Welcome to the Teaching Architecture + Energy project at Washington University. This site is part of a collaborative network of energy technology teachers in architecture schools, sponsored in part by the U.S. Dept. of Education. Our goal is to make it easier for architecture students to understand energy concepts and to design energy efficient buildings. The curricula developed here and at other universities is centered around Energy Scheming, a energy simulation tool that helps the student think about energy as an integral part of building design.

**Climate:**
context for design

**Exercises:**
"recycling with energy scheming"

**Example:**
shanley building

Student Work

Legal Disclaimer
RECYCLING WITH ENERGY SCHEMING:
Schematic Design & Performance

TERRAIN MAP: outline of exercise

A. DOCUMENTING: input your building

B. DEFINING: take-offs and specifications

C. ANALYZING: understanding energy patterns

D. RE-DESIGNING: 'generate and test' cycles

E. EVALUATING: energy codes as indicators

Download the PDF version of the exercise
In Part C of this exercise, you interpret and assess the buildings performance using feedback from the Window Sizer and Graphic Reports.

1) **Use the Rule-of-Thumb Window Sizer**
   Now that your building specification is complete, you can look at *Energy Scheming*’s graphic feedback. To understand how your design is performing at a coarse level for daylighting, solar heating, and ventilation, use the R/T window Sizer tool.

2) **View the Graphic Report**
   - Examine the "Net Flow" graphic report showing all four climate days.
   - Examine the "Total Gain and Loss" format, for the same days.
   - Examine the report "By Element Group," for the same four days.

3) **Interpret and assess the building’s performance**
   Interpret the graphic reports and recommend design changes to improve performance. Annotate your reports.

**Part C Grading Criteria**
C. ANALYZING: understanding energy patterns

1. Use the Rule-of-Thumb Window Sizer

Now that your building specification is complete, you can look at Energy Scheming’s graphic feedback. To understand how your design is performing at a coarse level for daylighting, solar heating, and ventilation, use the R/T Window Sizer tool.

The Window Sizer is accessed from the “Rule-of-Thumb / Window Sizer...” menu. From within the Window Sizer, you can also review your parameters for Solar, Daylighting and Ventilation, by clicking on the buttons. For help, see the section “The Rule-of-Thumb for Sizing Windows,” in Chapter 5 of the ES Manual.

Your design performance goal, in PART D of this exercise, will be to get as many of the factors as close to 100% of your targets as possible. For now, just make sure that you are seeing bars in all of the areas where you should.

- **If the bar for solar heating does not show up**
  Check the orientation of solar windows. For solar heating, only glass oriented within 22.5° either way from south (SSE, S, SSW) will be included in the R/T calculation.

- **If solar gain performance looks very high or very low**
  Check that the floor area you specified in the project definition matches the actual floor area of the building or portion of the building that you are studying in ES.

- **If you do not see any stack ventilation bars**
  Make sure that both inlets and outlets are specified. If only inlets or only outlets are specified, stack ventilation will not work.

- **If you do not see one of the cross ventilation bars**
  Cross ventilation requires both inlets and outlets. Make sure that you have windows facing the prevailing wind (inlets) and some windows away from the prevailing wind (outlets). ES treats as inlets windows oriented within 45 degrees of the prevailing summer wind direction.

- **If daylighting bars do not show up in each zone**
  Be sure that you have both electric lights and windows defined and associated with each zone. To associate a window or electric lighting zone
with a daylight zone, click in the appropriate part of the daylight zone icon that shows up in each window and lighting spec window.

**Analyze the Window Sizer Feedback**

If your bars are not all at 100% of your targets, which is probably the case, make recommendations for what you plan to change in PART D to improve performance. In the example above, the building needs the following things to improve R/T performance:

- **Solar gain is 10% over target.** This is probably not a problem. Pay attention to ventilation and lighting first.

