Model Revision: Phase 1
Direction for SRA
Date Updated: March 3, 2015

Objective: The updates described herein should all take place simultaneously in Portfolio Manager. They are the first of a series of updates that will incorporate revised models (CBECS 2003) into Portfolio Manager. As the new models take a different format than the existing models, there are new procedures that will be incorporated. Subsequent phases of the process will consist of adding 1 more revised model at a time, as they are completed.

Timeline: ASAP

Items:

- Office and Financial Center – New Terminology
- Occupants – New Terminology
- New Attribute for Offices, Banks, Courts
- Revised Office Model Format (Office, Bank, Court)
- Revised Garage Model
- New Source Energy Conversion Factors
- New procedure for combing multiple spaces in a building
    - Methodology for primary spaces
    - Methodology for secondary spaces
- New Attribute for Computer Data Center
- New weather normalization
- Coefficient Correction in K-12 Model
- Office Model Lookup Table
- Log of SRA Questions & Responses

Important Note – Testing of New Methods
As has been done in the past, once all of these changes have been developed, EPA would like SRA to compute the "old" and "new" ratings for all buildings in Portfolio Manager, in order to help us understand the changes and prepare effective communication. Per SRA Question # 2.1.1.3 (See Log of SRA Questions at the end), EPA created a template of the general format that this summary information should take. Please note that the excel provides format guidance, and does not include each column that is listed and requested in the EPA response to Question 2.1.1.3.

We may also develop a way to test more specific parts of the new routines, according to a model similar to the weather normalization test that we conducted in January of 2007. Direction on that testing will be provided, as necessary.

Office and Financial Center – New Terminology

The terminology Office (General), Office(Financial Center), etc is considered to be unnecessarily cumbersome for Portfolio Manager Users. It should instead be replaced with 3 simple categories:

1. Office
2. Bank / Financial Institution
3. Courthouse

This categorization means that we are no longer going to have separate Bank and Financial Center categories in Portfolio Manager. All existing space classified as Office (Financial Center) or Office (Bank Branch) shall be reclassified as Bank/Financial Institution.

Please note that this change in terminology will need to be reflected in Portfolio Manager Help and on the web site.

Added Note (per 6/13 meeting):
For the purpose of computing the predicted energy with the new benchmarking equation, and for the purposes of applying eligibility rules, Office, Bank/Financial Institution, and Court spaces should all be combined together. They are considered ONE space as far as the benchmarking is concerned, with the multiple names to facilitate use for our partners. In any single building the office benchmarking model equation should only be calculated once (where it is applied to the summed attributes for all office, bank, and court, spaces listed).

Occupants – New Terminology

EPA will change the field "Occupants" under the Office/Bank/Court model to "Workers on Main Shift". This should be changed in Portfolio Manager, PM Help, the web site, and all other instances. This is a long overdue change that brings the definition in-line with the real required input for the ENERGY STAR model.

This will also require a change to the definition listed in PM Help.

- Current Definition:
  Indicates the total number of employees who work in this office space. The normal occupant density ranges between 0.3 and 10 occupants per 1000 square feet (92.8 square meters).

- New Definition:
  Indicates the number of employees who are present during the main shift. This is *not* the total number of employees or visitors who are in a building on during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters).

There will be no change to the default value of 2.2 workers/square foot.

The same terminology change will be implemented for the Other space type.

New Attribute for Offices, Banks, Courts

The new benchmarking equation will require two additional pieces of information: the percent of the office/bank/court that is heated and the percent that is cooled. In order to avoid common confusion for office owners of whether to include common spaces like elevator shafts, or unventilated places like storage rooms, we will not ask this question directly. Rather the attribute should be set up as follows:

Is any portion of this space heated? Yes/No
    If the person selects yes, the page should refresh to say:
    Is 50% or more of this space heated?

If the space is not heated, then 0 percent will be assigned.
If 50% or more of a space is heated, then 100 percent will be assigned.
If less than 50% of a space is heated, then 33 percent will be assigned.

We will ask about cooling the same way:

Is any portion of this space cooled? Yes/No
    If the person selects yes, the page should refresh to say:
    Is 50% or more of this space cooled?

If the space is not cooled, then 0 percent will be assigned.
If 50% or more of a space is cooled, then 100 percent will be assigned.
If less than 50% of a space is cooled, then 25 percent will be assigned.

