Federal Utility Partnership Working Group
Spring 2012
Jekyll Island, GA

Renewable Energy in the South-East

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Renewable Energy Technologies

Photovoltaics

PIX 1870

Wind Power

PIX 8727

Solar Water Heating

PIX 1050

Solar Vent Air Preheat

PIX 12132

Concentrating Solar

PIX 18700

Biomass Heat/Power

PIX 11913

Daylighting

PIX 17041

Ground Source Heat

PIX 07096

Landfill Gas

PIX 3626

A Birthplace of the Solar Industry

Workers assemble collectors at the Solar Water Heater Company in Miami, FL, 1936

In 1925, the Miami Herald listed the company as one of the seven largest construction companies in Miami

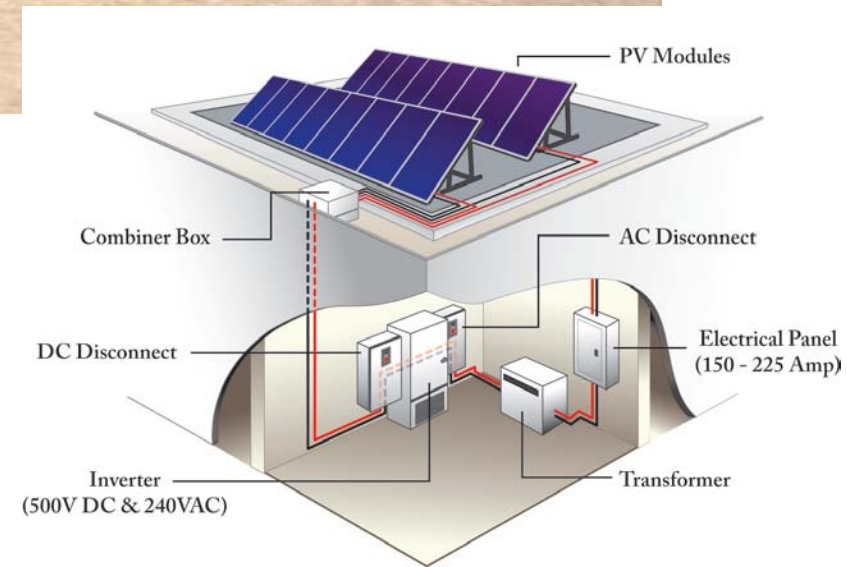
By 1942 SHW was used by ½ of the population including 80% of all new homes in the Miami area.

A Golden Thread, 2500 Years of Solar Architecture and Technology
by Ken Butti and John Perlin

PV: Distributed Generation

PV Costs:
Residential: $5,710/kW
Commercial Rooftop: $4,590
Utility Fixed: $3,800/kW
Utility Tracking: $4,400/kW

Veterans Administration
Loma Linda CA
309 kW_{dc}
1,584 Sanyo 195-watt PV modules
497MWh/year delivery;
$60k/year savings;

