

Interactive Visualization for Analysis of Northland's Energy Usage

Thomas Jansen, Northland College

Introduction

- Northland has implemented several systems that are meant to reduce energy usage.
- Data to assess these systems are not easily accessible and, in some cases, not collected at all.
- Monitoring and analyzing the state of the College's energy consumption is difficult and sometimes inaccurate.

Objectives

- Provide an interactive visual of energy usage since 2005.
- Highlight important points from Northland's energy data.
- Provide a guide to future data collection for both energy usage and reduction.

Methods

- Obtained the amount of natural gas (ccf) and electricity (kwh) used per building per month each fiscal year.
- These data were brought into RStudio for manipulation, and paired with other relevant data such as ambient temperature.
- An interactive web page that allows users to monitor and observe the College's energy usage was created using the Shiny programming language.

Example Observations

- Natural gas and electricity usage exhibit an annual cycle by month (Figure 1).

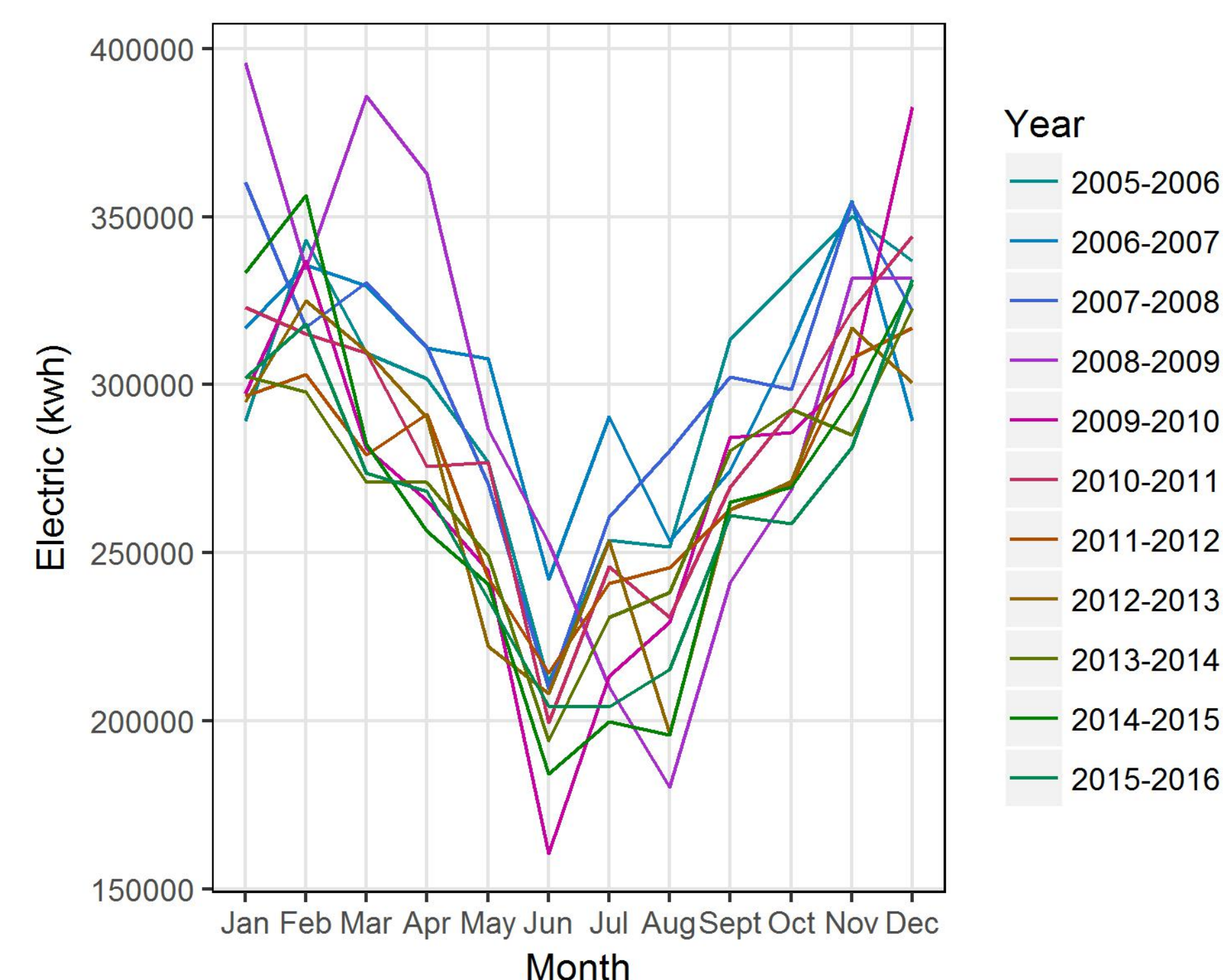


Figure 1. Total monthly electricity usage from 2005-2016.

