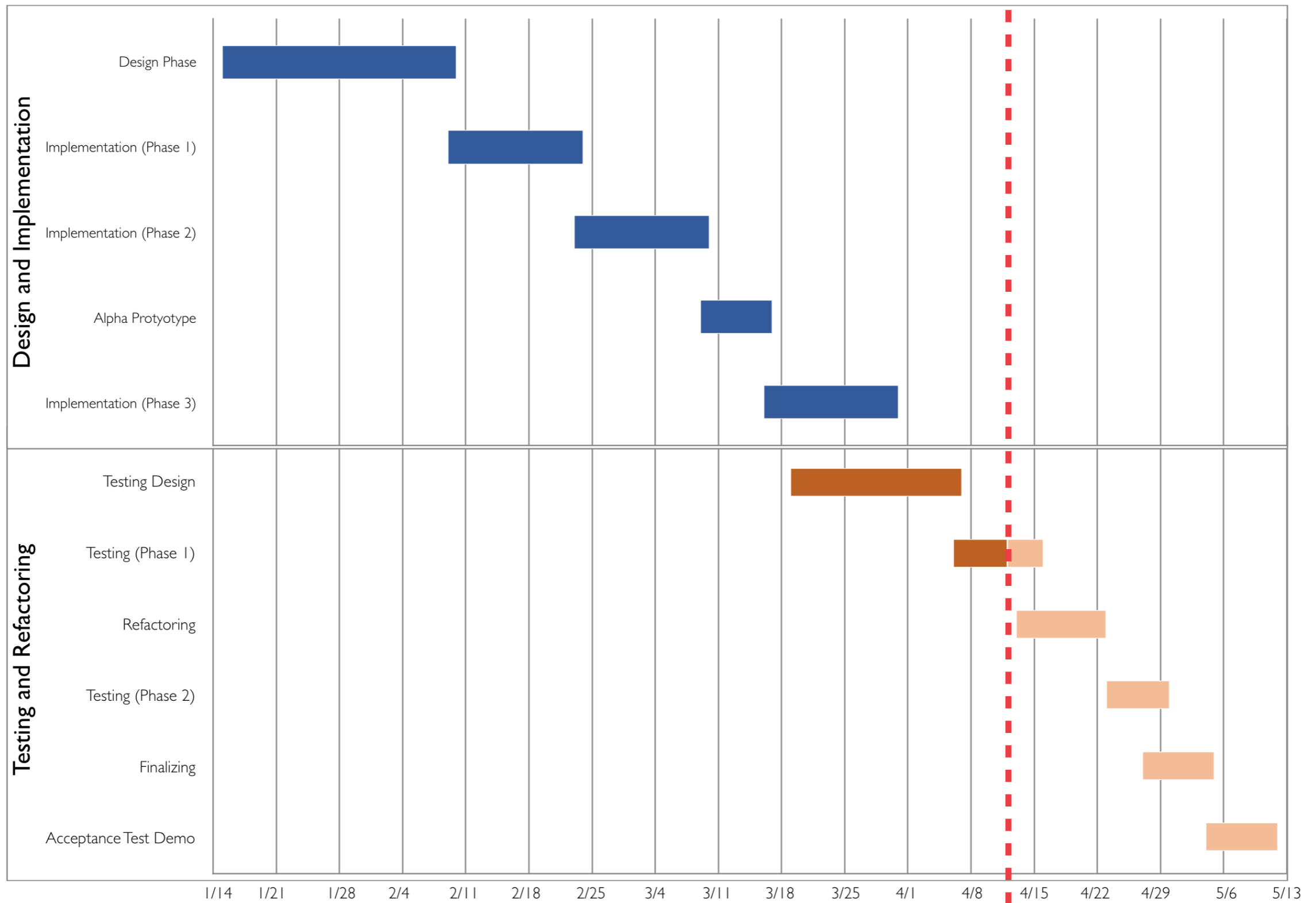
[Delete](#)

CHALLENGES AND RESOLUTIONS

- Disorganized Database
 - Not explicit where exactly data is coming from
 - Implemented functions to find and categorize sensors. Not all sensors can be categorized for lack of information. About 5,000 out of 11,000 sensors categorized
- Connecting to Building Controllers
 - Software is outdated, passwords missing, controllers are not uniform
 - Relying on historical database to be as up to date as possible and designing with future live data integration in mind
- Hosting with NAU
 - Currently testing with ITS
 - Preliminary Tests have worked, hosting the system as a whole is problematic at the moment

