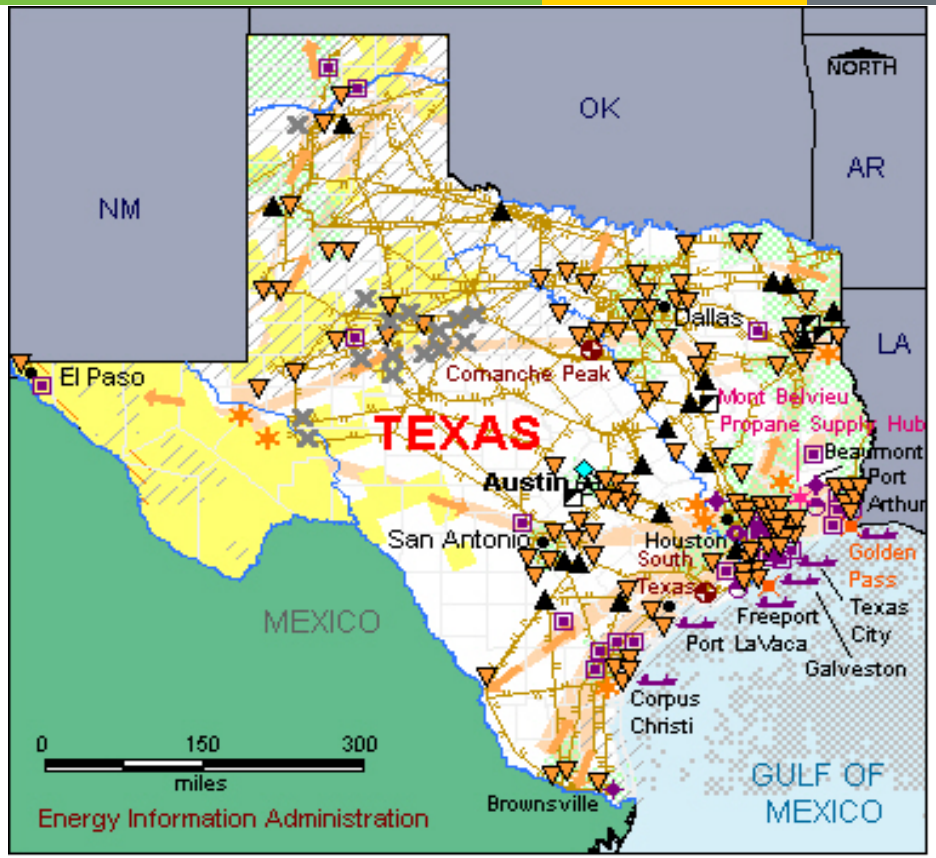


Analysis & Tools to Spur Increased Deployment of "Waste Heat" Rejection/Recycling Hybrid GHP Systems in Hot, Arid or Semiarid Climates Like Texas

May 19, 2010

Principal Investigator (always include)
Glenn Masada
University of Texas at Austin

Ground Source Heat Pumps Demonstration Projects

Mandatory Overview Slide

Timeline

Project start date: June 1, 2010

Project end date: December 31, 2011

Budget

Total Project Funding:	$313,200
DoE Share:	$250,000
Awardee Share:	$63,200

Barriers—none

Partners: Central Texas GHP Systems Consortium

Solennium	Climate Master
Austin Energy	Good Company Associates
ToolWerks	Austin Technology Incubator
Solar Array Ventures	TexasIsHot

