REVIEW AND MARKET NEEDS EVALUATION FOR THE CMHC LIFE-CYCLE COSTING SOFTWARE

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EXECUTIVE SUMMARY

Introduction

Changes in the regulatory environment mean that higher energy standards are being mandated, but there are concerns that construction upgrades be cost effective. Accordingly, software that can provide the energy performance and costing information at the same time is very attractive. The CMHC developed a Life-Cycle Costing software that has the potential to be a tool to address these concerns.

Objectives of this study

This study was undertaken to perform a critical review of the software, and to perform a market survey to identify the commercial opportunities for the software.

Technical Review

The LCC software concept is sound but a number of problems have been noted in the execution of the intent of the program. The software requires much more work before being ready as a Beta version for testing.

The software must be fully implemented under Windows, requires documentation and on-line help, must be easy to use, provide a reasonable reaction time for data acquisition and calculations, and provide a range of printed and screen reports. The current documentation package was written for an earlier version and is not suitable for use with the current version.

The program must be compared more extensively with other programs and be checked against monitored results with actual weather files to verify all the calculation modules.

Data bases must be complete and accurate at the time of product release and must allow user modification. They must be completely reviewed as information is not complete, and do not reflect many current construction assemblies in use today. The database should run concurrently with, or be part of the analysis mode, so that changes can be made as the program is being run, without the need to exit the program.

Customer support for this type of product is essential. Customer support policies and procedures must be clearly defined, and may have to be charged for. Consideration should be given to providing customer support using a bulletin board system (BBS), which could also be used to update users with new database files and program patches.

There are no programs that directly compete with the CMHC LCC software, so on one hand there is an opportunity to introduce a new product; on the other, there may be a good reason why nobody has ever done this, as the cost database would be outdated as soon as it was released, due to regional/seasonal/personal variations in prices.

Market Survey

A market survey to provide information on the potential market for the LCC software was done through a mail survey of a random selection of potential purchasers involved with light construction, and demonstration presentations to potentially interested groups. A high number of responses were received from builders and inspectors, and considerably fewer from designers and suppliers.

Only 13% of respondents indicated no computer use at this time. The IBM or compatible PC is the dominant platform (78%) while 13% use the MAC. The trend is towards more powerful PCs (41% use a 486 processor).

The ability to compare a design to current code standards was ranked highly by all respondents. The overall interest level in a software program that provides energy performance and costing at the same time was 6.6 (out of 10) with builders highest at 7.4 and inspectors at 6.5.

A significant proportion (40%) of builders and inspectors indicated plans to purchase energy analysis software within 2 years while designers had little interest in purchasing such software. With the average interest in this type of product at 6.6 out of 10 and 59% of respondents interested in purchasing this type of product within two years, a reasonable justification for the saleability of this type of product has been established, at an average price of $272 suggested by the respondents.

The interest level figures are valid at the time of the survey (spring of 1994). If it takes one to two years to complete a marketable version of the software those with any real interest may have already purchased a competing product. It should be kept in mind that 46% of HOT2000 users have no interest in purchasing this product., and even with the support of the R-2000 Program, there is a relatively small number of users of HOT-2000.

The program is designed to perform energy analysis and costing. Should it be deemed worthwhile to continue with the software development, two versions might be developed: one for energy analysis only and one as originally designed. The energy analysis program could be priced lower to attract sales of the product that would be lost to those not wanting a costing feature. This could simplify the use of the program and make it more marketable for building inspectors who might use it as a compliance tool for performance energy codes. However, the competition is greater for an energy analysis version, and most users already use HOT2000.

Given the present shape of the software and the number of other software packages available, a major investment will have to be made in order to develop the CMHC LCC into a viable, ready to use package. It will also require a major marketing effort to support a stand alone software package. We are of the opinion that the window of opportunity for this type of software may have already passed by.

If there is interest at CMHC to pursue the LCC software development, it may be more useful to investigate taking some components, such as the code comparisons or costing elements, and tying them to existing software such as HOT-2000.

RÉSUMÉ

Introduction

L'imposition de critères énergétiques de plus en plus rigoureux à la suite de changements dans la réglementation suscite des préoccupations quant à l'efficience des améliorations en construction. C'est pourquoi l'accessibilité à un logiciel fournissant de l'information tant sur l'efficacité énergétique que sur les coûts s'avère intéressante. La SCHL a élaboré un logiciel d'estimation du coût global, qui pourrait servir à apaiser ces préoccupations.

Objectifs de cette étude

Cette étude avait deux objectifs : soumettre le logiciel à une revue critique et effectuer une étude de marché pour en évaluer la demande.

Revue technique

Le concept du logiciel est valable mais certains problèmes ont été notés dans le déroulement du programme. Le logiciel devra être remanié avant que l'on puisse en tester une version Beta.

Le logiciel doit être complètement articulé sur "Windows", offrir de la documentation de même qu'une aide en direct, être facile à utiliser, prévoir un délai de réaction raisonnable pour la saisie des données et les calculs, et offrir un éventail de rapports imprimables ou visibles à l'écran. La documentation présentement disponible, écrite pour une version antérieure, ne se prête pas à la version actuelle du programme.

Tous les modules de calcul du programme doivent faire l'objet d'une comparaison étendue avec d'autres programmes et d'une vérification des résultats obtenus à partir de véritables dossiers climatiques.

Les bases de données devront être complètes et précises au moment de la diffusion du produit et les utilisateurs devront pouvoir les modifier. Elles doivent être révisées en entier, puisque l'information n'est pas complète et ne tient pas compte de bien des méthodes de construction d'usage courant. Elles devront s'exécuter en même temps que la fonction d'analyse, ou en faire partie, afin que des changements puissent être faits sans pour autant avoir à sortir du programme.

Ce type de produit exige un service à la clientèle. Les lignes de conduite et méthodes de ce service doivent être clairement définies, mais les frais d'utilisation pourraient être imputés à l'utilisateur. Ce service pourrait être offert par bulletin électronique transmettant également les mises à jour au sujet des nouveaux dossiers de la base de données et les corrections au programme.

D'une part, ce serait le moment de lancer un nouveau produit puisqu'aucun autre programme ne rivalise directement avec le logiciel de la Société; d'autre part, l'inexistence d'un produit concurrentiel est fort probablement due au fait que la base de données, sitôt lancée, deviendra rapidement périmée à cause de variations de prix à caractère régional, saisonnier ou personnel.

Étude de marché

Une enquête postale effectuée auprès d'éventuels acheteurs choisis au hasard et oeuvrant dans le domaine de la construction légère, ainsi que des démonstrations à des groupes potentiellement intéressés ont fourni l'information nécessaire à une étude de marché destinée à évaluer la demande pour le logiciel. Les constructeurs et les inspecteurs ont répondu en grand nombre, à l'exception des concepteurs et des fournisseurs.

Seulement 13 % des répondants n'utilisaient pas d'ordinateur à ce moment-là. Ainsi, 78 % utilisaient un produit IBM ou compatible, tandis que 13 % utilisaient Macintosh. La tendance est aux ordinateurs plus puissants, 41 % utilisant des processeurs 486.

Tous les répondants ont attribué une cote élevée à la capacité du logiciel de comparer un modèle précis avec les exigences actuelles du Code. Les constructeurs (7,4 sur 10) s'avèrent les plus intéressés par un logiciel calculant en même temps l'efficacité énergétique et les coûts; les inspecteurs (6,5 sur 10) ont manifesté un intérêt légèrement inférieur à la moyenne de 6,6 sur 10.

Une proportion appréciable (40 %) des constructeurs et inspecteurs ont indiqué leur intention d'acquérir un logiciel d'analyse énergétique d'ici à deux ans, alors que les concepteurs manifestaient peu d'intérêt à cet égard. Comme le niveau moyen d'intérêt pour ce logiciel se situe à 6,6 sur 10 et que 59 % des répondants se montrent intéressés à en faire l'acquisition en moins de deux ans, on a justifié logiquement de vendre le logiciel au prix moyen de 272 $ proposé par les répondants.

L'intérêt suscité valait pour l'époque du sondage (printemps 1994). Si la mise au point d'une version commercialisable du logiciel prend un ou deux ans, ceux qui sont vraiment intéressés auront possiblement acheté le produit d'un concurrent. Il faut aussi se rappeler que 46 % des utilisateurs du programme HOT-2000 ne sont aucunement intéressés à l'acheter, et même malgré l'appui offert par le programme R-2000, il y a relativement peu d'utilisateurs du programme HOT-2000.

Ce logiciel analyse simultanément l'efficacité énergétique et les coûts. Si l'on jugeait à-propos d'aller de l'avant, on pourrait élaborer deux versions : une version se prêtant à l'analyse de l'efficacité énergétique seulement et l'autre conforme à ce qu'elle devait être à l'origine. Le logiciel d'analyse énergétique pourrait se vendre meilleur marché et ainsi attirer les acheteurs n'ayant aucun intérêt pour l'estimation des coûts; son utilisation en serait simplifiée d'autant et il serait plus facilement vendable aux inspecteurs en bâtiment qui pourraient s'en servir pour juger de la conformité aux codes de l'énergie. Par ailleurs, la concurrence est plus forte pour un programme d'analyse

d'efficacité énergétique sur le marché, la plupart des utilisateurs exploitant déjà le logiciel HOT-2000.

De sérieux efforts de développement devront être faits pour que le logiciel d'estimation du coût global de la SCHL soit viable et prêt à être utilisé, étant donné son état actuel et le nombre de produits offerts sur le marché. Puisqu'il s'agirait d'un logiciel autonome, sa commercialisation devrait être accompagnée d'un important battage publicitaire. À notre avis, le créneau pour ce genre de logiciel n'existe plus.

Si la SCHL veut poursuivre le développement de ce logiciel, il serait plus avantageux d'étudier la possibilité d'en combiner certaines composantes telles que celles qui permettraient d'établir des comparaisons avec le Code ou d'établir des coûts avec un logiciel existant comme le HOT-2000.

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1. INTRODUCTION

Changes in the regulatory environment mean that higher energy standards are being mandated. The major concerns associated with these changes are that construction upgrades be cost effective. Accordingly, software that can provide the energy performance and costing information at the same time is very attractive. The CMHC developed a Life-Cycle Costing software that has the potential to be a tool to address these concerns.

OBJECTIVES OF THIS STUDY

This study was undertaken to carry out a critical review of the current status of the software, to perform a market survey to identify the commercial opportunities for the software, and to ascertain the market niche for this type of tool.

2. TECHNICAL REVIEW

SYSTEM REVIEW

The software has three principal components: life cycle costing; energy calculations; and costing. Multiple runs using various assumptions and options were made to ascertain user friendliness, clarity of screens, and technical review of results.

Overall, the software concept is sound, but a number of problems have been noted in the execution of the intent of the program. Accordingly, it is difficult to suggest that the software is close to being a Beta version for testing.

This program is structured as a 'Windows' program, but it is not a true Windows program. It cannot multi-task with other programs (most DOS programs can at least be switched to and from), and the windows screen-saver has been disabled. For this product to be marketable the final product must be a true Windows program.

The program requires more work to make it a workable package. It must be rewritten for the Windows platform. A DOS program that looks Windows-compatible but is not will not satisfy the user, especially as the program cannot be run under DOS alone. Among other things, the program should support a mouse, and should allow multi-tasking (one of the key strengths of the Windows environment).

