VALIDATION OF HOT2000™ USING HERS BESTEST

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ABSTRACT

HOT2000™, a residential energy analysis program, is constantly under evolution. New models are added to the program and its user base is ever expanding. As such it is important to continuously validate the program and ensure that it will be useful in its intended markets. To this end, HOT2000™ has been run through the HERS BESTEST, a comparative testing method against other detailed simulation programs. This report outlines the cases modeled and the assumptions which were made. It presents the results with an analysis and provides recommendations for HOT2000™ as well as for the HERS BESTEST.

BACKGROUND

HOT2000™ (Natural Resources Canada, 1995) is a simplified residential heat loss analysis program, that is widely used in North America by builders, engineers, architects, researchers, utilities and government agencies and by a number of users in Europe and Japan. Utilizing current heat loss/gain and system performance models, the program aids in the simulation and design of buildings for thermal effectiveness, passive solar heating and the operation and performance of heating and cooling systems.

HOT2000™ uses a bin based method and long term monthly weather files to analyze the performance of the house. It includes such complex, interactive models as the Alberta Air Infiltration Model (AIM-2)(Walker and Wilson, 1990 and Bradley, 1993) which accounts for wind and stack effect and the interaction with mechanical ventilation and the Mitalas Method (Mitalas, 1982 and Canadian Home Builders Association, 1991) which analyzes below grade heat loss from the foundation and accounts for seasonal variation in soil temperatures and the effect insulation configuration has on heat loss. HOT2000™ is a three zone model (attic, main floors and basement) which considers utilized solar and internal gains and heat transfer between zones when calculating loads. It also accounts for on and off cycling and part load factors when determining the performance of the heating system.

More recently, sister programs to HOT2000™ (they share the same calculation core) have been developed. EC2000 (Natural Resources Canada, 1997) will be used as the compliance software for the performance path of the Canadian National Energy Code for Houses (National Research Council Canada, 1997), AUDIT2000 (Natural Resources Canada, 1997) has been developed to meet the needs of the retrofit market and Quick2000 (Natural Resources Canada, 1997) for a proposed Canadian Home Energy Efficiency Rating System (CHEERS) initiative.

HOT2000™ has undergone many validation tests over it's 14 years in existence, however, as housing technology changes and new models are added to the program it is important that the accuracy of the program be maintained. For this reason and to determine if HOT2000™ and AUDIT2000 would be acceptable as a compliance program for use in U.S. HERS programs, HOT2000™ was run through the Home Energy Rating System (HERS) Building Energy Simulation Test (BESTEST) (Judkoff and Neymark, 1995b).

SUMMARY OF HERS BESTEST

The Home Energy Rating system Building Energy Simulation Test, known as HERS BESTEST, was developed by the National Renewable Energy Laboratory (NREL) for the United States Department of Energy for the U.S. Home Energy Rating System (HERS) .

The HERS BESTEST is an extension of the IEA BESTEST which was developed by the International Energy Agency Solar Heating and Cooling Task 12 and the Energy Conservation in Buildings and Community Systems Annex 21 (Judkoff and Neymark, 1995a) The IEA BESTEST is a useful test procedure for building simulation program developers. The test procedure involves comparing a program's results to results from eight state-of-the-art building energy simulation programs. The IEA BESTEST is a more detailed and harsh test that is meant to be used for finding and diagnosing errors in programs.

The HERS BESTEST is also a comparative test. A programs' results are compared to those from the following three reference programs: BLAST 3.0 (Level 215), DOE2.1E (W54) and SERIRES/SUNCODE 5.7. HERS BESTEST was designed so that certifying agencies can establish their own test criteria based on their own particular needs. On its own though, all one can do with the HERS BESTEST is determine how the program's results compare to the reference programs'. There is nothing to say that the reference programs necessarily define the range for correct answers. Nevertheless, if a program's results fall outside the range defined by the reference programs it does warrant some concern since all three reference programs have already been subjected to extensive analytical and empirical testing.

Users of the HERS BESTEST must realize too that the definitions for "good" and "poor" results depend on what a building simulation program is intended to be used for. A particular building energy simulation program may be appropriate for some applications but may require different modeling capabilities or higher accuracy for other applications.

