Course 22 – Energy Modeling and Analysis (Version 3.0)

**Course Description:**

This course reviews some significant energy consumption terms and concepts, and exercises in unit conversions. General energy use in buildings is reviewed, and how this might change with different materials and habits. Equations and calculation exercises – by hand with a calculator and with a computer spreadsheet function – are a basis for general models describing a circumstance. Changing some variable values, and recalculating the outcomes, builds an appreciation of the relative significance of some changes on the modeled energy use. Changes could include different building materials, their characteristics, building and energy usage habits, and site conditions. There are available online information sources that can aid in making working assumptions, as “perfect information” is often prohibitively expensive. With a better understanding of general energy models and analysis, one can better form relevant general opinions about energy efficient upgrades for existing buildings. As better quality information about a site is available, models can be refined; uncertainties reduced, and better decision making results.

**Rationale:**

Understanding the equations, calculations, and applications of general energy modeling and analysis in this course, prepares one for a future course involving applying these with measured or reasonably assumed information for a site. An introduction to energy modeling and analysis provides a basis for understanding the design loads and influences on them that can impact project decision making – technical, social and financial.

Examples of anticipated outcomes after course completion

* Review and make calculated estimates of average and peak loads for types of residential building energy uses
* For a customer’s house, consider currently used materials, designs, and habits, and reasonably potential changes
* Make reasonable technical suggestions for improving energy efficiency, and their financial effectiveness

**Task 01 - Understand energy consumption in building systems**

* Unit conversions
* Conductance, Resistance, Wall Dimensions, Thickness
* Heat, Cool, Lights, Equipment, Industrial use
* Electricity, On-site fossil fuel use, Low carbon sources

**Task 02 - Energy use in residential building systems & applications**

* BZ Bldg – Concrete, Block, Wood framed upper floors
* WUFI Software – Heat and Moisture Transiency
* Passive House Planning Package (Software)
* RetScreen (Software)

**Task 03 - Prepare opinions on cooling energy loads using hand calculations and available software models**

* Info. Sources, Working Assumptions, Measurements, Calculations, Conversions, Uncertainties
* Residential (Belize) Building Scenario
* Commercial (Belize) Building Scenario

**Task 04 - Understand typical building designs, common building materials, and their impact on associated comfort**

* Belize and North American examples
* Moisture flows, humidity, vapour barriers, temperature
* Slide Lecture
* BuildingScience.com information resources

Building Science Corporation (private sector services)

* Articles, Papers, Guidance documents available online
* Events & Training (e.g. online $$/session; CEU credits)
* Document Search (e.g. Type; Climate Zone) – BA 1208 Performance of a Hot-Humid Climate Community
* (Available for Download – Copied for this session)

Designs That Work (from Document Search and Filter)

* DTW: New Orleans - Project Home Again Phase 1 & 2
* Case Studies of affordable and energy efficient
* detached homes (After Katrina: Copy for this session)
* https://www.buildingscience.com/documents/case-studies/cs-la-new-orleans-pha/view

Project Home Again – New Orleans

* Enclosure Design
* Mechanical Design
* Lessons Learned & Future Projects
* Technology Gaps and Barriers
* https://www.buildingscience.com/documents/case-studies/cs-la-new-orleans-pha/view

**Task 05 - Identify energy efficient upgrades for existing buildings**

* Heating and Cooling
* Lighting
* Cooking
* Plug In equipment

**Proposed Breakdown of Focus (in lieu of Marking” in Competency Based Course and Program)**

20% Individual Tests (Examples)

* (12 %) Task 1 Understand Energy Consumption Test 01
* (08 %) Task 5 Identify energy efficient upgrades Test 02

30% Individual Assignments / Projects (Examples)

* (12 %) Task 2 Energy Use in Buildings
  + (12 %) Passive House Planning Package (Software) Assignment 01
* (8 %) Task 3 Prepare opinions on cooling energy loads
  + (4%) Hand Calculations (Residential) Assignment 02
  + (4 %) Hand Calculations (Commercial) Assignment 03
* (10%) Task 4 Calculate Dew point Using Temperature Differential               Assignment 04
* Psychrometric Chart and Excel Workbook
* Assess Belize Case Study on wall and floor for condensation risk at different temperatures and relative humidity