It is important not to release the source code as this will make the program inappropriate for use in a Standards application (such as the model National Energy Code or provincial building codes). It is appropriate to provide a detailed description of program algorithms, especially to allow those algorithms to be validated. However, allowing public access to the source code will make it easy to "modify" the program to produce non validated results. Such modifications would be difficult to monitor (because it is almost impossible to detect). Control of source codes allows the standardized approach necessary for Energy Code compliance assessment.

OPERATING PERFORMANCE

While the computing world is changing, with ever faster machines, the apparent requirement for a least a 386 with 8 Meg of RAM to be able to operate the software restricts the potential access to the software and potential users. While we understand that 4 MB should be all the capacity required, the present software format would be difficult to operate with 4 MB.

On a 486 33 mHz (8 Meg RAM) machine selecting a house file takes approx. 25 seconds; opening the program (menu 1) takes 5 seconds; to call up a data base takes 8 seconds; to accept an entry 5 seconds; moving down a page in the data base approx. 6 seconds.

On a 386 SX (8 Meg RAM) machine selecting a house file takes approx. 55 seconds; opening the program (menu 1) takes 15 seconds; to call up a data base takes 15-25 seconds; to accept an entry 15 seconds; moving down a page in the data base approx. 10 seconds. When asked to run an auto upgrade of all systems, on a modest file, the total time for calculation was in excess of 1 hour 25 minutes.

On a 486 25MHz machine we found that the function to develop a list of cost-effective upgrades is extremely slow, possibly because of all the disk access time. Auto-upgrade takes between 3.2 and 3.8 minutes (depending on the complexity of the house being analysed), which is quite a while on a 486. It was also noticed that the evaluation of the options for the envelope takes most of that time, with no indication to the user that anything is happening.

Several timed runs were performed, to compare the LCC software with HOT-2000 (some of the slowness of the LCC runs can be attributed to unfamiliarity with the program):

Run	Description	Hot-2000	LCC
1	Load Program, calculate & Print existing file	1m 30s	2m 20s
2	Load file, change one parameter, calculate & print	1m 29s	6m 00s
3	Input BC Advanced house data - mostly new elements (input in database); calculate & print	35m 00s	1h 30m+*
4	Debug and correct inputs	18m 30s	no attempt

* program locked-up about half way through input process losing all inputs. Assuming that the database contained all the required building systems, the input time would have been shorter. A direct comparison is difficult to make without taking into account the database inputs, as it is not possible to input entries into the LCC software unless there is complete database information, unlike a stand alone energy analysis program like HOT-2000.

The operating speed of the software leaves much to be desired. The access time to the program, and the time to make entries is extremely slow. With the range of other software packages, users have become accustomed to quick performance.

There are far too many files used by the program. This causes slow execution, as the program spends a lot of time accessing the hard drive, opening and closing files. File management, updating the database, and program execution would be simplified by using fewer, larger data support files. It may be possible to improve performance through redesign of the data base structure to include portions loaded in memory at start up for use (e.g. select items to be read for data) and indexed to what is required to be read from the disk only when needed.

DATA ENTRY

Overall, the interface appears quite dated - character graphics, lack of mouse support (the mouse moves the cursor but it cannot be used for selection), and there are some garbage characters on the screens. The program screen messages should also be improved.

The reliance on numeric descriptors results in the input screens being difficult to check for accuracy - one has to constantly check the database to see the numeric descriptors and what they mean. The on-line calculator is a very useful feature, but could be jazzed up (users - especially Window users - have high expectations of screen graphics and functionality). Some user data input could be converted to scroll box selections of actual descriptions versus numeric input for an item.

The context-specific help is useful; it could also refer the user to specific areas of the manual for detailed information on complex topics.

When an attempt was made to input a complex file for a real house (run 3 above) it illustrated a number of weaknesses in the program. These include:

- the input of precalculated header area was overwritten by a program calculated value
- a quick comparison of novel assemblies is difficult as all inputs (thermal and economic) for it are required before the program will accept the assembly. This could lead a user to putting in "temporary" values, corrupting the database.
- only two assemblies are allowed for each window or wall orientation, ceiling, etc.
- patio doors should be input with the windows
- no mention is given of solar heat gain factors (changes due to reflective coatings, etc.)

Comments related to specific screens:

In the 'Activity Selection' screen, {PgDn} or {PgUp} exits the program.

In the opening screen, there is no indication, for the first-timer user, of how to "Position cursor beside desired activity...." (use {End} or {Home} keys, then the arrow keys). In the wrap up menu there is a problem: the program asks user to save data {Y/N}, but neither Y nor N (nor y nor n) is accepted as a valid response. In fact, we could not find any keystroke that would be accepted, except {Esc}, which does not save entered data.

There is no opportunity to save the file, or auto save feature, at any point in the program, or at the end of the input of information for a screen.

inststr/lvl4

When making an entry, the cursor automatically moves to the top of the form rather than remaining in place.

When a data base is being accessed when making entries, it automatically moves to the top of the form, rather than the relevant section (e.g. when inputting information for interior doors, it is still necessary to roll through all the doors, rather than just going to the interior doors section of the data base).

Wall/floor header entry that is required does not accept user inputs. It appears to require compatibility with the walls. However, it is entirely likely that the header may be built substantially differently from the walls. A warning message would be a more appropriate way of highlighting a potential problem area.

No help is available on {F7}

sbstr1

Needs definitions of basement wall components

Does not allow access to all 'assem'

"Attachment" entry is not accepted when full basement assemblies are being input.

A basement wall above grade (10101 - a concrete block wall, uninsulated) is not accepted - a "not valid configuration" message is provided.

Conc/wood junction: does not accept user inputs.

Horizontal basement insulation scheme: entries can be made, but are arbitrarily changed, then deleted by the program. It would appear that this is a non-functioning module unless within extremely tight limits, but it is not indicated what the acceptable limits are.

walls

When the data base is called up, it goes directly to the top of the list, not to the assembly element shown.

windo

Inadequate area allowed for units. If units are input by size and window properties, more entries per facade must be allowed. A suggested capacity of a minimum of 10 entries per facade would be more reasonable.

Entries should be in feet, as this is the standard industry dimension, and not inches.

ceil

Default values presented do not relate to items on the legend.

hamgt

Space heat: there does not appear to be any options for user input of efficiency & size data

Domestic Hot water: "R-2000" option looks for a chimney description, when in reality this may not be applicable (e.g. for power vented or direct vent units).

ANALYSIS

House Description

On screen *desc*, under units of measurement, {2} (imperial units) is not accepted.

The concept of using a database of building sections is good, since it allows for standardized results and can simplify inputs. However, there needs to be more flexibility in its application, and a description of assemblies used - both on screen and as a printout.

Confusing, questionable and inconsistent information is provided in the help screens. For example, for the Tightness values for walls (T = 1 to 9) - the Help screen indicates the following: *"different envelope building elements with the same **AVB thickness** must not have different tightness numbers or the analysis may be compromised."* However, tightness of the envelope does not depend on the thickness of the air-vapour barrier.

Type of foundation is available only from [Help], while other parameters are presented on the input screen. The character graphics meant to represent various foundation configurations are very confusing.

On the foundation input, there is apparently no allowance for crawlspaces, however, *slab on grade* with a wood floor type selected did call up a screen which asked for *closed* or *open* and *wall area and insulation values* (parameters used in a crawlspace!).

It is also apparently not possible to enter a variable insulation scheme as often happens in real houses.

Terminology used for building components should be reviewed to keep it standard with industry usage, and other software programs that potential users may be familiar with. E.g. "overhang exposed to outside" could be referred to as cantilevered or exposed floor area.

ENERGY PREDICTION

The program must be compared more extensively with other programs, to try out all of the calculation modules, and the program must be checked against a variety of monitored results with actual weather files.

A cursory comparison of the life cycle costing software (LCCS) with HOT2000 (v. 6.02) by L.J. Parson advised that *"Given the magnitude of the disparities in results between LCCS and HOT2000..., it is considered that no further changes are required to the CMHC 2 program."* Given the fact that only one type of house (basement) was evaluated (3 locations, 3 levels of insulation), this remark appears to be premature. Given that the differences (but **only in heating energy**) ranged as high as 41%, the observation should have been tempered.

Further, the differences with HOT 2000 results were not consistent over the range of levels of insulation as the differences increased with insulation levels. Therefore, any retrofit or upgrade calculations, which depend on comparisons between houses with different levels of insulation, and the subsequent economic evaluations, will be adversely affected. Yet the economic impact of varying insulation levels is the core purpose of this program.

More checking of inputs, by the program, is required as the inputs are being made, or at least prior to running the calculations. The 116 m^2 sample house came out with an average height of leakage area of -13596 ft above the ceiling and sensible cooling load gains of -6342 W! Given that upgrade (parametric) calculations can consume significant amounts of time, the user does not want to wait until these calculations are complete to find that there is a simple error in the inputs.

The window model needs to be updated to reflect the latest information and modelling techniques, including spacer information. Mechanical/electrical modelling needs to allow for radiant heating options.

The same house data was simulated on ENERPASS, HOT2000 v6, and CMHC's LCC. ENERPASS and HOT2000 agreed pretty well, but LCC predicted the energy consumption to be about 35% higher than either of them. This is probably because LCC appears to be far off in its estimation of solar gains. It appears not to include solar gains from non-south facing orientations, and the solar gains from south-facing orientations are low by an order of magnitude.

Design-day heat loss appears to be calculated correctly, as are internal gains (but then again the internal gains are input to the data base) and water heating loads, but the space heating load is erroneous. Specifically, the results (Space + DHW) for a 123m^2 bungalow are:

HOT2000	62,400 MJ
ENERPASS	63,200 MJ
LCC	84,000 MJ.

A note with the LCC results that says "this house requires 39 GJ more energy than the total annual energy target required by R2000".

COSTING - CALCULATIONS

The software has the capacity of providing costing information, for all components of the house construction. However, the sequence of input screens for data entry is not clear for the user. Especially confusing is the sequence that relates to components that are not a part of the building envelope used in calculating heat losses such as project soft costs, excavation & site preparation, interior framing and finishes. An orderly, easy to use access sequence is not provided.

OUTPUT

Input parameters are output in a very limited manner. Other software (e.g. HOT-2000) allow the run to be recreated and checked from printed output. That is not the case with the output from this program. An optional longer printout format is needed so that all input data can be printed in addition to calculation results.

Not all characters print out on a Laserjet II printer. For example, superscripts are dropped, so that ft^2 becomes ft.

3. DATA BASES

The Data base information is contained in separate databases: Building Elements & Assemblies; Mechanical & Electrical systems; Products & Materials; Trades & labour; Tables & constants; and provinces & cities. However, each is interrelated.

It is evident that the information contained in the data bases is not complete and does not reflect many of the current construction assemblies in use today. The data contained must be completely reviewed in detail.

Data bases must be complete and accurate at the time of product release. A BBS could be used to update users with newer database files. Consideration could be given to allow users to modify certain elements of the data bases. Any data bases that contain local variables must allow user modification.

Difficulty in attaining valid data base information for items in the program that seem to have a lower level of interest would indicate removing these features at this time. They can be added to a future version when valid data can be provided and a level of demand is shown.

There are some very confusing operations. For example, when reviewing a roof database entry, when information was sought for "materials" the first screen that came up was information for foundation materials. Because of the slow screen access, it took over 1 minute to reach the relevant components.

The database should run concurrently with, or be part of the analysis mode. The values are

difficult to change when running the program. It is necessary to exit to the database, modify or make a new entry, then re-enter the analysis part of program and select a new item. This is particularly inconvenient with sections that are continuous, such as attic insulation. Either the database should be modifiable from within the analysis program or the two parts of the program should multi task under windows so that they can be run simultaneously.