The HERS BESTEST consists of two tiers of tests. The Tier 1 cases test a typical U.S. house with average thermal mass. An initial base case is set up and tested, then modified for subsequent tests which analyze specific aspects of the program such as glazing, ground coupling and envelope resistance. The Tier 2 cases focus on passive solar construction. The total window area in the Tier 2 cases is larger than the Tier 1 cases (237 ft^2 vs. 197 ft^2 respectively). Case 165 has been omitted from this analysis since it models vertical fins on windows and HOT2000™ is unable to do so. A general description of each of the cases is outlined in Table 1. The Tier 1 cases are designated by an L before the case number and the Tier 2 cases are designated by a P.

Table 1 Case Descriptions

Case #	Description	Infil (ach)	Int. heat (Btu/d) Sens.	Int. heat (Btu/d) Lat..	R-value (h ft^2 F/Btu) Walls	R-value Ceil.	R-value Floor	Window Type	Window Orient.	Window Overhang	Subfloor
L100	Base Building	0.67	56,105	12,156	12	21	14	S	Avg. Dist.	No	Crawl
L110	high air infil.	1.5	56,105	12,156	12	21	14	S	Avg. Dist.	No	Crawl
L120	high wall & ceiling R-values	0.67	56,105	12,156	24	60	14	S	Avg. Dist.	No	Crawl
L130	high window R, low SHGC	0.67	56,105	12,156	12	21	14	DLE	Avg. Dist.	No	Crawl
L140	glazing area	0.67	56,105	12,156	12	21	14	None	N/A	No	Crawl
L150	glazing orient.	0.67	56,105	12,156	12	21	14	S	100% South	No	Crawl
L155	overhang	0.67	56,105	12,156	12	21	14	S	100% South	Yes	Crawl
L160	glazing orient.	0.67	56,105	12,156	12	21	14	S	50% East 50% West	No	Crawl
L170	internal loads	0.67	0	0	12	21	14	S	Avg. Dist.	No	Crawl
L200	low efficiency	1.5	56,105	12,156	5	12	4	S	Avg. Dist.	No	Crawl
L202	low exterior solar absorptivity	1.5	56,105	12,156	5	12	4	S	Avg. Dist.	No	Crawl
L302	uninsulated slab	0.67	56,105	12,156	12	21	Unins	S	Avg. Dist.	No	Slab
L304	perimeter insulated slab	0.67	56,105	12,156	12	21	Edge ins	S	Avg. Dist.	No	Slab
L322	uninsulated full basement	0.67	56,105	12,156	12	21	Unins	S	Avg. Dist.	No	Basement
L324	insulated full basement	0.67	56,105	12,156	12	21	Ins	S	Avg. Dist.	No	Basement
P100	high mass passive solar	1.5	56,105	12,156	24	60	23	DW	100% South	No	Crawl
P105	overhang	1.5	56,105	12,156	24	60	23	DW	100% South	Yes	Crawl
P110	lower thermal mass	1.5	56,105	12,156	24	60	23	DW	100% South	No	Crawl
P140	glazing area	1.5	56,105	12,156	24	60	23	None	N/A	No	Crawl
P150	glazing orient.	1.5	56,105	12,156	24	60	23	DW	Avg. Dist.	No	Crawl

Avg. Dist.: average distribution for window placement
DLE: double pane, low-e glass, wood frame, insulated spacer
S: single pane, clear glass, aluminum frame with thermal break
DW: double pane, clear glass, wood frame, metal spacer

Each test case is run independently for heating and for cooling except for the 300 series (foundation analysis) which is only run for heating. Tier 1 heating cases and all Tier 2 cases use Colorado Springs weather (a clear, cool climate), while Tier 1 cooling cases use Las Vegas weather (a hot, dry climate).

ASSUMPTIONS MADE IN HOT2000™

The HERS BESTEST manual has tried to account for the fact that different energy analysis programs require different formats for data input by including a multitude of input information. If the case could not be precisely modeled, assumptions were made to model it as closely as possible. When possible, a sensitivity analysis was performed on questionable input parameters in order to bracket the most accurate answer. This section outlines the assumptions that were made.

Component R-values

In general, the program is supposed to be tested using the most detailed level of modeling it is capable of and for the most part this rule was followed. The one case in which the most detailed level was not used was for the input of R-values of envelope components. HOT2000™ has the capability of calculating the effective R-value of an envelope component accounting for framing area, thermal bridging, interior and exterior film coefficients and individual component layers. However, the composite R-value specified in the HERS BESTEST manual was input directly instead, in order to eliminate extraneous sources of discrepancies in the results.