- **Cross ventilation outlets and inlets are both at over 200% of target.** This is not necessarily a problem. Too much ventilation can be reduced by not opening the windows all the way. However, operable windows are more expensive than fixed windows, so some of the window types could be changed to fixed types. Remember that the wind speeds being used in the climate file are from the airport, so they will be higher than the wind speeds at your building, unless your site is very open, like an airport. Therefore, unless you have adjusted your climate file for a reduced wind speed that represents site conditions, you will WANT to oversize cross ventilation windows. For dense urban sites, shoot for near 200%. For suburban sites, make your target 150%.

- **Stack ventilation inlets are at 165% of target, while the stack vent outlets bar shows just over 70% of target.** Again some oversizing is not a problem. If the same windows are being used for cross ventilation and stack ventilation, then, because stack ventilation openings must be larger, cross venting openings may be oversized. In the example building, more stack outlets must be added, on any elevation, while inlets could be decreased by either changing window types or making smaller windows. The other design option is to increase the stack height. Higher stacks require smaller windows to remove the same amount of heat. Stack height can be increased design of the section, by making ventilation “chimneys,” or by lowering inlets and raising outlets in the wall.

- **Daylighting for the three zones specified shows that Zone One is close to its target, needing only a small amount of increased window area.** Zone Two is substantially below target, at just over 70%. Window area in Zone Two should be increased by 30%. Zone Three is above the target by 75%. This means that the space will be much brighter than intended or needed. The windows in Zone Three probably need to be smaller. However, some of these windows may be facing south and thus used for solar gain. This can be addressed in two ways, by reducing non-south windows in Zone Three, or by changing some direct gain solar collection windows into an indirect solar gain strategy, such as a thermal storage wall or sunspace, so that the windows are collecting heat, but not necessarily admitting too much light. Excess glass above what is required for daylighting, also carries a thermal penalty because it is a poor insulator and because it may admit summer solar heat gains.

**Turn in**

- *A record of the “Percentages of Target Area Achieved.”*
  - You will not be able to print the takeoffs unless you use a screen capture technique.

- *Recommendations to improve the Rule-of-Thumb Window Sizing Performance for*
  - Heating
  - Ventilation
  - Daylighting

For a guide, see the shanley example.

Jump to the next section: View the Graphic Report
Only the graphic report, numeric reports, and the advisor report can be printed from ES. To export any screen or graphic from ES for use in another application, such as a word processor used to create your assignment report, use a screen capture technique. Options include:

- **Apple System Screen Capture.**
  The key command "COMMAND-SHIFT-3" will take a snapshot of the screen that can be opened in Photoshop or any image editor that will read PICT format. When you do this, you will hear an audible click. The image is stored on the local hard drive (Macintosh HD) and is named, "PictureN," where N is a sequential number. If you take several screen captures, they will be labeled, "Picture 1," "Picture 2," "Picture 3," etc. To open them, first start Photoshop or your favorite imaging program, choose FILE /Open, and navigate to your local hard drive where you will find the images. The image will be of the entire screen, so you will want to crop it to just the part you need. The image is created by default in RGB color. If the source captured is gray scale, you can convert the image to grayscale to make a much smaller file (in Photoshop, choose IMAGE / Mode...).

- **Screen Snap Utility.**
  If you are working on your own Mac or a Mac that you can configure by adding files to the system folder, you may want to try out the screen snap utility Snap Jot. It is freeware. Download Snap Jot and place it in the Extensions Folder within your System Folder. Download Snap Jot DA and place it in the Apple Menu Items Folder within your System Folder. You can use Snap Jot to take a picture of any portion of your screen.

- **Energy Scheming Screen Snap.**
  ES version 3.0 and higher has a built-in screen capture function available for selected screens.

SAVE and BACK-UP your work.
C. ANALYZING: understanding energy patterns

reports

2. View the Graphic Report
   - Examine the “Net Flow” graphic report showing all four climate days.
   - Examine the “Total Gain and Loss” format, for the same days.
   - Examine the report “By Element Group,” for the same four days.

   - From the “VIEW” menu, choose “Graphic Report.”

   - To make ES calculate and draw the graphic report, click on the “Calculate button in the lower left corner.

