



# Kansas State at Salina

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# Overview

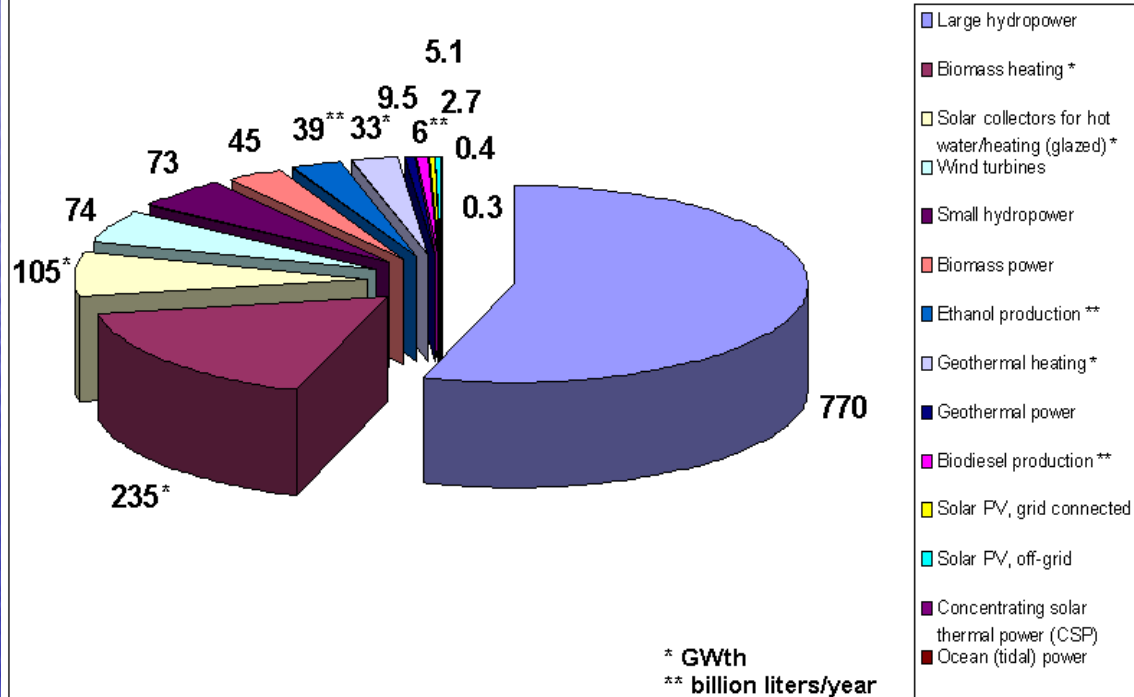
- Breakdown of Renewable Energy and Wind Energy
- Why Horizontal Axis Turbines won't work and why Vertical Axis Turbines will
- Proposed Sites for Vertical Axis Turbines on the Salina Campus
- Overview of Solar Energy

