Solar Panel Site Suitability Study
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Project Goals:
• Determine a suitable study area by availability of LiDAR.
• Use a LiDAR generated DEM for Solar Analysis.
• Use the Oregon Department of Transportation's (ODOT) Solar Project methodologies as a guide to develop a model for use in our study area.
• Use the model to determine areas with high solar potential using the Solar Radiation Tools in ArcGIS.
China is currently seen as a leader in the development and use of solar energy. The Chinese government heavily subsidizes green energy.

The average US Home consumed 10,650 kW/Year in 2009.

United States Department of Energy

- Rooftop Solar Challenge
  - $12 Million
- Recent investment to bolster technology to concentrate solar energy
  - $60 million
ODOT Study

• In 2008, ODOT built the first solar highway project in the US.
  o Generates 130,000 kWh/year.
• ODOT’s long term goal is to build enough renewable energy capacity to make all 47 M kwh required annually.
  o signals, illumination, buildings, ramp metering.

ODOT Study:

• Criteria Used from ODOT study:
  o Southern orientation
  o Slope of less than 1.5%
  o Identify which sites are in flood plains or that have known wetlands or protected stream corridors
ODOT Processes

- ODOT didn’t use ESRI’s Solar Radiation tool.
- ODOT used National Renewable Energy Laboratory (NREL) tools.
  - Make Solar Array

PVWatts Grid Data Calculator
ODOT Processes:
Online PVWatts Viewer:

http://www.nrel.gov/gis/

NREL Solar Resource Fraction Map
The solar radiation tool in ArcGIS doesn't include reflected radiation.

The total radiation is calculated as the sum of the direct and diffuse radiation.

Exclusionary Criteria:

- Slope
- Aspect
- Floodplain
- Wetlands
- Total Solar Fraction
Study Area:

![Study Area Map](image1)

Study Area

![Resampled 30 foot DEM](image2)
Solar Radiation in Study Area During Study Period

Solar Radiation Per Square Meter Between January 5 and June 9

Slope

Areas With Slope Less Than 15%
Aspect

Areas With South Facing Aspect

Floodplain

100 Year Floodplain Map
Wetlands

Map of Wetland Areas

Slope / Aspect Intersect

Areas With South Facing Aspect and >15% Slope
Slope / Aspect / Water Subtracted

Study Area Solar Sites Over 3m²:
Solar Radiation in Study Area During Study Period

Solar Radiation Per Square Meter Between January 5 and June 9

95% Map

Map of 95% Total Solar Resource Fraction
90% Map

Map of 90% Total Solar Resource Fraction

85% Map

Map of 85% Total Solar Resource Fraction
Conclusions

• Comparing results to NREL lends credibility to our methodologies

Continuing Questions:

• There is a pronounced and unexplained increase in selected area between the 90% TSRF and 85% maps.
Continuing Questions:

Mean average of solar radiation output is 82% of the maximum solar radiation output.

132,832 - total acreage of study area

5% .61 acres, no sites over an acre

4.592 * 10^-4 % of total area

10% 72,936.44 total acres. Maximum of 27.71 acres, 10 sites over 1 acre

0.055 % of total area

1.5% 10,037 of 421.8 acres. 589 sites over 1 acre. 8.008 % of total area

Conclusions :

• The ESRI Solar Radiation Tool works well but.......  
  o TAKES A LONG TIME!
    - 8 to 12 hours
    - 2m DEM ran for 9 days and was not half complete.
    - Estimate for the 1 m DEM run just under 5 weeks.

• The LiDAR data provided an effective DEM for analysis

• The raster calculator was effective for extracting from streaming servers.
Conclusions:

• Developed methodologies to calculate solar potential based on criterion.
• Able to use LiDAR Derived DEM throughout the process.
  o Took into account terrain
  o Worked with raster calculator.
• Throughout the process valuable knowledge and information was gained.
  • We Learned A LOT!

Further Investigations:

• Additional exclusionary criteria:
  o Land use / availability
  o Proximity to solar energy conversion resources
  o Hazardous material investigation
• Calculations of possible energy outputs in selected areas.
• Use NREL data and tools.
  o Use of meteorology data.
• Make use of the ESRI Point Solar Radiation tool.
• Set custom parameters on Area Solar Radiation tool
Thank You to Lynn Averbeck and Alsea Geospatial, Inc.!

Questions?

http://solaroregon.org/news/pacific-power-announces-solar-farm-plans/image