   - To change the graphic report format, find the floating palette named “Graph” on the graphic report window. Hold down on the lower menu and a pop-up menu will give you a range of options for how to view the graphic report. Select the desired graph type.
You should generate three graphs in the types shown below. Adjust the scale as necessary, so that all four graphs fit on one page and are as large as possible on the page, yet, keep all three graph types the SAME SCALE for comparison.

NOTE: You can also drag the graphs up or down in the report window by dragging on the black square handle at the end of each graph’s zero line.

● Examine the "Net Flow" graphic report showing all four climate days. Net Flow reports are a good way to determine which season the designer should focus attention on first. Focus design attention on the season(s) with the largest net loads.

● Examine the "Total Gain and Loss" format, for the same days. Total Gain and Loss reports are useful in determining peak loads, and their causes, in summer and winter.
Examine the report "By Element Group," for the same four days. The Element Group graph is useful for determining the relative importance of different building elements and internal gains in contributing to heat loss and gain across the day.


Turn in

- **Annotated Printouts of these three reports.** They represent your beginning performance.

For a guide, see the *shanley example*.

SAVE and BACK-UP your work.
RECYCLING WITH "ENERGY SCHEMING": Schematic Design Performance
Suggestions for how to explain your work.

Below are some suggestions for a possible format used to annotate screen captures or prints of graphs. You may document and explain your work in any way you choose. A recommended method is to capture screens from ES, cropping and labeling in an image processor, such as Photoshop or Canvas; then import the image into a page layout program like PageMaker or a word processor like MSWord to annotate and write up your work.

1. Annotate the graphs
   a. Highlight the hours on the graphs when certain phenomena are taking place and key them to your explanations.
   b. Draw the outline of your "old" graph on top of your "new" graph and highlight the differences. Key the highlights to your explanations.

   An example:

   ![Graph Example]

   1. The dark line shows the profile of the previous graphic output. Reduction in solar gain by shading was effective in lowering the peak load.
   2. Reduction in infiltration was effective in reducing loss.
   3. The roof gain is still high. It may be able to be reduced by making the shingles light in color.
   4. Electric lighting cannot be reduced because there is insufficient light available for daylighting.

2. Annotate the schedules

   The performance of a building is often greatly influenced by when people are present, when lights and equipment are on or when shading is allowed. There are also important interactions between the climate and schedules. Annotating the schedules will sometimes help you explain why the building is performing the way it is.

   For example:
1. There is no heat gain from people in the middle of the day because the people are gone and the lights and equipment are turned off.

2. Heat gain could be reduced by having a higher thermostat set-point at mid-day when the building is unoccupied.

3. Cross ventilation is "on" all the time and there is wind, therefore there must not be any windows facing in the correct direction to ventilate because ventilation is not shown in the load graph.
3. Interpret and assess the building’s performance.
Interpret the graphic reports and recommend design changes to improve performance. Annotate your reports.

Now your task is to figure out how your building is performing and what you should do to improve the performance.


- Energy Scheming allows you to look at two basic energy design goals:
  - To reduce the daily net heat flow in the building during all 24 hours to zero or near zero, using conservation and passive strategies, thereby minimizing the energy use of the building. In practice, this “Zero Energy” goal is difficult to achieve, but ES can help you get closer.
  - To reduce the peak loads in summer and winter, thus reducing the size and expense of mechanical equipment.

- Things to Consider:
  - To what season should you direct more of your design attention, based on performance of your first scheme?
  - What season has greatest net gain? Greatest net loss? At what time of day?
  - Are losses and gains generally high or low? What is the implication?
  - Are gains and losses likely to be in the same area of the building, so that they could be used to offset each other?
  - For the most extreme gain and loss hours, what elements are primarily responsible?
  - What design changes or strategies will you pursue?

- Recommend at least eight significant design changes, four each at each of two scales:
  - building scale
  - component scale

- If you are using ES version 3.0 or higher, first analyze your results with the advisor and thermographics functions turned off. Then, after recording your insights, run the thermographics and advisor. How good was your assessment?

Turn in:
- A 500 word statement
  Describe what thermal problems you have and how you will solve them. Be prepared to discuss this in class.

