



# Southern USTAR TOIP

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# Agenda

- USTAR
  - TOIP Objectives
  - Focus Areas
- Renewable Energy
  - USU Biofuel
  - National and local resources
  - Emerging Technologies
  - Hybrid Technologies
- RPS (Renewable Portfolio Standard)
  - 20% / 2025
  - Projects
- So. USTAR Affiliations
- TCG Grants

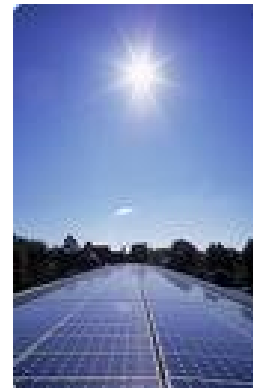


# USTAR FOCUS AREAS

- BioDevice/BioPharma
- Medical Imaging and Brain Medicine
- Nanotechnology
- Imaging Technologies & Digital Media
  - CASI
- Energy
  - Fossil Energy – Carbon Engineering
  - Biofuels
  - Intuitive Buildings
  - Alternative Energy

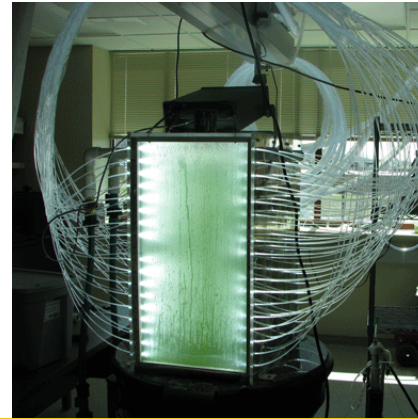
# Renewable Energy!!!

- Biomass
- Geothermal
- Solar
- Wind



# USU Biofuels

- Solar collector + growing tanks + best strain of algae = High output of lipids
- Won federal research funding
  - Potential collaboration with GA
- Pilot project
  - Locations
    - St. George
    - Fillmore
    - Vernal
    - Cedar City



The USTAR Biofuels Team has kicked off three projects that could bring more money and business to the State:

- Algae biodiesel pilot project (DOE grant via General Atomics)
- Algae-based jet fuel (DOD grant)
- Biological carbon sequestration for coal-fired power plants

# BioMass Renewable Energy

- Energy Potential Relevant to Utah...

- Algae 24,000+ gal/acre
- Others (not specific to Utah)
  - Corn 400 gal/acre
  - Soy Bean 60 gal/acre
  - Sugar Cane 800 gal/acre
  - Switch Grass 1,200 gal/acre
  - Jatropha 300 gal/acre
- Cheat Grass Biomass (USU)
- Woody Biomass (deadfall)

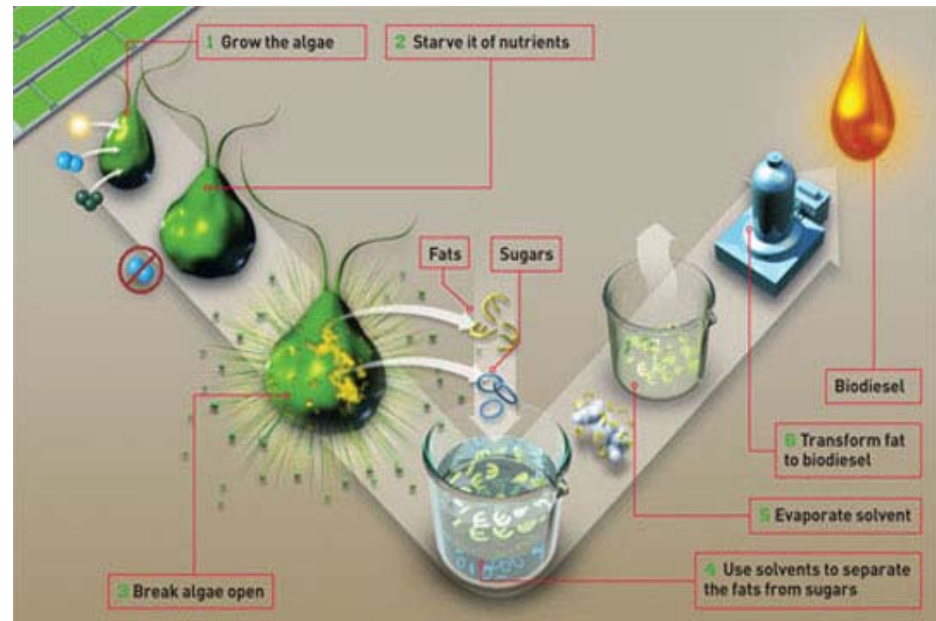


## Energy Concentration (Btu's)

Diesel	130,500
Biodiesel	128,000
Gasoline	115,000
Corn ethanol	84,000

# Technology Issues

- \$----Cost----\$
  - Dewatering
  - Collection
  - Stimulating Algae to give up their oils
- Transformation
  - To fuels, “clouding”
  - To precursor chemicals
  - To viable/valuable co-products