- Natural gas usage is affected by ambient temperature (Figure 2).

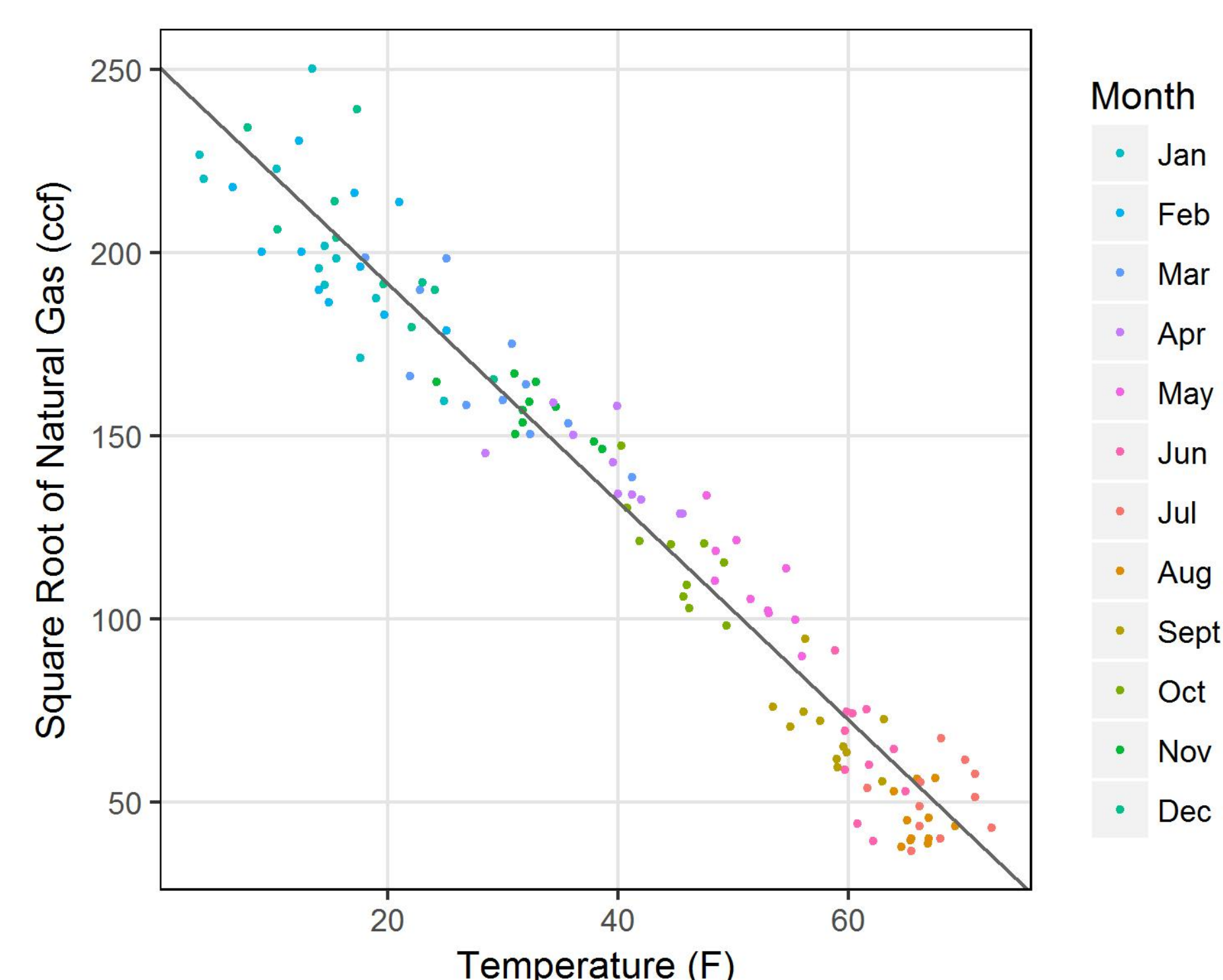


Figure 2. Square root of monthly natural gas usage from 2005-2016 compared to average monthly temperature.