For a guide, see the shanley example.

SAVE and BACK-UP your work.
EXAMPLE PROJECT
shanley dental building, clayton, mo

Harris Armstrong, Architect, 1936

Worked Example
Re-Cycling with Energy Scheming exercise

Model
Final Drawings
Drawings
Site Photos
EXAMPLE PROJECT: example exercise

outline of example problem pages

A. DOCUMENTING: input your building (example)
   1. Assemble Schematic Plans and Elevations of Your Design
   2. Identify the Building's Construction Type(s)
   3. Diagram the Solar Concept
   4. Determine Your Simulation Strategy
   5. Diagram the Daylighting Zones
   6. Get the Drawings into the Computer
   7. Create a New Climate, if necessary

B. DEFINING: take-offs and specifications (example)
   1. Tune Settings to Fit Your Building
   2. Define Your Daylight Zone Icon
   3. Set Performance Goals for Lighting and Heating
   4. Create Plan Specifications
   5. Create Elevation Specifications

C. ANALYZING: understanding energy patterns (example)
   1. Use the Rule-of-Thumb Window Sizer
   2. View the Graphic Report
   3. Interpret and Assess the Building's Performance

D. RE-DESIGNING: generate and test cycles (example)
   1. Re-Design to Meet Your Window Performance Targets
   2. Re-Design to Reduce Net Flows and Peak Loads
   3. Print the "Energy Performance Report"
   4. Document Design Changes

E. EVALUATING: comparing with energy codes (example)
   1. Set an Energy Budget
   2. Choose Reference Criteria
   3. Model Your Reference Case Building
   4. Compare the Performance of the Two Designs

Download the PDF version of the exercise
C. ANALYZING: understanding energy patterns

use the rule-of-thumb window sizer

1. Use the Rule-of-Thumb Window Sizer

Turn in

- A record of the "Percentages of Target Area Achieved."
- Recommendations to improve the Rule-of-Thumb Window Sizing Performance for Heating, Ventilation, and Day lighting

The Rule-of-Thumb Window Sizing Aid for the Shanley Building as built is shown above. Remember that the meaning of the 100% line is set for each passive strategy in the parameters section. (setting parameters)

**Solar Gain**
The solar gain rule-of-thumb, for which our target of 100% represents a 49% SSF, show that we are about 35% of the way toward our goal. The building could use more south facing glass. This may be a challenge in our redesign, since its narrow face is to the south, leaving the whole north wing of dental offices with no south elevation. Our redesign might look for a way to bring in south sun through the roof.

**Cross Ventilation**
We are currently meeting all of our needs for cross ventilation outlet, but show no inlets. The outlets are from the operable windows on the east side. There are no north, west or south operable windows on the main floor. Also, there is no path for air to move from potential south inlets at the basement level to the east side outlets. Our summer wind is form the south. Obviously, we need some south inlets! We could also get cross ventilation going in the basement recreation room if we made part of the east window on that level operable, like on the floor above. Since air flow from south to north through the building will be unlikely, given its plan, we should probably add some operable windows on the west. That way, air could move down the hall and help suck ventilation air out of the offices.

**Stack Ventilation**
We have no stack ventilation currently specified. Stack ventilation requires a difference in height between inlets and outlets to drive the chimney effect. In
the original design, this is not possible. If there were west operable windows at the reception area, or over the stair, the open stairwell might be used as a stack to vent the basement. The waiting room has a high ceiling, so low inlets with high outlets could generate some stack cooling there. In the office, if we add south roof light, we might find a way to also get some stack outlet, preferably to the north, away from the prevailing breeze, so that any breeze could augment the stack cooling by creating a negative pressure on the outlets as it moved over the roof. Since it can sometimes be calm in St. Louis when it is hot, we will pay special attention in the redesign to improving stack ventilation, which works without the wind.