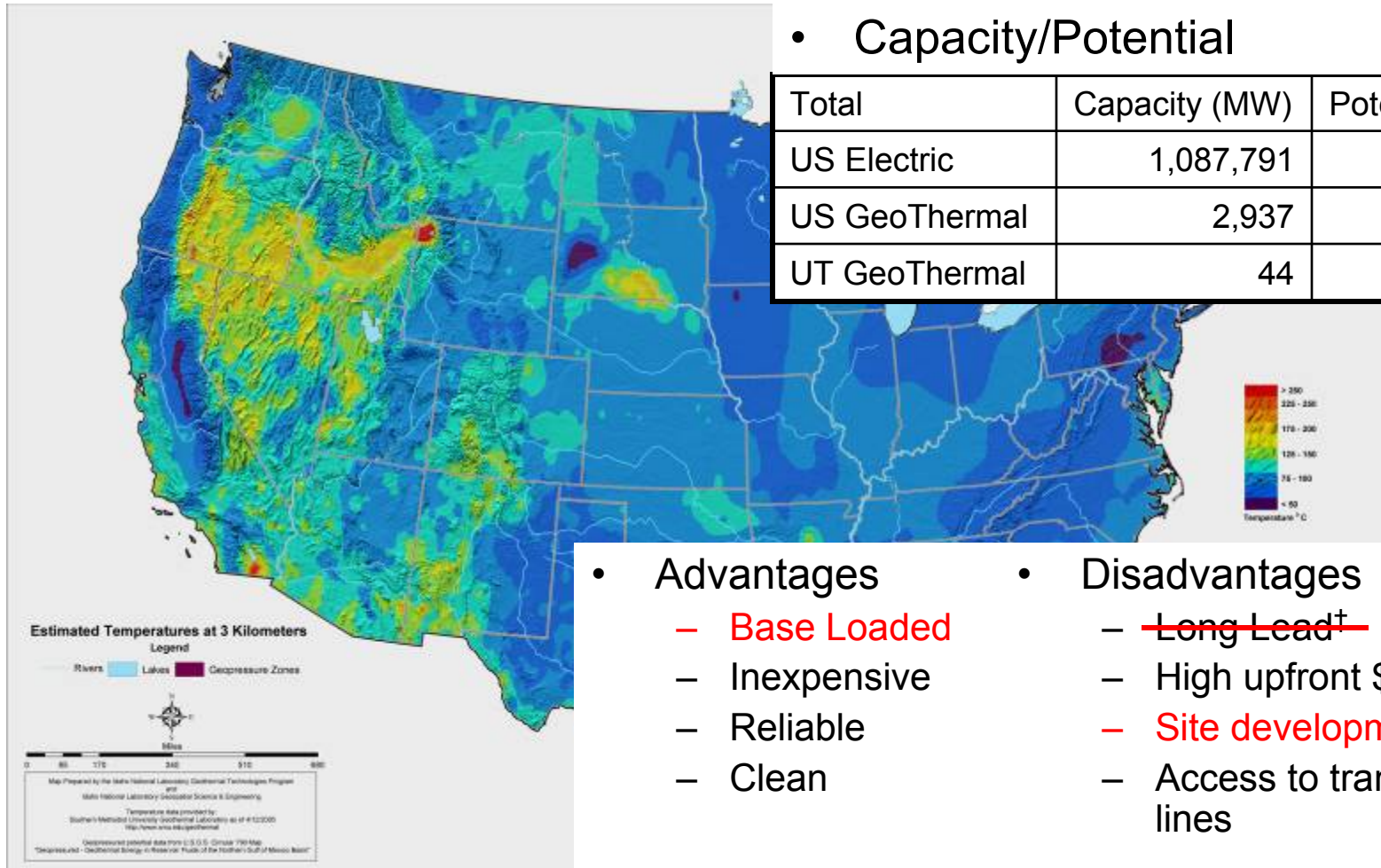


# US GeoThermal

- Capacity/Potential

Total	Capacity (MW)	Potential (MW)
US Electric	1,087,791	
US GeoThermal	2,937	39,090*
UT GeoThermal	44	2,166*

\*Estimated



- Advantages

- **Base Loaded**
- Inexpensive
- Reliable
- Clean

- Disadvantages

- ~~Long Lead†~~
- High upfront \$
- **Site development risk\*\***
- Access to transmission lines

† Raser solution

\*\* EGI opportunity

Sources: UREZ, GTEA, WREZ



# Utah GeoThermal

Total	Capacity	Proposed
1 - California	2,541 MW	1,037 MW
2 - Nevada	310 MW	1,500 MW*
3 - Utah	44 MW	244 MW

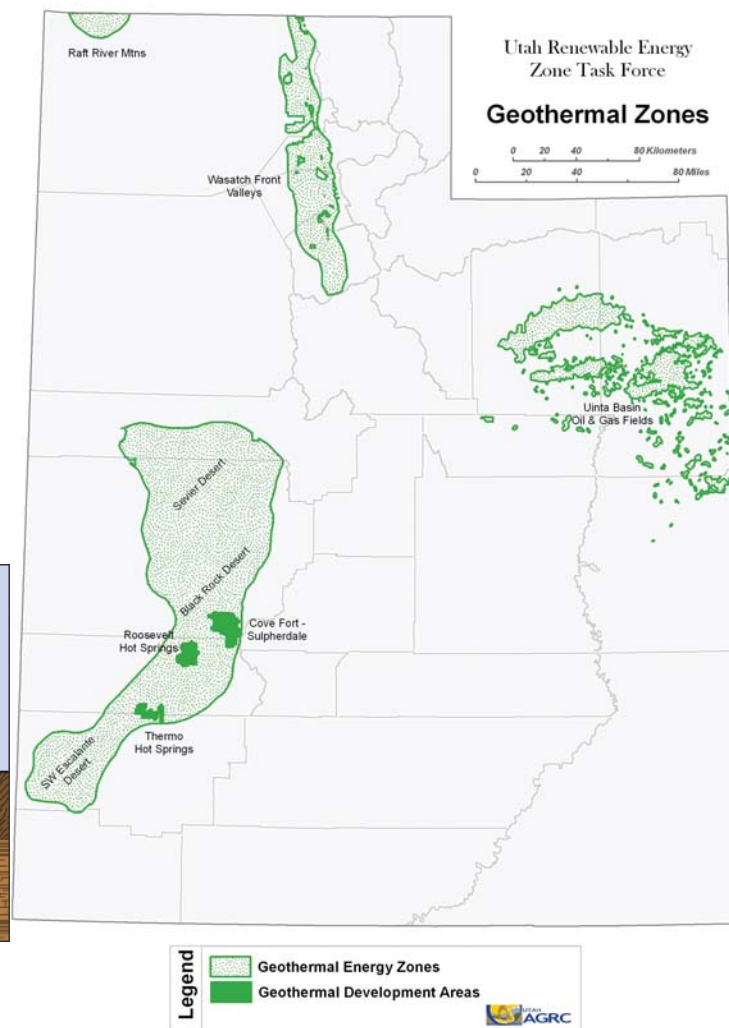
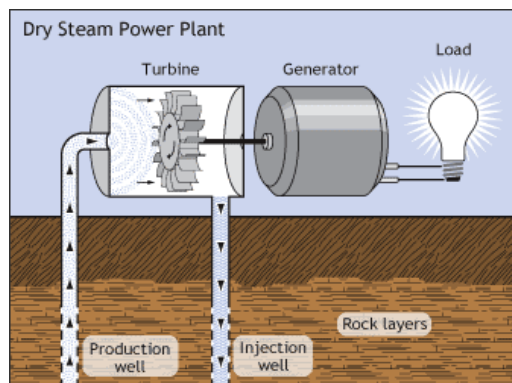
- Technology
  - 1<sup>st</sup> Gen: Dry Steam
  - 2<sup>nd</sup> Gen: Flash (Blundell, PC)
  - 3<sup>rd</sup> Gen: Binary (Thermal, Raser)