Relevance of Project: Motivation

Texas: Energy Production/Consumption

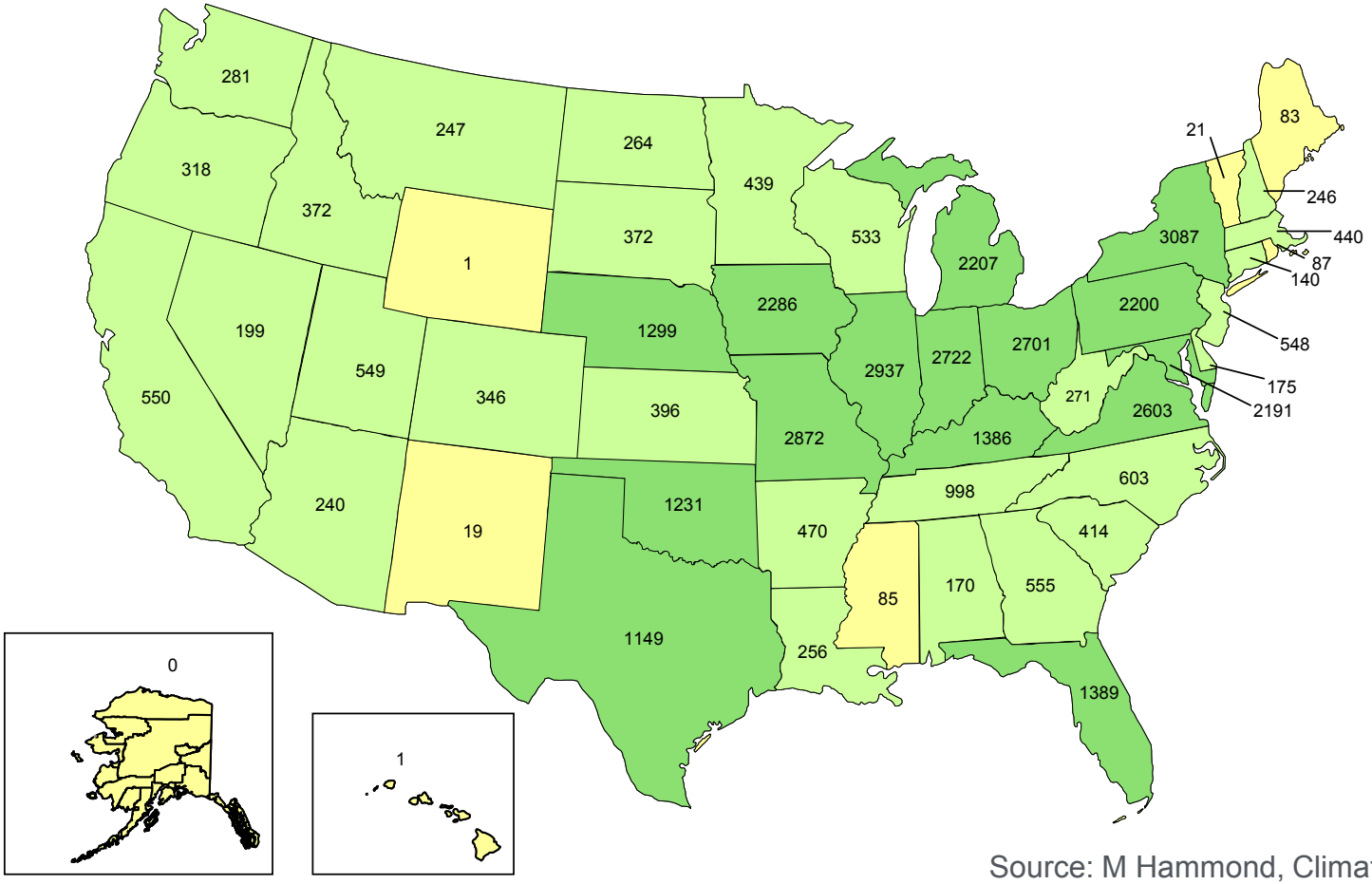
- 1st in crude-oil production and consumption
- 1st in natural gas production and consumption
- 1st in electricity production and consumption
- 1st in coal consumption
- 1st in wind energy production
- Largest nuclear reactors (S-TX) until recently
- 1st in the number of oil/gas wells drilled
- ERCOT controls 75% of TX electricity

http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=TX

Relevance/Impact of Research

BUT, Texas is:

- 15th in GHP installations: 2006

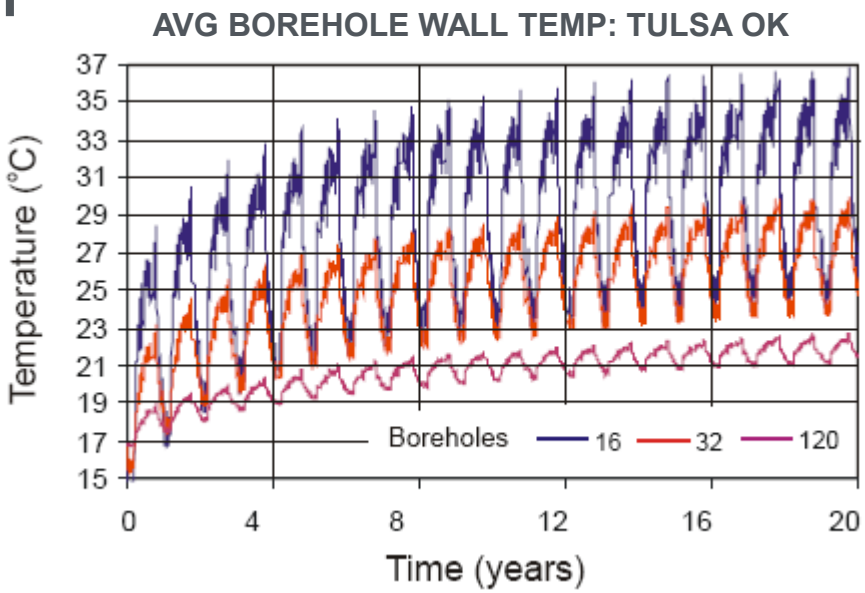


Source: M Hammond, ClimateMaster

How can we make Texas 1st in GHP installations?

Barriers to GHP Use in Texas

- Public Awareness/Education
- Upfront Costs
- Long cooling season
- 'Bad' Initial Experiences
- Geology/Hydrology