Window Solar Heat Gain Coefficient (SHGC)

Similarly to the component R-value case, the SHGC of the windows were specified so that the overall SHGC for the window equaled that specified in the HERS BESTEST manual. The manual gives a lot of details on windows, including a breakdown of the centre of glass (cog) and edge of glass (eog) SHGC. However, there is no explanation as to how they derive their final values. As such, it was decided to make sure that the overall value was equal to that specified in the manual instead of using the model in HOT2000 to calculate the overall SHGC from the specified values for cog and eog SHGCs and thereby eliminating extraneous sources of discrepancies in the results.

Infiltration

The HERS BESTEST provides the required infiltration rate to the program and does not actually test a program's capability of predicting the rate. This is an important aspect which should be tested in a program since infiltration can account for 16% to 35% of the heating energy requirement in existing houses (Scanada, 1996).

HOT2000™ has a detailed air infiltration model which calculates the infiltration rate on a monthly basis. As such the rate cannot be held constant as the HERS BESTEST requires. In order to simulate a constant infiltration rate, the air leakage was minimized and a balanced central ventilation system provided the air change rate. The air leakage was minimized by inputting "Blower Door Test" values for the air change rate and the equivalent leakage area. This still resulted in small air leakage rates for both the heating and cooling cases. The ventilation supply and exhaust fans were then set to an appropriate flow rate in order to achieve the required constant air infiltration rates for each case.

Internal Gains

For the base case, in order to model the required 56,104 Btu/d (16.456 kWh/d) sensible and 12,156 Btu/d (3.564 kWh/d) latent loads, the occupancy and lighting loads were adjusted. In HOT2000™, 0.72 kWh/d of latent loads (including domestic activities) and 1.6 kWh/d of sensible loads are assumed per adult. The number of adults and percent time at home were adjusted according to the latent loads required (2 adults at 93%) and the lighting loads were used to make up the difference in sensible loads (13.5 kWh/d). A similar methodology was used for the other cases.

This was accurate for the heating case however further adjustments were required for the cooling case as heat gains from the air conditioner fan provided some of the sensible load. Several iterations of runs were performed in order to determine what value to enter for the lighting load to account for the remaining sensible loads. The required value for the base case was determined to be 1.1 kWh/d.

For case L170, the internal gains are supposed to be set to zero. HOT2000™ is unable to make the internal gains from the a/c fan zero. Therefore for this case, the internal gains were over that required by the test. As well for cases L200 and L202 the internal gains from the a/c fan were higher than the total internal gains required, even with the lighting and occupancy minimized.

Thermal Mass

The HERS BESTEST does not directly provide the effective thermal mass of the building, which is the value that HOT2000 requires. As such the total building capacity was used as the effective thermal mass value. This may cause the HOT2000 results for heating to be a little higher than if the actual effective thermal mass value had been used.

300 Series Cases (Foundations)
It was not possible to model the foundation cases in HOT2000™ as specified by the HERS BESTEST manual. The manual lays out two methods for modeling the heat loss: the ASHRAE method and a soil coefficient method. The latter method models the soil as a large amount of mass in contact with ambient air. In other words a U-value can be assigned to the soil and it is modeled as an above-grade component with no thermal mass. Both of these methods assume that the heat loss is driven by the ambient air temperature and ignore the heat loss to the deep ground.

HOT2000™ uses the Mitalas heat loss method to model foundations. This is a detailed model which takes into account seasonal soil temperature variations and heat loss to both the deep ground and the surface. This method has been validated against real houses and was found to give accurate results.

The foundation cases were run in any case, however it was not expected that the results would be similar to the reference cases.

For case L304, the required skirt insulation was modeled as a higher R-value on the perimeter insulation, since a skirt cannot be specified in HOT2000™.

For Cases 302 and 304 the R-value used for the floor was 0.9 ft^2•F•h/Btu higher than required. HOT2000™ has a lower limit on the allowable R-value. This will be adjusted in subsequent versions.

Currently, a new foundation heat loss model, BASESIMP (Beausoleil-Morrison and Mitalas, 1997), is being implemented into HOT2000. BASESIMP, the next-generation of the Mitalas method, is a regression-based algorithm developed from thousands of parametric finite-element based simulations. It is able to model above grade portions of basements, more insulation configurations and better account for corner heat loss. Once implemented the foundation cases will be rerun through HERS BESTEST.