**Due to the formatting of PM, SRA will reword these questions so that they read as a single entry question (without page refreshing)
**Also note that since the previous version this section has been slightly edited:
-Buildings that are exactly 50% heated or cooled should be assigned a value of 100%
-Buildings that are less than 50% cooled should be assigned a value of 25%

Revised Office Model Format (Office, Bank, Court)

The new office model will rely on the following equation:

SourceEUI = 186.609
+ 34.175 [Ln(square foot) - 9.5346]
+ 17.278 [(computer density)- 2.2308]
+ 55.959 [Ln(weekly operating hours) - 3.9716]
+10.340 [Ln(worker density) - 0.5616]
+ 0.008 [HDD*PercentHeated- 4411.0157]

+ 0.014 [CDD*PercentCooled- 1156.5708]
- 64.827 [SmallBank] * [ln(Square foot) – 9.5346]
+ 34.202 [SmallBank * [Ln(worker density) – 0.5616]]
+ 56.300 [SmallBank]

Where:
Source EUI = Source Energy per square foot
Square foot = total floor area of space
Worker density =number of workers per 1000 ft^2 (=1000*workerNumber/ft^2)
Computer density = number of computers per 1000 ft^2 (=1000*PCNumber/ft^2)
HDD/CDD = Heating/Cooling Degree Days (experienced, not 30 year avg)
Percent Heated/Cooled = PM assigns percent, see above under "new attribute"
Small Bank = This is 1 for a Bank that is 50,000 square foot or smaller
(and this is 0 for any other building)

Added Note (Per 6/13 Meeting)
Before applying this equation to compute a prediction, the attributes for all office, bank/financial institution, and court spaces should be combined. Instructions for combining are provided on page 5. Because these spaces are all combined into one, for a single building, the preceding benchmarking equation should only be applied one (1) time.

Whole Building Consideration – Note on Small Banks
There is an important note on the "Small Bank" Terms in the preceding equation. The analysis and ratings are designed to rate entire buildings, not spaces within buildings. Therefore, when our analysis shows an interaction term for Banks that are smaller than 50,000 square foot in size, this interaction is statistically valid for *buildings* that are smaller than 50,000 square foot, not for pieces of buildings that are smaller. Mathematically, this means that the "Small Bank" adjustment only occurs for banks that are less than 50,000 square foot. To ensure that our ratings reflect this analysis, the small bank adjustments should only occur when:

- The sum of all Office, Bank/Financial Institution, Courthouse Space is less than 50,000 square foot; *and*
- The Bank/Financial Institution represents more than 50% of that sum (sum of all Office, Bank/Financial Institution, Courthouse).

These conditions ensure that we only apply the adjustment to Bank/Financial Institution *Buildings* that are smaller than 50,000 square foot.

A lookup table for this new model is presented at the end of the document and attached in Excel. Unlike previous lookup tables, this lookup table is *not* presented in units of source energy. It is presented in a unitless ratios representing the actual energy/predicted energy.

Note that with this methodology of predicting EUI it could be possible to receive a negative prediction of EUI. This is not expected, however, when attribute values fall well below average ranges (i.e. a building that is only open 5 hours a week), this can occur. In these cases, the program should default a negative prediction to a value of 1 and in this case, the building should receive an NA as its rating (NA Message: "The combination of space attributes is unexpected and cannot be assessed) *(does SRA have a better suggestion for this message?)*. Ideally, SRA will be able to note any occurrence of negative values and inform EPA.

To score a building that consists of one office/bank/court space only:

1. Calculate the predicted Source EUI
2. Calculate the predicted Source Energy use (=Predicted EUI * Square foot)
3. Calculate the efficiency ratio = Actual Source Energy / Prediction from Step 2 (where the actual energy use is summed from all meters)
4. Lookup the ratio in the lookup table
5. Return rating

To score a building that consists of multiple office/bank/court spaces:

1. The attributes will be combined for all office/bank/court spaces within a single building

Added note (per 6/13 meeting)
This means the attributes should be added across all office, bank, and court space. The attributes of all three of these spaces are added together and the modeling equation is applied a single time.

    a. Square foot = add the square foot for all spaces
    b. PCs = add the PCs for all spaces
    c. Workers on Main Shift = add the workers for all spaces
    d. Operating Hours = Compute the average operating hours *weighted by floor space*
    e. Percent Heated
        i. Calculate the average percent heated using the binned value (0, 33%, or 100%) for each space. *(average weighted by floor area)*
        ii. Place average from step i into the appropriate bin
            1. value = 0, in the 0 bin
            2. 0<value<50%, in the 33% bin
            3. value>=50%, in the 100% bin
    f. Percent Cooled – Compute like Percent Heated (except here, the bins are 0, 25%, 100%)
    g. Values needed for the predicting equation (such as worker density) are then computed with these aggregate figures.