40% Group Projects (Examples)

* (30 %) Task 2 Energy Use in Buildings
  + (18 %) RETScreen Expert (Software) Group Project 01
  + (6 %) RETScreen 4 activities in course Group Project 02
* (3 %) Spreadsheet Calculation – C35 PV Installation application
* (3 %) Spreadsheet Calculation - C34 Solar Hot Water application
  + (6 %) Engineering and Course Textbook (2005) Group Project 03
* (2 %) Wind Energy Project Analysis
* (2 %) Photovoltaic Project Analysis
* (2 %) Solar Hot Water Project Analysis
* (10 %) Task 4 Understand typical building designs
  + (3 %) Belize and North American examples Group Project 04
  + (7%) BuildingScience.com information resources Group Project 05

**This Breakdown is used in the draft Technical Delivery and Assessment Plan (TDAP).**

Task 01 (12% - Individual Test)

Understand Energy Consumption

* (3%) Unit conversions
* (3%) Conductance, Resistance, Wall Dimensions, Thickness
* (3%) Heat, Cool, Lights, Equipment, Industrial use
* (3 %) Electricity, On-site fossil fuel use, Low carbon sources

**(12%) Individual Test 01 - Task T 01**

12% as 1% x 12 Questions

Instructor provides

Q 01 – Unit conversion 1 (Scenario from Sunlight to electricity stored in a battery)

Q 02 – Unit conversion 2 (Scenario form electricity stored in a battery to a signal light)

Q 03 – Unit conversion 3 (Giga, Mega, Kilo . . . Milli, Micro)

Q 04 – Conductance – Define and Describe two (2) relevant examples

Q 05 – Resistance - Define and Describe two (2) relevant examples

Q 06 – Wall Dimensions and Thickness – On a steady 30 Celsius day, a food Cooler box with 25 mm thick insulation with an inside temperature of 4 Celsius at 12 noon, and will warm to (Pick a temperature “T”) by (Pick a time). If the insulation was 50 mm thick, when would you expect the inside temperature to reach the Temperature “T”? Why? (Consider also adding the Cooler box dimensions)

Q 07 – Heating and Cooling – Describe “Degree days” (with numbers) with respect to a fluid

Q 08 – Lights – 60 W incandescent vs 60 W LED

* Compare energy used in an hour
* Compare light given off in an hour (measured in Lumens)

Q 09 – Plug in Equipment – “Always on” equipment and energy use (e.g. TV, lap top at “sleep”)

Q 10 – Electricity (AC / DC / 3 phase / single phase / Volt / Amp / Ohm / Watt)

Q 11 – On-site fossil fuel use (wood / coal / oil / gas) (e.g. how much at home that might be reduced)

Q 12 – Low Carbon sources - Define and Describe two (2) relevant examples

Task 02 (12% - Individual Assignment / Project)

Energy use in residential building systems & applications

* BZ Bldg – Concrete, Block, Wood framed upper floors
* WUFI Software – Heat and Moisture Transiency
* Passive House Planning Package (Software)
* RetScreen (Software)

**(12%) Individual Assignment 01 - Task T 02**

Passive House Planning Package (Software)

* International Passive House Association (IPHA) (Germany):
* https://passivehouse-international.org/index.php?page\_id=188
* Available resources (free) online useful for Course C22
* Step by Step retrofits (EuroPHit) / 124 p PDF file copied for this Session
* AZEB Methodology: 17 Steps to Create affordable nearly Zero Energy Buildings:
* 78 p PDF file copied for this Session
* IPHA Active for more comfort brochure: / 68 p PDF file copied for this Session
* IPHA Sample Course Slides / 2.1.1 Thermal Insulation / 11 p PDF (22 slides)

Instructor presents an example for a scenario (draft version in course materials).