RESULTS

The following four tables contain the results of the analysis of HOT2000. The results for the three reference programs were taken from the HERS BESTEST manual. An analysis of the results is provided in the next section.

Table 2 Annual Heating Loads (MBtu/yr)

Case #	BLAST 3.0	DOE 2.1E	S/S 5.7	**HOT2000**
L100	61.94	58.00	72.4	61.08
L110	85.93	81.36	96.52	83.14
L120	50.27	45.08	57.83	48.23
L130	46.34	45.82	49.98	42.49
L140	49.14	47.24	52.48	48.35
L150	54.92	49.47	64.03	50.87
L155	57.38	52.28	66.91	54.22
L160	62.88	58.28	73.5	65.88
L170	73.06	71.64	85.45	74.01
L200	133.97	136.12	168.33	125.92
L202	137.46	142.06	172.54	131.44
L302A	70.48	67.43	82.90	70.30
L302B	65.25	60.12	73.10	
L304A	60.06	56.62	69.15	61.36
L304B	55.59	50.11	61.58	
L322A1	91.66	88.27	105.94	126.35
L322B1	81.82	77.71	92.38	
L322A2	92.50	86.33	107.69	126.94
L322B2	87.97	82.87	92.11	
L324A1	64.90	61.10	72.56	84.87
L324B1	54.57	50.38	62.44	
L324A2	65.02	60.31	73.47	86.49
L324B2	60.40	51.88	65.30	
P100	12.31	10.02	14.4	13.27
P105	14.59	12.10	16.97	15.26
P110	22.38	20.19	23.79	21.08
P140	29.40	25.82	29.42	29.00
P150	25.10	22.58	27.99	23.57

S/S: SERIRES/SUNCODE 1:basement & main floor are 1 zone
A: ASHRAE method 2:basement & main floor are 2 zones
B: soil coefficient method

Table 3 Delta Annual Heating Loads (MBu/yr)

Case #	BLAST 3.0	DOE 2.1E	S/S 5.7	**HOT2000**
L110-L100	23.99	23.37	24.12	22.06
L120-L100	-11.67	-12.92	-14.57	-12.85
L130-L100	-15.60	-12.18	-22.42	-18.59
L140-L100	-12.80	-10.76	-19.92	-12.73
L150-L100	-7.02	-8.53	-8.37	-10.21
L155-L150	2.46	2.81	2.88	3.35
L160-L100	0.94	0.28	1.10	4.80
L170-L100	11.12	13.64	13.05	12.93
L200-L100	72.03	78.12	95.93	64.84
L202-L202	3.49	5.94	4.22	5.52
L302A-L100	8.54	9.43	10.50	9.22
L302B-L100	3.31	2.13	0.71	
L302A-L304A	10.42	10.81	13.75	8.94
L302B-L304B	9.66	10.02	11.53	
L322A1-L100	29.72	30.27	33.54	65.27
L322B1-L100	19.88	19.72	19.98	
L322A2-L100	30.56	28.33	35.29	65.86
L322B2-L100	26.03	24.87	19.71	
L322A1-L324A1	26.76	27.17	33.37	41.48
L322B1-L324B1	25.25	27.34	29.95	

Table 3 Continued

L322A2-L324A2	27.48	26.02	34.22	39.86
L322B2-L324B2	27.57	30.99	26.81	
P105-P100	2.28	2.08	2.57	1.99
P110-P100	10.07	10.17	9.39	7.81
P140-P100	17.09	15.80	15.02	15.73
P150-P100	12.79	12.56	13.60	10.30

S/S: SERIRES/SUNCODE 1:basement & main floor are 1 zone
A: ASHRAE method 2:basement & main floor are 2 zones
B: soil coefficient method

Table 4 Annual Sensible Cooling Loads (MBtu/yr)

Case #	BLAST 3.0	DOE 2.1E	S/S 5.7	**HOT2000**
L100	54.66	60.80	59.32	53.15
L110	57.70	63.83	63.16	56.87
L120	51.34	56.14	55.01	48.80
L130	36.95	41.26	38.92	36.80
L140	23.52	26.54	24.65	24.64
L150	67.72	77.35	72.04	60.67
L155	54.08	59.06	57.51	51.26
L160	62.61	68.68	67.60	61.94
L170	45.83	49.06	49.31	43.12
L200	65.70	73.10	76.71	68.27
L202	59.61	62.24	70.58	63.47
P100	18.11	23.03	20.08	22.27
P105	11.95	13.63	13.45	16.90
P110	30.18	36.49	30.86	22.27
P140	1.67	2.84	1.73	4.07
P150	12.42	15.03	14.03	14.82