- Advantages

- Proximity to S.Ca
- Open lands
- Utah Companies
- EGI

- Disadvantages

- Water
- Access to transmission lines
- Land/environmental



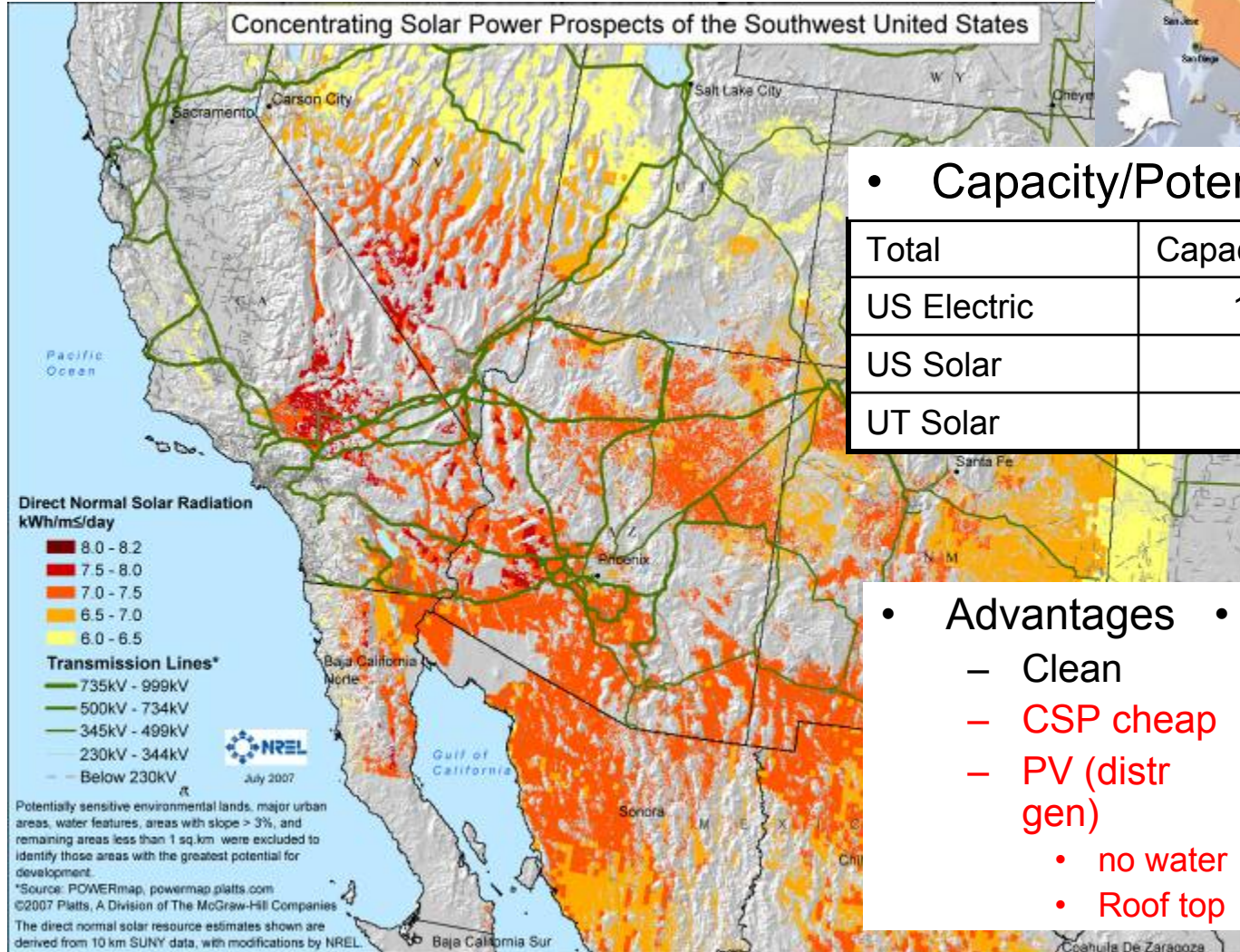
Sources: UREZ, GTEA, WREZ



# US Solar



Concentrating Solar Power Prospects of the Southwest United States



- Capacity/Potential (CSP/PV)

Total	Capacity (MW)	Potential (MW)
US Electric	1,087,791	
US Solar	1,293*	≥10,000,000
UT Solar	0.8	75,000**

\*2007: CSP 419; PV 874  
\*\*Max, no efficiency calcs

- Advantages
  - Clean
  - CSP cheap
  - PV (distr gen)
    - no water
    - Roof top
- Disadvantages
  - PV, expensive
  - Not base loaded
  - Expensive trackers

Sources: UREZ, GTEA, WREZ



# Utah Solar

Total	Capacity (MW)	Proposed (MW)
1 - California	853	4,500*
2 - Nevada	79	20,960*
3 - New Jersey	69	N/A
29 - Utah	0.8	0.1

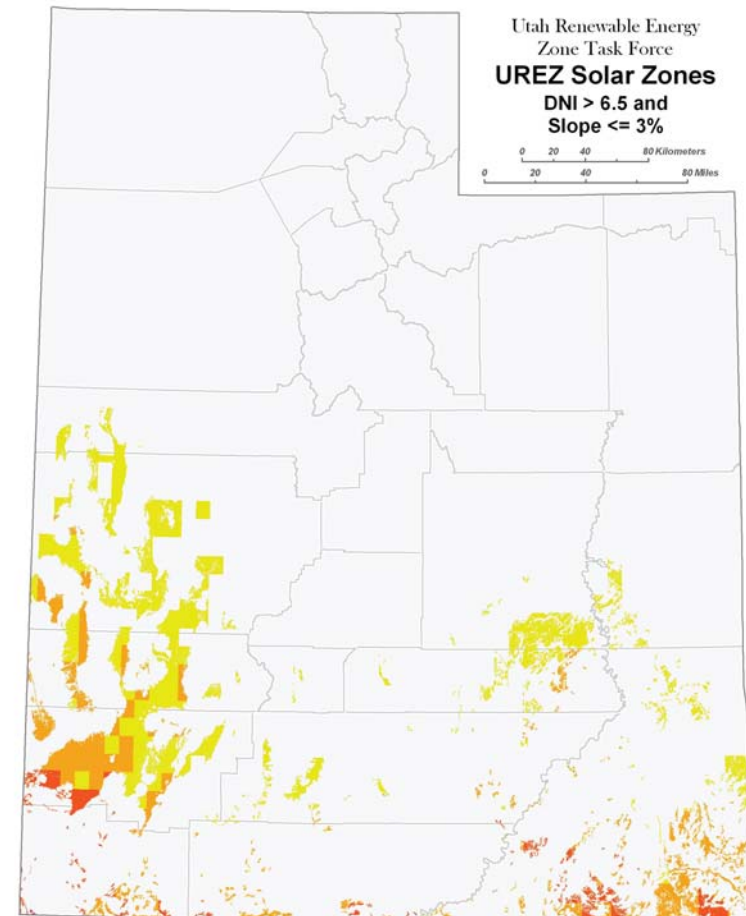
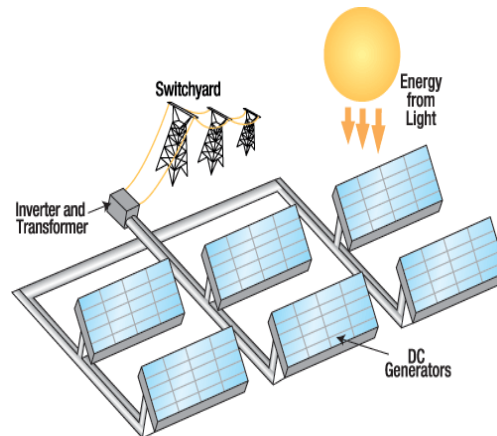
- Technology
  - 1<sup>st</sup> Gen: CSP, Rigid PV
  - 2<sup>nd</sup> Gen: Thin film PV
  - 3<sup>rd</sup> Gen: CPV