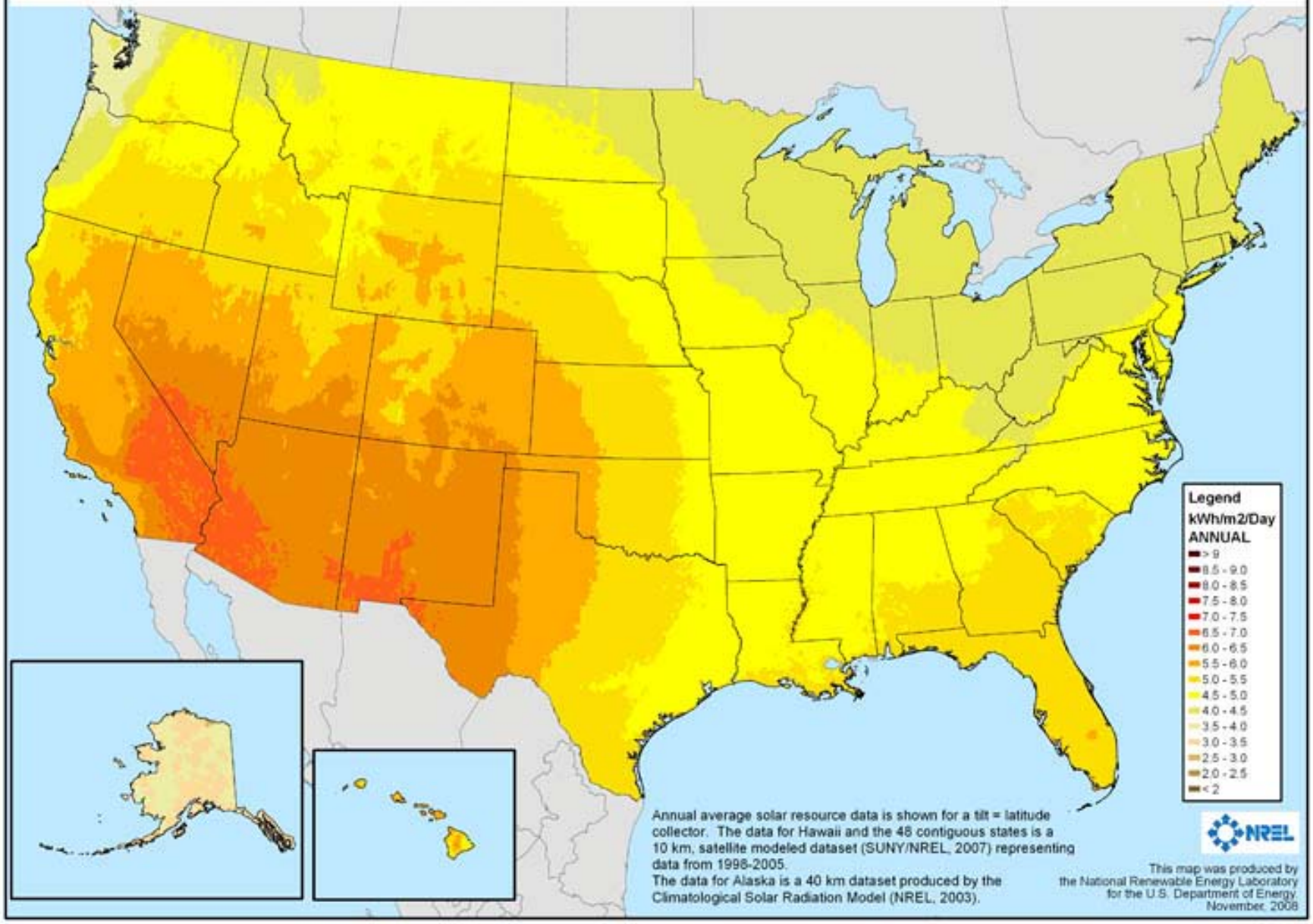


PV: Utility-Scale Distributed Generation

Alamosa CO
8.2 MW-dc
80 acres of land
Colorado`s Renewable Energy Portfolio Standard (RPS)
Financed, built and maintained by SunEdison, under a Solar Power Services Agreement (SPSA) 20 years.
Project constructed by 70 tradesmen.
Maintained by 2 full-time employees.
Operating since April 2007

Photovoltaic Solar Resource:
Flat Plate Tilted South at Latitude

Annual

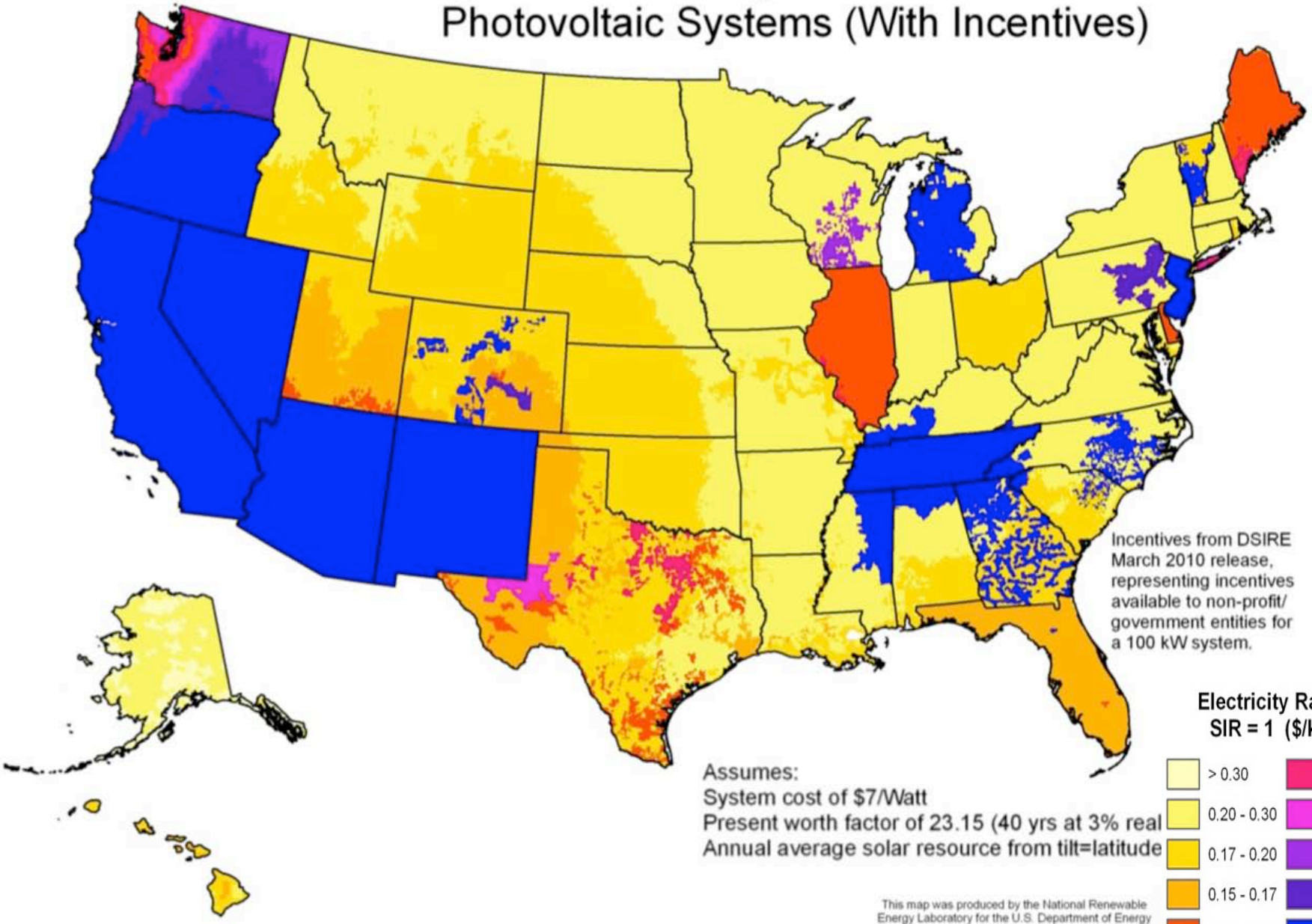


Annual average solar resource data is shown for a tilt = latitude collector. The data for Hawaii and the 48 contiguous states is a 10 km, satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.
The data for Alaska is a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).

NREL

This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
November, 2008

Electricity Rate for Savings-to-Investment Ratio = 1 for Photovoltaic Systems (With Incentives)



Concentrating Solar Power Technology

Mirrors are used to reflect and concentrate sunlight onto receivers that collect this solar energy and convert it to heat.

