

	Arch 440P	Energy Conscious Architecture
Spring 2007		

Credits:	Proposed increase from 2 to 3
Type of Course:	Seminar
Class Meetings:	Weekly
Prerequisites:	ARCH 212 for undergraduates, none for graduate students
Enrollment Capacity:	18
Instructor:	Brent M. Porter
Contact Information:	718-789-5426

COURSE DESCRIPTION

Bulletin Description:

Considerations include aesthetics and the architectural form of energy-conscious architectural design, drawn largely from worldwide indigenous architecture in which high-quality architecture is expressive as well as functional. Architectural model making and drawing comprise the bulk of class work.

Detailed Description:

This course begins its thirty fourth year as an elective to back up the mechanical, electrical and plumbing required course, MEP 212, and to continually provide an updated forum for design applications and research in the important "green design" dialogue. The course has achieved breakthroughs in solar studies and shadowing impact, most recently concerning the proposed Atlantic Yards development. More than two dozen students have built the solar designs they developed in the course. Feedback from such projects informs the curriculum while providing insight into changing needs. Student participants and the instructor have received major design awards and research grants, including the first "Solar Access Study for NYC." An emphasis on solar zoning by means of "solar zoning envelopes" has emerged as a major contribution to the curriculum if not the field of architecture.

It is ENVIRONMENTAL IMPACT and inequities in a broad range of essential strategies of environmental assessment that fuel a new commitment to "energy consciousness. Topics which require a fresh look constitute a broad range: 1) beginning with the Environmental Impact Study manual the City of New York uses to assess impact on its energy and environmental resources including orientation to sunlight or shadowing; then 2) heat islands which arise, damage to the urban tree forestation program and global warming; to 3) energy potential and strategies for assuring a sound environmental future.

Therefore, the course interweaves critical environmental topics. The discourse begins with flow of energy, energy losses and gains, then the primary gain from the sun, wind effects driven by the sun and temperature differences, ventilation, humidity control and thermal comfort in general. Of major concern is access to sunlight and the lack of shading of neighboring properties. If access to solar energy can be enabled in the urban design, planning and

architectural design fields, a major frontier is opened for future energy resources, essential as the decline of oil in the next thirty years must be replaced with ethenol fuels and alternative energy sources such as solar and wind. The introduction of both hand-drawn and computerized generation of “solar zoning envelopes” provides an effective way to shape a building envelope for a particular site to guaranteed as much solar access as possible without shading neighbors within specific time restraints throughout the year. In balance with utilizing sunlight --particularly as solar photovoltaic cells are incorporated seamlessly into expansive glazing for example -- is the recycling and reuse of integral resources such as rainwater, grey water, waste products for generating methane and the retention of waste heat for cogeneration.

The research and development of these strategies are growing worldwide. The course will take full advantage of the Internet and various timely publications to keep track of recent developments. The instructor’s more recent research in Scandanavia will be shared. Guest speakers in conjunction with fieldtrips within NYC and in association with such groups as the NY Chapter, AIA, will be scheduled when possible.

Student Learning Objectives

Students are encouraged to integrate the various topics covered in a current project such as their design studio projects when possible. Great success to this end has been achieved over the years. On occasion, a student has an actual project such as a passive solar house to design and build. These projects have been successfully demonstrated in the course, then later monitored as to the success of the designs which has become part of the literature incorporated in lectures. One notable design won one of the highest architectural design awards in Canada for its successful passive solar and other energy conscious strategies, a project began in the course.

The required MEP material is enhanced with a plethora of design ideas which have a deep technological basis but do not necessarily yield detailed engineering and scientific information useful to the architectural student. However, an awareness of the latest “cutting edge” applications of science and technology is most important to challenge current design thinking and prepare the architect for dialogue with other professionals engaged in “appropriate technology.”

The course fulfills the following NAAB requirements:

1. Verbal and writing skills: Ability to speak and write effectively on subject matter contained in the professional curriculum.
___ (Technical curriculum in the field)
11. Western Traditions: Awareness of the indigenous, climatic based design and traditions of architecture and urban design in the Western world.

Classroom activity will include a weekly lecture by the instructor with slides largely photographed on site in the various cities and countries represented, a film or video and short student presentations of research on particular topics which arise in class discussion from the preceding week. The worksheet format will be used to measure progress in the required energy conscious design exercises, the drawing and/or modeling of a major architectural design project which each students has done or is presently engaged in which energy conscious measures are appropriate. or prototype, the underlying geometric analysis of the selected example or prototype, and the reporting of Internet searches to enhance participation in class, These Internet searches and individual architectural studies. are collected and made available through the library of the Christina Porter Memorial Lighting Lab of the School of Architecture.

Course Goals

Goals include but are not limited to the following:

First, to recognize the critical energy strategies which can be integral to architectural design, urban design and planning.

Second, to prepare a “solar zoning envelope(s)” for an actual site in which the student is engaged such as that for his/her design studio. This will influence the form and shaping of the bulk of the student’s basic design.