- Advantages

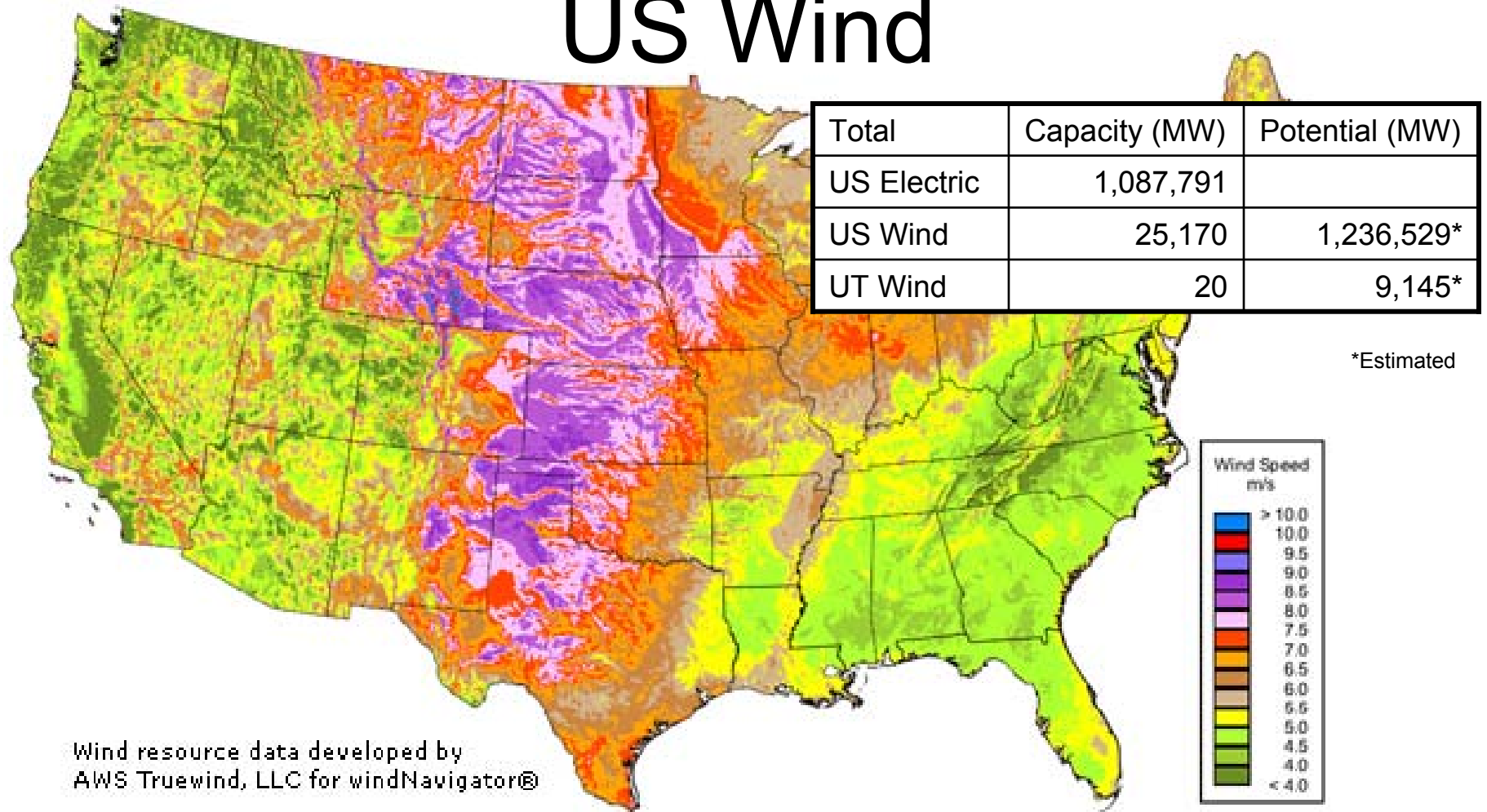
- Proximity to S.Ca
- Open lands
- Jobs (CSP)
  - 40-50 per plant

- Disadvantages

- Water (CSP)
- No Utah Companies
- Access to transmission lines
- Land/environmental



# US Wind



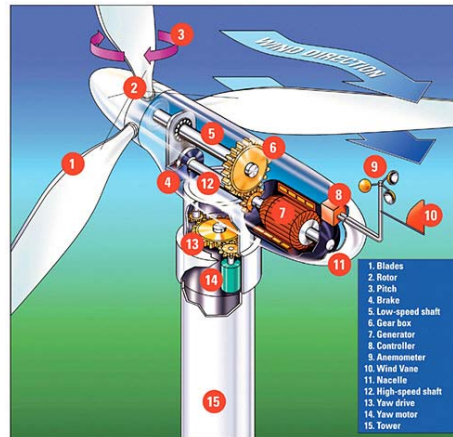
Wind resource data developed by  
AWS Truewind, LLC for windNavigator®

- Advantages
  - Clean
  - Cheap
  - Dual use
- Disadvantages
  - Not base loaded
  - Predictability\*
  - Transportability

# Utah Wind

Total	Capacity (MW)	Proposed (MW)
1 – Texas	7,116	1,651
2 – Iowa	2,790	20
3 – California	2,517	275
29 – Utah	20	203

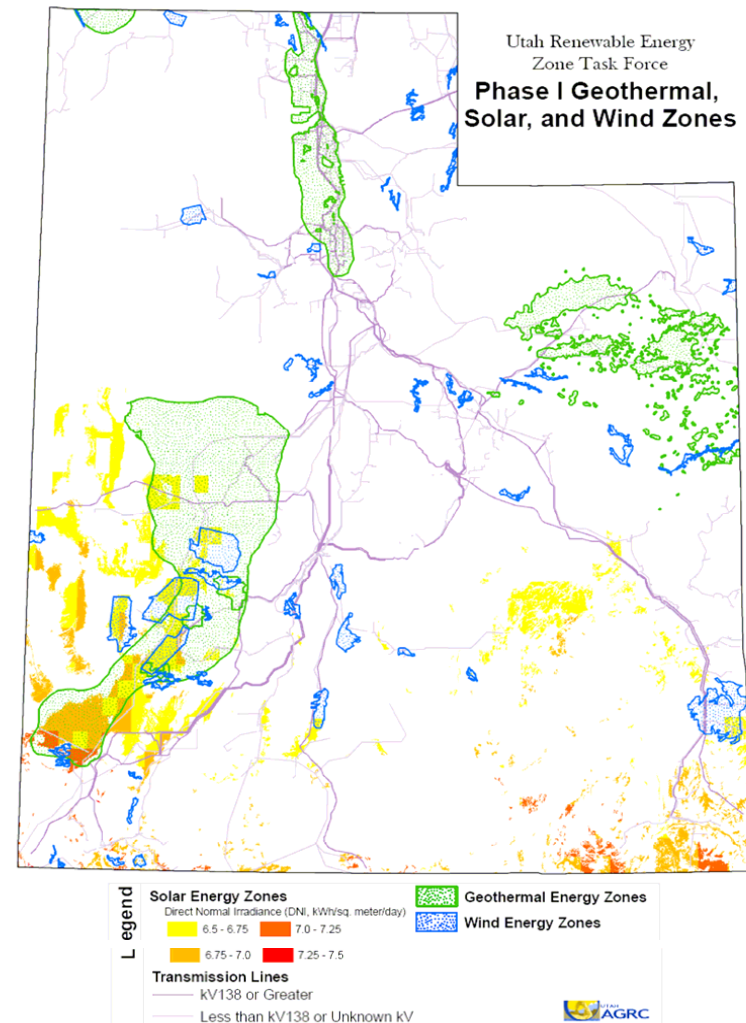
- Technology
  - Blades
  - Generator
  - Tower
- Advantages
  - Proximity to S.Ca.
  - Open lands
  - No water use
- Disadvantages
  - Limited Resources
  - Access to transmission lines
  - Land/environmental
  - No Utah Companies