Pix 6051

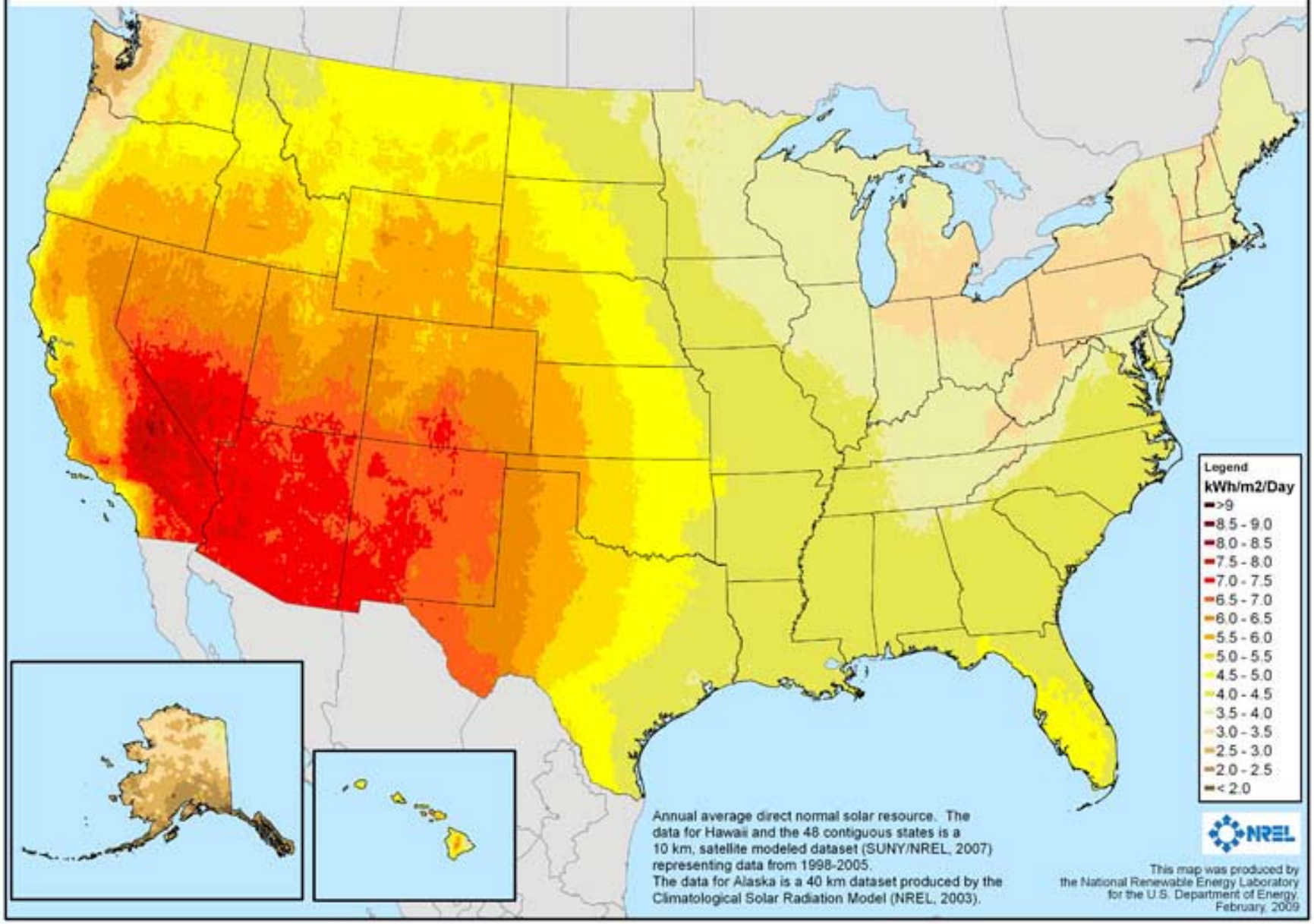
Cost: $5,132/kW

Pix 19881

Pix 14955

Concentrating Solar Resource: Direct Normal

Annual



Annual average direct normal solar resource. The data for Hawaii and the 48 contiguous states is a 10 km, satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.
The data for Alaska is a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).