There are inadequate definitions for venting devices, and definitions of chimney terms used. Does "chimney on outside wall" assume an uninsulated exterior chimney?

Wall surface descriptions for the solair calculations does not mention wood siding, or how wood siding should be considered.

Absorptivity data base {S} cannot be accessed from the walls screen.

DATABASE VALUES

Thermal resistance values for walls are very high. Thermal bridging does not appear to have been accounted for. For example, a 2x6 wall is RSI 3.80 (400mm and 600mm stud spacing - there should be different values for each), instead of approximately RSI 3.0. Note that the composite wall thermal resistance will also depend on construction details (corners, intersecting walls, etc.) and the amount of extra framing due to windows and doors. (HOT2000 Version 7 will allow the user to factor in these characteristics).

A 2x6 wall, R21.58 in the database, becomes R22.14 in the house description screen. It is not clear why this is happening. Perhaps errors could be introduced because some numbers are being rounded off.

It would be easier to maintain current values (costing and thermal performance) if the composite assembly could be built up rather than relying on the original input data.

4. DOCUMENTATION

The best software requires documentation for users to be able to benefit from all features of the package. An ambitious program such as CMHC's LCC software must be easy to follow. The documentation must be clear and follow a logical sequence, information must be easy to find (an index is useful if the chapters are not distinct). A major design element of good documentation is to reduce the need for customer support.

It is very difficult to assess the program without being able to follow along in the manual. The current documentation package was written for an earlier version and is not suitable for use with the current version. It contains errors which detract from the program appearance, and should be edited to remove inconsistent information. It must be rewritten for the current Windows application.

An extensive help file is also required, and use of context sensitive help would be an additional benefit. Use of actual screens from the program should be included in the manual to provide the user with a visual reference point. These screens are not to be text based representations but actual screen captures from a grey scale monitor saved to a bit map file for use with a desktop publishing program. Images of icons used in the program should also be used in the documentation to guide the user.

The documentation should include a tutorial with a step by step walk through of a sample design from start to finish. The documentation should emphasize the use of the tutorial before attempting a real project. This is another item that will reduce customer support calls. Other useful features in the documentation include a flow sheet of program operation, showing menu tree structure and a list of files on the program diskettes (useful for troubleshooting).

If it is intended to retain the DOS platform, a clear set of instructions on how to access the program from the DOS C: > prompt should be included in the manual.

CUSTOMER SUPPORT

Customer support for this type of product would be essential. Customer support may have to be charged for as any profits made from sales could be negated by free support. Consideration may be given to providing customer support using a bulletin board system (BBS). A BBS could also be used to update users with new database files and program patches.

Users normally call the person that they purchased the product from for support. Who pays when the phone rings? Customer support policies and procedures must be clearly defined.

5. COMPETING SOFTWARE

The following is a comparison of the potential market competition for the software. The programs listed are divided into economic (costing) programs with some energy analysis capabilities and energy analysis programs that also do economic analysis (beyond a simple energy cost calculation, so that some form of LCC or NPV is done).

The major source for software in this list was the ASHRAE software directory, which is the most comprehensive available listing of technical software. All software has been available for at least two years and has some installations in use, so that the software described is complete and available. We mention this as it is not unknown for software to be publicised prior to its final development.

Information on number of installations for each is not available.

Economic Analysis Programs (that also do some energy analysis)

E20-11 (Carrier Corporation, Syracuse, New York)

This program provides simple payback, cash flow (present worth or actual value), or life-cycle cost analyses. It can be used in combination with Carrier's HAP energy analysis program to evaluate energy conservation measures, and can be leased for US $100 (HAP leases for US $1000). Carrier also produces an advanced module that performs economic analysis of building and HVAC designs in accordance with US government standards (as per the LCCID system, q.v.). Fuel escalation rates are available for various regions of the US and various energy usage sectors with the advanced module. Users can include effects of discounting, constant vs. variable escalation, and investment credit. The advanced module can be leased for US $ 100.

ENVEST (Alliance to Save Energy, Washington, DC)

This program does financial calculations of energy conservation, fuel conversion, and cogeneration projects. Measures are treated as investment options and evaluated according to payback, internal rate of return, and cash flow. Users can vary assumptions, energy price projections, alternative financing options, and check cogeneration designs for feasibility. The program is available for US $ 100.

The E-VALUATOR (Cornerstones Energy Group, Inc., Brunswick, Maine)

This is actually a set of six software modules to be used in a Sharp 1500 Series programmable calculator (included in the package price). Each module determines savings, return on investment, and payback, and prints out graphical results on a cash-register-style tape. Modules include analysis for gas, oil, or electric heat, and commercial, residential, and hydronic systems. The modules (and programmable calculator) are available for US $ 500.

LC2M (MC2 Engineering Software, Miami, Florida)

This is a life-cycle-cost calculation program that returns owning costs (annual energy costs, operating costs, maintenance, initial investment) to present value at a user-specified discount rate. This program is compatible with life-cycle cost analysis requirements for US federal building projects, and is available on a 30-year lease for US $ 200.

LCCID (Blast Support Office, Urbana, Illinois)

This program is available for DOS, VAX, VULCAN, and NOS platforms, was developed by the US Department of Defence, and includes economic and design criteria for the US military (and is also appropriate for use in other US federal agencies, such DOE and OMB). It is intended to be a tool for evaluating design alternatives for new construction and retrofit, and will calculate life-cycle costs for a range of energy conservation alternatives (based on database information). The program is available for less than US $50.

PICKUPM (Garrison/Lull, Princeton Junction, New Jersey)

This program extracts data from AutoCad drawings and uses an external database to assign materials lists and cost estimates to the construction and HVAC equipment. The program is available for over US $ 1000 per copy.

UPBEAT (Planergy, Inc., Austin, Texas)

This is a spreadsheet-style program that performs cost-benefit analyses from the perspective of participants and non-participants in conservation programs, utilities, and society in general. The DOS-based program is available for over US $1000, and is intended more for utility agencies than general users.

ENERGY ANALYSIS PROGRAMS (that also do some economic analysis)

ASEAM-2 (ACEC Research & Management Foundation, Washington, DC)

This program uses the modified bin method to calculate heating and cooling loads and energy consumption for commercial and residential applications. The program also does life-cycle cost calculations for both public and private perspectives, and is available for US $200.

F-LOAD (F-Chart Software, Middleton, Wisconsin)

A PC or Macintosh program that uses standard ASHRAE methods to provide estimates of monthly and annual energy requirements. The program can do life-cycle cost analyses and cash-flow calculations for changes in equipment, building operation and construction, and is available for US $ 500.

TRAKLOAD EAS (Morgan Systems Corporation, Berkeley, California)

This program uses ASHRAE and DOE calculation methods to determine energy cost and use patterns, and calculates costs, savings, and payback from a set of over 100 energy retrofit measures recommended by an auditor. Engineering and financial reports are generated, and the program is available for over US $ 1000.

ENERCALC (Texas A & M University Dept of Architecture, College Station, Texas)

This program performs a simplified energy analysis and produces life-cycle cost (present worth) analysis of investment plus energy costs. The program is available for US $ 200.

TRACE (The Trane Company, La Crosse, Wisconsin)

This program uses standard ASHRAE algorithms to perform energy analysis. Parametric analyses of up to four different architectural, HVAC system, equipment, or economic alternatives can be performed, with printouts of life-cycle cost, internal rate of return, net present value, and payback. The program can be leased for US $ 200 or purchased for over US $ 1000.

There are no programs in this list that directly compete with the CMHC LCC software. This could be a good thing or a bad thing, depending on your point of view. On one hand, there is an opportunity to introduce a new product; on the other, there may be a good reason why nobody has ever done this. The latter view reflects some of the comments received from builders (and others) on the CMHC LCC concept, in that the cost database would be outdated as soon as it was released, that it is impossible to account for regional/seasonal/personal variations in prices, and that most builders are unwilling to stake their financial solvency on a computer printout.

Builders do not normally look at life cycle costing, as their interest is the more immediate concern of "how much does it cost", and perhaps "what is the payback"? Building scientists, managers, architects, researchers and policy people will have an interest in computer simulation for energy analysis and payback periods, but life cycle costing analysis is not done too often.

HOT-2000 and ENERPASS

HOT-2000 software program (with about 700 registered users in Canada and the USA) is strictly an energy analysis program, and has no costing modules. It was developed as a compliance tool by the R-2000 Program, and has been aggressively marketed in Canada and the USA. The latest version (v 7.0) will be marketed for $295.

The energy analysis module of the CMHC LCC software is similar to HOT-2000. These are both single zone energy analysis packages.

ENERPASS is a functioning multi-zone energy analysis software that has not been actively marketed, so that there are only about 50 users.

6. MARKETING SURVEY ANALYSIS

The best marketing plan will not be worth anything if it is not based on adequate information. It is easy to calculate and provide speculative information about market penetration, but only concrete orders will show how accurate the predictions may be.

A two pronged market survey was done to provide information on the potential market for the LCC software and the potential user response. This was done through a mail survey of a random selection of potential purchasers, and demonstration presentations to potentially interested groups.

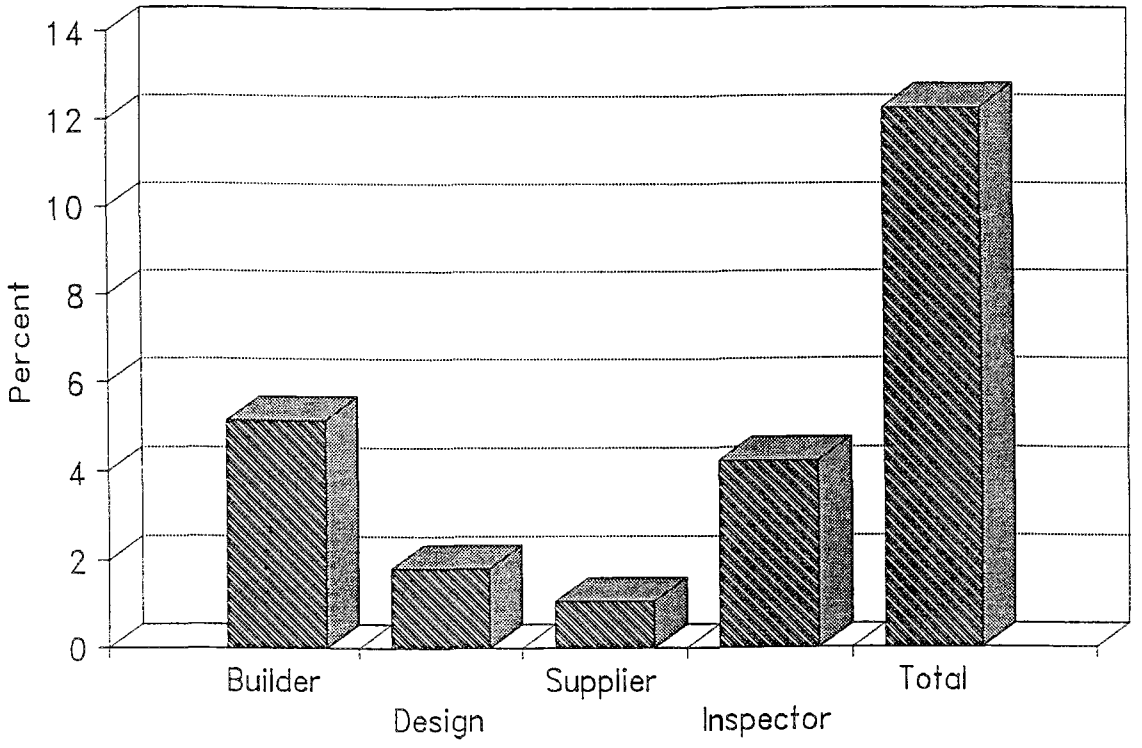
Survey Questionnaire

661 copies of a questionnaire (Appendix A) were mailed out to a sample of building industry members, including 75 architectural firms in BC that do a substantial portion of residential work; 56 CHBA-TRC members; 70 municipal building inspectors across Canada, and a random sample of 460 subscribers of Solplan Review (residential builders, academics and building officials). 78 completed questionnaires (11.8% response) were received; 18 pieces were returned by the Post Office. *(fig 1)* The survey size analysed was the 78 responses received.

