

Cleveland State Community College  
Energy Efficient Residential Construction  
Zero Energy Housing Certificate Course Summary

CST 2040 Renewable Energy - an overview of current energy usage in our modern industrialized society. Production, storage, distribution and use of energy are the keys which have led to an increasing reliance on finite (non-renewable) fossil fuels. Looks at traditional fossil fuels such as oil, coal and natural gas in terms of their utility, their respective current usage rates, quantity used and importance of usage in the past century, remaining proven and expected reserves both nationally and worldwide, and the expected rate of growth in worldwide demand for these sources in the near future.

After a look at the efficiencies of various energy systems such as losses inherent in electricity generation and distribution, the course delves into an overview and then into specific details of alternative renewable energies, including direct solar photovoltaic (pv) electrical generation, solar thermal energy generation (both active and passive), modern wind power generation, harnessing ocean actions, converting biomass, and other alternative fuels, such as hydrogen fuel cells. Emphases are placed on the site specific suitability of the various techniques, government regulations and the various economics of use including whether conventional "returns on investment" are meaningful for all the systems.

The course then focuses more sharply on overall energy management concerns in a more localized residential setting. The course will delve into the economic, ethical, environmental, comfort and practical progress which can result when an individual's energy efficient lifestyle concerns are coupled to energy efficient residential construction. When building any human scaled structure, the decisions made early in the design cycle greatly affect the resulting efficiency and utility of the structure.

Solar PV panel electricity generation and solar thermal hot water generation are each singled out for investigation concerning state-of-the-art materials and equipment and their availabilities and current usages.

The concept of the "Zero Energy Home" (ZEH) will be introduced including a review of current efforts and progress throughout the country to meet this goal. Geothermal heat pumps and structurally insulated wall and foundation panels will also be described due to their respective uses as integral parts of the ZEH efforts.

CST 2050 Solar Photovoltaic (PV) System Design and Installation - This course provides the basic details of sizing a PV installation to meet expected energy needs, the techniques of rooftop installation to withstand regional weather expectations, the need for site specific electronics to change varying DC solar generated electricity to utility grid uniformity of AC electricity, how to work with the needed utility grid inter-tie safety disconnections, and other details in preparation for national certification as a PV installer. This course provides the information needed for the student to be able to aid anyone interested in solar PV generation, and prepares the student for the national certification test. The student also meets the requirements for a national entry level (apprentice) installer certificate.

CST 2610 Energy Efficient Residential Elements - This course will provide a foundation of techniques, methods and practices of energy efficient construction for residential and commercial applications. Special focus will be placed on treating buildings as interrelated systems and applying that concept to new construction and remodeling existing buildings. Topics covered will include (but not be limited to) energy and energy use in buildings, building materials, insulated wall elements such as structural insulated panels (SIPS),

insulated poured and pre-cast concrete walls, air leakage, alternatives to current practices, air quality and ventilation, and site management. The course will also address solar hot water installations and specialized solar grid-tied electric codes (NEC 960).

**CST 2620 Ground Source Heat Pumps** - This course will address the use of ground sourced heat pumps as an energy efficient choice for heating, ventilating, and air conditioning (HVAC). The course will cover closed loop and open loop designs, residential usage of ground source heat pumps, adaptation to an energy efficient building envelope, introduction of make-up air, trenching vs. well drilling, ground loop requirements, Manual J load analysis to size the ground source system, and desuperheater add-on hot water elements. This course will also have the benefit of a ground source heat pump demonstration project where a unit has been installed in the construction technology laboratory.

**CST 2500 Home Energy Rating System** - This course addresses the use of computer software and rating criteria to evaluate and score homes using residential energy rating systems. Emphasis is placed on gathering data from building plans, manufacturer's specifications, and on-site testing. Course completion prepares students for national certification as a home energy rater.

**CST 2400 Service Learning with Habitat for Humanity** - This course will enable student to have hands-on involvement in a Habitat for Humanity construction project where many of the concepts presented in previous courses are put into practical application. The processes and policies used by the Habitat organization will provide monitoring of student participation and involvement. At the completion, students will be able to properly apply energy efficient building techniques and principles, promote energy efficient construction through proper application and interaction with other volunteers, demonstrate proficiency dealing with window and door installations, moisture sealing, air leakage sealing, proper insulation installation, ductwork installation, etc., serve as a resource for guiding an energy efficient construction, and describe Habitat for Humanity policies for a safe, energy efficient construction.

**Non credit course – Home Weatherization Process** – This course will address the process of home weatherization and should align with requirements of any program related to Stimulus funding. It begins with a home inspection that documents the as found conditions and recommendations for improvement. The second step addresses the work performed by the contractors or subcontractors to address the recommendations for improvement. The third step involves a revisit by the home energy rater to verify the work was properly performed and to conduct post testing to confirm the effectiveness of the installations.

**Non credit course – Home Weatherization for Installers** – This course will address the materials, techniques, and technologies for proper home weatherization. It will examine the proper installation of typical materials, such as insulation, sealing, widows, weather stripping, and duct work repairs. It will cover the documentation of completed work as outlined n the Home Weatherization Process course.