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February, 2009

Solar Water Heating System

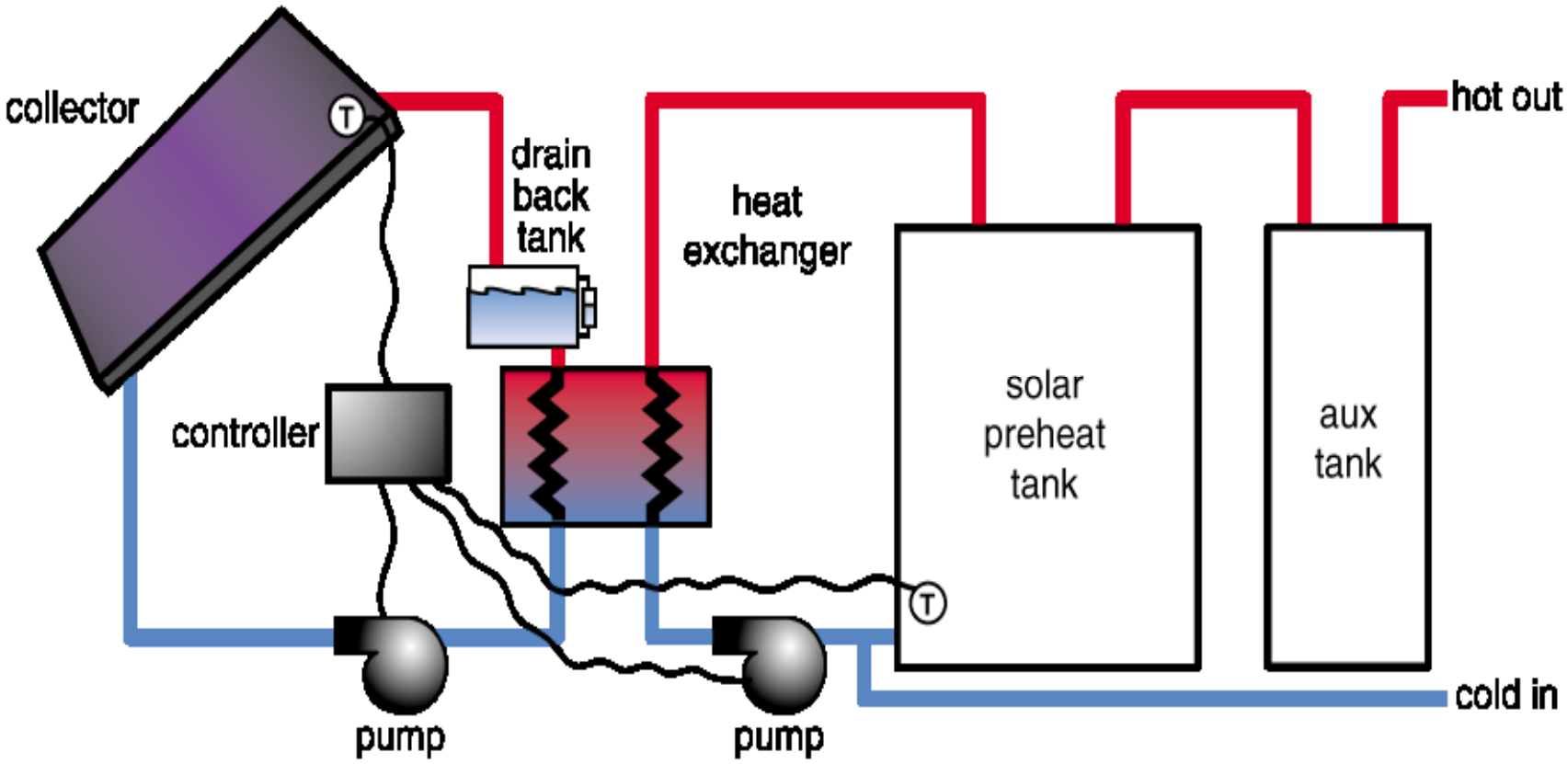


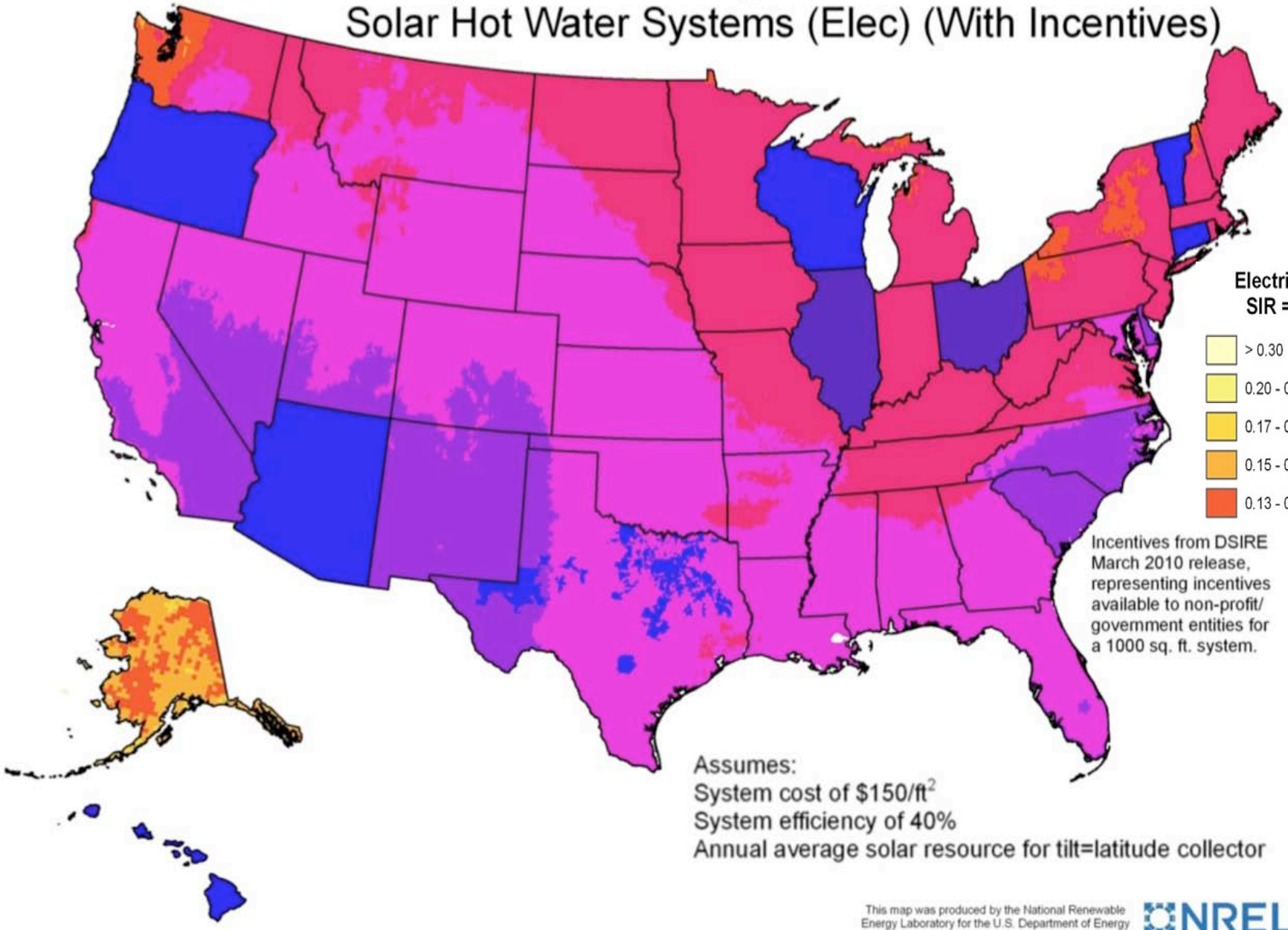
Figure by Jim Leyshon

Solar Water Heating Systems

USCG Rescue Swimmer Training Facility, Elizabeth City, NC

USCG Base Portsmouth, Va

Electricity Rate for Savings-to-Investment Ratio = 1 for Solar Hot Water Systems (Elec) (With Incentives)



This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy
Map created by Donna Heimiller - Oct. 7, 2010