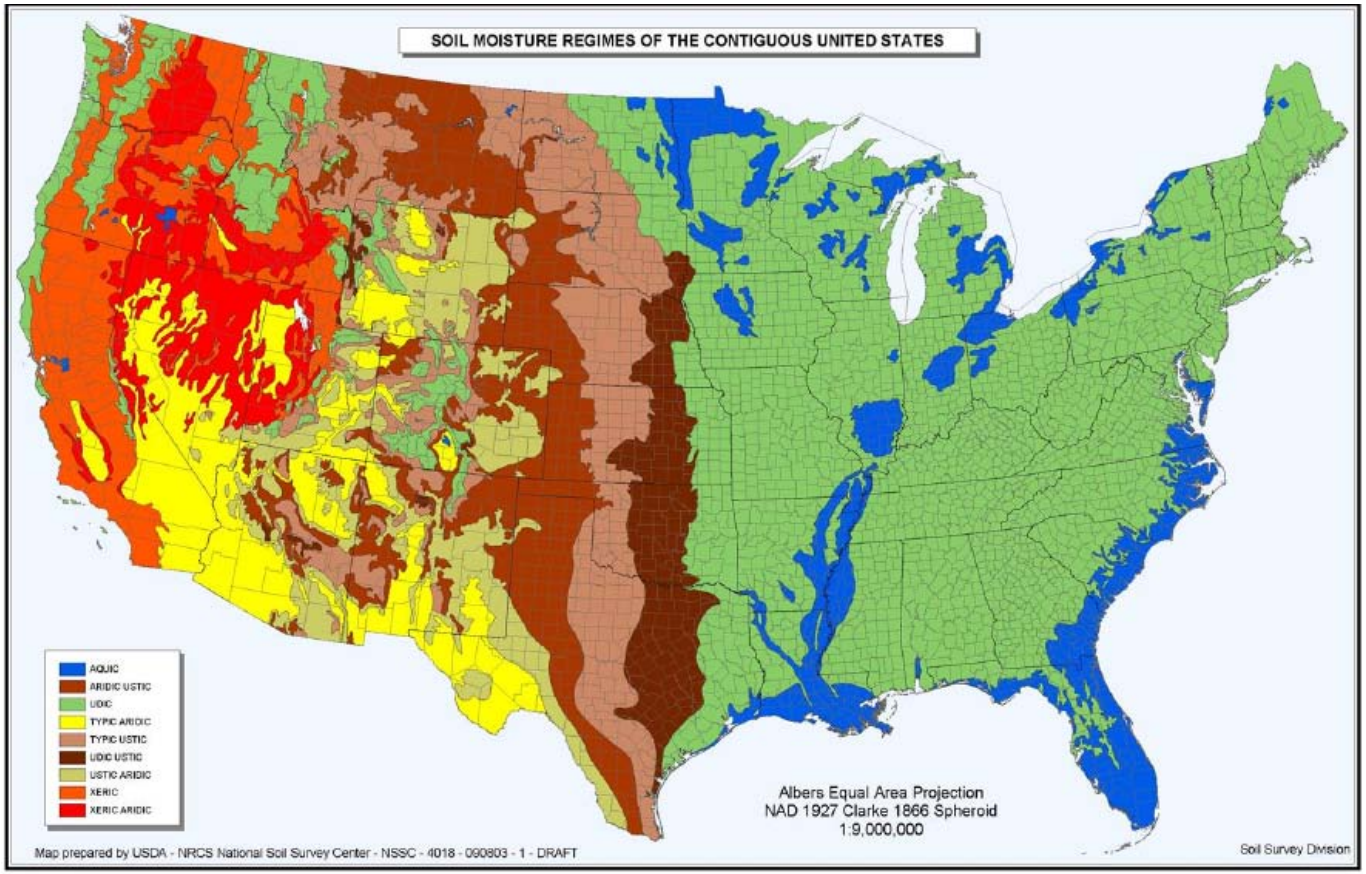


Source: D. Fisher, S. Rees 2005

Texas Geography/Hydrology: Soil Moisture