Daylighting
All daylight zones show sufficient window area to meet the daylight factor targets we set earlier for each zone. However, zones I, II, and IV show excessively high levels, with two zones over 200%. Let's take a look in more detail to understand why. First of all, as with all rules-of-thumb, we should take a look at the assumptions used, to see how close they match the building we are analyzing or designing. The daylight sizing rule-of-thumb assumes single glass, no external obstructions, and 40% average internal reflectance. Our internal reflectances range from 45% to 55%, somewhat higher than the R/T. However, we have double glass or glass block throughout. Double glazing reduces the visible transmission of the window by about 7% from that of single glass. Glass block transmission is actually about the same as clear glass, but depends on the product used. Most of our windows are unobstructed, excepting the south facing basement windows, which have deep shading that undoubtedly reduces the amount of daylight that reaches the window. All in all, we can probably trust the R/T, as the double glazing losses are offset by the higher internal reflectances. However, we should probably oversize the zone V windows somewhat from the R/T recommendations.

Analysis and Redesign Recommendations

Zone I: Waiting Room
This zone has large windows facing south and moderate areas facing east. It registers at +200% of target. Since the south windows are providing most of our solar gain aperture so far, we probably don't want to reduce their area, unless, we can really do a good job distributing south glass to other parts of the building. We could look at reducing the area of east windows, although we should keep enough to do the cross ventilation job. We set the design target of this space at 4% DF (reading). Given its central experiential role and its role as direct gain heating, we could look at raising the target. Another option would be to redesign the south wall with more indirect solar gain, such as a south facing sun space enclosing the balcony, or a partial masonry thermal storage wall. That would allow us to keep the desirable south sun for heating, but reduce the size of the windows that are over-lighting the space, potentially causing uncomfortable glare.

Zone II: Reception Area
This zone has small glass block windows to the north and a large glass block window to the west. Since the R/T sizer shows the zone at over 160% of target, and since unshaded west windows will capture unwanted summer sun, they could be substantially reduced in size, while still meeting the daylight goal.

Zone III: Dental Offices
The offices and examination rooms in Zone III are coming in right on target. Looks like their sizing is fine.

Zone IV: Corridor
The corridor, Zone IV, shows a +200% sizing bar. Its target is set at 2% DF, plenty high for navigating a corridor. This indicates that, as in the reception area, the west facing glass block area could be reduced.

Zone V: Basement Recreation Room
This zone's bar is just under the 100% target. We should look at two things here: 1) increasing the area by say 20% to account for the reductions in lighting by the deep shading, and 2) finding a way to get more of the useful south solar heat into the south windows, perhaps by making the balcony penetrable to sun.
C. ANALYZING: understanding energy patterns

2. View the Graphic Report

Turn in
- Annotated Printouts of these three reports. They represent your beginning performance.

Annotated "Net Flow" graphic report for the Shanley Building.

Annotated "Total Gain and Loss" graphic report for the Shanley Building.
Annotated "By Element Group," graphic report for the Shanley Building.

Jump to the next EXAMPLE section: Interpret and Assess the Building's Performance
graphic report: net flow report

- "Net Flow" graphic report
- "Total Gain and Loss" graphic report
- "By Element Group" graphic report

"NET FLOW" graphic report for the Shanley Building.

![Graphic Report - Shanley11/9 - Total Net Heat Flow - Final Results](image)
Analysis
The "Total-Net Flow" graphic report shows that the building is thermally unbalanced in all seasons. Winter losses at night peak around 80,000 Btu/hr. Summer gains peak in the afternoon just under 60,000 Btu/h. This indicates a significant summer and winter condition, indicative of a continental temperate climate. Spring (March) and Fall (September), follow the same pattern as Winter and Summer, respectively. So even when temperatures are much less extreme, the building is not able to use gains to offset losses (or vise versa) during any time of the year. We will have to address all seasons equally in the re-design.
**Analysis**

The "Total-Gain & Loss" graphic report shows that in the winter, losses heavily outweigh gains. In order to get the building to balance in the heating...
season, we will have to drastically reduce losses. Any effort to increase gains, such as by increasing south windows to capture more sun, will be futile in the face of these large losses.