2. Determine whether the combined office/bank/court space qualifies for the "Small Bank" adjustments in the model. The combined office/bank/court space qualifies if:
    a. The square foot of the combined space (from 1.a) is 50,000 square foot or smaller, *and*

    b. The square foot of any bank space(s) is more than 50% of the total square foot from 1.a
3. Compute the predicted EUI using the combined values obtained from step 1 (use the Small Bank adjustments, if needed)
4. Calculate the predicted Source Energy use (=Predicted EUI * Square foot)
5. Calculate the efficiency ratio = Actual Source Energy / Prediction from Step 2 (where the actual source energy use is summed from all meters with the appropriate conversion factors)
6. Lookup the ratio in the lookup table
7. Return rating

To score a building that includes an office space with another type of space (primary or secondary, please see discussion below).

Revised Garage Model

The revised garage model will also take on a new form, which estimates the required fan and lighting power. This will require a new set of space attributes. The new approach will work for all parking (whether an open parking lot or a garage), so we will no longer need that second page prompting the user to select between the two. Rather, there will be one space available, Parking. All existing garages and parking lots will be recoded into this new space (see guidelines, below)

New Space Attributes - Parking

A. Total Gross Floor Area of Parking
B. Parking ft^2 that is enclosed
C. Parking ft^2 that is not enclosed (with a roof)
D. Parking ft^2 that is open (no roof)
E. Hours of Access (means total hours when it is possible for a vehicle to enter/exit)

When the user has entered all three, the system should check that B+C+D=A, if not the user should not be able to save the space: they should see a flag and be required to fix the numbers.

Predicting Equation

The garage prediction will be calculated in units of Source Kbtu, as follows:
(The space attributes are referenced by letters corresponding to the preceding list)

Garage Prediction (Source Kbtu) = Prediction for Enclosed
+ Prediction for Not Enclosed
+ Prediction for Open

Garage Prediction (Source Kbtu) = 29.9 * B + 0.27 * B * E
+ 29.9 * C
+ 20.0 * D

Whole Building Consideration

Under the new format, there is no reason why a given building in Portfolio Manager would require more than one Parking/Garage space. The new system accounts for any type of structure or surface parking. However, we know there are existing buildings with multiple "Garage Spaces", in some cases this was done to separate out roof space. At this time we are not going to change any of their information, we will allow them to have two spaces designated as "Parking". However, since this is not necessary (unless there are two separate enclosed parking areas with different hours of access), we would like to add a flag to the system. If a building already has a "Parking" space and the user attempts to add a second, then he/she should see a flag indicating that in most cases this is not necessary, and require that they confirm to add the space anyway.

Recoding Guidelines
Because the new attributes for Parking differ from the attributes required for Parking Garage and Open Parking lot, the following table summarizes re-coding guidelines.

Re-coding Guidance for Parking		
Old Variable	***Equivalent New Variable***	***Note on Conversion***
Existing "Parking Garage" Space		
Garage	Parking	New name
Gross Floor Area	Total Gross Floor Area	Same variable, new name
Number of Workers	NA	Number of workers will no longer display or be requested (but can be retained in the system for reference)
Operating Hours/Week	Hours of Access	The new variable (hours of access) will be created; its initial value will be set to the current value for operating hours. *Operating hours will no longer display (but can be retained in the system for reference)*
Floors Above Ground	Parking ft^2 that is not enclosed (with a roof)	Parking ft^2 not enclosed = Gross floor area*(Floors above/total floors[1]) *Note that #Floors Above will no longer display (but can be retained in the system for reference)*
Floors Below Ground	Parking ft^2 that is enclosed	Parking ft^2 enclosed = Gross floor area*(Floors below/total floors) *Note that #Floors Below will no longer display (but can be retained in the system for reference)*
NA	Parking ft^2 that is open (no roof)	New variable – Populate with a zero value
Existing "Open Parking Lot" Space		
Open Parking Lot	Parking	New name
Gross Floor Area	Total Gross Floor Area	Same variable, new name
Operating Hours/Week	Hours of Access	The new variable (hours of access) will be created; its initial value will be set to the current value for operating hours. *Operating hours will no longer display (but can be retained in the system for reference)*
NA	Parking ft^2 that is not enclosed (with a roof)	New variable – Populate with a zero value
NA	Parking ft^2 that is enclosed	New variable – Populate with a zero value
NA	Parking ft^2 that is open (no roof)	New variable – Populate with a value equal to the gross floor area

[1] The total number of floors is the sum of the floors above ground and the floors below ground

New Source Energy Conversion Factors

Based on our research and analysis the new source conversion factors are summarized in the following table.

Summary of Changes to Site-Source Conversion Factors		
Fuel Type	**Current Factor**	**New Factor**
Electricity	3.013	3.340
Natural Gas	1.024	1.047
Fuel Oil (1,2,4,5,6,Diesel, Kerosene)	1.0	1.01
Propane & Liquid Propane	1.0	1.01
Steam	1.39	1.45
Hot Water[2]	1.0	1.35
Chilled Water	1.0	1.0
Wood	1.0	1.0
Coal/Coke	1.0	1.0
Other	1.0	1.0

These new source conversion factors will be applied uniformly to *all* buildings in Portfolio Manager, even those that do not have an office space. We understand that this means *all* buildings may experience a small change in rating.