# Overview (Cont.)

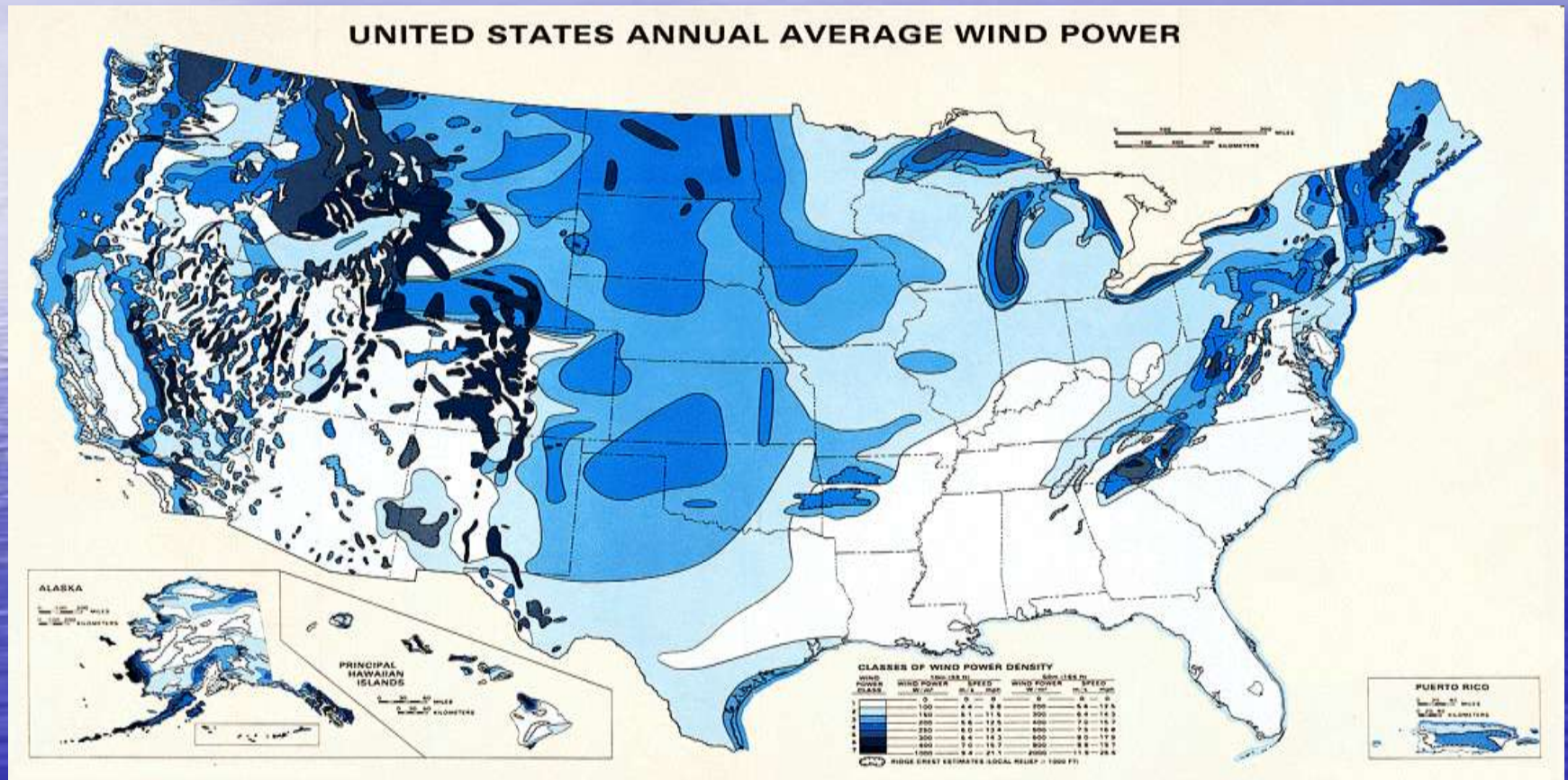
- Proposed sites for solar energy system on the Salina Campus
- Scale Model
- Possible Scheduling