Task 02 (30% - Group Project)

Energy use in residential building systems & applications

* BZ Bldg – Concrete, Block, Wood framed upper floors
* WUFI Software – Heat and Moisture Transiency
* Passive House Planning Package (Software)
* RetScreen (Software)

(18 %) RetScreen Expert (Software Project)

(6 %) Engineering and Course Textbook (2005) /  456 p PDF copied for this session

* (2 %) Wind Energy Project Analysis
* (2 %) Photovoltaic Project Analysis
* (2 %) Solar Hot Water Project Analysis

(6 %) RETScreen 4 activities in course

* Adapt a RET Screen Project Analysis to a Belize Scenario
* Applications for C31 Comm 3, C32 Math 2, and C35 Tech Drwg
* (3 %) Spreadsheet Calculation – C35 PV Installation application
* (3 %) Spreadsheet Calculation - C34 Solar Hot Water application

**(18%) Group Project 01 - Task T 02**

RetScreen (Software)

* Download for Free – RETScreen Version 4
* Available Online Tutorials
  + Version 4 RETScreen
  + https://www.youtube.com/watch?v=xi6vyA80Nds
  + https://www.youtube.com/watch?v=2T07FdAlT4c
  + https://www.youtube.com/watch?v=xICZOzNIW4s&list=PL37A8D6844FB50866&index=4&t=49s
  + <https://www.youtube.com/watch?v=F3HsYt7gDAs&list=PL37A8D6844FB50866&index=4>

Instructor leads class through survey of RetScreen 4 applications (for C34 and C35 Course Work).

Instructor leads class through more advanced RETScreen Expert applications (for C22 Course Work)

Task 02 (18% - Individual or Small Group Project)

Energy use in residential building systems & applications written in APA format, Example is below, word document is in C23 Resources.

RETScreen Expert Analysis of Belize Residential Home

Comparison of Existing Energy Consumption to Consumption After Upgrades

Student Name

C 23-Energy Efficiency and Analysis

Instructor Name (Mr. Banner)

Date

Contents[[H1]](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx" \l "_msocom_1)

[Executive Summary. 2](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095274)

[Objective. 3](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095275)

[Scope. 3](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095276)

[Technical Report Components. 3](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095277)

[Student Title Page. 3](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095278)

[Table of Contents- See the comment on the Table Of Content page for instructions. 3](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095279)

[Executive Summary. 3](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095280)

[Main Body of Report 4](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095281)

[Conclusion. 4](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095282)

[Appendix. 4](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095283)

[APPENDIX A: Domestic Hot Water Upgrade Tank Specifications. 5](https://nscc-my.sharepoint.com/personal/w0200281_campus_nscc_ca/Documents/Documents/00-Kris/00%20NSCC%20International/00_BELIZE%20PROJECT%202023/0%20C22/RESOURCES/Projects/Individual%20Project/Individual%20Project%20RETScreen%20Expert%20Model%20of%20Belize%20Residential%20Home.docx#_Toc134095284)

 Executive Summary

 The Executive Summary should be one or two pages at the most, depending on the size of the report. The Summary should be on its own page, at the beginning of the report.

The Individual Project will serve as a study of the RETScreen Expert software, using a Belize residential home plan as a guide for the construction type, and an Excel example of the proposed upgrades. A technical report will be written to identify cost, energy and emission reductions based on the upgrades with recommendations to improve the home’s comfort and health.

 Objective

The objective of this project is to collect data from a plan drawing of a residential home in Belize City and create a base model of the home in RETScreen Expert, and using the same base model, add upgrades to improve the building’s energy efficiency and demonstrate cost, energy and emissions reductions resulting from the upgrades.

# Scope

Create an Excel sheet with input data for the house measurements. Example: Height, width, and thickness of concrete walls to calculate the area and R-value of the slab. This data will be entered into the RETScreen Expert file. Compiling the data first will make entering the data into RETScreen easier and will provide a backup for areas and R values.