New procedure for combing multiple spaces in a building - Primary Spaces

In order to rate a building with more than one type of primary space, the following procedure will be applied:

1. Create a combined lookup table
    a. As with the current models, this will be completed by "adding across" the two lookup tables.
    b. For each space with an old model (i.e. school) there is a unique look up table in units of source energy
    c. For each space with a new model (i.e. office) there is a lookup table in units of the energy efficiency ratio – This can be converted into units of source energy by multiplying each ratio by the predicted energy intensity and the floor space value. The following example table works through this calculation at 3 scores.

[2] Currently Hot Water is listed in each of the technical descriptions with a conversion factor of 1.0. However, Hot Water is not a fuel option in Portfolio Manager. Hot Water will be added as a fuel option in Portfolio Manger and its conversion factor will be 1.35, as listed.

Score	Energy Intensity Ratio	Source Energy Value
99	0.2	1,600,000
75	0.4	3,200,000
30	2.1	16,800,000
Note: this assumes a building with a predicted EUI of 80 and a floor space of 100,000		

d. The combined lookup table adds across the source energy at each score. The following table illustrates an example of this for an office and school.

Score	Office Source Energy	K-12 Source Energy	Combined Source Energy
99	1,600,000	1,000,000	2,600,000
75	3,200,000	2,500,000	5,700,000
50	8,000,000	5,000,000	13,000,000
30	16,800,000	8,000,000	24,800,000

e. The actual source energy use (the total summed across all meters with ***no*** weather normalization) can be directly looked up in the combined source energy column.

2. It is important to note that the proposed method, when applied to a combination of two new spaces can also be computed directly in ratio units, where the ratios are added across and ***weighted according to the relative predicted source energy use***. This method is mathematically identical. It is described in the following table.
   a. As the two methods are mathematically identical, SRA should select the methodology that minimizes programming time and works best within the tool. It may be useful to try to plan for a future in which all models will have a ratio lookup table, in that case this second method may reduce overall time spent.

Rating	Office Lookup Ratio Value	K-12 Lookup Ratio Value	Combined Lookup Ratio Value
100	0.2	0.15	0.185
75	0.36	0.29	0.339
50	1.0	1.0	1.0
25	2.9	3.5	3.08
Note: *These number are sample figures, and assume a building that is 70% office (i.e the office predicted energy accounts for 70% of the total predicted energy)*			

New procedure for combing multiple spaces in a building - Secondary Spaces

Each secondary space has a predicted energy use (or energy use per square foot). According to the current routines these values are added to the energy values in the lookup table. Our analysis indicates that a superior methodology is to subtract the energy

use from the actual energy value instead. Therefore predicted secondary space energy will no longer impact the lookup table, it will be subtracted directly from the actual source energy consumption.

Our analysis indicates that at this time, there is not a risk that the prediction for the secondary space will exceed the actual energy consumption and result in a negative value after subtraction. However, we should potentially be prepared for this case, as in theory we should be prepared for a future with net-zero energy buildings. Therefore, there should be a condition that states if a negative value is obtained, then the user receives an actual energy value of 0 (which would mean a score of 100). Ideally SRA would track the occurrence of any such zero values and report them to EPA.

New Attribute for Computer Data Center

This addition will no longer be included with Phase 1 of the office release. When we have the required information, will we will pursue this change as its own enhancement.

New weather normalization

During the fall of 2006, SRA developed new code for weather normalization (the process of converting actual energy use to the energy use that would have been experienced if the building experienced 30-year average temperatures). Based on recommendations from SRA and internal discussion, EPA will use the Phase 1 Model Revision release to apply the new weather normalization routine to all buildings. This will have important implications for the displayed Ratings, Weather Normalized Source Energy Intensities, and the APER of all buildings. Considerations for each of these metrics are outlined below.

Ratings

In their predictive equations, all ratable building currently reference the 30-year average HDD and CDD values. Going forward all predictions will reference as experienced HDD and CDD values instead. Using the experienced HDD and CDD values will result in new adjustments and lookup tables for each building.

Currently the energy use for all buildings is weather normalized (brought to the 30 year average) and that normalized value is compared to the lookup table to assign rating. Going forward the actual source energy use (no weather normalization) will be compared directly to the lookup table.

We understand that this change will result in rating changes for all buildings. EPA will review all of these rating changes (once they are computed by SRA) prior to release.