# Breakdown of Renewable Energy

**Renewable Energy, end of 2006 (GW)**



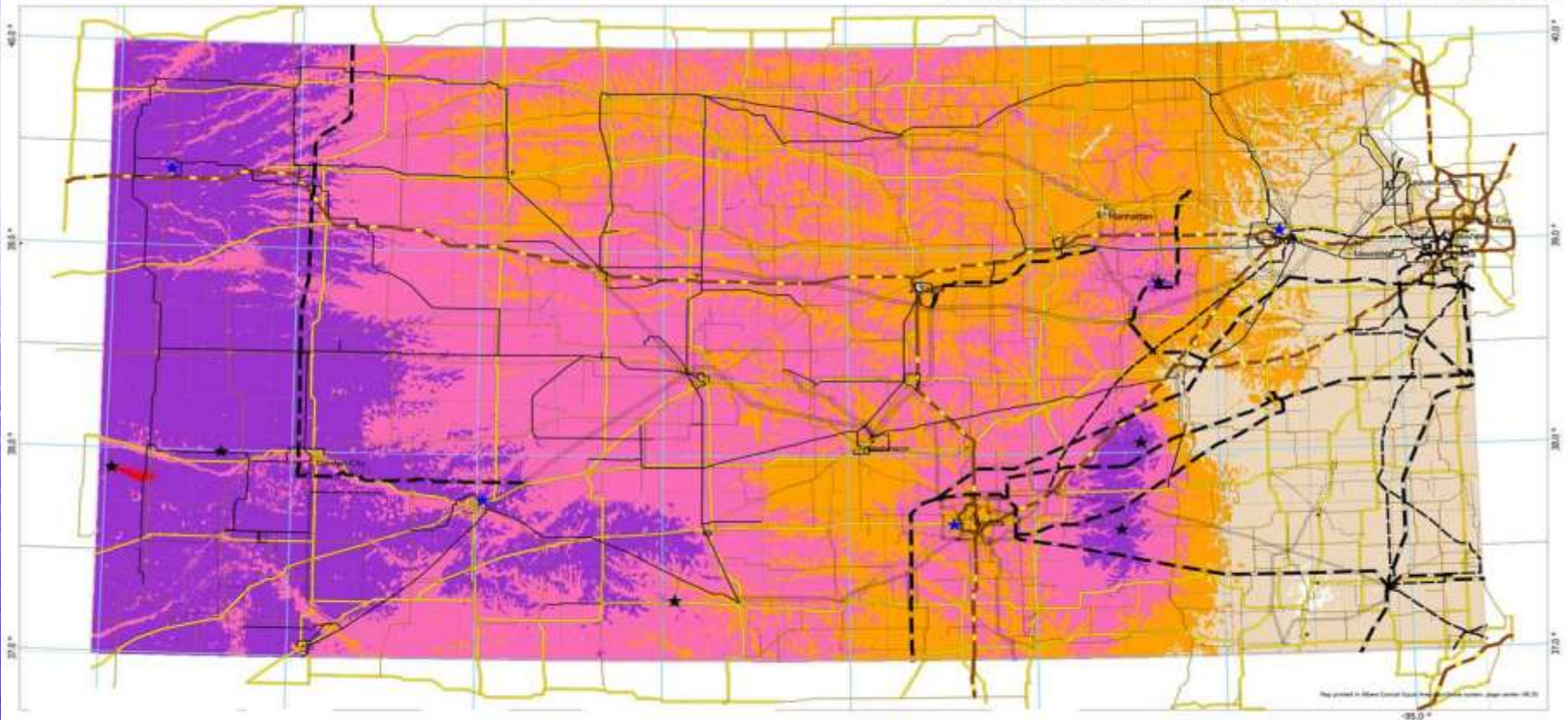
# Average Wind Energy Capacity







# Kansas Average Wind Energy Distribution

**Kansas Wind Resource Map**

(Estimated average yearly wind speeds at 50 meters in meters/second)



	<b>Class 4</b>	<b>15.7 - 16.8 mph</b>
	<b>Class 5</b>	<b>16.8 - 17.9 mph</b>

	<b>Class 2</b>	<b>12.5 - 14.3 mph</b>
	<b>Class 3</b>	<b>14.3 - 15.7 mph</b>

# Problems With On Campus Wind Generation

- 10' per 100' radius distance from airport requirement rules out traditional horizontal axis wind generation.
- Distance from public streets and buildings also makes horizontal axis wind generation difficult for campus use.
- Large turbines would be required to achieve stand alone campus generation

# Vertical Axis Wind Generation

- Vertical axis turbines are smaller in height and in production capacity, cheaper and meet the requirement for use on campus.
- Would be good only for supplemental use.
- Without extremely large quantities, vertical axis turbines are not feasible to carry the full load of the campus.



# Proposed Vertical Axis Wind Turbines



- Delta II model from PacWind.
- Rated at 10 Kw.
- Costs \$35,000.00 per unit.
- Jay Leno uses one of these models to support the load of his car garage.

# Proposed Vertical Axis Wind Turbines (Cont.)

- Delta I model from PacWind.
- Rated at 2 Kw.
- Costs \$5,500.00 per unit.



# Proposed Vertical Axis Wind Turbines (Cont.)

- Seahawk model from PacWind.
- Rated at 500 W.
- Costs \$4,500.00 per unit.



