Discover Your Potential

Solar Energy Estimation Project – Airdrie, AB

Project Proposal

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7 Pages

1 Executive Summary

This proposal was sparked by the results of the solar energy feasibility study of Calgary previously done by our team. Using the conclusions and recommendations of this study, we are moving forward with creating a more accurate and detailed estimates for solar energy systems: both for municipalities and the general public.

Initially, we will create a custom tool to provide these estimates, and once it is refined, it will be scaled up to a web-app. The tool will highlight solar feasibility on a per-home basis and provide an accurate estimation of how much a solar system will cost, the solar energy system that a given home should require, as well as the expected energy and economic returns. This will then be transformed into an informative and interactive web application, and integrated to a webpage. The overall objective of this web based application is to provide comprehensive and accessible solar energy estimates as a means of promoting solar energy in Airdrie, without needing any technical knowledge.

Data for this project will be acquired from numerous sources; literature research, census data, and from industry sources. Literature research from the National Renewable Energy Laboratory (NREL, 2016) in the US is invaluable, as they have spent decades studying solar energy. Census data from the City of Airdrie is important to provide more targeted suggestions to the citizens of the city. Finally, industry sources are necessary for accurate costs and grant information (Government of Alberta, 2016).

Implementation will be done systemically, and by using modern technologies to plan and accelerate the project's progress. Initially, our process from the feasibility study will have to be refined; this will be done in ArcGIS for Desktop. Once completed, this process will be used to create our web app; it will first be tested on the City of Airdrie, and once a high quality is achieved, we'll expand the reach of the app for the rest of Canada, time-permitting.

Our team is experienced at producing high quality deliverables for projects, on-time; this project falls neatly within our qualifications, and as such, will also result in a high quality, valuable end-product for the community.

2 Rationale

Our previous solar feasibility study served as a stepping stone to this project. The study had considered socio-economic factors, along with solar radiation levels to establish how economically viable solar energy is within Calgary neighbourhoods. Our study concluded that numerous Calgary neighbourhoods can make the transition to solar energy, and save money in the process; while being more sustainable for the environment as well. This encouraging discovery has propelled our study to new depths – the creation of a web application to share with the public.

We had a few municipalities to choose from for benchmark tests; in the end, Airdrie was selected, for numerous reasons. The main reasons: data and sunlight. We know from our previous study that Calgary receives a lot of sunlight—the most of any large metropolitan centers in Canada. More than enough sunlight hours to economically power our homes. High resolution data is required, however, to produce more precise estimates for the costs—and Airdrie has shared high-quality data in the past. Along with its proximity to Calgary, the City of Airdrie is an excellent opportunity to test a solar energy estimating app, which can then be scaled to anywhere data is available.

3 Project Implementation

3.1 Deliverables & Scope

Implementing this project would be daunting normally; yet, technology enables this experienced team to scale the solar energy analysis to a better resolution and precision. This resolution will allow for concise estimates, and can help change the way people see power – since the new knowledge will be easily shareable and scalable. The project will produce a process (a custom GIS tool), which can then be

shared in different ways on the Internet: ArcGIS Online, Social Media, and a project web-page with an integrated web-app.

This will be limited to the City of Airdrie, initially, but can readily be scaled to other locales once the process and app are validated.

3.2 Required Software

To refine our process, and produce quality solar radiation (or insolation) maps to base our estimates on, Esri's ArcGIS Desktop will be used extensively. Its tools have been easy to use and test different models. After our process has been refined, it will be developed into a web-app for use on the Internet; ArcGIS Online will likely be used. Other alternatives will be explored, such as QGIS or Google Maps & Cloud. The final product will be integrated to a simple website that can easily be accessed and shared by anyone with the link – this website will be created in one of numerous, simple ways, like SquareSpace, or Wordpress. It will simply act as the portal to the web-app, and a place for more information on our project.

3.3 Data Sources

Due to the nature of this project (process driven instead of data driven) the need for high-resolution data is less urgent; yet, still important for better estimates. Specifically, the data required to make this solar project really shine: census data, socioeconomic data, electricity rates, and high-resolution elevation data (can be derived from LiDAR data, for instance). Up-to-date and even archived census data is available from the City of Airdrie website (reference); as well previous years' census information, if needed. In addition, LiDAR data will be acquired from the City of Airdrie, and will be used to interpolate high resolution digital elevation models (DEM).