# Utah Resource Overview

- Electricity capacity (MW)\*
  - Total Current: 7,075
  - Fossil: (92%) 6,535
  - Renewable goal<sup>†</sup> 2,000
- Facts about Utah
  - Renewables: 44<sup>th</sup>

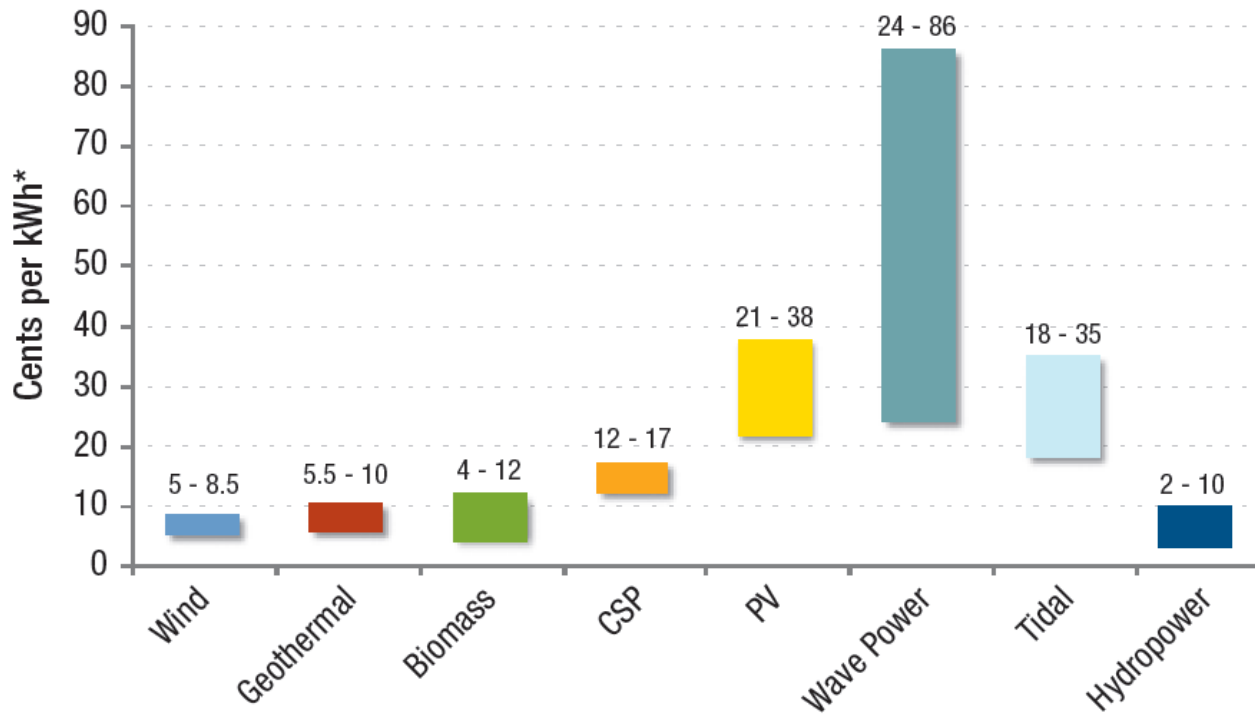
Type	Current	Planned	Potential
Solar	0.8 MW	0.1 MW	75,000 MW
Wind	20 MW	203 MW	2,750 MW
Geo*	44 MW	244 MW	2,166 MW
Total	65 MW	447 MW	79,916 MW



\*<http://geology.utah.gov/emp/energydata/electricitydata.htm>

<sup>†</sup> Governor Hunstman goal: 1,800MW, includes some growth

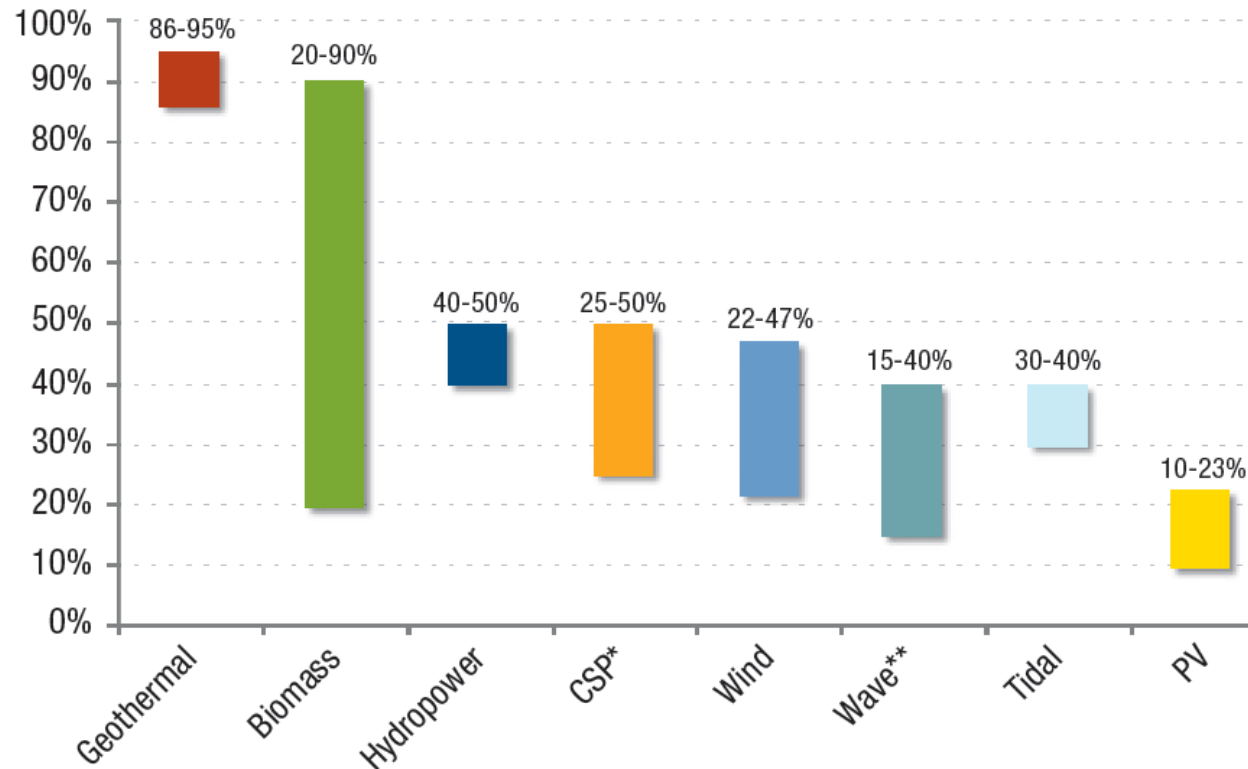
# Amortized Cost for RE



\* Average cost will vary according to financing used and the quality of the renewable energy resource available.