# Proposed Vertical Axis Turbine Sites



# Proposed Vertical Axis Turbine Sites

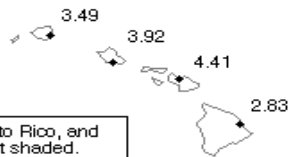


# Average Solar Energy Distribution

## Alaska



## Hawaii



Hawaii, Puerto Rico, and Guam are not shaded.

## San Juan, PR



## Guam, PI

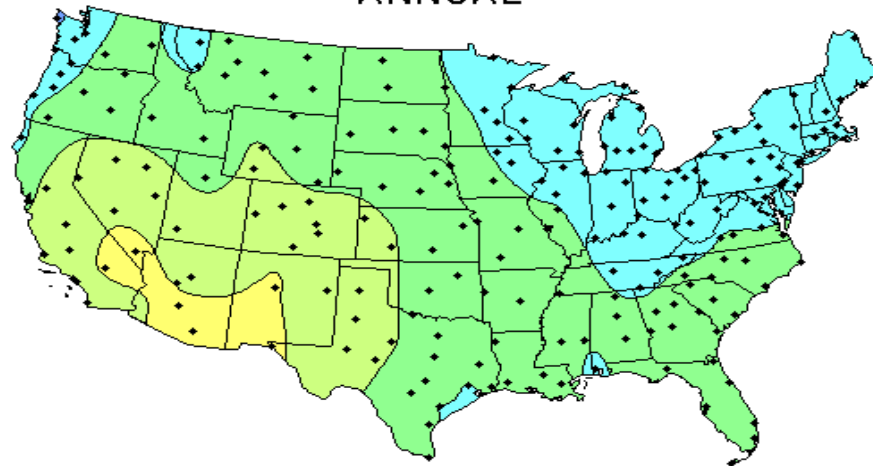


## Collector Orientation

One-axis tracking parabolic trough with a horizontal east-west axis

## Average Daily Solar Radiation Per Month

ANNUAL



## East-West Axis Tracking Concentrator

This map shows the general trends in the amount of solar radiation received in the United States and its territories. It is a spatial interpolation of solar radiation values derived from the 1961-1990 National Solar Radiation Data Base (NSRDB). The dots on the map represent the 239 sites of the NSRDB.

Maps of average values are produced by averaging all 30 years of data for each site. Maps of maximum and minimum values are composites of specific months and years for which each site achieved its maximum or minimum amounts of solar radiation.

Though useful for identifying general trends, this map should be used with caution for site-specific resource evaluations because variations in solar radiation not reflected in the maps can exist, introducing uncertainty into resource estimates.

Maps are not drawn to scale.



National Renewable Energy Laboratory  
Resource Assessment Program

kWh/m<sup>2</sup>/day



# Proposed Solar Energy System For Use on Signs on Centennial Road

- 80 Watt BP Stand alone solar panel.
- Would be enough to support LED lighting for the signs on Centennial Road.
- Costs \$469.95 per unit.



# Proposed Solar Energy System For Use on Signs on Centennial Road (Cont.)



- New LED Floodlights to replace existing 75 W sign lighting.
- 1 W lights that operate between 12-24 Volts.
- Costs \$252.00 per unit.





# Proposed Solar Energy System For Use on Signs on Centennial Road (Cont.)



- 92 Amp-Hours @ 20 Hour Rate.
- 12 Volt and 24 Volt models.
- Costs \$189.00 per unit.



# Proposed Solar Energy Sites



# Proposed Solar Energy Sites



# Proposed Solar Energy Sites



# Proposed Modeling/Design Projects

- A scale model of one or more of the proposed sites for either solar or wind energy or both.
- A tool that is useful in either measurement or creation of renewable sources of energy.

# Estimated Costs and Budgets

- Currently we have no budgeted funds and have no physical designs that could potentially be approved for budgeting.
- We are working towards a physical design of a model or measurement to build by years end.

# Possible Scheduling

- February 10<sup>th</sup> 2009 – We will have a design for a model or tool that we can build.
- April 18<sup>th</sup> 2009 – We would like to have a working model or tool that we can display at open house.
- May 15<sup>th</sup> 2009 – Research paper will be completed.
- Continuous – Research sites and designs that are applicable to this project.

Questions?