3.4 Data Management Structure

The structure of this data will be robust; stored in geodatabases, organized by features, rasters and tables. Once the refinement of our process is complete, we'll publish it to a server-based database, such as those found in ArcGIS Online, or SQL databases, and we'll test the robustness of our data structure again – since errors would lead to unusual or nonsensical results being displayed.

3.5 Data Security

We will be managing a large amount of high-resolution data; and as such, its reliability and security is paramount to the project's completion. It will be managed on secure server instances on the web, and backed up on a shared Google Drive. Our data will then also be backed up as weekly snapshots, and stored on a separate machine. A live backup is also stored, in case servers cannot be accessed. This ensures we don't lose data, and that mistakes and corrupted files can be recovered as well. We're also dealing with high-resolution data, so it must be kept secure; to that end, only the team members and stakeholders have access to raw data. The public would only see data visualized through the app.

3.6 Intended Database Model

Our database model will be very similar to our previous feasibility study – a relational database that will be used to undergo the calculations required for system estimations. These calculations are based on solar insolation maps, and in this project we plan to integrate the database model directly into ArcGIS, instead of externally, like in our feasibility study. Keeping these databases easy to understand will require more steps, however.

3.7 Metadata Maintenance

To this end, keeping the data organized will be done with continuous metadata updates; whenever data is published to the team, metadata will be published as well. This way, data stays organized, easy to understand, and satisfies many industry standards. Clear data will be critical to complete this project smoothly, and as such, metadata will be maintained thoroughly.

3.8 Data Handling & GIS Processes

At this point in time minimal data translations, transformations and conversions will be needed. ArcGIS can natively handle LAS data (typically the data form of LiDAR) which eliminates the need to convert the LiDAR data. Most likely all of the data collected will need to be transformed to an appropriate custom coordinate system for Airdrie. This data must undergo geoanalytical processes: a digital elevation model (DEM) surface will be interpolated, and will then be used by the Area Solar Radiation tool with settings appropriate for the region, thus producing the solar radiation maps.

As mentioned earlier, these solar radiation maps will be used to calculate and produce the estimates (or quotes) for specific households. These calculations are based on our findings in the Solar Feasibility study, will be based on up-to-date cost estimates for solar energy systems, and will be applied to fields within geodatabase objects.

3.9 Final Scale & Industry Standards

The ultimate goal of this project is create a web based application that will allow users to estimate the specific cost of a solar system, as well as how much money they can save by switching to solar energy. As a result, the final scale will vary, and maintaining data to Industry standards is critical to ensure the information remains relevant and valuable.

The final scale will, of course, be at a scale where the general public can understand and visualize what they see – so it must be a large enough scale to view their homes (1:1000 to 1:5000). This will vary based on the data available per location.

As for maintaining data accuracy to industry standards: we will be ensuring all conversions and interpolations are representative of the real world, while still being accurate enough to produce estimates close to real installation and maintenance costs. This will be done with literature reviews from the NREL costs analysis (NREL, 2016), as well as communicating with current solar and electricity companies to ensure our cost data is accurate.

3.10 Team Members

Team members will be assigned generic roles, yet will be expected to equally work on all project components, as needed. David Bouchard is the technical lead, Nick is dealing with project deadlines and management, and Josh is the project administrator. The team has worked very well in the past, and will continue this trend for this project.

4 Concluding Remarks

Our project seeks to further last terms research and provide a user-friendly solar tool application for the town of Airdrie. This accessible and comprehensive web app will display solar feasibility estimates to homeowners on a per-home basis. In order to proceed, our team's next steps will be to obtain LiDAR data from the city of Airdrie, implement our relational database and to begin the construction of our solar feasibility estimation tool. We are passionate about solar energy as an environmentally and economically responsible way forward; we believe that by making this information easily accessible to the citizens of Airdrie, solar energy will gain momentum in the region – and the rest of the country.

5 References

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