Added Note (per 6/13 building)

This means with these changes all ratable buildings will begin to use the as experience HDD and CDD values in place of the 30 year averages and will use actual (non-normalized) source energy to determine the rating.. This applies to every building that receives a rating, not just office buildings.

Weather Normalized Source Energy Intensity
The new procedure will be used to adjust each energy consumption value for a 12 month period to the energy that would have been experienced in the 30 year average year. This new normalized value will be divided by the average square foot of the 12 month period of interest to present the Weather Normalized Source Energy Intensity. It is EPA's understanding that this is how the WN Source Energy Intensity is already calculated, the change will only affect how the "Adjustment factor" is computed.

Adjusted Percent Energy Reduction
The weather normalized source energy is currently part of the calculation of the APER. Going forward, this will no longer be the case for ratable buildings (though it will be the case for non-ratables):

- Ratable Buildings: To evaluate the adjusted percent energy reduction the actual energy in the baseline year will be compared to the actual energy in the current year, where the actual energy in the current year is adjusted by a normalization factor (equal to: Energy Use Prediction in the Baseline Year/Energy Use Prediction in the Current Year):

$$APER = \frac{EnergyBaselineYear - EnergyCurrentYear(normalizationFactor)}{EnergyBaselineYear}$$

$$APER = \frac{EnergyBaselineYear - EnergyCurrentYear(\frac{\Pr edictionBaseline}{\Pr edictionCurrent})}{EnergyBaselineYear}$$

This represents two changes:

  - The Predictions for the current and baseline year should use the actual experienced HDD and CDD values. (replaces current procedure that uses 30-year average values)
  - The Energy Use values for the current and baseline years should not be subjected to weather normalization. (replaces current procedure that uses weather normalized energy use values)

Added Note (per 6/13 building)
This means with these changes all ratable buildings will begin to use the as experience HDD and CDD values in place of the 30 year averages and will use actual (non-normalized) source energy to compute the APER.. This applies to every building that receives a rating, not just office buildings.

- Non Ratable Buildings: Non-ratable buildings are currently (to be implemented on 4/27) evaluated according to the following procedure

$$APER = \frac{\frac{WNSourceEnergyBaseline}{SquareFootBaseline} - \frac{WNSourceEnergyCurrent}{SquareFootCurrent}}{\frac{WNSourceEnergyBaseline}{SqaureFootBaseline}}$$

$$APER = \frac{WNSourceEUIBaseline - WNSourceEUICurrent}{WNSourceEUIBaseline}$$

For the non-ratable buildings there is no change in the overriding procedure. However, the method for calculating the Weather Normalized Source Energy Values will be changed given the new methodology for computing the adjustment factor (see preceding discussion of change to weather normalization).

Note that a non-ratable building shall be defined as *any* building that cannot receive a rating. For all non-ratable buildings, we will apply the new normalization routine to calculate the adjusted percent energy reduction (APER).

Coefficient Correction in K-12 Model

Per email correspondence from Steve Murray (dated 12/9/2004), there is currently a mis-match between the technical description for the K-12 Model and the EMAC values that are use in Portfolio Manger:

- Technical Description (Correct) coefficient for HDDxPH = 0.00006155
- EMAC/PM (Incorrect) coefficient for HDDxPH = 0.00004609

In light of the other changes which will impact scores (source conversions and weather normalization), we are going to take this opportunity to correct this mistake in Portfolio Manager. Please correct the EMAC value to correspond with the technical description. Per email correspondence (dated 1/3/2005) we understand that this change will result in score increases for most schools (though some will see no change in score, none will experience a decrease). Given that this analysis is over 2 years old, we understand that specific score changes will not meet the forecast.

Office Model Lookup Table

Rating	Cumulative Percent	Ratio
100	0	0
99	0.01	0.278705054
98	0.02	0.328378785
97	0.03	0.363069513
96	0.04	0.390860472
95	0.05	0.414570191
94	0.06	0.435548169
93	0.07	0.454555724
92	0.08	0.472068834
91	0.09	0.488406944
90	0.1	0.503795953
89	0.11	0.518402156
88	0.12	0.532351935
87	0.13	0.545743906
86	0.14	0.558656676
85	0.15	0.571154088
84	0.16	0.583288821
83	0.17	0.595104957
82	0.18	0.606639831
81	0.19	0.61792541
80	0.2	0.628989379
79	0.21	0.639855874
78	0.22	0.650546148
77	0.23	0.661079059
76	0.24	0.671471454
75	0.25	0.681738493
74	0.26	0.691893906
73	0.27	0.701950188
72	0.28	0.711918839
71	0.29	0.721810423
70	0.3	0.731634749
69	0.31	0.741400967
68	0.32	0.751117652
67	0.33	0.760792889
66	0.34	0.770434339
65	0.35	0.780049297
64	0.36	0.789644751
63	0.37	0.799227395
62	0.38	0.808803777
61	0.39	0.818380192
60	0.4	0.827962809
59	0.41	0.837557683
58	0.42	0.847170782
57	0.43	0.856808019
56	0.44	0.866475277
55	0.45	0.876178438
54	0.46	0.885923374
53	0.47	0.895716094
52	0.48	0.905562599
51	0.49	0.915469015