We feel that this survey approached a fair cross section of the residential building industry. While the bias is to subscribers of Solplan Review, this publication reaches a significant portion of the light construction sector in Canada, so the mailing would favour those with an interest in energy issues.

The questionnaire did not single out educators, and a mailing to educators was not made, although there are a number who subscribe to Solplan Review, and would have received a mailing.

Figure 1 Return Response Rate



Demonstration presentations

To supplement the mail survey, demonstration presentations were made to a select group of potential users. Each session was a presentation about 30-45 minutes long, using overheads of selected screens. The objective of these presentations was to provide target audiences with information about the LCC software and to solicit their reaction to the software. Audience members were provided with a copy of the survey questionnaire to complete at that time or to mail in. Questionnaires received at the demonstration sessions were not separated for analysis from the ones that were mailed in.

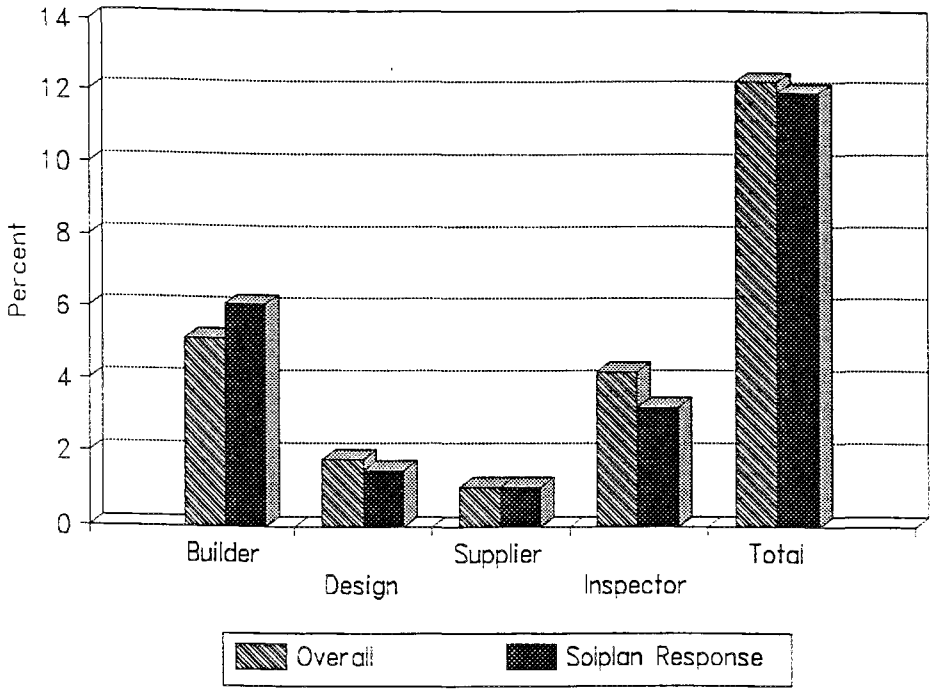
Presentations were made at the Ontario Builders Forum in Toronto, CHBA-BC Technical Advisory Committee, and the CHBA National convention. While these organizations and their members represent only a portion of the target audience, they are suitably representative of key groups to provide significant information to assist the development of the marketing strategy.

Demographics

Respondents to the questionnaire were categorized into four broad areas:

1: Builders (including sub trades and renovators);
2: Designers (including architects and engineers);
3: Suppliers (including manufacturers and supplier);
4: Inspectors (building inspectors, energy services, researchers, government and utility: program administrators, educators).

Figure 2 Return Response Rate Overall vs Solplan Review subscribers



The overall response rate for the four groups (builders, designers, suppliers and inspectors) was compared to Solplan Review readers only. The results varied less than one percent. This indicates that the mix of Solplan readers that responded were representative of the market surveyed. *(fig 2)*

A high number of responses were received from builders and inspectors, (78%) and considerably fewer from designers and suppliers. Most respondents are involved with light construction (residential, single-family and duplex; town houses and some multiple). The building inspectors identified they were involved will all types of construction. *(fig. 3)* Approximately 50% of respondents were owners or principals in their organization.

Leading trade magazines read by 59% or better are Solplan Review (69%), Home Builder magazine (63%) and Builder (59%). Solplan was the highest as the survey was sent to 460 subscribers out of the 661 total

Computer systems in use

87% of respondents use computers. Only 13% indicated no computer use at this time. The trend is towards more powerful PCs with an adequate amount of RAM. 78% use an IBM or compatible PC; 13% use a MAC and 13% do not use a computer. (these percentages add up to 104% as 4% use both.). *(fig 4)*

Figure 3 Involvement with Light Construction

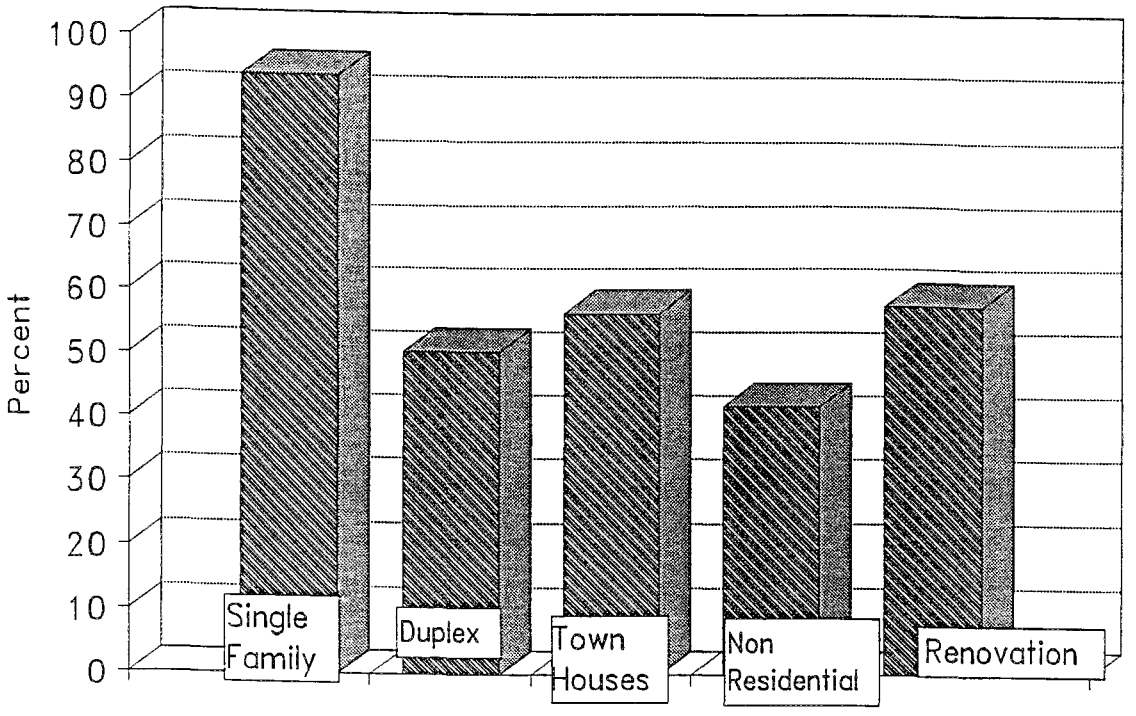
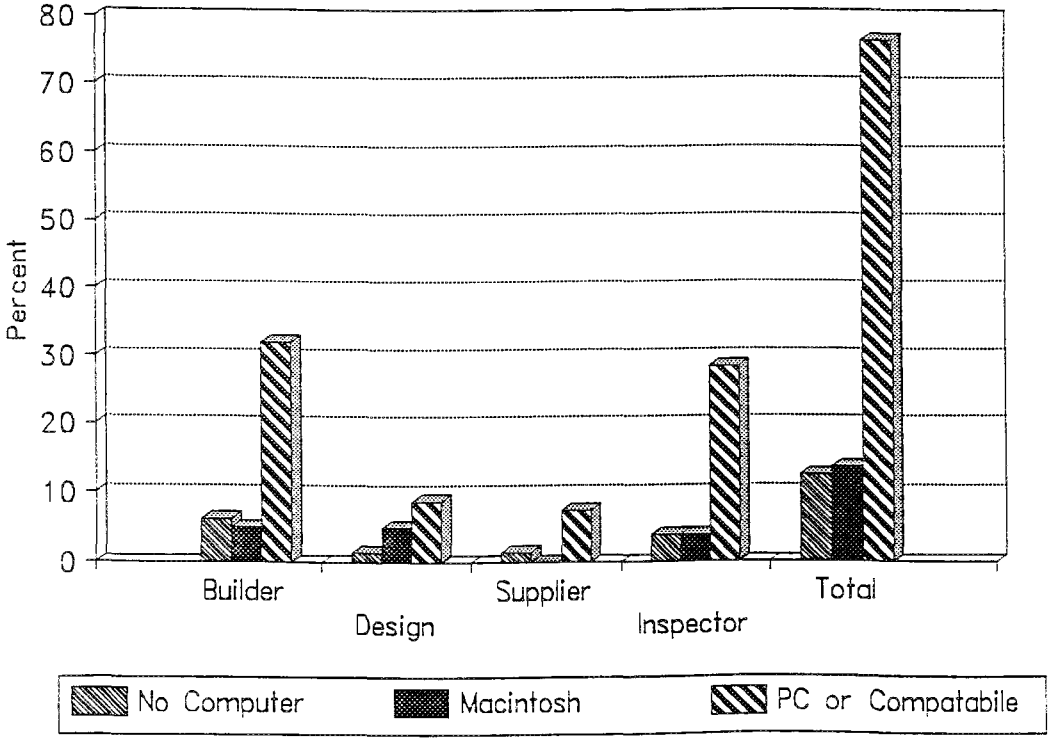


Figure 4 Computer use



41% of respondents use a 486 processor, 23% use a 386 processor, while 13% are still using a 286 unit. *(fig. 5)* 42% have 4 MB of RAM memory, while 30% have 8 MB or more. DOS is the dominant operating system (74%), and 44% use Windows. *(fig. 6)*

Software used in conjunction with construction activities is primarily Spreadsheets, CAD and word processing. Because it is used as a compliance tool for the R-2000 Program, HOT 2000 is virtually the only energy analysis software currently in use (by 38% of respondents). Only 2 other software packages (The Evaluator and Audit) were identified as being used, each by one user.