- Dexter Library and Ponzio Campus Center have geothermal units that use electricity and heat from the earth to control temperature.

Example Observations

- Athletics Building Jul 2009 to Jan 2012
 - Structural issue with the swimming pool was fixed with an inefficient system causing an increase in gas usage (Figure 3).

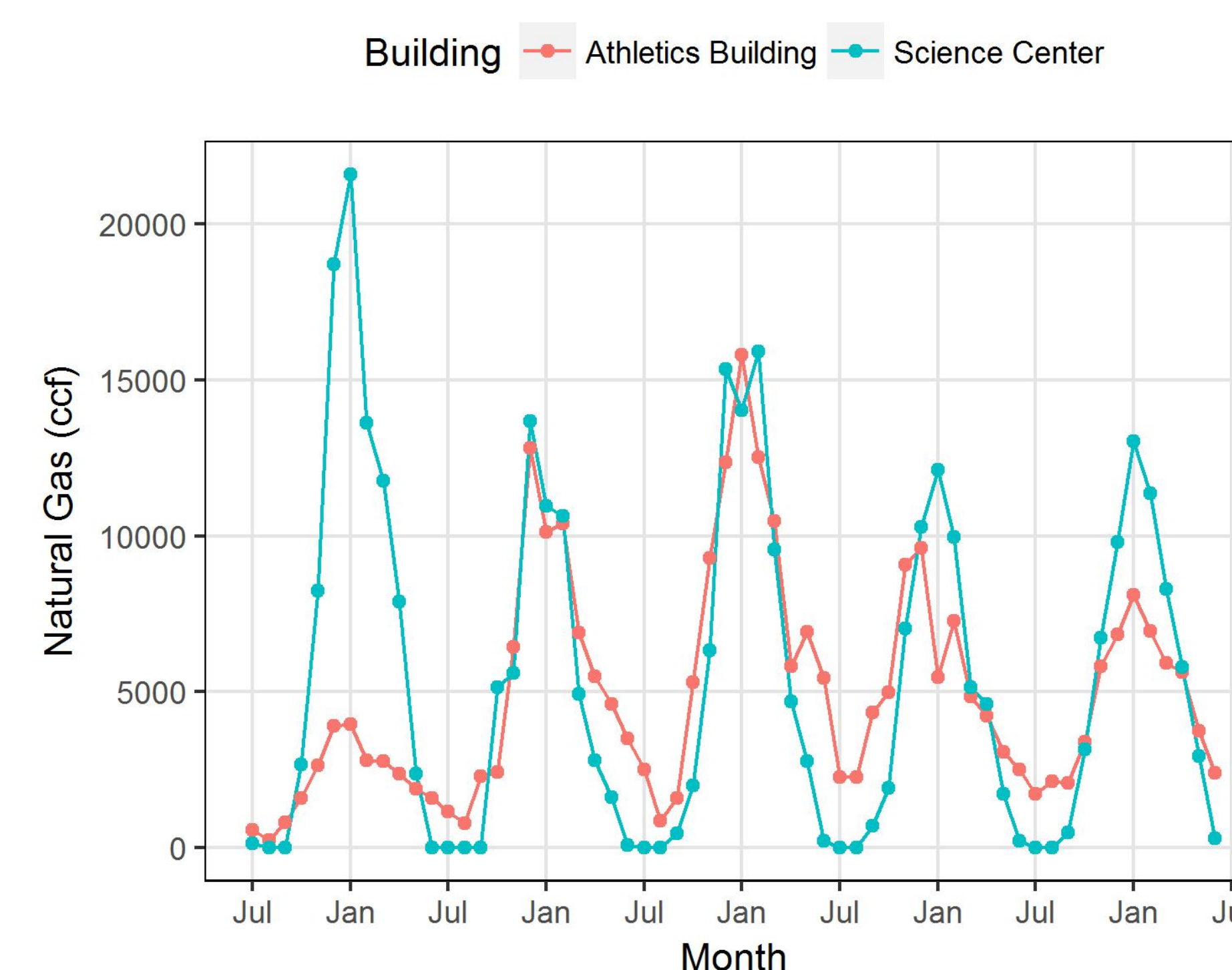


Figure 3. Athletics Building natural gas usage from 2008-2013.