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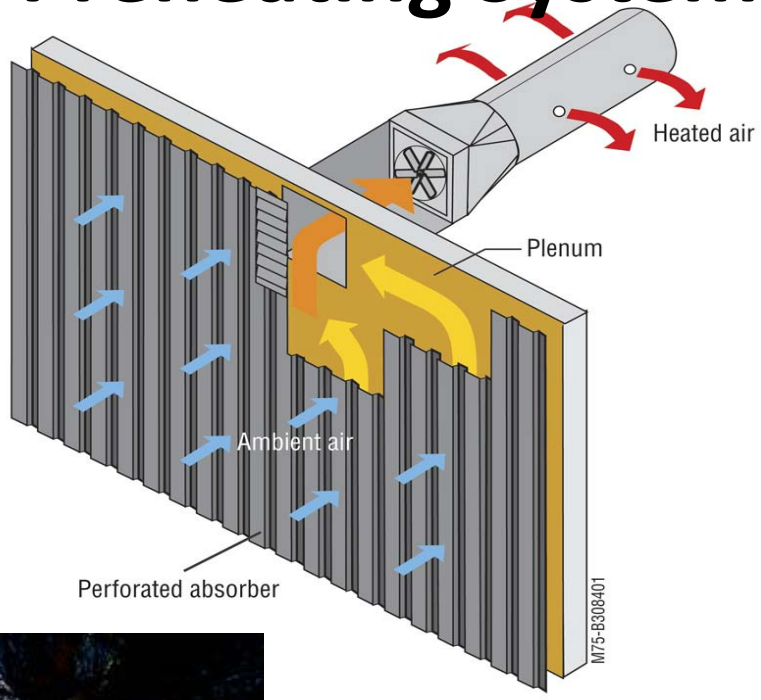
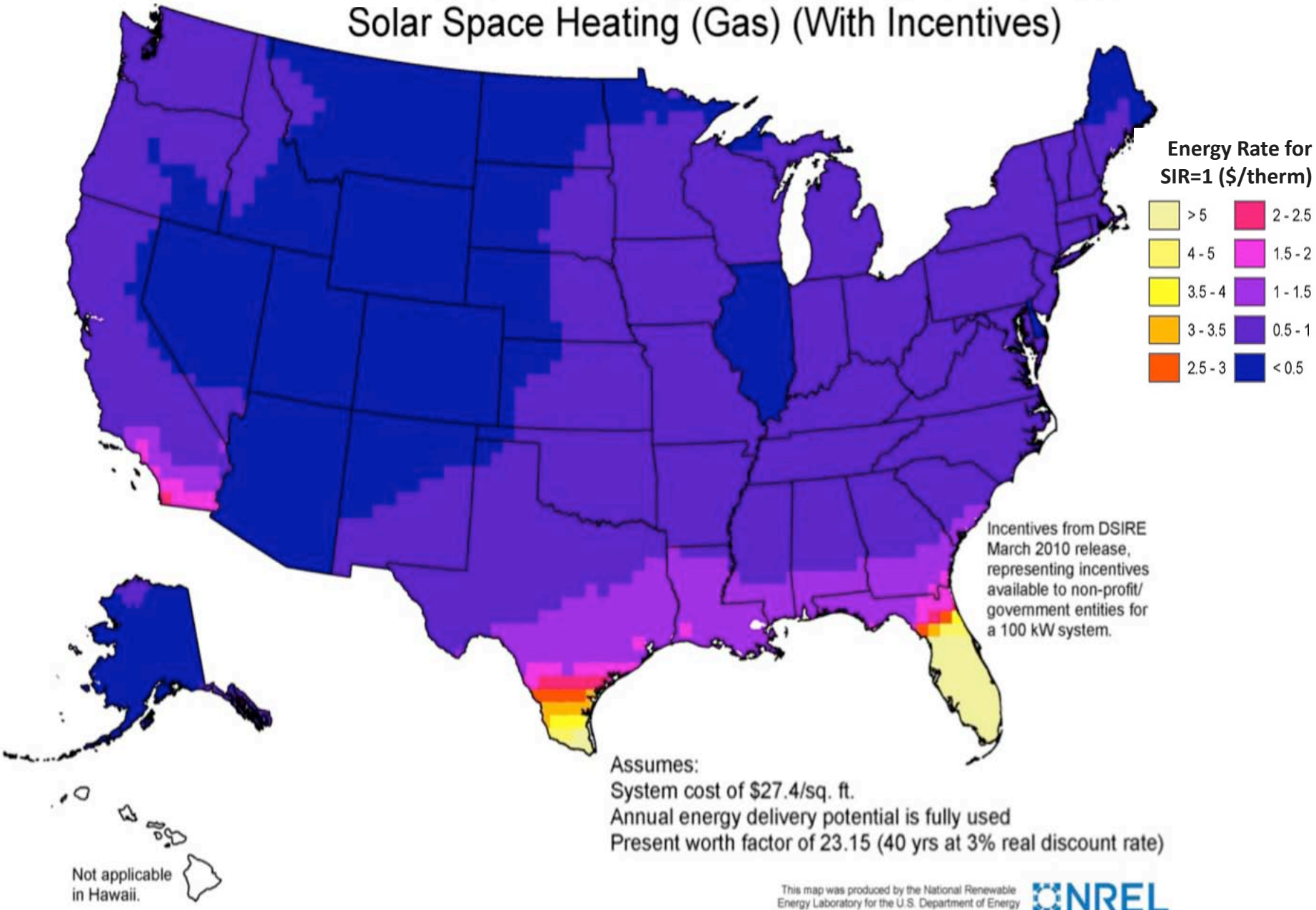
Solar Ventilation Preheating System

- Transpired solar collector
  - Perforated sheet metal
- Air distribution
  - Ductwork, fan and bypass damper
- Controls
  - Thermoostat or EMCS



Cost: $40/sf

Energy Rate for Savings-to-Investment Ratio = 1 for Solar Space Heating (Gas) (With Incentives)



Wind Energy Systems

Pix 2102

Small (≤10 kW)