S/S: SERIRES/SUNCODE

Table 5 Delta Annual Sensible Cooling Loads (MBtu/yr)

Case #	BLAST 3.0	DOE 2.1E	S/S 5.7	**HOT2000**
L110-L100	3.04	3.02	3.84	3.72
L120-L100	-3.32	-4.67	-4.31	-4.35
L130-L100	-17.71	-19.54	-20.40	-16.35
L140-L100	-31.14	-34.26	-34.68	-28.51
L150-L100	13.06	16.55	12.72	7.52
L155-L150	-13.64	-18.29	-14.53	-9.41
L160-L100	7.95	7.88	8.28	8.79
L170-L100	-8.83	-11.74	-10.01	-10.03
L200-L100	11.04	12.30	17.39	15.12
L202-L202	6.09	10.86	6.14	4.80
P105-P100	-6.16	-9.41	-6.63	-5.37
P110-P100	12.07	13.45	10.78	0.00
P140-P100	-16.44	-20.19	-18.35	-18.20
P150-P100	-5.69	-8.00	-6.05	-7.45

S/S: SERIRES/SUNCODE

ANALYSIS

The following analysis is broken up into sections with respect to the four result tables. The results to the 300 Series (foundation) runs are not dealt with in those four sections, but instead under their own heading at the end of the Analysis section.

Annual Heating Loads

In all cases except L130, L200 and L202, HOT2000™'s annual heating loads were within the range laid out by the reference programs. In the three cases where the results were outside the range, they were close enough to have confidence in them.

Delta Annual Heating Loads

In all cases HOT2000™ predicted the appropriate direction for the change in heating load. However, there were a number of cases in which the delta annual heating load for HOT2000™ fell outside the range of the reference cases. These cases tended to have to do with the solar model. Two of the cases were from Tier 2 which specifically tests high passive solar contribution. The other two where a larger difference was found were in the cases of all the windows being on the South side or on the East and West sides.

HOT2000™ determines solar utilization from a series of curves based on a mass gain ratio (MGR) and a gain load ratio (GLR) (Barakat and Sander, 1982) This model was developed using an hourly simulation program, modeling a house with an even distribution of windows around the house and for five different weather regions. This model was validated against empirical data, however, the cases tested limited ranges of MGRs and GLRs. It is possible that for MGRs and GLRs that are outside the range of the original model (as might be possible in a case with all windows on the South side) the accuracy decreases. The Barakat-Sander model should be examined in more detail, to determine the limitations of the model.

Annual Cooling Loads

The results presented here are actually a second set of results from HOT2000™. The first analysis of HOT2000™ helped to identify a factor within the cooling model that was inappropriate. The factor was causing the program to underpredict the cooling loads. The factor was also tied into the thermal mass model and thus with it's removal the thermal mass case is not fully functional. The factor has since been removed and the thermal mass model will be reexamined.

As can be seen by the results in Table 4, most of the results are either within or close to the range laid out by the reference programs. Once again the highly solar cases stand out as being outside our own confidence margins from the reference cases. In particular L150 and a couple of the Tier 2 runs.

A more detailed look at case L150 was performed through examination of the monthly results. During the large cooling load months, HOT2000™ was either within or close to the range of the reference cases. It was during the swing months and in winter when the cooling loads are much smaller that

HOT2000™ was further off. If the problem with this case is due to the MGR and/or GLR being out of range, it may not be as important an issue, if only because it is unlikely that a house will have all of it's windows solely on the South side. It does mean however, that for a highly passive solar design, certain limit guidelines would have to be specified for the user as to when HOT2000 gives reasonable results.

Case P110 is off because of the cooling factor which was removed from the program. The factor was tied into the thermal mass model and without it, changing the thermal mass, as with this case, does not affect the cooling load as it should.