Sources: Sandia National Laboratory, Idaho National Lab, Carbon Trust, Simmons Energy Monthly, U.S. DOE EERE, California Energy Commission, IEA, SolarBuzz LLC

# Generation Capacity



\* CSP reaches the upper part of this range when systems are combined with natural gas co-firing

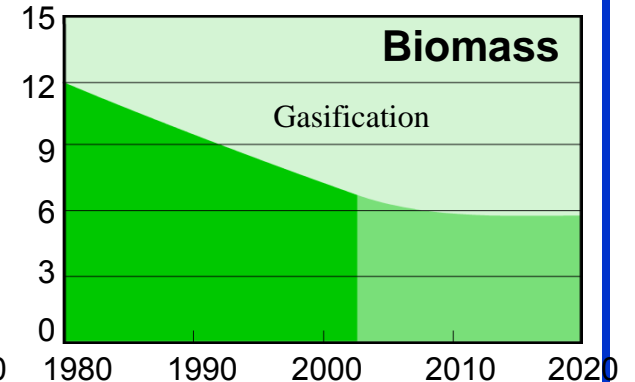
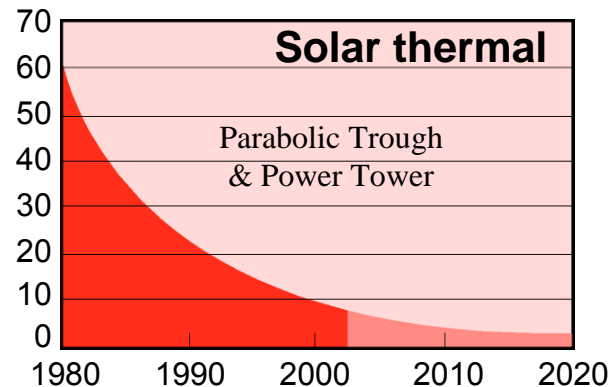
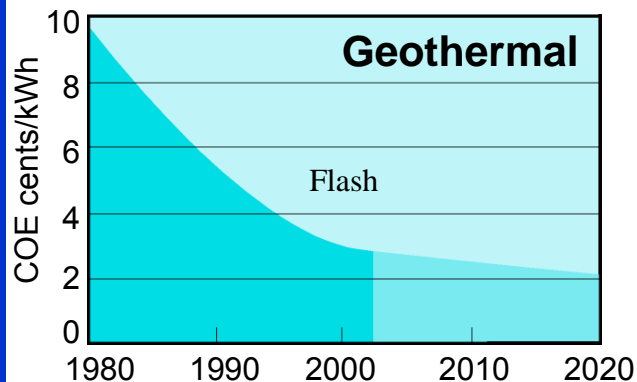
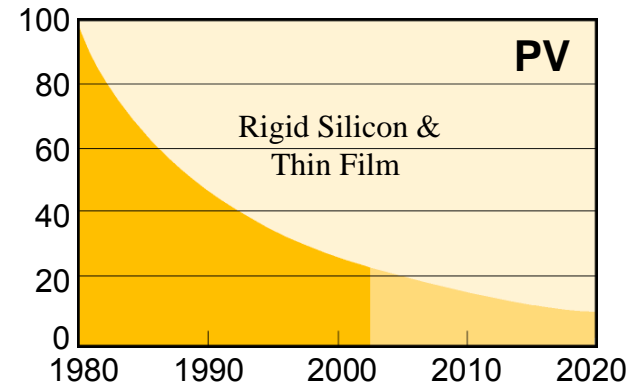
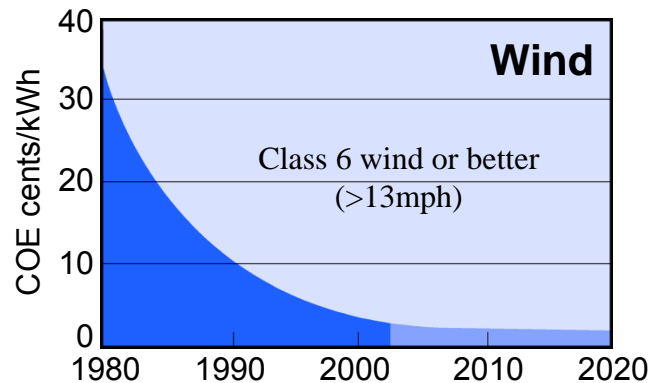
\*\* This range is derived from experimental wave installations

Sources: EERE, GEA, NREL, Idaho National Lab, EPRI, Ocean Power Delivery LTD, Simmons Energy Monthly

- Percentage of the time generating (typical)

# Renewable Energy Cost Trends

Levelized cents/kWh in constant \$2000<sup>1</sup>



Source: NREL Energy Analysis Office ([www.nrel.gov/analysis/docs/cost\\_curves\\_2002.ppt](http://www.nrel.gov/analysis/docs/cost_curves_2002.ppt))

<sup>1</sup>These graphs are reflections of historical cost trends NOT precise annual historical data.

Updated: October 2002

# O&M Direct Job Creation

Type	Current	Planned	Potential
Solar	0.8 MW	0.1 MW	75,000 MW
Wind	20 MW	203 MW	2,750 MW
Geo	44 MW	244 MW	2,166 MW
Total	65 MW	447 MW	79,916 MW

Type	Jobs Factor	Planned	Potential
Solar	1 per 2 MW	0	37,500
Wind	1 per 20 MW	10-12	138
Geo	1 per MW	244	2,166
Total		254	1k-2k



## USTAR TOIP Role

1. **Assist** in site selection/development
2. **Broker** services with USU/UU
3. **Connect** to state agencies
4. **Engage** with ED professionals
5. **Screen** for synergistic opportunities
6. **Disseminate** info & tech developments

# Emerging Technologies

## Wind

- CASI- USU (Lidar)
- Gearless Turbines
- Floating Turbine
- Vertical Axis “Egg Beater”