Calculate dimensions and R-values for all envelope components, (an example Excel sheet is provided)

Model all information from the drawing in your RETScreen Expert File, taking screenshots for each building component and pasting them into a Word document.

Model upgrades in RETScreen Expert and demonstrate cost, energy and emission reductions based on the upgrades. Example: Add two inches of expanded polystyrene to the walls and compare the base building model to the upgraded building model to determine cost, energy and emissions reduction, taking screenshots for each building component and pasting them into a Word document.

Write a technical report on the results of the RETscreen Expert base model and upgrades using the **American Psychological Association (APA) formatting style**. Use the reports tab in RETScreen to generate various reports and include them in your own report submission.

Technical Report Components

Student Title Page per APA Guidelines [Purdue Edu Technical Report Writing Example](https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/general_format.html)

## Table of Contents -

## See the comment on the Table of Content page for instructions.

# Executive Summary

 A one-page summary of key findings that are written once the report has been written. The summary is read by an Executive stakeholder (decision maker or owner) in the project to determine the action required based on the summary. The reported outcome should be captured in the summary, providing critical information without the need to read the entire report.

# Main Body of Report

Using applicable citations for information used that has a copyright rule and correct Heading format (Heading 1, 2, 3 etc.). Use this report example for headings.

# Conclusion

A summary of the next steps based on the report’s findings. The summary should not include any new information that has not been delivered in the Executive Summary of the Main Body of the report.

# Appendix

Appendices of the reports generated from the RETScreen Expert model, and any technical documents related to the proposed mechanical upgrades. Example: APPENDIX A: Short description, centered on the page. Only one Appendix A, B, C etc., per page.

 Please see the example on the next page.

APPENDIX A: Domestic Hot Water Upgrade Tank Specifications

**(6%) Group Project 02 - Task T 02**

Engineering and Course Textbook (2005) /  456 p PDF copied for this session

* (2 %) Wind Energy Project Analysis
* (2 %) Photovoltaic Project Analysis
* (2%) Solar Hot Water Project Analysis



Instructor leads class in introduction to the Engineering and Course Textbook from 2005 for Clean Energy Project Analysis. A PDF copy of this textbook is part of the Resource materials for this course.

(Open the Textbook and Review)

Q 01 (2 %) - Wind Energy Project Analysis



Given this table of varying average wind speeds for a site, and if the calculated Energy Production for a small wind system is 150 MWh over a year, what would be an estimate of the energy production for 2 months in the fall if the average wind speed was 6.5 m/s?

If the small wind system had overload protection such that it stopped operating when wind speeds exceeded 10 m/s, and in September – October this happened 5% of the time, what is the estimated energy production?

Q 02 (2 %) - Photovoltaic Project Analysis

From page PV32-33





Calculate the useable battery capacity (QB) for the following scenario:

* The L (equivalent DC load) is . . . . (e.g. 12 V)
* The “n” number of days of autonomy is . . . . . (e.g. 2 days)
* The “d” maximum depth of discharge is . . . .
* The “nB” battery efficiency is . . . . (e.g. 30%)
* Battery Temperature “TB” is . . . . (e.g. 25 C)
* The discharge rate “r” is . . . .

Q 03 (2 %) – Solar Hot Water

From SWH 25



For the following scenario, calculate the energy required (Q load in Joules)

* V load = volume of desired water (litres) . . . . (e.g. 120 litres / day of hot water)
* Cp = Heat capacitance of water (4200 Joules/kg)/degree C)
* P = density of water (1 kg / litre)
* T cold = temperature of water to be heated . . . (e.g. 12 C)
* T hot = desired heated temperature of water . . . (e.g. 30 C)

Task 03 (8% - Individual Assignment / Project)

Prepare opinions on cooling energy loads using hand calculations and available software models

* Info. Sources, Working Assumptions, Measurements, Calculations, Conversions, and Uncertainties
* Residential (Belize) Building Scenario
* Commercial (Belize) Building Scenario

**(4%) Individual Assignment 02 - Task T 03**

Hand Calculations (Residential)

Instructor presents an example for a scenario (draft version in course materials).