TX has 6 regions

Central/West
Low moisture



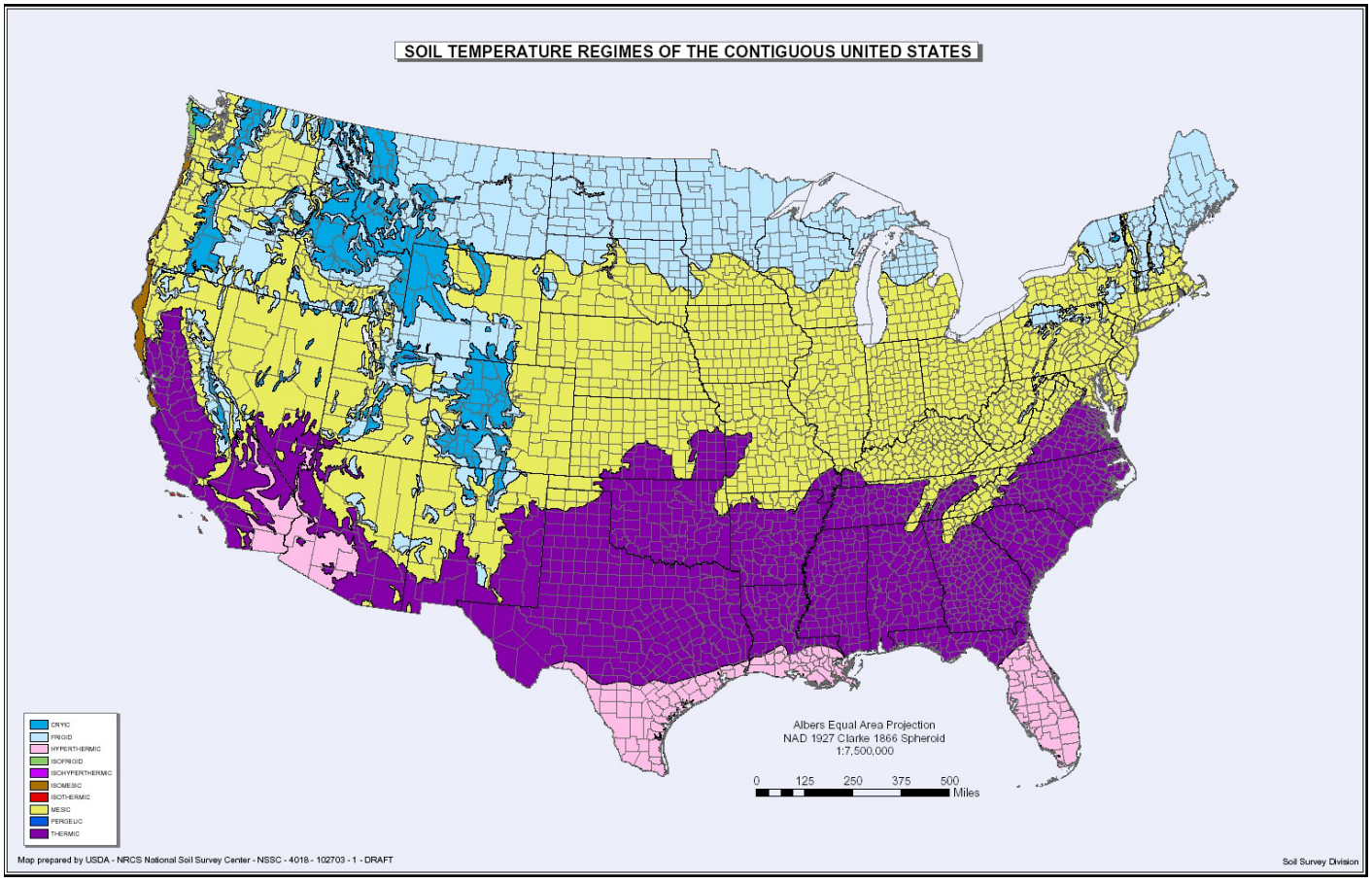
Texas Geography/Hydrology: Soil Temperature