PROGRAMS USED	Builders	Designers	Supplier	Inspectors	Overall Average
MS Excel	10	6	3	4	28%
MS Word	4	4	3	5	20%
MS Powerpoint	1	0	0	0	1%
MS Works	3	1	1	4	9%
Wordperfect	5	3	3	17	35%
MS Project	2	0	0	0	2%
Pagemaker	3	1	0	2	7%
Accpac	1	0	0	0	1%
Photo Shop	1	0	0	0	1%
other accounting	4	1	1	0	7%
other spreadsheet	9	3	5	15	40%
other word processor	6	2	2	1	14%
Access	2	0	0	0	2%
other database	3	2	1	10	20%
Corel Draw	3	0	0	1	5%

(numbers are absolute numbers of users by category of respondents)

LCC Software usefulness analysis

A series of analysis modules, with individual components were listed, and respondents of the questionnaire were asked to indicate how useful the different components were for them. This was meant to elicit the relative importance of the various items, and at the same time it provided an indication of the potential characteristics of the software.

The items listed included all the identified features and components in CMHC's LCC software. Elements have been combined in related groupings. Respondents were asked to rank the elements on a scale of 1 to 5, with 5 most important or useful, and 1 not important or not useful. The following analysis relates to the options presented on page 3 of the questionnaire (Appendix A).

Energy Analysis:

The importance of energy analysis to provide a range of calculations was fairly uniform and moderately high among all interest groups. Annual building energy consumption was consistently the most important by all respondents. Combining costing functions with energy analysis was important to suppliers. Data for sizing heating systems was important to builders and designers. *(fig. 7)* Calculation of air flow leakage on energy consumption was important to all groups. *(fig. 8)* Graphic output was of interest to designers (perhaps due to their graphical orientation). Cool-

Figure 5 PC Processors (CPU's)

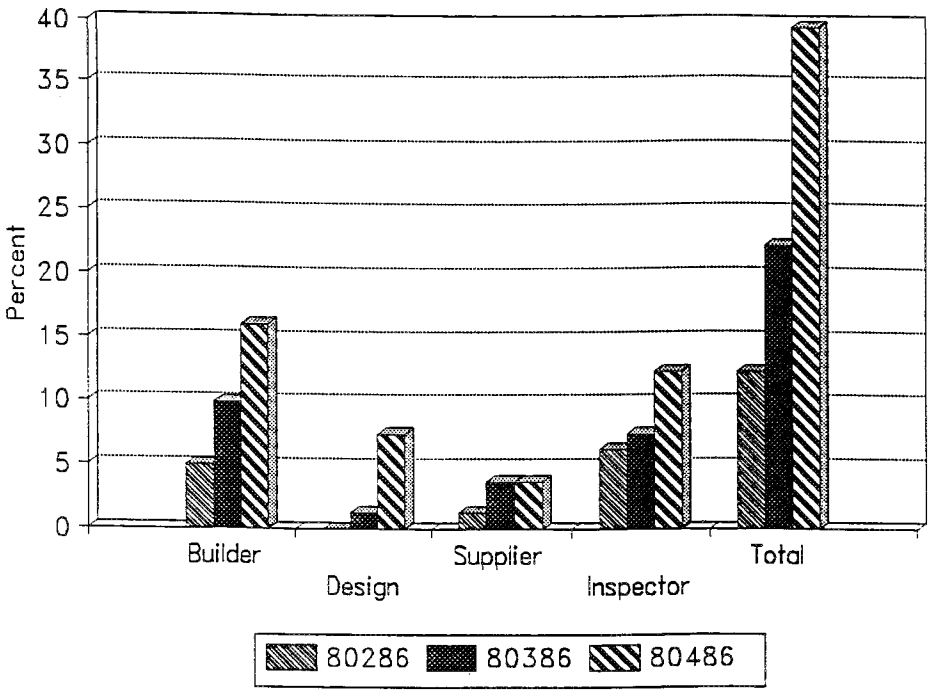


Figure 6 PC Operating environments

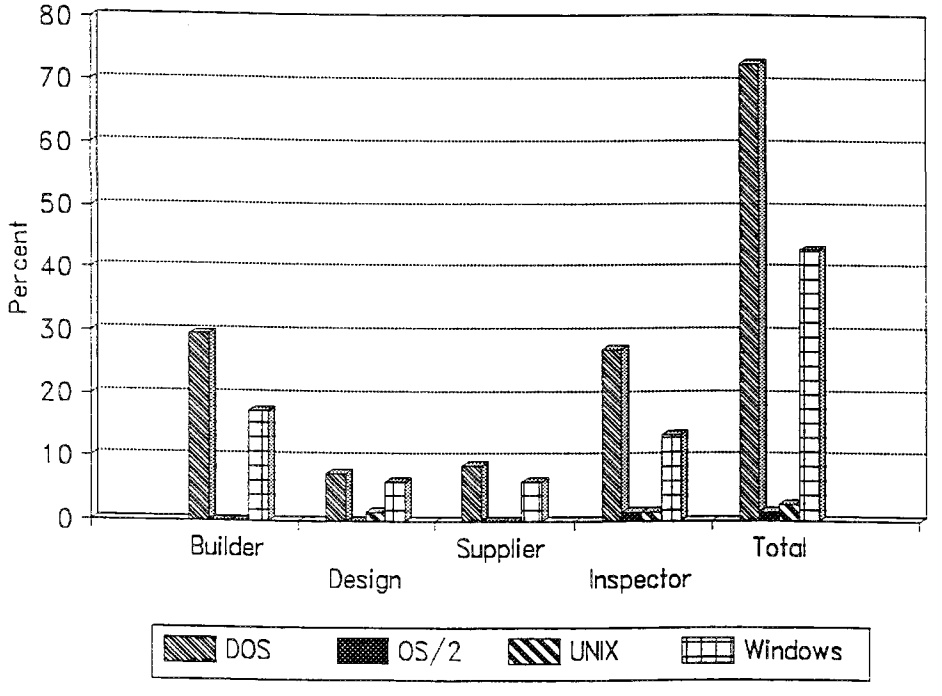


Figure 7 Energy Analysis (1)

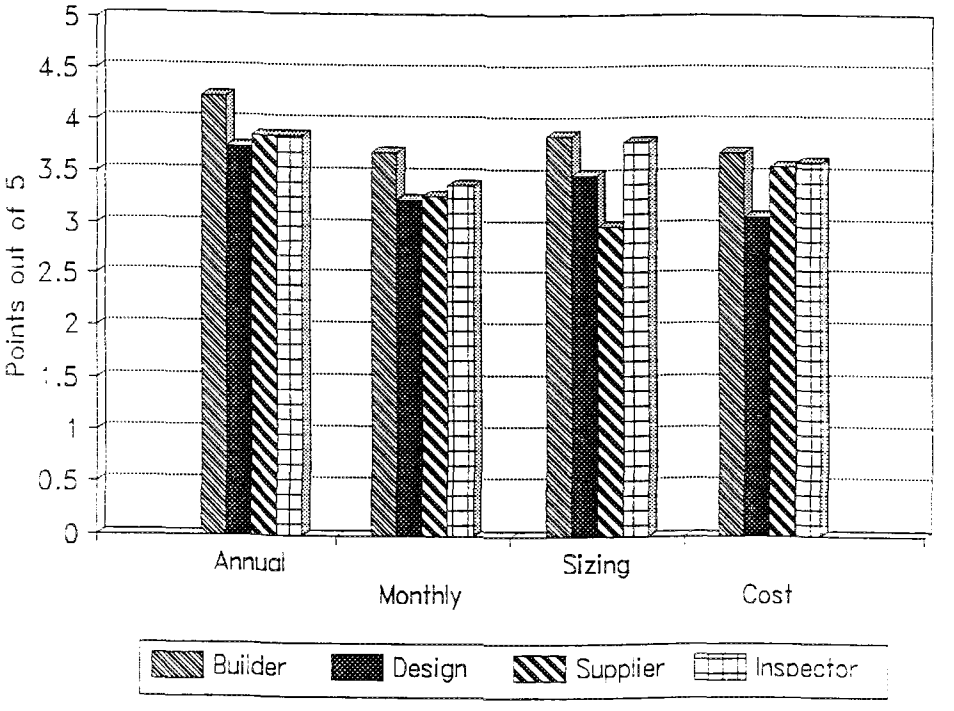
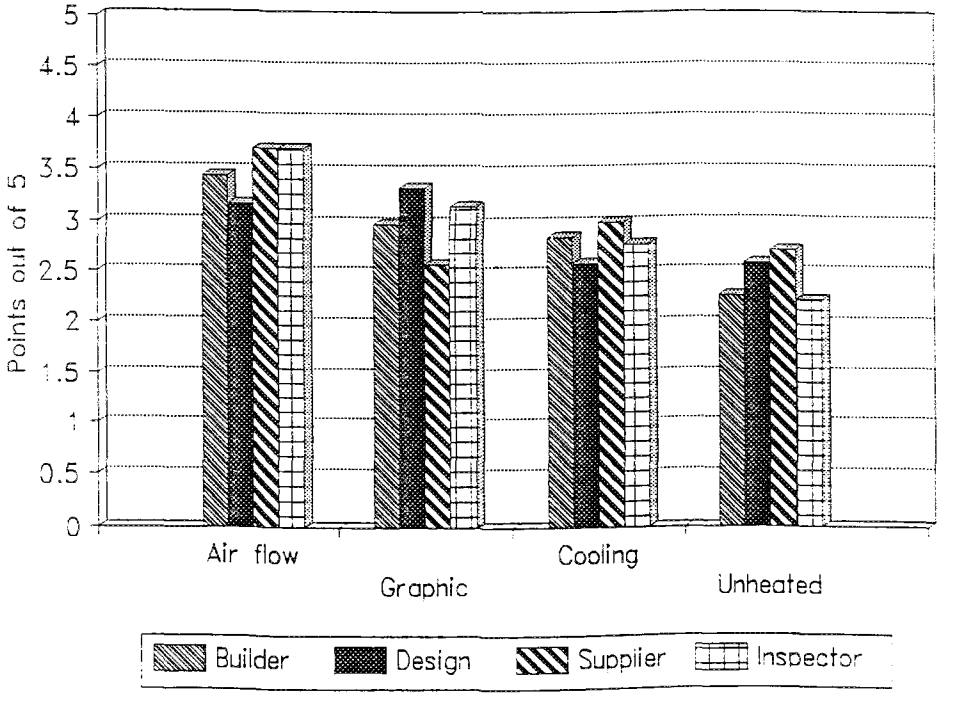


Figure 8 Energy Analysis (2)



ing calculations and Modelling of unheated spaces was ranked lower.

Elements modelled:

The LCC software models various basement configurations, micro-climate effects, solar access, occupancy and life-styles including thermostat setbacks, garage and porch impacts, heating and ventilating systems, cooling systems and heat pumps. For builders and designers, building envelope components, including basement variations and mechanical systems were the most important elements modelled. *(fig. 9)* Components deemed least important were microclimate effects and garage/porch impacts. *(fig. 10)*

Costing Analysis:

On average suppliers valued the costing analysis highest, *(fig. 11)* while builders ranked the ability to customize the data base most important. Designers ranked costing information the lowest. The costing information is presented as composite prices for building components. Builders ranked the presentation of component prices the highest, closely followed by individual unit prices and detailed costing information. Costing information was significantly less important to the others.