Rating	Cumulative Percent	Ratio
50	0.5	0.925441595
49	0.51	0.935486743
48	0.52	0.945611048
47	0.53	0.955821308
46	0.54	0.966124562
45	0.55	0.976528131
44	0.56	0.987039576
43	0.57	0.997667003
42	0.58	1.008418734
41	0.59	1.019303594
40	0.6	1.030330898
39	0.61	1.04151052
38	0.62	1.052852951
37	0.63	1.064369374
36	0.64	1.076071746
35	0.65	1.087972892
34	0.66	1.100086608
33	0.67	1.112427786
32	0.68	1.125012549
31	0.69	1.137858414
30	0.7	1.15098447
29	0.71	1.164411615
28	0.72	1.17816278
27	0.73	1.192263249
26	0.74	1.206741002
25	0.75	1.221627143
24	0.76	1.236956405
23	0.77	1.252767759
22	0.78	1.269105168
21	0.79	1.286018498
20	0.8	1.303564664
19	0.81	1.321809057
18	0.82	1.340827351
17	0.83	1.360707829
16	0.84	1.381554399
15	0.85	1.403490574
14	0.86	1.426664811
13	0.87	1.451257812
12	0.88	1.47749271
11	0.89	1.505649653
10	0.9	1.536087272
9	0.91	1.569275363
8	0.92	1.605846676
7	0.93	1.646683052
6	0.94	1.693067609
5	0.95	1.746975249
4	0.96	1.811687387
3	0.97	1.893296432
2	0.98	2.0053174
1	0.99	2.190161245

Log of SRA Questions & EPA Responses

(Initial EPA Responses are in Blue, updated response are in Red)

1. **SRA Questions – First Round, Received by EPA and answered on 3/19**

1.1. EPA states that any facility with an office space will NOT be weather normalized.

1.1.1. Will this be the case for ANY building with an office/financial center/bank/court space, regardless of the gross floor area of that office compared to the rest of the building? For example, if we encounter a facility that is 98% supermarket with a small office that comprises 2% of the facility's gross floor area, should we not weather normalize?

Refer to Weather Normalization Section – Weather normalization will no longer be a part of any ratings, instead all buildings will use experienced HDD, CDD

1.2. Regarding the EPA statement: The new benchmarking equation will require two additional pieces of information: the percent of the office/financial center/bank/court that is heated and the percent it is cooled:

1.2.1. EPA phrased it as a building question and not a space question. Is that intentional? Is it appropriate to collect this information as space attributes?

This has been corrected in the write up. This information will be collected as a SPACE attribute.

1.2.2. If so, then data would be collected regarding how much of a building is heated/cooled at a **building** level, but since similar data is currently collected as space attributes, how should this data be collected for a buildings with multiple office spaces?

NA – This will be a space attribute for Office spaces only, so it will not affect the other spaces.

1.3. For the new heating and/or cooling attributes for all office types: 1) General Office, 2) Financial Center, 3) banks, and 4) courts, the proposed question-and-refresh to collect the attribute data does not fit into our standard data collection model, which may require significant development; therefore, SRA recommends we collect this attribute data in a single entry format that will eliminate the need for a page refresh (SRA would provide a wireframe of this design, including appropriate language for the attribute title and its options).

This is acceptable.

1.4. Regarding the EPA statement: The terminology Office (General), Office (Financial Center), etc., is considered to be unnecessarily cumbersome for Portfolio Manager Users. It should instead be replaced with four simple categories: 1) General, 2) Financial Center, 3) Bank, and 4) Courthouse.

1.4.1. SRA recommends redesigning Portfolio Manager so a user could select these four office types in the "space type drop down" menu instead of

having to drill down after selecting "Office" and then selecting the type of office (on a second page).
Yes, EPA agrees, this is part of the reason for trying to simplify the naming.

1.5. Can EPA provide any additional information on the new Garage Model?
Updated – refer to text.

1.5.1. Can EPA provide any details concerning how the new garage model will work with the new office model and other existing space models?
Updated – refer to text.

1.6. When can SRA expect to hear back from EPA concerning each item highlighted in yellow (re: Model Revisions – Phase 1 – DRAFT Documentation).
Updated – refer to text.

1.6.1. Note: Since the Lookup Table for the new office space model is required before any testing on the new model can begin, comments from EPA are of vital importance.
Updated – refer to text.