Scenario 01 - Residential

* Perfectly sealed box (house) 40 ft (12 m) x 24 ft (7 m) x 10 ft (3 m)
* Air exchange rate = 0
* Temperature (evenly mixed) (T1) starting at 22 C at 02 pm (time 1).
* Temperature (evenly mixed) (T2) desired at 20 C at 06 pm (time 2).

Scenario 02 - Residential

* Leaky box (house) 40 ft (12 m) x 24 ft (7 m) x 10 ft (3 m)
* Air exchange rate (windows, doors) of full volume every 3 hours (or 0.33 full volume / hour)
* Outdoor temperature is a constant 25 C
* Temperature (evenly mixed) (T1) starting at 22 C at 02 pm (time 1).
* Temperature (evenly mixed) (T2) desired at 20 C at 06 pm (time 2).

Student Learner Participant self selects changes to default scenario for their scenario.

Q 01 - Participants calculate for default setting

* What is cooling energy load to achieve T2 for Scenario 1?
* What is the cooling load to achieve T2 for Scenario 2?

Q 02 - Participants revise variable value X to A, recalculate, review, and consider significance

* What is cooling energy load to achieve T2 for Scenario 1, if T1 is 24C?
* What is the cooling load to achieve T2 for Scenario 2, if T1 is 24 C??

Q 03 - Participants revise variable value Y to B, recalculate, review, and consider significance

* What is cooling energy load to achieve T2 for Scenario 1, if time 2 is 8 pm?
* What is the cooling load to achieve T2 for Scenario 2, if time 2 is 8 pm?

Q 04 - Participants revise variable value Z to C, recalculate, review, and consider significance

* What is cooling energy load to achieve T2 for Scenario 2, if air exchange rate is 0.5 full volume / hour ?
* Comment on temperature change versus time change versus air exchange rate change on the calculated cooling energy load?

**(4%) Individual Assignment 03 - Task T 03**

Hand Calculations (Commercial)

Instructor presents an example for a scenario (draft version in course materials).

Scenario 03 - Commercial

* Perfectly sealed box (warehouse freezer) 50 ft (15 m) x 20 ft (6 m) x 14 ft (4 m)
* Air exchange rate = 0
* Temperature (evenly mixed) (T1) starting at 5 C at 01 pm (time 1).
* Temperature (evenly mixed) (T2) desired at 4 C at 08 pm (time 2).

Scenario 04 - Commercial

* Leaky box (warehouse freezer) 300 ft (90 m) x 50 ft (15 m) x 15 ft (5 m)
* Air exchange rate (doors) of full volume every 20 hours (or 0.05 full volume / hour)
* Outdoor temperature is a constant 30 C
* Temperature (evenly mixed) (T1) starting at 5 C at 01 pm (time 1).
* Temperature (evenly mixed) (T2) desired at 4 C at 08 pm (time 2).

Student Learner Participant self selects changes to default scenario for their scenario.

Q 01 - Participants calculate for default setting

* What is cooling energy load to achieve T2 for Scenario 1?
* What is the cooling load to achieve T2 for Scenario 2?

Q 02 - Participants revise variable value X to A, recalculate, review, and consider significance

* What is cooling energy load to achieve T2 for Scenario 1, if T1 is 24C?
* What is the cooling load to achieve T2 for Scenario 2, if T1 is 24 C??

Q 03 - Participants revise variable value Y to B, recalculate, review, and consider significance

* What is cooling energy load to achieve T2 for Scenario 1, if time 2 is 8 pm?
* What is the cooling load to achieve T2 for Scenario 2, if time 2 is 8 pm?

Q 04 - Participants revise variable value Z to C, recalculate, review, and consider significance

* What is cooling energy load to achieve T2 for Scenario 2, if air exchange rate is 0.5 full volume / hour ?
* Comment on temperature change versus time change versus air exchange rate change on the calculated cooling energy load?