- Homes
- Farms
- Remote Applications
- Cost: $11,000/kW

Pix 16904

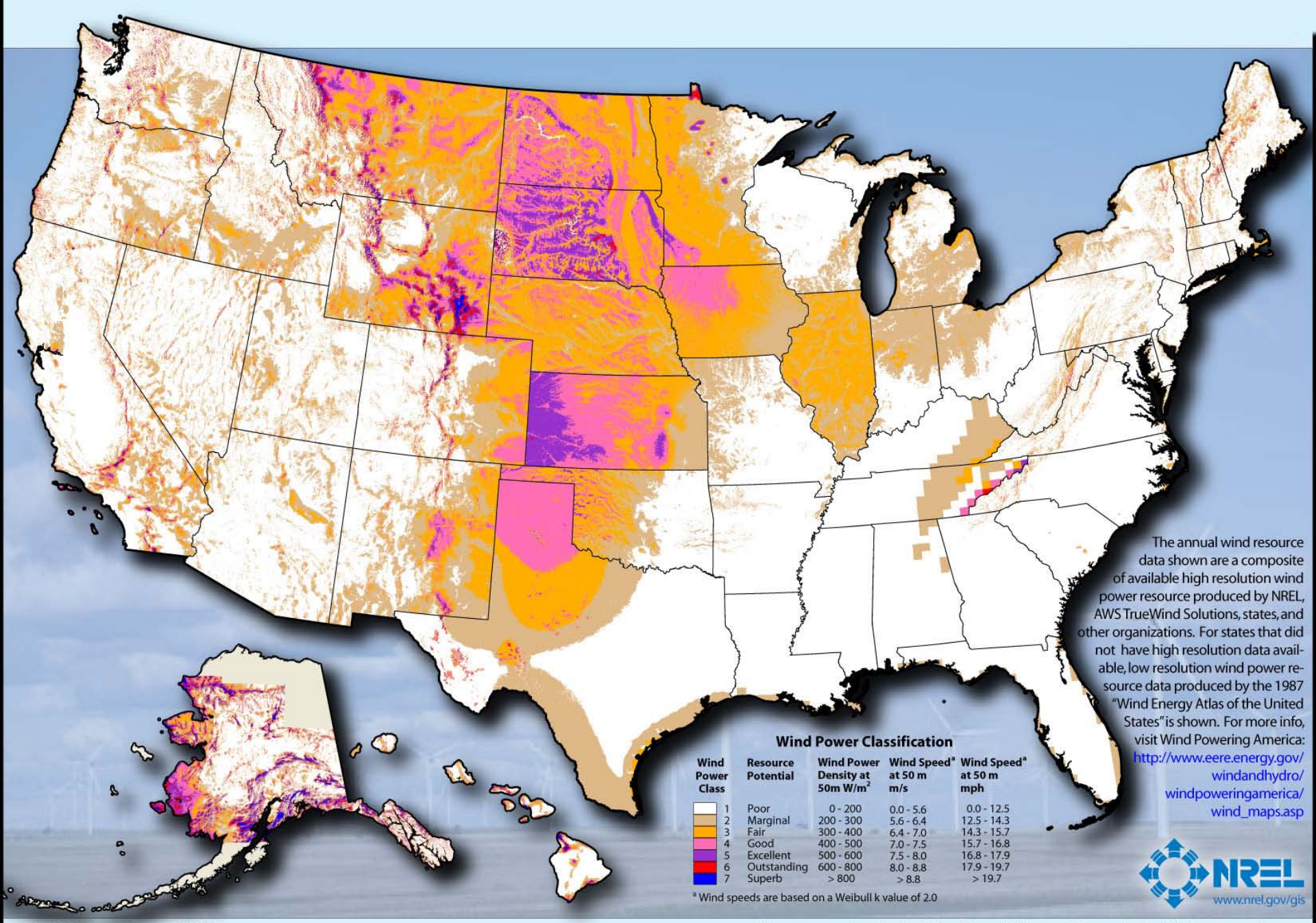
Intermediate (10-250 kW)

- Village Power
- Schools, businesses
- Hybrid Systems
- Distributed Power

Pix 16707

Large (660 kW - 2+MW)

- Central Station Wind Farms
- Distributed Power
- Community Wind
- Cost: $2200/kW



Author : Billy Roberts - October 20, 2008

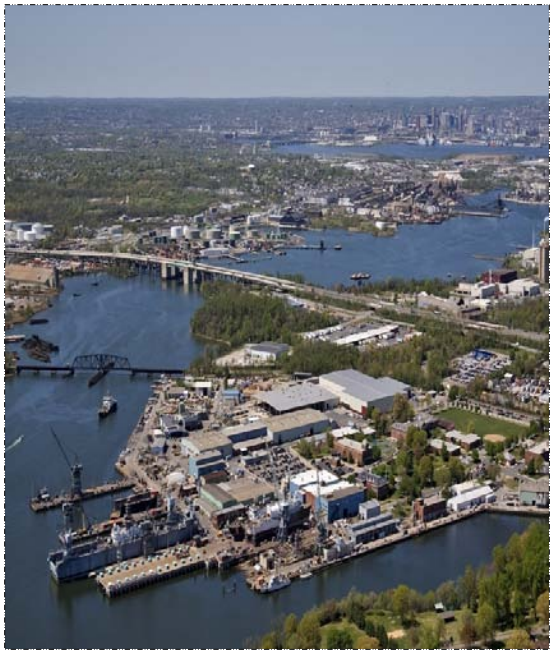
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.

Biomass Energy Systems

Pix 15830

- NREL, Colorado
- 3.3 million cost under an ESPC
- Cost savings projected $400,000/year
- The wood chips cost $29 per ton or $2.42 per million BTUs