- Dexter Library Jan 2008-2009
 - Geothermal unit was repaired, reducing natural gas costs to heat the building (Figure 4).

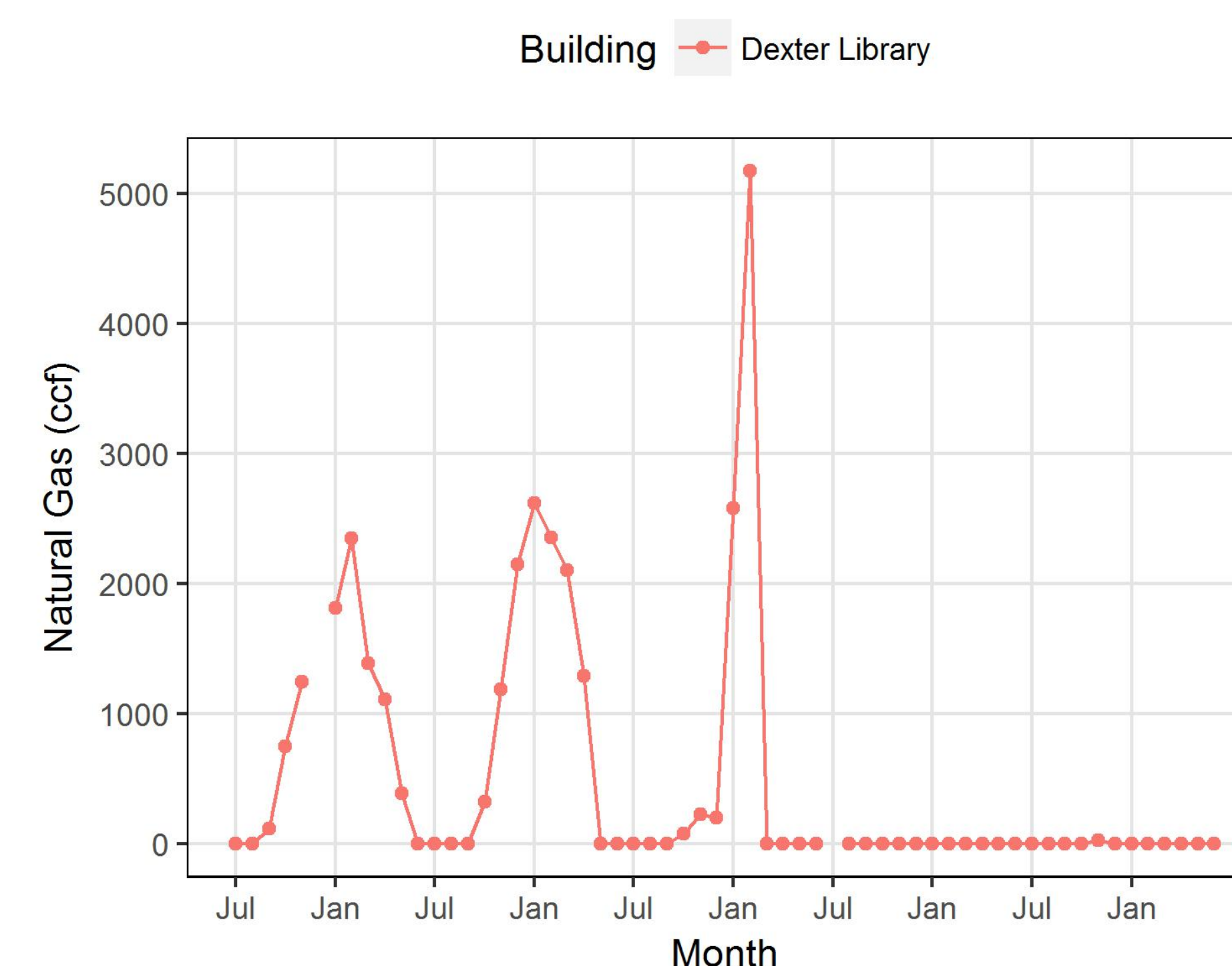


Figure 4. Dexter Library natural gas usage from 2006-2011.