Financial Analysis Evaluation:

Overall, the financial analysis evaluation ranked low. Builders valued the ability to determine payback period highest. *(fig. 12)*

Figure 9 Elements Modelled (1)

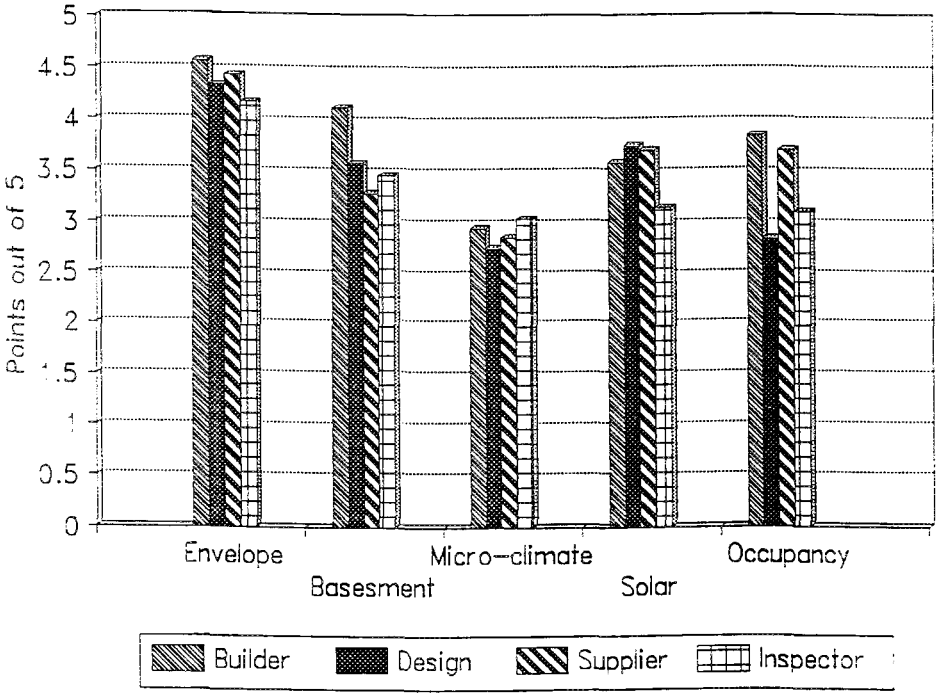


Figure 10 Elements Modelled (2)

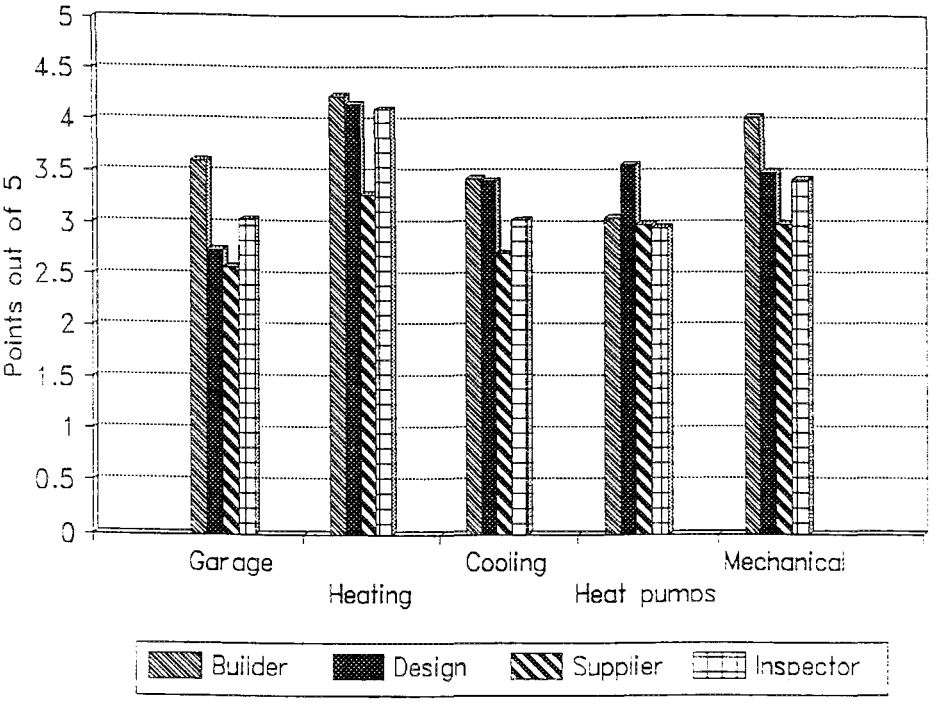


Figure 11 Costing Analysis

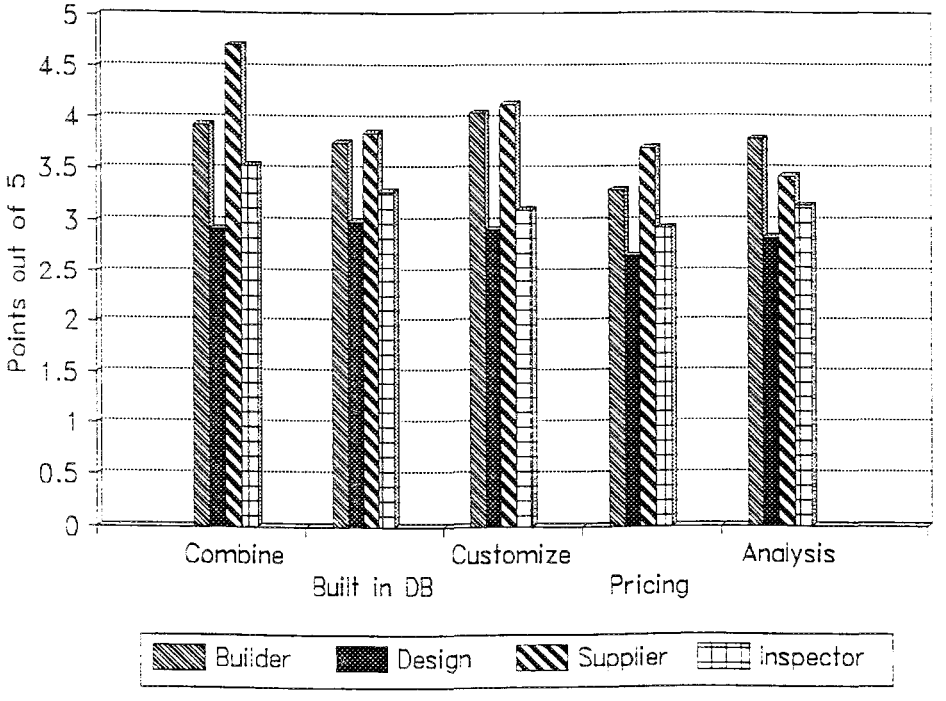
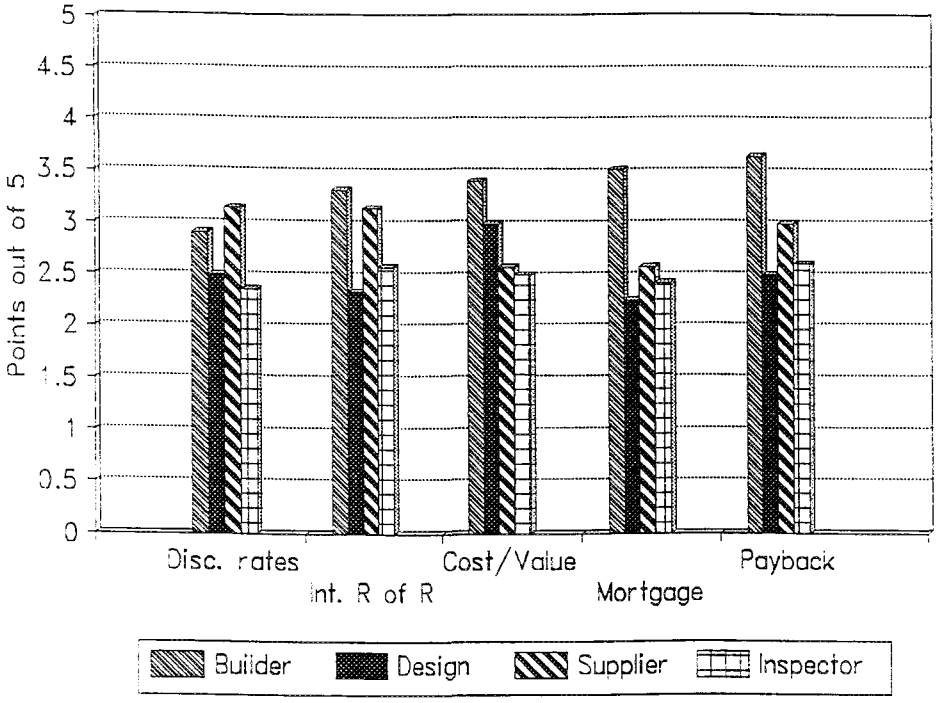


Figure 12 Financial Analysis Evaluation



Upgrades:

Builders and suppliers ranked the ability to determine the cost benefits of various upgrade options highest. This was of less importance to designers and inspectors. *(fig. 13)*

Comparisons:

The ability to compare a design to current code standards was ranked highly by all respondents. *(fig. 14)* The ability to compare to Ontario building code requirements was only considered from Ontario respondents. Probably because of the recently implemented energy requirements in Ontario, the usefulness of the comparison was ranked highest amongst all questions. Comparison to R-2000 program requirements was also very highly rated by builders, designers, and suppliers. Being able to reconcile measured energy consumption figures with results obtained by analysis was ranked lowest.

Data Base usefulness:

Costing information by building component and heating system efficiencies were highly rated by all respondents. Designers showed least interest in utility rate information and customizable data, while suppliers ranked it highest. *(fig. 15)* Most useful report formats are hard copy and screen display. Output of data to spreadsheets was less important.

How would you use this software?

Builders and designers are most likely to use this software as a design tool. Inspectors are most likely to see its value as a compliance tool for performance energy codes. Builders also see it as a sales tool and a costing tool. *(fig. 16)*

