North Carolina State University

REST: Renewable Energy Generation with Solar Thermal Systems

Instructor Information

William Guiney
bill@articsolar.com

Bill Guiney is the President of Artic Solar, Inc. a high temperature solar thermal company. Previously he was the Director of the Solar Heating & Cooling Business at Johnson Controls, Inc. where he was involved in over 250 commercial solar projects. His areas of responsibility have included both Photovoltaic and Solar Thermal technologies. At Artic solar, Bill is currently developing high temperature (+350oF) solar cooling and industrial process heating projects. Bill has 33-years of experience in the solar industry as a retailer, contractor, distributor, manufacturer and educator. Bill has provided many Renewable Energy and Energy Efficiency training programs and has been an instructor for solar thermal energy systems at the North Carolina and Florida Solar Energy Centers. Bill has served on the solar thermal technical committee of the North American Board of Certified Energy Professionals (NABCEP), committee chair of the Texas Renewable Energy Industries Association and he has been a certified Home Energy Rater and previously held a Solar Contractor license in the State of Florida.”

Course Information

Course Description

This course is one of eight courses housed under the award-winning Renewable Energy Technologies Diploma Series. This five-day workshop on Solar Thermal technology focuses on domestic solar hot water systems, but will discuss the various applications of solar thermal technology. You will learn how to site a system based on solar fundamentals and how to size a system based on thermal load analysis. You will explore system components, types, and designs as well as best practices regarding installation, maintenance and troubleshooting. A hands-on installation of both a fully-operational drainback and a pressurized glycol system will cap the week. An optional NABCEP Solar Heating (SH) Entry Level Exam is offered. Please note this is not NABCEP certification, it is simply an indicator of knowledge gained at the Entry Level and a differentiator to a potential employer. You must meet additional experiential requirements to sit for the NABCEP Solar Heating Installer Certification Exam. This course counts toward the educational requirement (other requirements needed) on the journey to becoming a NABCEP Certified Solar Heating installer. Details Here.

Required Text & Materials

- 40 hour custom curriculum covering the NABCEP SH Entry Level Learning Objectives

Structure

This is an onsite course that will be provided using classroom lectures and a hands-on lab.
STUDENT LEARNING OUTCOMES. **Students will be able to:**

- Identify system components
- Identify system types and applications
- Identify optimum sites for solar thermal systems
- Identify NC code requirements for solar thermal systems
- Calculate thermal load for a solar thermal system
- Identify the appropriate type of solar thermal system based on application, site and load
- Calculate piping and flow rates to correctly size
- Design a solar thermal system given certain criteria
- Troubleshoot a solar thermal system in several scenarios
- Safely and correctly assist in installing 2 types of domestic solar hot water systems – a pressurized glycol unit and a drain back system
- Identify your competency level regarding the tasks on the NABCEP Solar Heating Task Analysis and gauge readiness to take the NABCEP Solar Heating Entry Level Exam based on NABCEP Entry Level Learning Objectives.
- Take and pass the optional Solar Heating NABCEP Entry Level Exam offered at the end of the week

**Course Calendar. Found on Website**

<table>
<thead>
<tr>
<th>Module</th>
<th>Date</th>
<th>Topic</th>
<th>Assignment Due</th>
</tr>
</thead>
</table>
| 1      | Day 1| • Introductions & Contracting in NC -Permitting/License requirements  
         |       | • Solar Thermal Applications  
         |       | • Site Assessments  
         |       | • Solar Water Heating System Types  
         |       | • Solar Water Heating System Types Continued  
         |       | • Wrap-up Q&A | |
| 2      | Day 2| • System Components  
         |       | • Mounting and Roofing Penetrations  
         |       | • STEP Mounting Video  
         |       | • Piping and Flow Rates  
         |       | • Pipe Sizing  
         |       | • Wrap-up Q&A | |
| 3      | Day 3| • Pump Sizing  
         |       | • Certifications SRCC (OG100 and OG 300)  
         |       | • OSHA Review  
         |       | • NABCEP review | |
- System Startup, Document Transfer & O&M Manuals
- SDHW System Sizing Software & Economics
- Polysun Training & Demo – Insight for Business Development
- Wrap-up Q&A

| 4  | Day 4 | Safety Considerations  
- System Types Review  
- Swimming Pools  
- NABCEP Study Guide and Review  
- Wrap Q&A |
|----|------|----------------------------------|

| 5  | Day 5 | Hands-on Lab- Pressurized glycol and Drainback System Install  
- Lay out piping  
- Mount panels  
- Connect all pipes  
- Wire sensors and pump  
- Pressurize Systems  
- Safety and Commissioning |
|----|------|---------------------------------------------------------------------------------|

### Grading

#### Course Grading

There will be assignments and quizzes to assess your comprehension of the course learning objectives and to assess your ability to apply these learning skills.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Quiz/Assessment</td>
<td>100%</td>
</tr>
</tbody>
</table>

**TOTAL** 100%

#### Scale

The grading scale is consistent with University policy ([http://www.ncsu.edu/grad/handbook/sections/3.18-grades.html](http://www.ncsu.edu/grad/handbook/sections/3.18-grades.html)) and is as follows:

<table>
<thead>
<tr>
<th>Letter</th>
<th>A+</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
<th>C-</th>
<th>D+</th>
<th>D</th>
<th>D-</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>97-100</td>
<td>93-96</td>
<td>90-92</td>
<td>87-89</td>
<td>83-86</td>
<td>80-82</td>
<td>77-79</td>
<td>73-76</td>
<td>70-72</td>
<td>67-69</td>
<td>63-66</td>
<td>60-62</td>
<td>&lt;60</td>
</tr>
<tr>
<td>GP</td>
<td>4.33</td>
<td>4.00</td>
<td>3.67</td>
<td>3.33</td>
<td>3.00</td>
<td>2.67</td>
<td>2.33</td>
<td>2.00</td>
<td>1.67</td>
<td>1.33</td>
<td>1.00</td>
<td>0.67</td>
<td>0.00</td>
</tr>
</tbody>
</table>
**Attendance**

**Policy**

Students are responsible to keep up with course materials and meet course required deadlines. Per the University, attendance will be taken at every class. Per the NC Clean Energy Center, students must be present **90%** of the class in order to receive credit for the course.

**Assignments & Quizzes**   In order to pass the class students must, at a minimum:

1.) Achieve a minimal **75%** pass rate on all quizzes

**Students who successfully complete course :**

1.) Receive an NCSU Certificate of Completion for the course
2.) Have completed 1/3 of requirements to earn a Renewable Energy Technologies Diploma
3.) Be eligible to sit for the NABCEP SH Entry Level Exam
4.) Have satisfied the entry level education requirements on the pathway to becoming NABCEP certified
5.) Be eligible for continuing education credits: 40 hours for AIA, PDH and CEU

**Academic Policies**

**Honesty & Integrity**

Students are required to comply with the University policy on academic honesty and integrity found in the Code of Student Conduct, outlined at http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php.

**Accommodations for Disabilities**

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office (http://www.ncsu.edu/dso) located at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State’s policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.1.php.

**Non-discrimination Policy**

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at www.ncsu.edu/policies/campus_environ or http://www.ncsu.edu/equal_op. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 515-3148.
Course Evaluations. Your evaluations matter and do result in changes to this course.

If you have concerns or suggestions for this course, please contact Maria O’Farrell, NC CETC Training Program Manager (mdofarre@ncsu.edu@ncsu.edu).