Task 04 (10% - Individual Assignment)

Understand typical building designs, common building materials, and their impact on associated comfort

* Belize and North American examples
* Moisture flows, humidity, vapour barriers, temperature
* BuildingScience.com information resources

**(10%) Individual Assignment 04 - Task T 04**

Task 4 Calculate Dew point Using Temperature Differential

* Psychrometric Chart and Excel Workbook
* Assess Belize Case Study on wall and floor for condensation risk at different temperatures and relative humidity

Belize Case Study for RETScreen Small Group Project included wall and floor section information

Instructor reviews use of Psychrometric Chart and Excel Workbook for calculating Dew Point.

Individual assignment to:

* Review the Case Study information
* Consider the condensation risk at different temperatures and relative humidity
* calculate the dew point

Task 04 (10% - Group Project)

Understand typical building designs, common building materials, and their impact on associated comfort

* (3 %) Belize and North American examples
* Moisture flows, humidity, vapour barriers, temperature
* (7%) BuildingScience.com information resources

**(03%) Group Project 04 - Task T 04**

Belize and North American examples

Moisture flows, humidity, vapour barriers, temperature

Instructor provides examples of Belize Residential, Belize Commercial, North American Residential, and North American Commercial building section drawings of exterior walls, floors, doors, windows, and roofs. Instructor provides examples of methods for calculating moisture flows, humidity, vapour barrier, and temperature flow.

Groups prepare a scenario that is reasonably expected to depict a residential building that they are familiar with in Belize, and a commercial building that they are familiar with in Belize.

Q 01 – Present as part of a letter report, section drawings of what is reasonably expected to represent the exterior walls, floors, doors, windows, and roofs for the two buildings in their scenarios.

Q 02 – As part of a letter report, state some relevant scenario working assumptions about building materials, construction and operation; as well as climate, and site conditions, and their changes over time; and based on this, calculate moisture flows, humidity, vapour barrier, and temperature flow.

Q 03 – Assume and describe some changes to the two building scenarios. Recalculate based on these changes. Prepare a letter report on the calculated changes when the building materials change.

**(07%) Group Project 05 - Task T 04**

BuildingScience.com information resources

Instructor provides online survey of useful information resources on this website (e.g. the examples of searching for documents or information on the website, such as those highlighted in the course materials (e.g. Type; Climate Zone – BA 1208 Performance of a Hot-Humid Climate Community).

Q 01 (4%) - From the Document Search function of BuilidingScience.com website, review the variety of documents and case studies in the “Designs that Work” section. Study the Project Home Again – New Orleans case study materials. including text on Enclosure Design, Mechanical Design, Lessons Learned & Future Projects, and Technology Gaps and Barriers. Submit a letter report commenting on what if any of the New Orleans case study information would be useful in revising and improving on two residential and two commercial Building Scenarios prepared for Group Project 01 – Task 04.

Q 02 (3%) - From the BuilidingScience.com website, review the variety of courses offered as part of professional development. Identify two (2) courses that you believe would be useful for you, and submit a letter report to your “employer” proposing that they consider paying for you to attend these courses, what the costs might be, and what value would this professional development bring to your team.

Task 05 (8% - Individual Test)

Identify energy efficient upgrades for existing buildings

* (2%) Cooling
* (2%) Lighting
* (2%) Cooking
* (2%) Plug In equipment

**(08%) Individual Test 02 - Task T 05**

8% as 2% x 4 Topics

Instructor leads discussions and provides some background information and general examples.

(2 %) Q 01 – For Cooling activities, identify an energy efficient upgrade for a typical residential building and a different one for a typical commercial building in Belize.

(2 %) Q 02 – For Lighting activities, identify an energy efficient upgrade for a typical residential building and a different one for a typical commercial building in Belize.

(2 %) Q 03 – For Cooking activities, identify an energy efficient upgrade for a typical residential building and a different one for a typical commercial building in Belize.

(2 %) Q 04 – For Plug-in-Equipment activities, identify an energy efficient upgrade for a typical residential building and a different one for a typical commercial building in Belize.