Figure 13 Upgrades

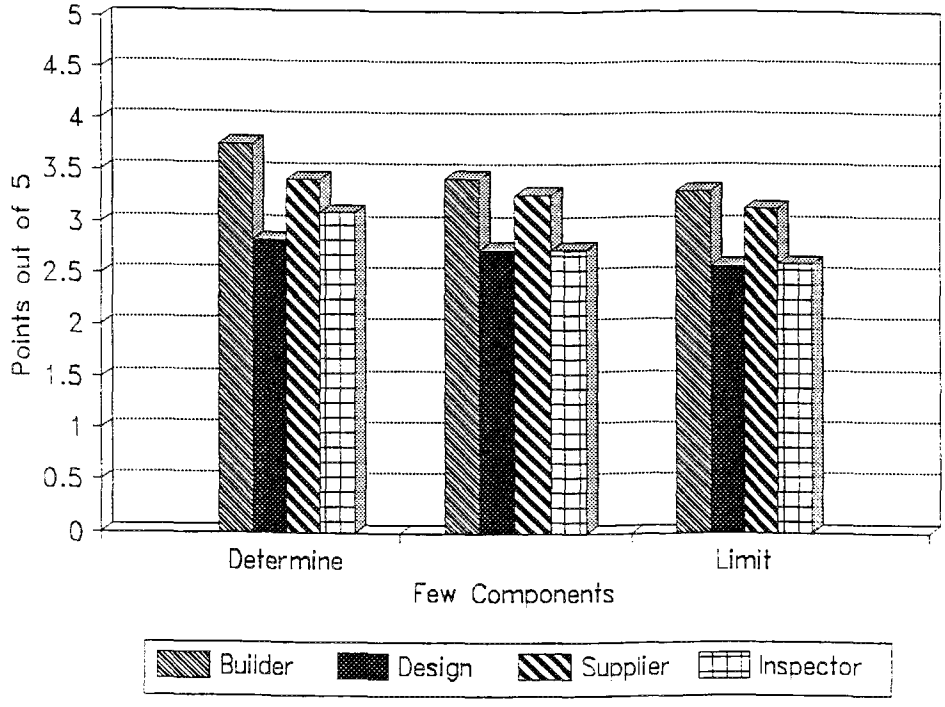


Figure 14 Standards Comparisons

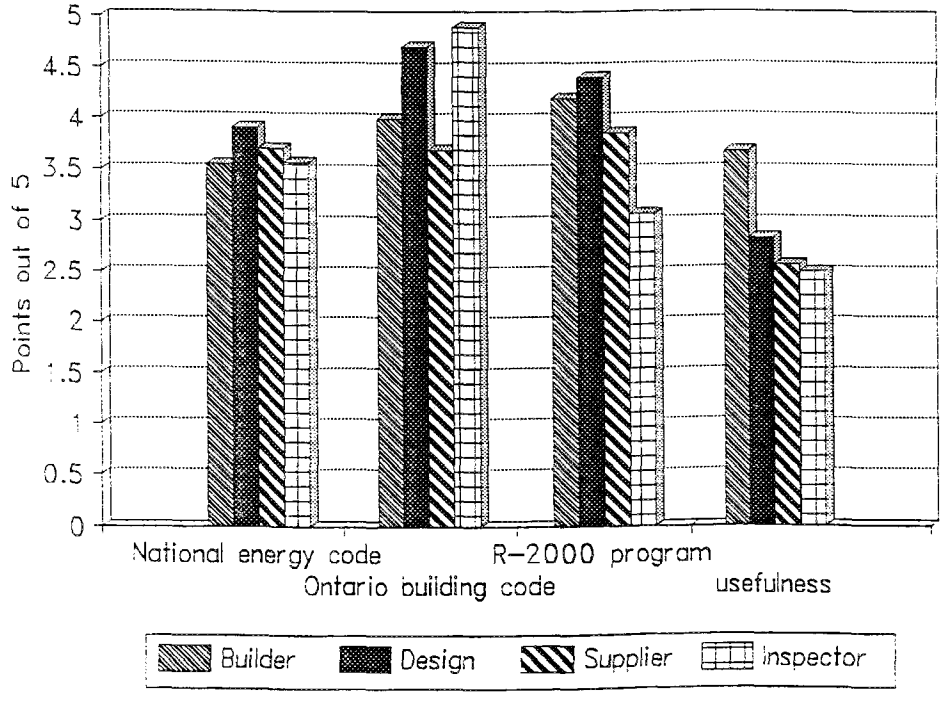
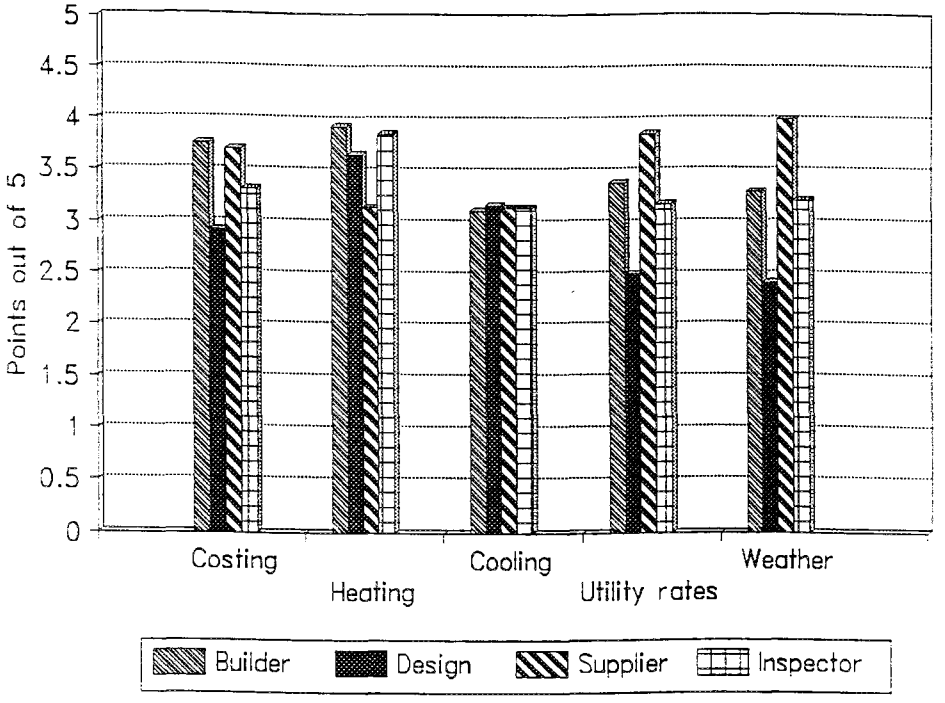


Figure 15 Data Bases



Overall Level of interest

The overall interest level in a software program that provides energy performance and costing at the same time was 6.6 (out of 10) with builders highest at 7.4 and inspectors at 6.5. *(fig. 17)* A 6.6 level is a positive response, although not overly enthusiastic. It assumes that all features implied are there, at the average suggested price. This figure can be assumed to diminish over time, as circumstances change and other products come on stream to meet this interest.

Interest in purchasing software that combines costing and energy performance calculations

A large proportion (40%) of builders and inspectors indicated plans to purchase some energy analysis software within 2 years *(fig. 18)* but a significant portion of builders also indicated they would not be looking at costing software. Similarly, builders indicated an interest in purchasing costing software within 2 years. Designers have indicated little interest in purchasing such software. *(fig. 19)*

Appendix B summarizes the overall survey responses to the various components identified in the survey. A broad overview indicates that at an interest level of 3.0/5 the majority of items are retained; at 3.5/5 only half are retained; at 3.7/5 only one quarter are, and at 4.0/5 there is virtually no reason to consider the product.

This analysis provides information on specific components of the software that may or may not be included in the software. A high interest level would indicate elements important to poten-