Higher soil temps

Texas is HOT

Highest Air Temps

- El Paso (114F)
- DFW (113F)
- Austin (112F)
- San Antonio (111F)

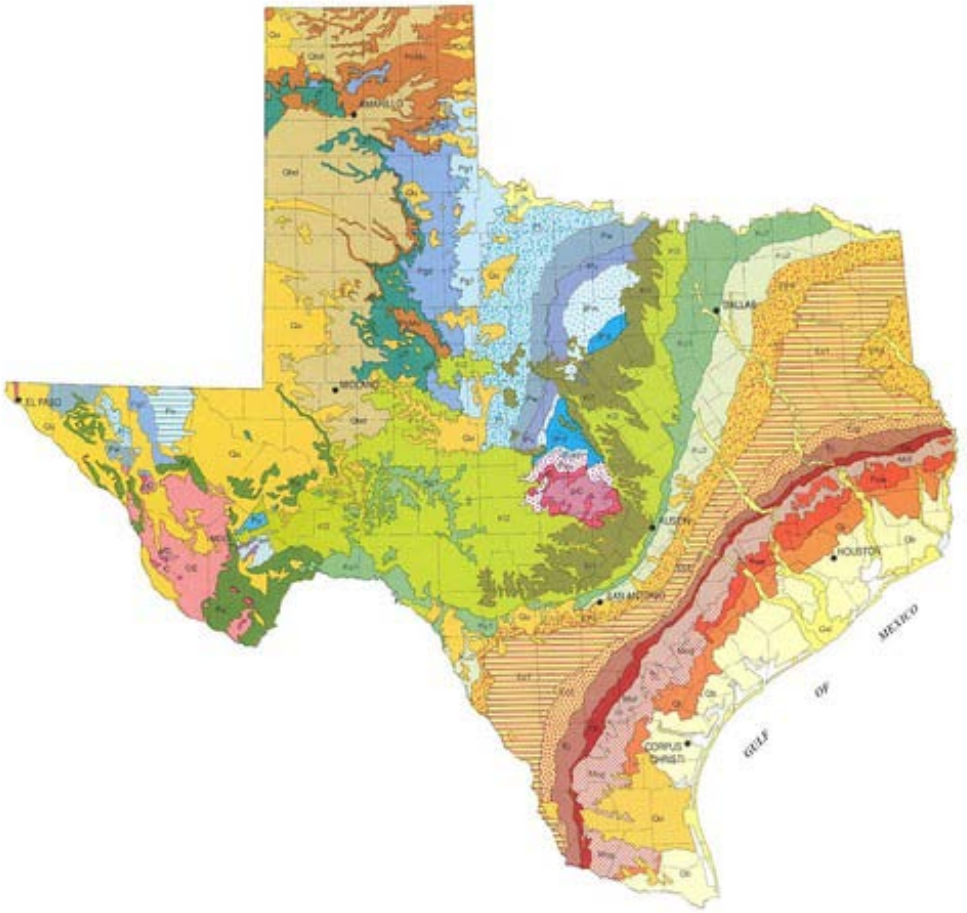


Texas Geography/Hydrology: Geology

Microcosm of US South, Plains, Gulf Rockies

Examples

- Sandstone
- Shale
- Cretaceous shale
- Limestone
- Precambrian gneiss
- Schist
- Granite
- Cretaceous/Pennsylvania strata



University of Texas Bureau of Economic Geology

Project Objectives

Develop analysis, modeling and decision–support tools to enable the selection, design and specification of supplementary heat rejection systems/devices that, when added to conventional GHP systems, make the resulting hybrid GHP system technically and economically viable in hot, arid or semiarid climates typical of the southwestern and western United States.

Approach: Tasks

(1) "Waste Heat" Rejection/Recycling Estimation

Assess "waste heat" that auxiliary SHR systems must reject/recycle

- Studies show that SHR systems are cost-effective in maintaining GHP efficiency
- Will study different:

  Building types

  Existing HVAC systems

  Local climate histories

  Building site characteristics (geology, hydrology)

  Resource availabilities (water/land/electricity)

(2) Technical Performance Analysis & Modeling

Assess overall SHR–augmented GHP system performance and efficiency—first-principles

- Building loads
- Integrated GHP/HVAC system
- SHR systems/devices

  Evaporative coolers/cooling towers, desuperheaters, etc.
- Ground loop

(3) Life–Cycle Cost Analysis & Modeling

Assess overall life–cycle costs, including installation and maintenance costs

- Parametric studies on design parameters
- Tradeoffs

(4) Web–Based, Decision–Support Tool Development

Tools to provide guidance regarding which SHR–augmented GHP systems offer the best performance at the lowest life–cycle cost for a given application.

- Link with energy efficiency websites (TexasIsHot)

(5) Milestones		**Months**
Task 1:	SHR Estimation	1-7
Task 2:	Performance	2-13
Task 3:	Life-Cycle Costs	3-16
Task 4:	Support Tools	2-16

Accomplishments

Expected Outcomes

Set of tools that provide engineering guidance to enable lowest life-cycle-cost GHP infrastructure for the various building types, sizes and usages depending upon their existing HVAC systems, local climate and building site characteristics.

Progress

Undergraduates currently investigating:

(1)Potential SHR systems/devices

(2)Appropriate models for building/SHR/ground loop energy computations.

Project Management/Coordination

Management Plan

Glenn Masada: Co-PI, Project Director, Project Administrator,Tech.

- Fiscal Management, Technical Reporting

Paul Ballentine: Co-PI, Director-Industrial Relations, Technical

- Commercialization

Tess Moon: Co-Investigator, Technical

Advisory Board (8 members): Quarterly meetings

- Cost share, Assessment, Technical, Commercialization, Dissemination

Other local resources: UT Bureau of Economic Geology, TX Railroad Commission

Project Management/Coordination

Schedule

Start: Jun 2010 End: Dec 2011

Quarterly Advisory Committee Meetings

Link with National Geothermal Data System (NGDS)

Provide reports and supporting data to the National Geothermal Data System (NGDS).

Future Directions

Future

Anxious to get started in earnest.

SUMMARY

- *Objective*: significantly increase the number of GHP installations in Texas and other arid, semi-arid areas
- *Method:*

  Develop SHR systems to enhance the performance of GHP installations

  Develop models for building loads, SHR, and ground loops

  Develop life-cycle cost analysis comparisons of designs

Mandatory Summary Slide

- *Outcomes:*

  Set of web-based, decision-making tools that provide engineering guidance to enable lowest life-cycle-cost GHP infrastructure for the various building types, sizes and usages depending upon their existing HVAC systems, local climate and building site characteristics