The result for Case L170 is also probably a little high based on the inability to zero the internal gains due to the air conditioner fan (see Assumptions made in HOT2000™ - Internal Gains). Having a higher internal gain would cause the cooling load to be overpredicted. Since the fan was set to auto, and thus was only run when the a/c was running, the maximum the result could be over by is 2.53 MBtu/yr (742 kWh/yr). Similarly, cases 200 and 202 were over the required internal gains by 5.20 MBtu/yr (1550 kWh/yr) and 4.92 MBtu/yr (1442 kWh/yr) respectively. However, since for these cases the fan was set to continuous and thus was run all the time, it is expected that the errors would be less than these amounts. The results for both case 200 and case 202 would still be within the range of the reference programs even taking this into account.

Delta Annual Cooling Loads
As with the heating cases, HOT2000™ appropriately predicted the direction of the changes in cooling loads. A greater difference was found between the delta annual cooling load results from HOT2000™ and the reference programs. This is not totally unexpected since the corresponding total annual cooling loads were not necessarily directly within the range of the reference cases.

300 Series Cases (Foundations)
The results of the slab cases fell within the range of the reference programs and as expected, the four basement cases did not match the reference cases (two runs were performed for each of the two basement cases with HOT2000™ as the HERS BESTEST allowed for the modeling of the basement as one zone with the main floor or as a separate zone).

The three reference programs were all run by the same person and following the same approach. Even with that there are discrepancies of up to 25% between their own results.

RECOMMENDATIONS

Having run HOT2000™ through the HERS BESTEST it has become apparent that two sets of recommendations are required: those specifically for HOT2000™ and other general recommendations.

HOT2000™
As mentioned in the introduction, the reference case ranges do not specify an absolute pass or fail. It is up to a certifying body to decide what should constitute a pass or fail dependent on the application in question. As such the following recommendations are being made:

- Most of the results that do not deal with highly passive solar cases are within a comfortable confidence margin, and thus a more detailed examination of the models is not necessary.

- The Barakat-Sander model should be examined in more detail to determine if it is the cause of the discrepancies in the more solar driven cases. Improvements should be made to the model if it is the cause.

- A re-evaluation of the thermal mass model in HOT2000™ is required, since the cooling factor was removed.

- The IEA BESTEST files should be re-run through HOT2000™, now that the cooling factor has been removed (Fraser, 1995). The IEA BESTEST is more of a diagnostic tool than the HERS BESTEST and thus may be able to help indicate sources of discrepancies.

- HOT2000™ should be compared against real data from monitored houses that have strong passive solar constructions. The BESTESTs only deal with other simulation programs and it is always important to perform a check with empirical data.

General
- It would be useful for the HERS BESTEST manual to give advice on how to determine what the effective thermal mass of the building is as not all programs contain a calculation for determining the effective thermal mass from the component assemblies.

- It is not always correct to follow the HERS BESTEST's rule of thumb to use the most detailed model the program has. As in the case of the component R-values and the SHGC, following this rule of thumb would tend to obscure the results.

- Since the soil conductivity is an important characteristic for modeling the foundation, it should be specified in the main body of the HERS BESTEST manual and not hidden in an appendix.

- In the weather summary table in the HERS BESTEST manual, the average yearly temperature is equated to the ground temperature. This is an approximation which is of little use, and thus misleads the user. It would be best if it were left out.

- Cases should be incorporated into the HERS BESTEST to assess a programs ability to model infiltration since it accounts for 16% to 35% of the annual space heating requirements in existing houses.

- As basements account for 10% to 40% of residential heating energy (Beausoleil-Morrison, 1996) this is an aspect which needs to be modeled correctly for residential buildings. The validity of the two modeling approaches specified in HERS BESTEST are questionable (Sobotka et al, 1994 and Sterling & Meixel, 1981). More recent research has provided more accurate methods that perhaps should be included in the reference results.

  It is not necessary to omit the ASHRAE method, but the reference programs should each use a different modeling technique to better establish an appropriate range.

- If large building simulation programs (e.g. BLAST, DOE) are to be used to model houses or to set the limits on acceptable results of other programs, it is important that better foundation models be incorporated into them.

- The HERS BESTEST does not lay out specific right and wrong answers. It strictly presents three reference programs with their results. Developers should not try to adjust their programs to exactly match these reference programs as it is not sure that they are more correct than the program being validated. An important test of a program's accuracy is against empirical data. Perhaps it would also be worthwhile to have an empirical form of the BESTEST.

- In implementing the HERS BESTEST, user's must determine their own confidence margins, and set limits for the results based on the particular application and on a case by case basis.

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