Third, to incorporate appropriate energy conscious measures and strategies in the design project at hand.

Fourth, to participate in teamwork for a unique “warm-up” project such as the continuing work on the impact and alternatives for the Atlantic Yards development and to continue that spirit of teamwork throughout the duration of the course – in fact, as a shared, vested interest in bringing “energy consciousness” to the School of Architecture and eventually to the profession.

The goals for the course fulfill the applicable NAAB requirements from the aforementioned:

2. Verbal and writing skills: Ability to speak and write effectively on subject matter contained in the professional curriculum.
- ____. (Technological understanding in design.)
11. Western Traditions: Awareness of the parallel and divergent canons and traditions of architecture and urban design in the Non-Western world.

Textbooks, Readings and Materials

Together the readily available and updated references are amplified by not only the weekly slide presentations but also an extensive collection of videotapes and films.

Perhaps most notable among the resources which have been gradually obtained for this course are the films, including “Energy by the Daystar,” “Desert Cloud,” “The Brookhaven House,” CBS coverage of the Hayden Planetarium’s special glass, Kiss and Cathcart’s videos of photovoltaic technology, General Electric’s “Innovative House,” PBS’s “Innovations” plus “Nova” and other programs, Al Gore’s “Inconvenient Truth,” the AIA Research Corporation’s “Energy Conscious Design” seminars particularly “Solar Envelopes” by Prof. Ralph Knowles, “Chaco Canyon” with its precise orientation of indigenous architecture and Pratt’s own lecture series including presentations by Edward Mazria speaking on behalf of the national AIA’s commitment to energy strategies for the future, the New Yorker’s global warming writer, Elizabeth Kolbert, and Australia’s Glenn Murcutt. As to the latter, many students have not seen these important lectures. Segments of the lectures will be re-shown in class.

Resources have been brought together at the Pratt Library and the Multi-Media Center to provide a unique collection which has been gradually expanded for student, faculty and staff use.

Assignments for student participation in class as well as preparatory work and final presentations will be guided by successful techniques used since the inception of the course.

Each week material will be distributed with topical reports due the following week and required reading, largely from obscure sources, but major texts available in Pratt Library. A collection of films and videotapes for use in class are also made available for further reference in the Multi-Media Center, Pratt Library. (Copying of additional videos from the instructor’s videotape collection is underway, as permitted for short term, instructional use.)

BIBLIOGRAPHY

Note: Each week a topical bibliography is issued for that week's subject matter. The main library serves for both general and specific information, a bibliography which has been gradually developed since the course began at Pratt Institute. Texts for required reading are all On Reserve at the Pratt Library.

Bibliography 1, Required readings:

Grillo, Jacques. Environment Climate and Design. (Global and regional climate based)
Kolbert, Elizabeth. Three articles on global warming. The New Yorker, 2004 – 2005.
Knowles, Ralph. Sun, Rhythm, Form. MIT Press.– and – Energy and Design, MIT Press.
McHarg, Ian. Excerpts from Design With Nature. Univ. of Pennsylvania Press.
Mazria, Edward. The First Passive Solar Home Design Handbook.
Olguay, Victor. Design With Climate. Princeton Univ. Press.
Konya, A. Architecture for Hot Dry Climates

Bibliography 2, Recommended readings:

Beckerman, Stuart; and Carol Slater. Air Rights in NYC. Association of the Bar, 36 W. 44 St., NY, NY; and conference proceedings, June 2006.
Recent architectural journals and news media. Selected articles for distribution in class.
City of NY's energy conscious design projects such as schools, daycare and health centers, courtesy of the Dept. of Design and Construction, and other sources.
Morphosis. California case studies by architectural firm. Curtain wall assemblages.
NY Chapter, AIA. Energy conscious lectures including exhibition and six lectures on the lighting and shading devices of Louis Kahn.
Natural ventilation of Pittsburgh's new civic center. In: Metropolis and other publications.
Progressive Architecture and Architectural Record (Journals), new and out of print articles including annual energy conscious design awards.
Toronto as case study. In: The Globe and Mail (newspaper), 2006.
Wright Water Engineers, Denver, Colorado. Water management, retention and recycling.
Windmills. Various sources. Windmill siting and erection conference proceedings.
Wind farms, economic development. London & NY: The Wall Street Journal, July 2006.

Bibliography 3, Additional reading and on-line listings and sources distributed in class weekly).

Proceedings of the annual American Solar Energy Society conferences.
Proceedings of the annual international Wind Effects Upon Buildings conferences;
available at the Engineering Library, E. 47th St.; and the NY Public Library.

Projects, papers and assignments:

Each week assignments for individual students important to the topical information shared at hand and/or to reflect the individual student's interest will be established for presentation in class the following week. The focus for each student's work will be his/her design project or other project deemed suitable for examination within the course. Assignments to proceed according to the following course scheduling, from large scale to small scale design.