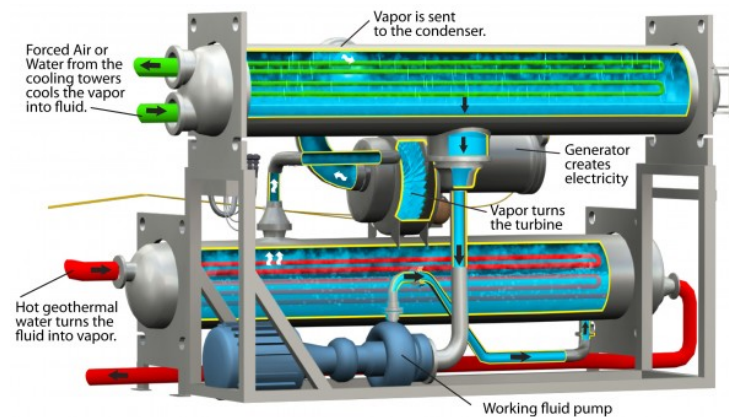
## Solar

- Printing Semiconductor
- Concentrated PV
- Nano-Cells



## Geothermal

- Binary
- “Bottom Cycling”

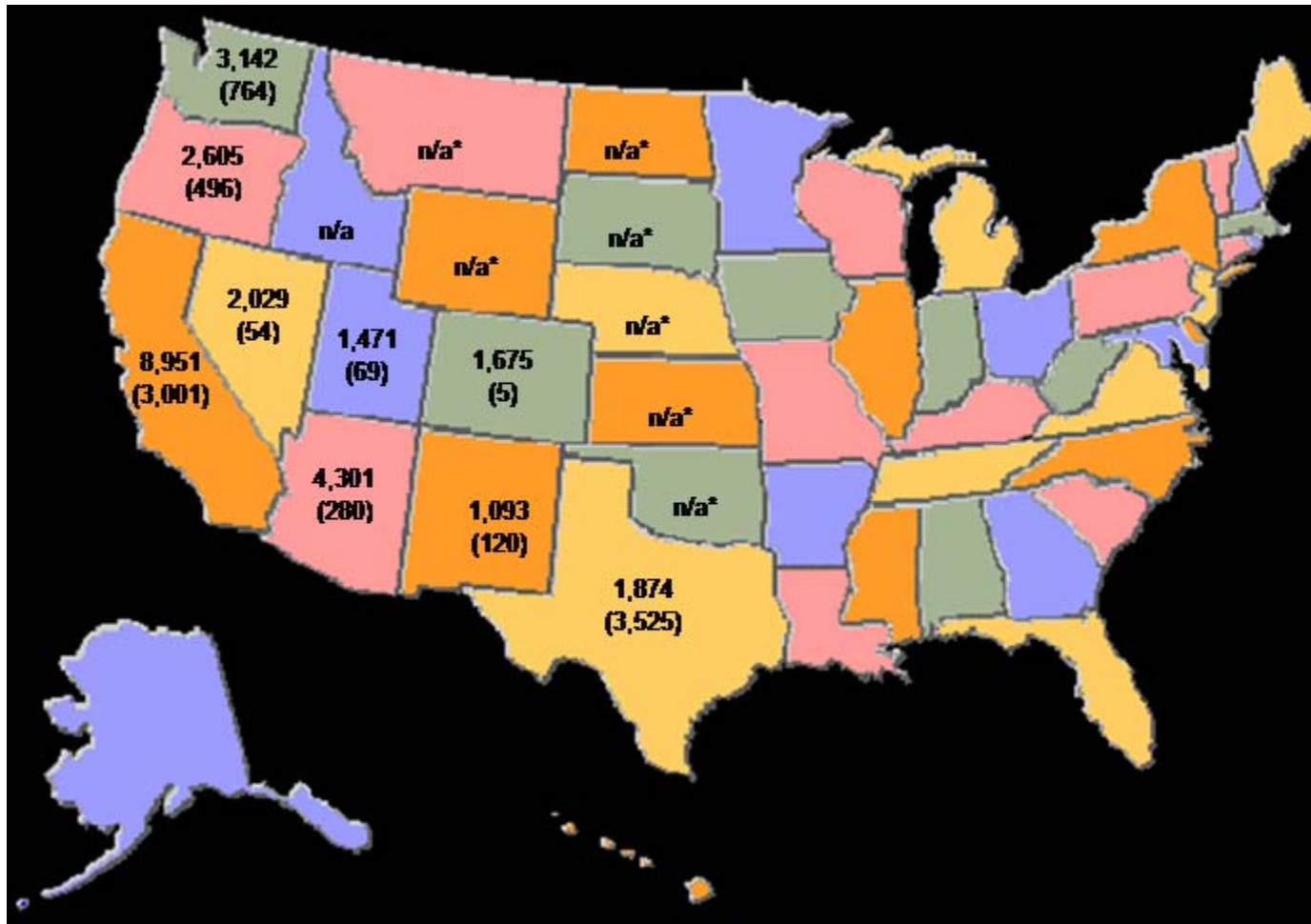


# Hybrid Technologies

- Corsa Motorsports
  - Bio-diesel
  - Battery Tech
    - Rapid discharge/recharge
    - Cooling technologies
    - Assistive drive
- H2O Performance
  - Adding Hydrogen to fuel mix
- Raser Tech
  - 100 MPG Hummer
- Solar Cars/Motorcycles
  - SUU CIET
- Hybrid Solar
  - Dual applications of CSPV & Geo



# Megawatts Needed to Reach RPS Goals by State as of 2007 (Planned Projects in Megawatts)



# RE Active Projects

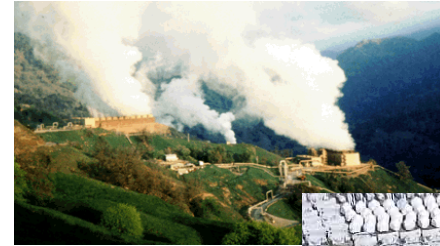
- First Wind (Milford Wind Corridor)
  - Key Contacts
    - Peter Sullivan – Development coordinator and board liaison
    - Shelly Teuscher – Gov't relations director
  - Phase I
    - 200 MW
    - 97 wind turbines (GE and Clipper)
    - 90 mile transmission line
  - Phase II
    - 100 MW
    - 68 wind turbines (GE and Clipper)
- Wasatch Wind
  - Key Contacts
    - Christine Mikell – Senior project development manager
    - Michelle Stevens – Director of marketing and communications
  - Spanish Fork Wind Farm (Edison Int'l)
    - 18.9 MW
    - 9 towers with 2.1 MW Suzlon turbines
- Raser Tech.
  - Key Contacts
    - Layne Ashton – Western Regional Project Manager
    - Issa Arnita – Director of Public Relations
  - Thermo Hot Springs
    - 10 MW Binary Geothermal Plant
- Sun Smart
  - Key Contacts
    - Brandie Gillette – PR manager
  - St. George Solar Farm – community owned
  - Phase 1 - 100 KW photovoltaic