Northland's Systems

- Northland's solar and wind energy systems are functional as of 2015; but data was only consistently collected in that year (Figure 5).

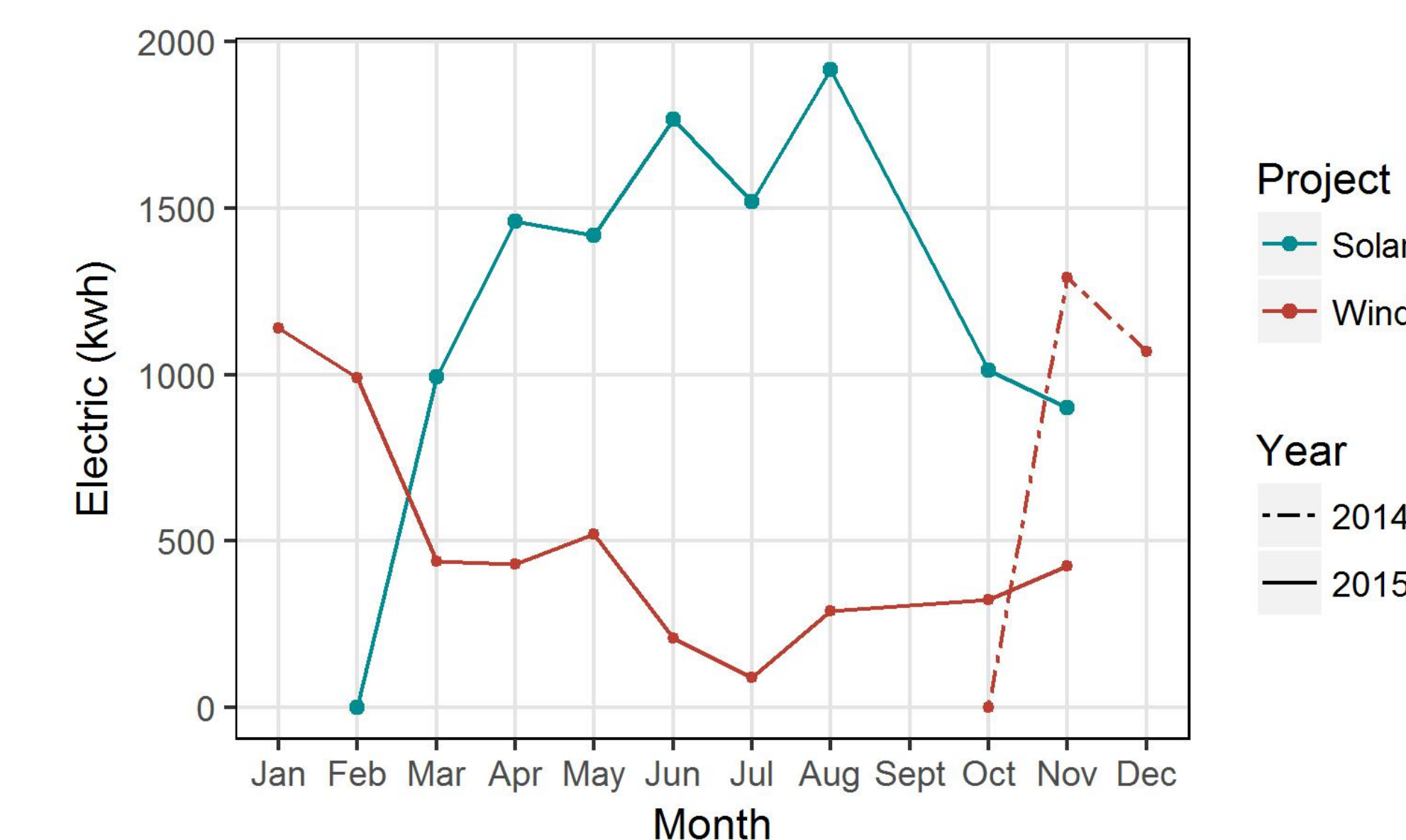


Figure 5. Total monthly electricity generated by wind and solar

Conclusion

- Consistent data collection will help students and faculty monitor Northland's energy usage.
- This data collection will assist Northland to troubleshoot issues with energy usage and systems.

Moving Forward

- Create a general guideline for all Northland energy data collection.
- Design, write, and implement software to record and transmit data from renewable energy systems to a locally hosted server.

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