1.7. Note: since these changes being addressed may have far reaching effects (especially with regard to TF, TFDX, PMDX, PM, public and help documentation for all systems), additional "in the weeds" questions will most likely come up once we've had the chance to delve into the requirements gathering/design process.
This is obviously expected. We will provide responses to any specific questions, and involve Bill von Neida as necessary.

1.8. Since we are changing the weather normalization routine which will affect user's ratings, SRA recommends we change the source energy conversion factors at the same time in order to minimize impact to the user. Do you agree?
Generally yes. This is why ***all*** changes listed in the document (including source energy) should occur at the same time.

1.9. Recommendations

EPA: The new weather normalization technique (already developed/programmed by SRA in December 2006) will be applied in two ways. We would like SRA's feedback on the two options.

SRA: SRA recommends that Option B is used. We feel it's easier to maintain and there is less possibility for errors. In addition, it should eliminate the possibility of inadvertently using the wrong method in future use.

Option A is feasible, but will be very difficult to maintain. We would suggest option B, which is much simpler from a programming standpoint as it cuts down on the number of

times we would have to address changes with the user and cuts down on any possible complications on maintaining multiple versions of the same process.

The section on weather normalization has been updated, taking into account SRA's recommendation. Please review the update section.

2. SRA Questions, Second Round Received by EPA on 3/28, answered on 4/2

2.1. EPA stated they would like an analysis of facility ratings before and after "all of these changes" have been implemented:

2.1.1.1.[Question] Will this analysis look at the overall system that has all the changes (new models for office, CDCs, Garages, etc., fuel type conversions and weather normalization routines)? Or does EPA want to run the analysis for each of these separately?
We would like to see the combined effect of all changes.

2.1.1.2.If separately, what comparisons would EPA like to see?
NA

2.1.1.3.[Question] What information would EPA like to see in the analysis besides the differences between the old and new ratings? Since the ratings will change on existing buildings and new buildings keep coming up, how do they want to see the reporting of these and test?

This is hard to define, since we cannot anticipate all problems. Generally we will want: Building ID, Location, Owner/Partner, Old Score, New Score, square foot, type of building, indication of whether they have a label and what years total site energy, total source energy, old WN Source, new WN source. We would also see the average value for the space attributes for each space type in the building.

As on the attached, this should be summarized in Excel, with 1 row per building. (I didn't put in a column for each attribute for each space, I just did a few to show the general idea…but we will want all attributes).

2.2. Given that 50,000 square feet is the cut-off point for Financial Centers, how will Portfolio Manager handle a facility with two Bank branch spaces with 30,000 Sq ft each? Can that be considered as a Financial Center of 60,000 sq ft? That is, should the max bounds be per space or per all spaces of the same type?

This is now addressed in the section on the new office model, specifically under the heading of "Whole Building Consideration"

2.3. Will EPA be providing SRA the content/description for these changes for the Web site? SRA assumes this information will also be placed on the Portfolio Manager home page as well? Will SRA be provided with the language for these areas?

Yes, EPA will provide this language. (but this should not slow development)

2.4. SRA understands "Total Critical (IT) Power" to be the minimum power needed to sustain operations in a data center. Is this correct?
No, this not correct. IT power is a measure of power required by the equipment, but does not include the supporting (HVAC) load which can be just as high.
THIS UPDATE HAS BEEN REMOVED.

2.4.1. Will the user be entering this attribute or will it be calculated by Portfolio Manager?
This will be a user entered field. (no longer applicable)

2.4.2. Regarding a user-entered value, what will the user actually be entering? What units will this be?
This is under the to be provided section. It will likely be in units of Kwh. (no longer applicable)

2.5. We realize EPA is still considering the attributes for the new garage model. So that SRA can accomplish as much as possible on the development of the new garage model now, can EPA provide any of the following?
Updated – refer to text.

2.5.1.1. Does EPA know any of the attributes that will be used? Is it possible for EPA to provide the shell of model equation similar to what was provided for the new office model understanding that the coefficient are still to be determined?
Updated – refer to text.

2.5.1.2. Will different garage types have different models?
Updated – refer to text.

2.6. EPA previously stated that the new "% heated" and "% cooled" attribute should be asked on the Space Type level for Offices only and not at the building level; however, in a building with multiple Office spaces, currently Portfolio Manager treats them as one large Office space. Portfolio Manager combines Floor space, Occupants, and PCs and adds them together, while the operating hours/week are weighted by floor space.

2.6.1.1. Regarding the variation from 33 to 100 percentage space attributes, does it make sense to implement this in 10 percent increments as opposed to the three static values?
No. This will be implemented in the binned approach, as described.