In the summer, gains occur all day long and taper off into the evening, but occur up until midnight. Almost no losses seem to be available during this season. The redesign will have to address how to increase losses, perhaps by ventilation. Until the potential for losses are increased, thermal storage will not be effective, because, even though the building may have the capacity to store heat in its mass, it seems to have no way to release it.
graphic report: "by element group" report

- "Net Flow" graphic report
- "Total Gain and Loss" graphic report
- "By Element Group" graphic report

"BY ELEMENT GROUP," graphic report for the Shanley Building.

Click on one of the graphs to see more detail
**Analysis**

The "by Element Group" graphic report shows which elements contribute to gains and losses in each hour. The *graphic legend* gives the meaning of each graphic symbol. In winter, we can see that the most significant losses come from walls, followed by floors and conduction through the windows. It's a pretty good bet that the walls and floors need better insulation (since they have none!). There is some solar gain, but not enough to offset the losses. There are relatively small gains from internal loads, such as people and equipment, but the beginning and end of the day show the lights, on as there is insufficient daylight during these times to meet the lights target.

Spring shows losses reduced, relative to winter. This makes sense, since the temperatures are not as low. With losses reduced, there is some excess solar gain during the day, and we see the thermal mass coming into play to absorb those excess gains. When the sun goes down, the mass symbol switches to above the zero line, as gain from mass, and starts to release its heat to meet night time losses. Unfortunately, not enough heat is stored to meet the heating needs of the building and the same wall, floor, and windows losses as in winter start to rule.

In summer, gains through the wall increase up to a peak in late afternoon. Solar gains are actually less in summer than in spring, because of the shading on east and south windows. In the overheated periods, shading is obviously being employed. Still, unless the losses can be increased substantially, we will need to look at how to keep even more direct sun out during the hot summer days. Note that excess heat is not being stored in the mass and that no ventilation is showing up below the zero line as losses. In fact, there is no evidence of ANY ventilation in the building. That is definitely something to investigate!

Fall shows a similar pattern to the summer day, except that, because the temperature is cycling from above the interior set point during the day, through the comfort zone, and down to a temperature below the low interior set point, we can again see mass at work. Since there are some small losses at night, when outside is cooler than inside, the mass can store heat during the day and release it at night. What if we could somehow speed up or intensify that process?
RECYCLING WITH "ENERGY SCHEMING": Worked Example

C. ANALYZING: understanding energy patterns

Assessment for redesign

3. Interpret and Assess the Building’s Performance

Turn in

- A 500 word statement. Describe what thermal problems you have and how you will solve them.
- "Net Flow" graphic report
- "Total Gain and Loss" graphic report
- "By Element Group" graphic report

Statement of the Thermal Problems in the original design for the Shanley Building

To make our descriptions easy to follow, each annotated graph (click on the links above) has a short analysis on the same page. Here we will summarize the analysis and make some plans.

Design for All Seasons

The Shanley Building in thermal terms, follows its climate quite closely. St. Louis has a four season climate with both significant cooling and heating seasons. From the Net Flow graphs, we saw that, in the winter, our building loses heat in all but one hour. In the summer, it has net gains every hour between 6 AM and midnight. Winter peak loss is between 5 and 6 AM, near the coldest time of the night. Summer peak is between 4 and 5 PM, near the daily high temperature. The milder spring and fall season do not come near to balancing, indicating that we will need to address all seasons in the redesign.

Unequal Gains and Losses

From the Gain & Loss graphs, we found that losses are higher in winter than any other season, and are more than twice the amount of gains. In summer, gains totally dominate, with almost no losses. The building is small and tightly planned, so that, if distribution were configured properly, gains in one area might be used to offset losses in other areas. However, in the current scheme, that can probably only happen with the help of ducts and fans.

Poor Thermal Envelope + Low Winter Solar Gains

From the Element Group graphs, we found that losses from walls and floors, and to a lesser extent, windows, obviously need to be reduced. The first step in our redesign will be to tighten up the envelope by adding insulation to the walls and floors and probably increasing the roof insulation, also, to bring the building up to at least the minimum energy code standards. After reducing winter losses, we will re-run the building to see if more heat is being stored in the mass -- and to see if we need to increase the solar gain. According to the R/T Window Sizing Aid, we need to increase our south window area. We plan to look at re-scheming the roof section as a way to get more south sun deeper into the north side rooms.