Course Calendar/Schedule

Week 1 Climate based regional scale, ecological zones, geographic location as to degrees North or South latitude, emergence of indigenous/climate based

	architecture and construction vernacular. Broad scale sources such as Ian McHarg's energy and ecologically based planning. Slides and videos.
Week 2	City and town scale, Indigenous settlements in Europe and USA. Introduction of work by Ralph Knowles in American Southwest.. Regional types as shown by Jacques Gillo. Solar zoning in Japan & USA. Student selects site for drawing "solar zoning envelope(s)," larger scale.
Week 3	AIA Research Corp. conference including Ralph Knowles extensive development of "solar envelopes" in the design studio. Solar zoning for the Atlantic Yards site and ensuing shadowing simulations. Preliminary pin-ups of solar envelopes. Computerization techniques reviewed. Preparation planning for solar envelopes at smaller scale; skylights, courtyards, atriums, etc. Extensive slides and videos of prototypal design guided by the restraints of solar zoning envelopes and comparable tools.
Week 4	Integration of solar and wind, including natural ventilation. Slides and film. Planned field trip to natural ventilation prototypes if possible. Internet findings by students. Introduction of Konya's air flow diagrams. Planning for use of Konya's work as applicable to students' projects.
Week 5	Humidity and thermal control annually. Energy budgeting. Recycling of waste heat. Thermal/infrared. heat flow photography introduced. Heat low simulations including possible water table modeling from past projects. Integration of strategies with solar and wind measures.
Week 6	"Envelope" design. Innovations in architecture including ventilation and curtain wall assemblages with glazing incorporating photovoltaics. Morphosis' architectural firm's recent successful projects in Los Angeles and San Francisco. Students application of similar strategies if applicable to their design work or alternative smaller scale strategies.
Week 7	Kiss and Cathcart's photovoltaics research and development. Guest lecture or field trip to K. & C.'s office or local project(s). Weekend field trip alternative. Slides and videos of integration of glazing, daylighting, photovoltaics, ventilation and insulating aspects in prototypal design.
Week 8	Daylighting meets artificial lighting at intimate scale (one room scale if Possible) in coordination with simulation techniques of the Christina Porter Memorial Lighting Lab Slides and videos of simulations and energy conscious measures at interior and exterior. Coordination with "solar envelopes" at smaller scale as compared earlier. overall projections.
Week 9	Envelope prototypes relation to retention and recycling of rainwater and on site reuse potential strategies. Possible field trip to high rise example in West Manhattan. Design findings developed in the course for Atlantic Yards alternative development and recycling. Slides and film. Projects.
Week 10	Students testing of design application to date. Preparation of streamlined energy budgeting of basic heat loss and heat gain including passive solar

Gain, cogeneration potential, etc. Basic heating and cooling inventories.. Energy measures accounting worksheets developed and tested in the course. Introduction of LEEDS and use in class as applicable. Guest lecturer. Students project analyses.

- Week 11 Detailed selection of materials, basic equipment such as miniature boilers if applicable and micro programming reflective of macro programming. "Brookhaven House" video and other videos and slides of selections.
- Week 12 "Interactivity affinity" processes to measure effectiveness. How to effectively integrate and weigh various strategies in final prototypal design. Summation of Internet findings from various global resources.
- Week 13 Preliminary presentation of final architectural design applications. Planned school-wide showing of Al Gore's "An Inconvenient Truth," if possible.
- Week 14 Studio Week. (Meetings with individual students at their convenience.)
- Week 15 Final review of presentations with guest commentators.

COURSE REQUIREMENTS

Readings from material distributed in class, class discussion, geometry worksheets and presentations of architectural drawings with underlying geometrical analyses derived from the course. As previously discussed, coordination of course requirements with textual, slide presentations and media lectures each week.

Assessment and grading

Conferences will be held with each student on a regular basis to discuss the individual's achievement and participation in the class. The weekly reports and design application work as assigned or contributed by each student will be graded at the mid-term and as a collection of materials at the end of the term. Each student will be encouraged to prepare at least one project development which is a current design project or a recent project. Students will write and/or talk about their weekly reports to be shared in duplicate copies with their fellow students. A portfolio of projects is maintained for each class from the inception of the course which are made available to students in the course when applicable and upon request by others. Unique research work will be honored with special grading to reward the individual's contribution to the development of the course. Fifty per cent of the grade will be for quality of design application and fifty per cent will constitute participation in the dialogue and findings of the class in the spirit of teamwork and cooperation. Design innovation will be particularly acknowledged.

POLICIES

Notify students that they must adhere to all Institute-wide policies listed in the Bulletin under "Community Standards" and which include policies on attendance, academic integrity, plagiarism, computer and network use.

Notify students of the Institute's policy regarding Students with Disabilities, which appears at: <http://www.pratt.edu/disabilityservices/Disability04-05.pdf>