# RE Planned Projects

## Planned RE Projects

- First Wind – Milford Wind Corridor
  - Phases II to V - 800 MW
- Wasatch Wind – New Harmony Mtn's
  - Anemometer data currently being collected
- Mountain West Wind – Escalante Desert
  - Anemometer data currently being collected
  - Funding via T. Boone Pickens / State Incentives
- Raser Tech.
  - SL County demonstration facility
  - Central Utah Plant ~20 MW
- Newcastle Geothermal
  - Joint venture for hybrid technology
- Blundell Geothermal
  - Expand upon current thermal field - introduction of new plant
- Enel North American
  - Cove Fort ~69 MW
- Idatherm
  - Renaissance Honeyville ~100 MW
- Sun Smart – St. George
  - Phase 2 - 100 kW photovoltaic



# Focus Groups

- SUTREC – Southwest Utah Renewable Energy Center
- Dixie Tech's & Cedar Tech's (Southern Utah Technical Council)
  - Technical and renewable energy focus & networking groups
- Southern Utah Dixie Angels
- Business Resource Center (BRC) at SUU and Dixie Business Alliance at DSC - one stop shops for business
  
- ITRE Incubators at SUU/Dixie
- UREZ – Utah Renewable Energy Zones
  - Phase 1: Identify Zones for geothermal, solar, and wind
  - Phase 2: Transmission Corridors

# ITRE – Institute of Technology and Renewable Energy

- Physical space & virtual
- Dixie Business Alliance Pilot project- two tech businesses- 9 employees
- SUU project – Searching for right companies
- 14 companies virtual incubation
- \$600 K EDA grant application – partners SUU, DSC, DXATC, Paiute Tribe, other corporations

# SUTREC

## Southwest Utah Renewable Energy Center

- MISSION STATEMENT

*The Southwest Utah Renewable Energy Center (SUTREC) showcases and promotes renewable energy in the resource-rich area of Beaver County and Southwest Utah. SUTREC Partners cooperate to advance renewable energy education, training, research, technology and production leading to high-skill, high-wage employment, Career and entrepreneurial opportunities.*

- PARTNERS

SWATC, USTAR, SUU Regional Services, SBDC, Beaver County School District, Beaver County Economic Development, Milford HS

- ACCOMPLISHMENTS

RE Fair, State Senate Resolutions, Training and Education, Funding Awards, Website, Work plan and by laws

*RE Fair – more than 600 participants*



# So. USTAR TOIP TC Grants

- These grants will assist faculty and industry to prototype, test, assess markets, and commercialize new products and services in high-growth markets.
- SUU
  - CCA Turbine Bio Fuel: Robert Fulton (\$30K)
    - Algae Biomass Dry, Micro-sized
  - Aries Technologies: Steve Pruitt (\$55K)
    - Assistive Drive Technology
  - IDT: Jason Pitt (\$30K)
    - Rail hub identification cap
- Dixie Applied Tech College
  - H2O Performance – Art Jeffs (\$30K)
    - Hydrogen/Oxygen gaseous additive
  - True Scale Technologies – Matt Excell (\$40K)
    - USB Port cloud tech access
- Dixie State College
  - SAT Logger: Metridyne (\$38K)
    - Water tension meter



# So. USTAR Concept to Company winners

General Tech contest held April 9 in St. George

- Vehicall – aftermarket auto upgrade that will allow the consumer to lock or unlock their vehicle from any phone..
- Smack Dab Laser – Laser construction layout for small contractors
- Walk 'N Roll – New rollator/walker design with semi-automatic front facing seat.

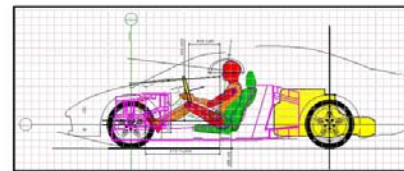
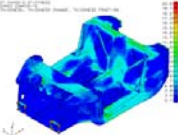
# Summary

- RE Resources
  - Adequate
  - Largely undeveloped
- Technology
  - Mature in most cases
  - Cost leveling out
- Research
  - Next generation
  - Niche Possibilities
- Utah Companies
  - Few
  - Capital will be key



e piphany  
energy

Ultra  
For



# Renewable Electricity Technology Cost Trends

## Chart Notes, Page 1

### Background

- The Cost Curves are expressed in constant, 2000 year dollars and based on a uniform set of financial assumptions consistent with Generating Company Ownership (balance-sheet financing).
- Actual project costs can vary substantially – not only over time, but from project to project – based on variables such as siting and permitting costs, land costs, transmission access, labor costs, and financing terms.
- The Cost Curves are **not based on specific project data**, but are composite representations derived from a variety of sources outlined below.
- Historic costs from 1980 to 1995 generally reflect costs that were published in various DOE Renewable Energy Program plans such as five-year program plans, annual budgets, and other program publications.
- The Future Cost Curves generally reflect how the DOE Renewable Energy Programs expect the costs of renewable energy to decrease through lowered technology costs and improved performances, resulting from R&D efforts and other factors.
- Projections of cost to 2020 for biomass, geothermal, and photovoltaic energy technologies are based on the DOE/EPRI Renewable Energy Technology Characterizations published in 1997. Wind and solar thermal costs represent more recent DOE Renewable Energy Program projections.
- The Cost Curves generally assume the availability of high-quality resources. This is an important point because systems using lower quality resources are being built, in some cases with costs as much as double those shown.
- The Cost Curves do not include the effects of tax credits or production tax incentives.

# Renewable Electricity Technology Cost Trends

## Chart Notes, Page 2

### General Observations

- The renewable technology cost trends typically show a steep decline from 1980 to the present. Projections show this decline to continue, but at a slower absolute pace as the technologies mature.
- Historic cost of energy trends reflected in this chart are in broad agreement with the trends published in “Winner, Loser, or Innocent Victim? Has Renewable Energy Performed as Expected?” Renewable Energy Policy Project, Report No. 7, April 1999.

### Technology Specific Notes

- **Wind technology cost projections represent wind power systems in locations with Class 6 resources.** Low wind-speed turbine technology is under development, which will make available large amounts of usable wind resources that are closer to transmission. Lower costs will result from design and technology improvements across the spectrum from foundations and towers, to turbine blades, hubs, generators, and electronics.
- **Biomass cost projections are based on gasification technology.** Lower costs will result from technology improvements indicated by current pilot plant operations and evaluation, including improvements in feedstock handling, gas processing/cleanup, and overall plant design optimization.
- **Geothermal cost projections are for Flash technology.** Cost reductions will result from more efficient and productive resource exploration and characterization as well as from continued improvements in heat exchangers, fluid-handling technologies, turbines, and generators.
- **Solar thermal cost projections are for Parabolic Trough and Power Tower Technologies** and are based on a detailed due-diligence study completed in 2002 at the request of DOE. Cost reductions will result from improved reflectors and lower-cost heliostat designs, improved solar thermal receivers, heat exchangers and fluid handling technologies, and turbines and generators, as well as from volume manufacturing.
- **Photovoltaic cost projections are based on increasing penetration of thin-film technology** into the building sector. Likely technology improvements include higher efficiencies, increased reliability (which can reduce module prices), improved manufacturing processes, and lower balance of system costs through technology improvements and volume sales.