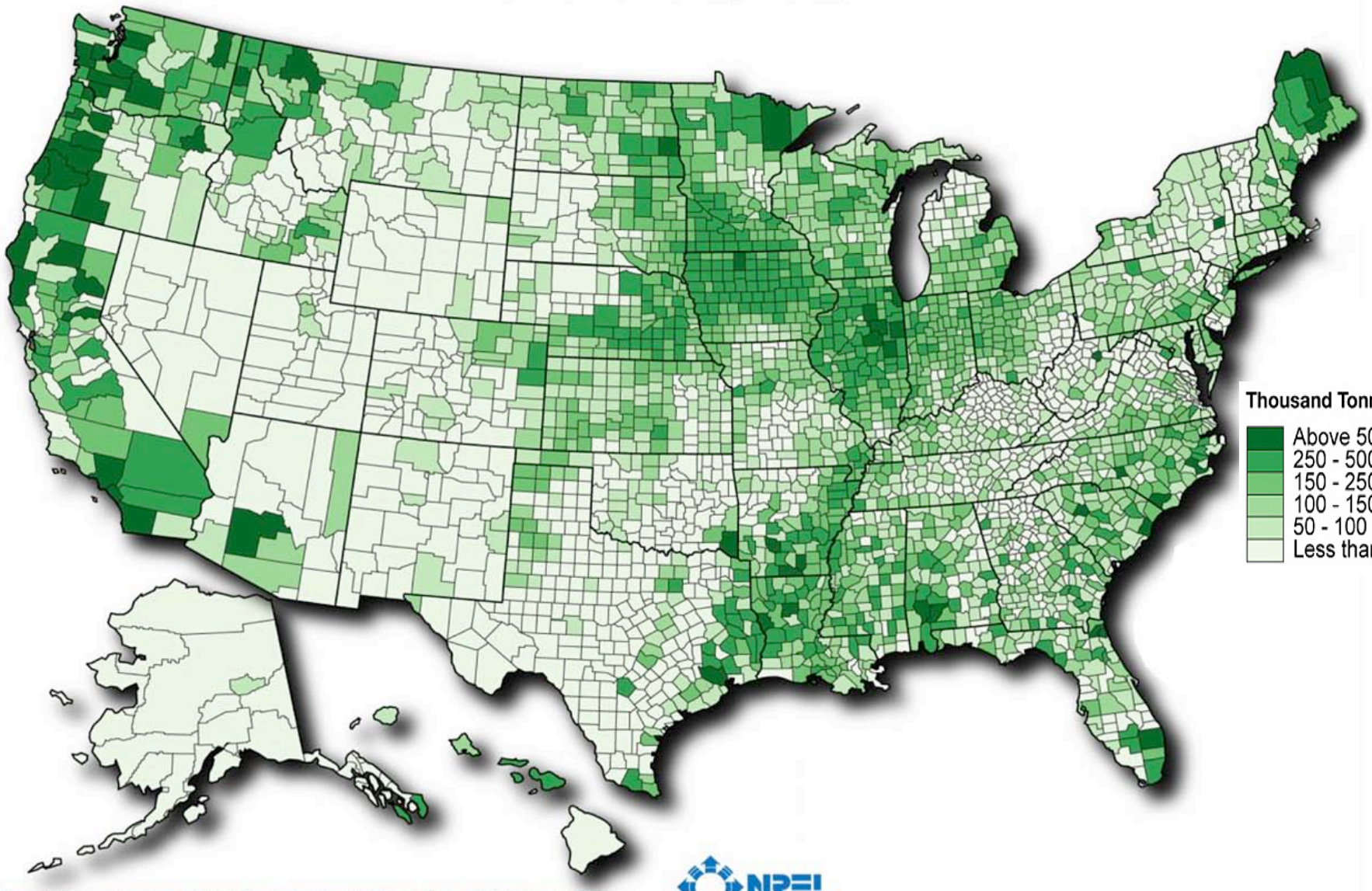
- **DOE Savannah River**
- New 20 MW wood waste cogeneration plant and two biomass heating plants
- Cost: $183 Million
- Savings $34 Million/year, 19 year contract
- 800 jobs from analysis to source supply; will employ 25 onsite and local forest industry



- **USCG Baltimore MD**
  Cogeneration Plant
  - 4 MW Electricity
  - 8,000 lb/hr Steam
- 15 year contract length
- Cost: $15 million
- Savings: $2.5 million/year

Biomass Resources of the United States

Total Resources by County



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October 13, 2009 Author: Billy J. Roberts

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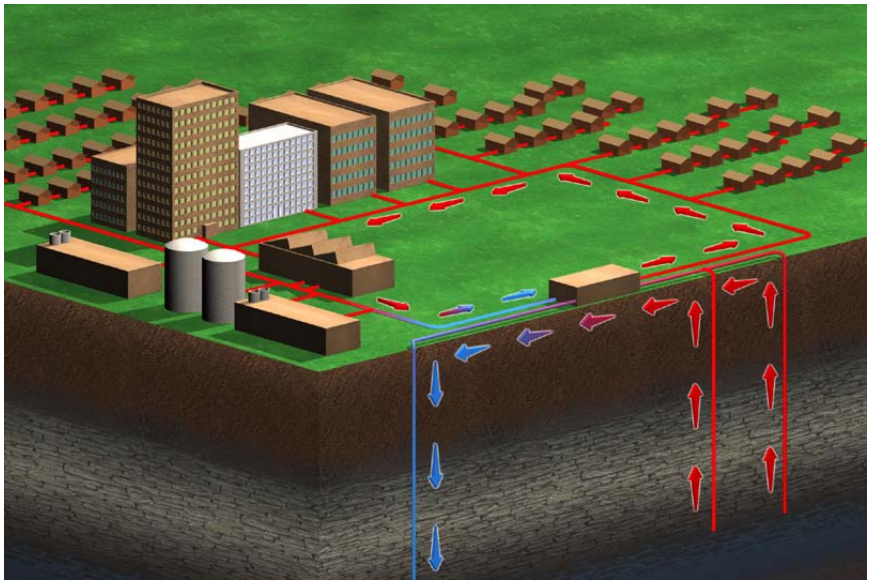
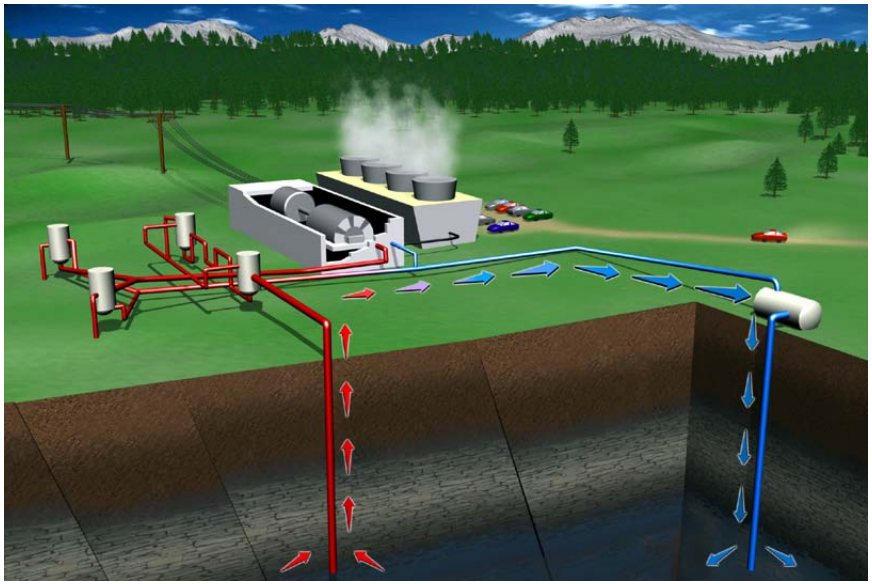
www.nrel.gov/gis