Summer Gains from Walls, Windows, Roofs

The summer day element group graph shows problems with walls, this time from too much conductive gain. It also shows that roof gains, despite being moderately insulated and finished with reflective aluminum paint, are about twice the gains from the uninsulated floors, indicating the effect of direct solar radiation on the near-horizontal roofs. This suggests that some attention to both increasing thermal resistance of the walls and finding a way to reduce the loads on the roofs would help. When we redesign the roof, we will try to reduce the horizontal component: more south or north facing roof will reduce its summer solar load.

No Inlets! Poor Ventilation Pathways

The summer day element group graph shows no mass or ventilation. Since we see some mass working in the spring and fall, we will assume for now that our first task is to get mass working in the summer and winter, before considering adding more. The R/T Window Sizing Aid, shows no inlets and about the right amount of outlets. Since the summer wind is from the south, we need to make some of the south windows operable, and plan a way for the air to move through the building, as we outlined in the Window Sizer analysis. Since the summer wind in St. Louis can sometimes be slow, especially at night, we think that we should give a shot to redesigning the building section to promote stack ventilation. Inlets can happen through the existing windows, but we will need lots of outlet!
Unshaded Gains from East and West Windows
The Element Group graph for summer showed solar gain through windows as as the largest contributor to gains. To see more detail, we looked at the graphic report for summer only, and set the graphic report format to "by Windows, Solar." The graph is shown above. The east windows are showing big gains in the morning, even with shading on the office windows, which are reduced as the sun moves to the south a near noon, leaving only diffuse solar gains from sky and ground reflection. Morning gains could be reduced by externally shading the glass block window in the waiting room and the basement recreation room. South windows, despite their large size, show low gains and appear to be well shaded. Afternoon gains are overwhelmingly from the unshaded west glass block windows. This could be addressed by reducing window area on the west, shading the windows, or both.

Check With the Advisor
To see how our interpretive skills are progressing, we checked in with the Energy Scheming Advisor. Read about how our analysis compares with that of the ES Adviser:
Summary
While it is tempting to suggest a dramatic (and simple) improvement, such as changing the orientation of the building from north-south elongated to east-west elongated, to get full sun exposure and full cross ventilation, we don’t think that Harris Armstrong’s client, Dr. Shanley, would have liked the idea of having to buy another lot to accomplish this. So, instead, we plan to stick with the site and basic footprint as given.

Here is a summary of our planned next design revisions:

Building Scale Strategies
- Redesign the roof section to get more south sun to north rooms.
- Redesign the roof section to reduce summer solar gain by having less horizontal slopes.
- Redesign the building section to increase the potential for stack ventilation.
- Redesign the south wall to retain or increase solar collection aperture, while reducing daylight, perhaps using a thermal storage wall or sunspace.

Component Scale Strategies
- Increase Insulation in walls, floors, basement walls, and roof to decrease winter conduction losses.
- Make south windows operable to promote cross ventilation. Track the path of airflow through the building and make sure each inlet has a way for the air to get out, such as in the basement.
- Improve shading on west facing windows to reduce solar gains.
- Reduce west facing window in the reception area (Zone II) to reduce solar gain and conduction loss/gain, while still meeting day lighting target.
- Redesign the south balcony to get more south sun to the basement.

Return to the EXAMPLE OUTLINE
Download the exercise and example
The following links download a PDF version of the exercise and the example.

- to download the files mouse click once on the links below
- to download all parts at once click here (RECYCLING WITH ENERGY SCHEMING 3.2MB) zipped
- to download a copy of Adobe Reader follow the following link

A. DOCUMENTING: input your building .5MB zipped
B. DEFINING: take-offs and specifications 1.2MB zipped
C. ANALYZING: understanding energy patterns .5MB zipped
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E. EVALUATING: energy codes as indicators .8MB zipped