SCHEDULE

Now -



TESTING

Unit Testing

- Backend
- StaticDataRetriever
- BackendRetriever
- Data Cleaning
- Statistics /
Conversions

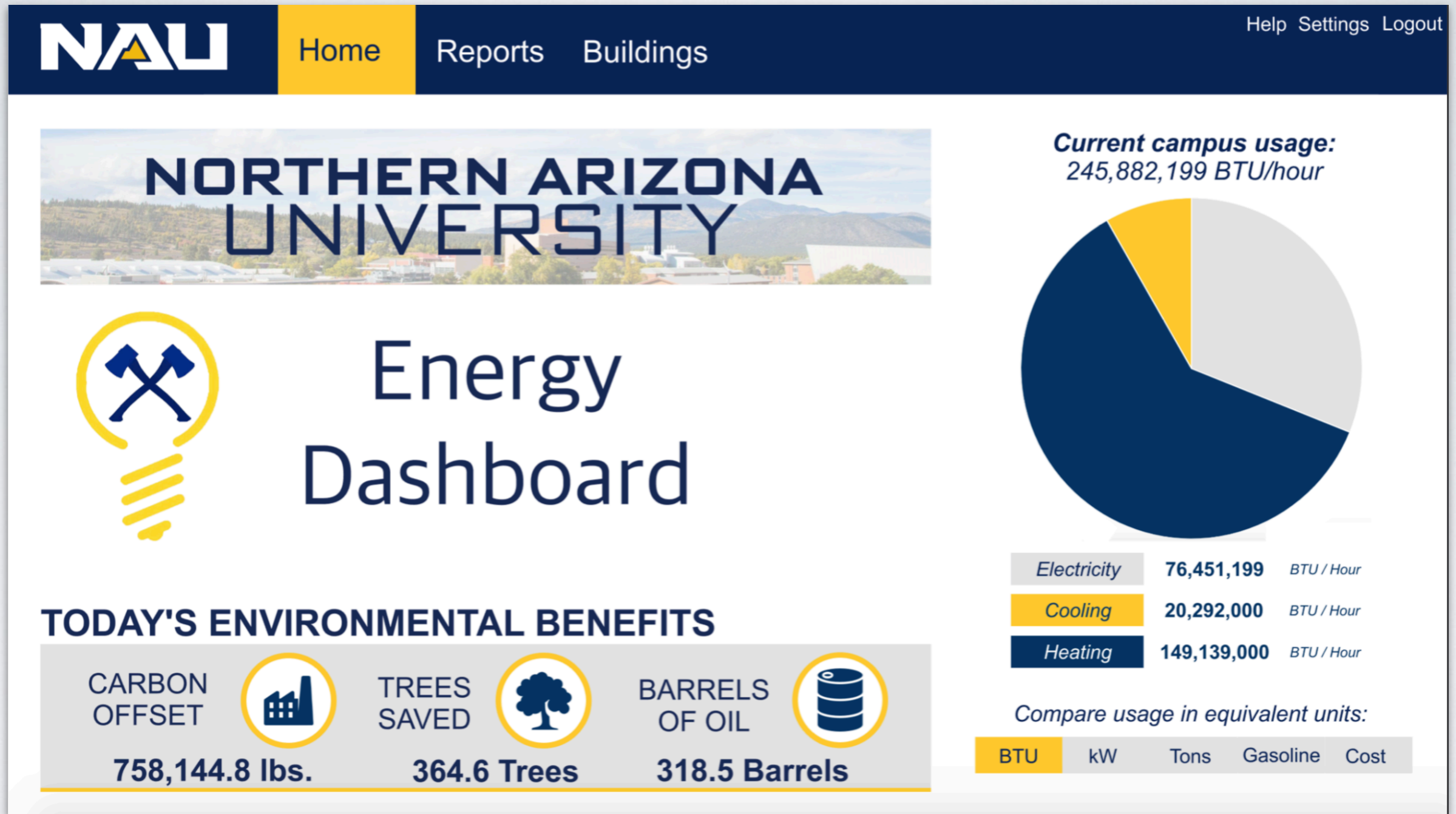
Integration Testing

- Models
- Views
- ITS Server

Usability Testing

- Homepage
- Building page
- Export page
- Admin page
- Methods:
 - Think Aloud
 - Timed Tasks

THE NAU ENERGY DASHBOARD: THINKING SUSTAINABLY



Promoting Sustainability Reducing Costs Facilitating Research Ensuring Conservation