Geothermal Energy Systems





Heat Production

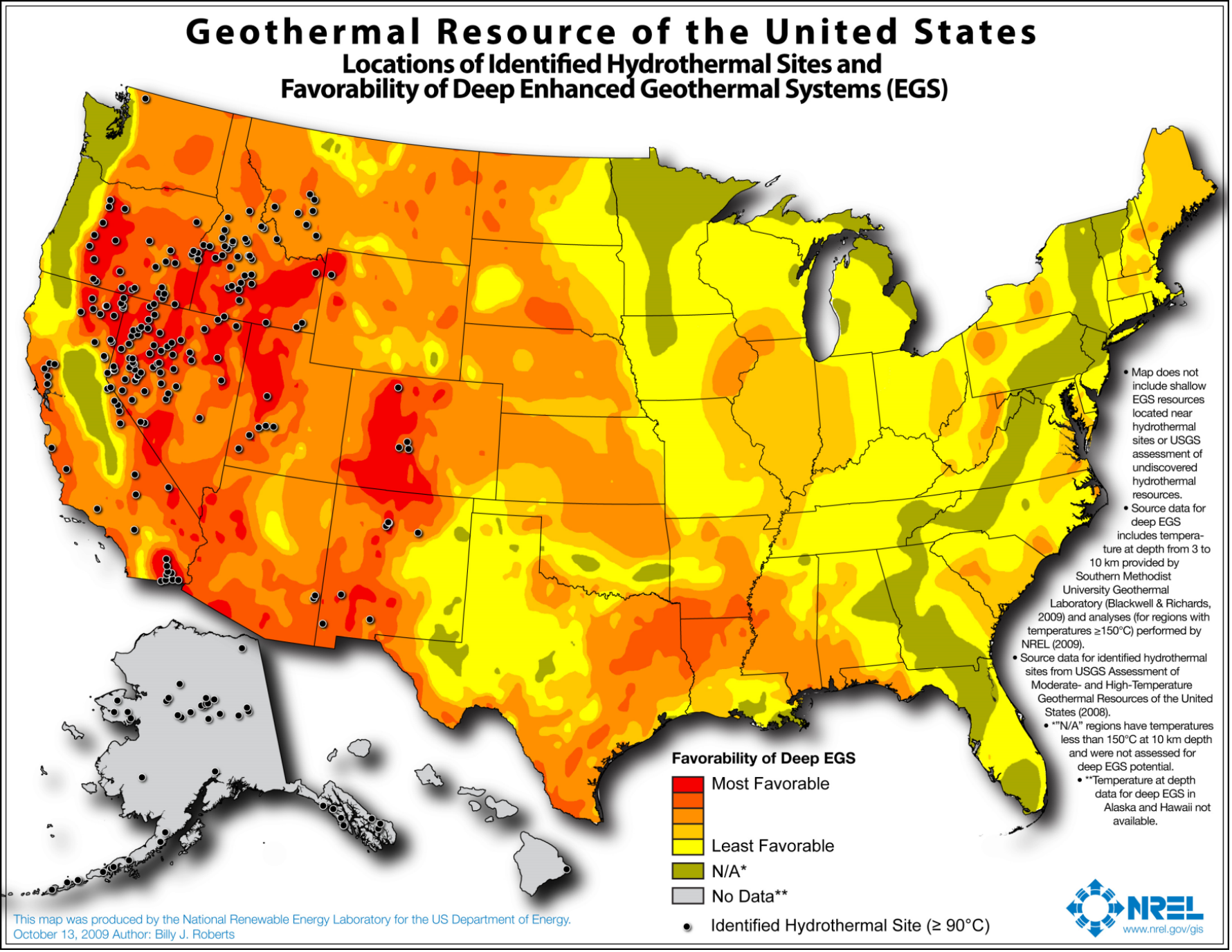
- District Heating
- Process Heat
- Agriculture
- Aquaculture

Electricity Generation

- Distributed Power
- Central Station Power

Geothermal Resource of the United States

Locations of Identified Hydrothermal Sites and Favorability of Deep Enhanced Geothermal Systems (EGS)



- Map does not include shallow EGS resources located near hydrothermal sites or USGS assessment of undiscovered hydrothermal resources.
- Source data for deep EGS includes temperature at depth from 3 to 10 km provided by Southern Methodist University Geothermal Laboratory (Blackwell & Richards, 2009) and analyses (for regions with temperatures ≥150°C) performed by NREL (2009).
- Source data for identified hydrothermal sites from USGS Assessment of Moderate- and High-Temperature Geothermal Resources of the United States (2008).
- *"N/A" regions have temperatures less than 150°C at 10 km depth and were not assessed for deep EGS potential.
- **Temperature at depth data for deep EGS in Alaska and Hawaii not available.

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www.nrel.gov/gis

Summary Comparison

Technology	Level of Commercialization.	LCOE with tax incentives	Capital Cost ($) 2011	Level of Site Impact
Photovoltaics;	Mature	$0.128/kWh to $0.154/kWh	$6,870/kW	Low, most buildings.
Solar ventilation air preheating ;	Underutilized	$0.064/kWhthermal	$27.40/sf	Medium, limited to low-heat-gain buildings
Solar water heating;	Mature	$0.08 to $0.20/kWhthermal	$75-225/sf	Medium, hot water loads only.
Solar thermal and solar thermal electric;	Mature	$0.090 to $0.145/kWh	$5,132/kW	HIgh
Biomass thermal and electric	Mature	$0.050 to $0.094/kWh	$3,995/kW	High
Geothermal Power;	Early	$0.042 to $0.069/kWh	$4,000/kW	High
Ground Source Heat Pump	Mature	$0.027/kWhthermal	$835/ton	Medium
Landfill gas;	Mature	$0.0493/kWh	$2,100/kW	Medium, virtual power from landfill
Fuel Cells;	Early	$0.115 to $0.125/kWh	$3,800/kW	Low
Wind;	Mature	$0.044 to $0.091/kWh	$1,966/kW	High

Thank You!