2.6.1.2. What value should the system use as the total % heated/cooled value? For example, consider the following facility:

- Space A has 50,000 sq. ft. and more than 50 % of the space is heated (100%)

- Space B has 10,000 sq. ft. and has less than 50% heated (33%)
- Space C has 2,000 sq. ft. and is not heated (0%).

I would assign this building 100%; As a whole, the building is more than 50% heated.

This is now addressed explicitly in the section on how to combine multiple office spaces together. Each bin value will be weight averaged together and the result will then be binned. For this example:

100%(50,000/62,000) + 33%(10,000/62,000) + 0% (2,000/62,000) = 85.97

85.97 is greater than 50%, so this space gets a binned value of 100%

2.7. Outstanding Issues

2.7.1. EPA needs to make final decision regarding Financial Center removal as space type in Portfolio Manager or to reclassify Financial Centers as Bank.

Updated – refer to text.

2.7.2. EPA needs to finalize the heating and cooling percentages to be used in the new office model when the user indicates the percentages listed below.

Updated – refer to text.

2.7.3. EPA needs to supply finalized lookup table for the new office model attributes.

Updated – refer to text.

2.7.4. EPA needs to validate new office model values (highlighted below in yellow):

Updated – refer to text.

2.7.5. EPA needs to supply appropriate data model for three Garage types: Enclosed Garage, Not-enclosed Garage, and Open Parking Lot.

Updated – refer to text.

2.7.6. EPA needs to identify the site to source energy conversion factors for all fuels in Portfolio Manager

Updated – refer to text.

2.7.7. EPA needs to provide documented references for these values for posting on Web site and in Portfolio Manager Help files.

Technical development does not depend on this. This will not be completed until every other outstanding issue is resolved.

2.7.8. EPA needs to decide whether or not to implement bounds on the adjustments for multiple building spaces (information on these bounds is still under review).

(decided – see text)

**EPA unsure if these following questions still apply, please clarify?

2.7.8.1. Operate on a space by space basis because it works off the building level where it aggregates the data? Or do it across the board for Space models?

2.7.8.2. How do we roll up the value?

2.7.8.3. How do we communicate alerts back to the user if offices are bound together?

2.7.9. EPA needs to finalize the space model for Computer Data Center, which will incorporate “Total Critical (IT) Power” into the rating. (Note: for the time being, “Total Critical (IT) Power” will not be required for benchmarking).
This update is no longer included.

2.7.10. SRA is still waiting on a final decision from EPA regarding the Weather Normalization Question (Q 1.9)
(Completed – see text)

3. SRA Questions, Third Round, Received by EPA on 4/26, answered on 4/27

3.1. The % Heated and % Cooled attributes are still phrased about "this building". Question 1.2 established that this would instead be asking about "this space".
Actually, this was updated in the version dated 4/19

3.2. That section also references the method of asking the question of whether the space is heated/cooled, with a refresh after a Yes/No question. Question 1.3 stated that this would be changed to a single entry format.
This will be updated for the next version. A single entry format is considered acceptable.

3.3. The current equation for Offices has a coefficient assigned to "Bank," "Finctr," and "Courthse" - these are additional values assigned to the Predicted Energy Consumption value. So, in essence, if the same attributes and energy consumption values were entered for an Office (General) and an Office (Bank Branch), the Bank would score higher. The new equation only has a set of additional calculations for "SmallBank" - so, there will be no added gain for a Courthouse, or for a Bank/Financial Institute over 50,000 sq ft. Is this intentional?
That is correct. Large Bank/Financial Institutions and Courts will not be treated any differently from offices.

3.4. Concerning the change from "Occupants" to "Workers on Main Shift" - should this change be made in the "Other" space types (which also uses "Occupants")?
This is a good idea. Let’s do that, too. (EPA will update the text accordingly with next draft)

3.5. The coefficient for the "Small Bank Square Foot" attribute is -47.023. This could lead to some confusion from our users, since for two banks that are exactly identical in all attributes and energy use except for the floor space, the smaller bank will get a *higher* rating.
If two small banks differ in their floor space, then they are also likely to differ in their EUI, therefore you cannot actually know which will score higher. Regardless, the negative coefficient is appropriate given the analysis and reflects the presence of an “economy of scale” So, the relatively larger “small banks” are expected to use less energy per square foot. Note, that it is less energy per square

foot, not less energy overall. The sign (negative) of this coefficient is correct given the properties of the CBECS data.

3.6. Regarding the possibility of negative predicted EUI: "Ideally, SRA will be able to note any occurrence of negative values and inform EPA." Is this meant for during the testing/comparison phase, or after the new benchmarking equations are launched?

Both.

3.7. Outstanding Issues

SRA did not raise any *new* outstanding issues, the issues addressed in this round are identical to those under section 2.7, above.