Figure 16 Use of Software

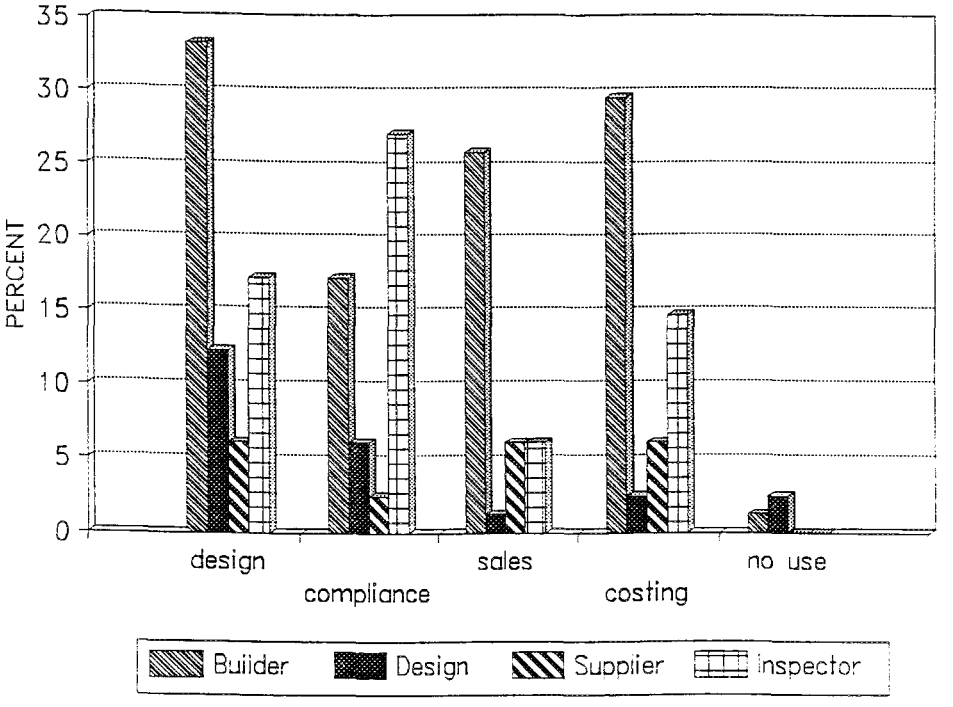


Figure 17 Level of Interest

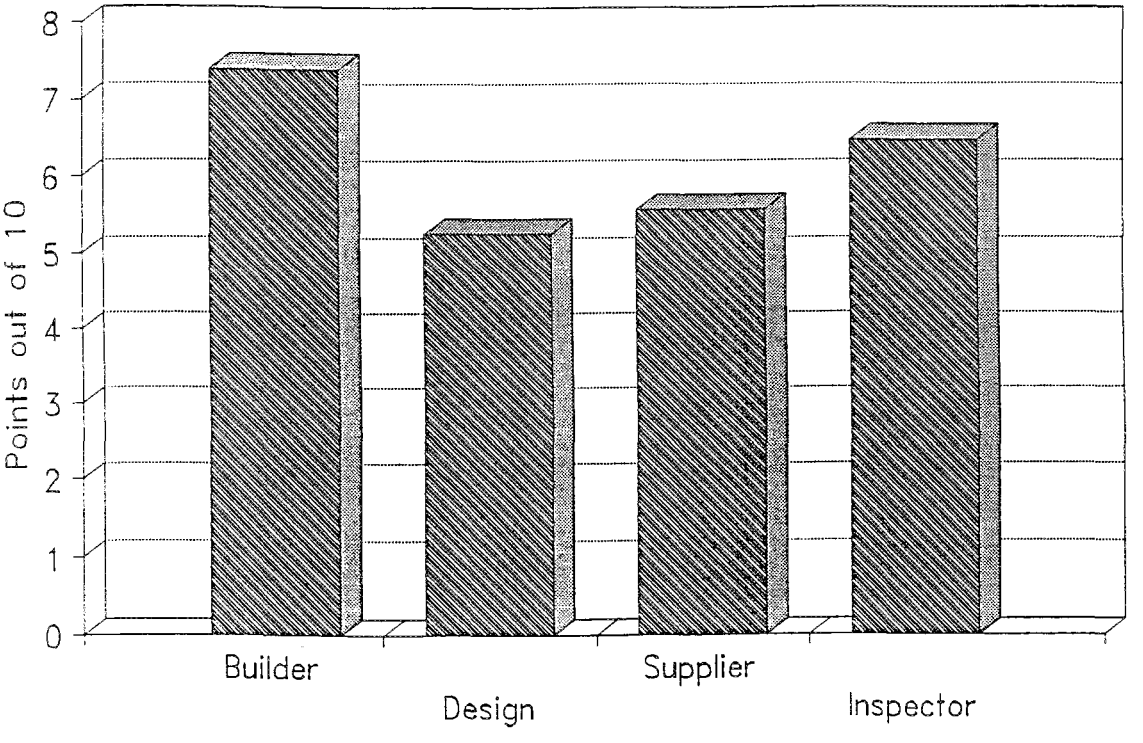


Figure 18 Plans to Purchase Energy Software

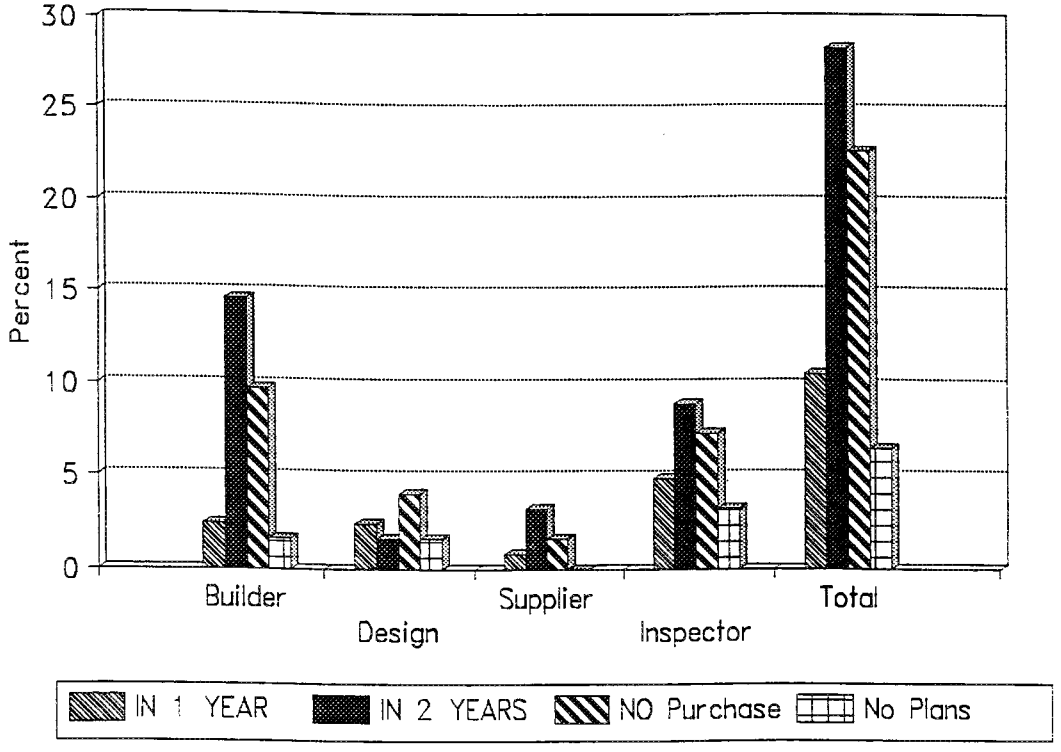


Figure 19 Plans to Purchase Costing Software

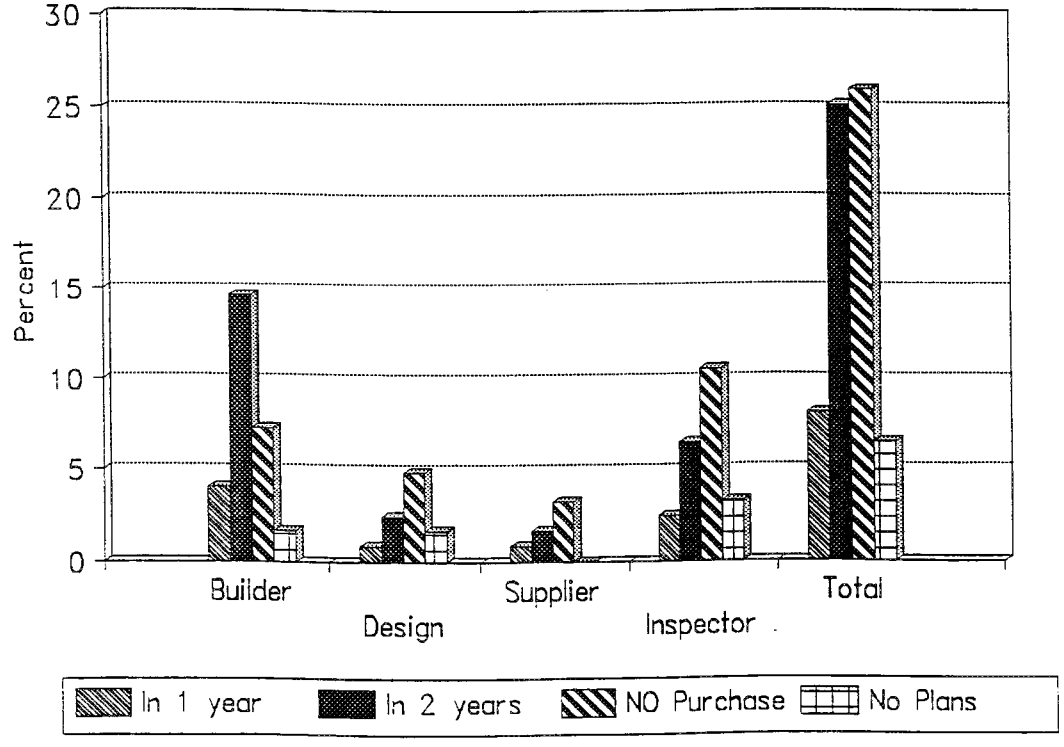
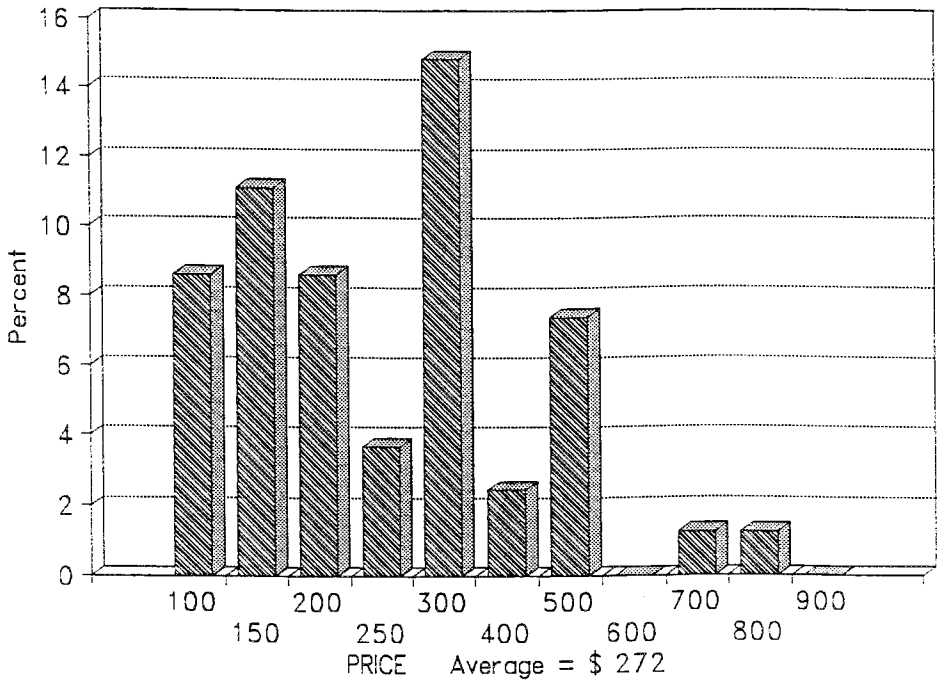


Figure 20 Price



tial users, while lower interest levels would seem to indicate features that would be nice, but with less importance.

The product should only proceed with all the elements if it is deemed reasonable that a 2.5 to 3 interest level in a component is justification for inclusion. If it is determined that the interest rate should be at least 3.5, then are the features that are left valid enough to actually produce a product of any interest at all?

As the survey respondents were answering the questionnaire with limited knowledge of the software, it would be reasonable to assume that an interest level of 3 to 3.5 would constitute a reasonable level for a given element.

Pricing:

Potential users are looking for a price for this kind of software product between the average price that they indicated at $272 to as high as $500. The most commonly cited price was $300, followed by $150. 2 quoted $1000 or more. The lowest was $79.95, average $272. *(fig. 20)*

A close look at the HOT-2000 users who responded compared to respondents noted the following:

	HOT-2000	Overall
Interest Level	6.7	6.6
Average price to pay	$235	$273
Plan to buy energy analysis Software		
In 1 year	13%	16%
In 2 years	38%	43%
No interest	46%	35%
Plan to buy costing Software		
In 1 year	13%	12%
In 2 years	38%	38%
No interest	46%	40%

The final selling price will be affected by the method of distribution. If the product is sold direct the end-user price could naturally be lower than the retail price if sold on the open market through dealers.

A true price comparison with HOT-2000 is not available, as it's development has been subsidized, and only the marketing costs are being recovered through sales of the software. It is useful to note that the price for HOT-2000 version 6 has been $275, and the recently issued version 7 is priced at $295.

Determination of market potential is difficult to establish as this is a very specialized market and products are not normally sold through conventional retail channels which are the main source of sales data. HOT-2000 has been widely marketed, and has the benefit of being the official compliance tool for the R-2000 Program. Even with that backing, it has only about 700 users, so unless there were some special "hook" to generate sales it would be optimistic to anticipate sales of 500 units in the first year or two after product launch.

Price determination will have to consider the cost of user support. Is it free and included in the price, by additional fee, or a charge for connection to a BBS? Are updates to data bases provided free or are there additional charges?

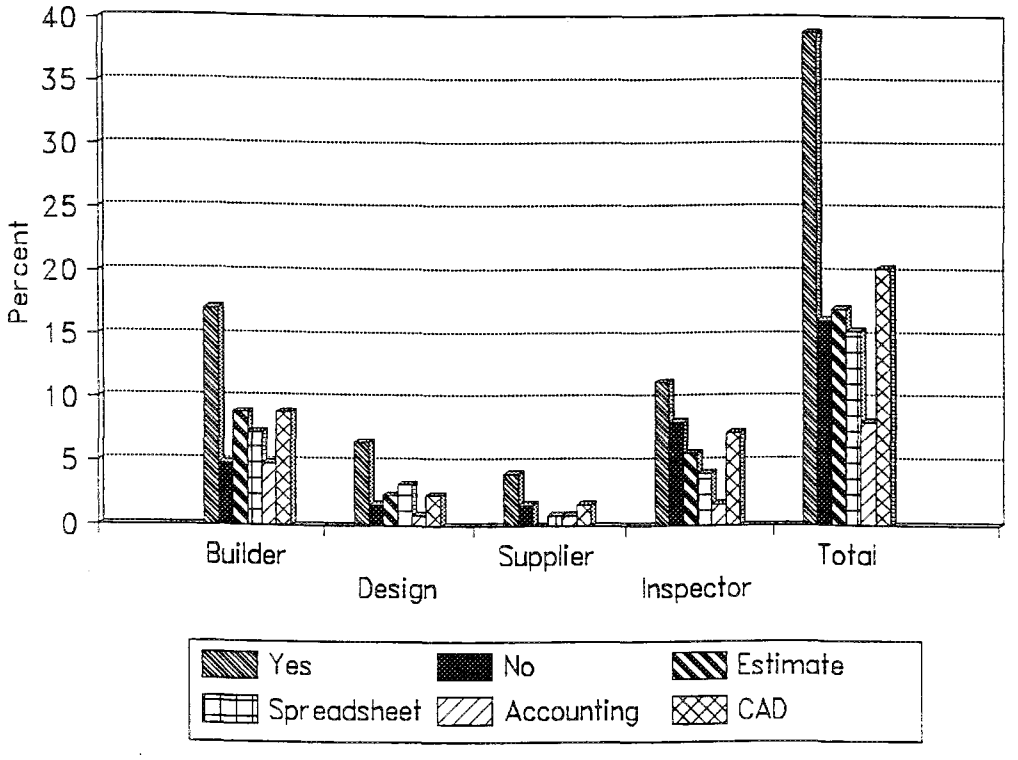
Revenues are a combination of sale of the program, customer support (cost or income), and data base updates. There is also income from annual product upgrades to registered users. The selling price will have to be measured against the revenue that can be generated through the level of market penetration for the known market. This will be the key to making a decision as to the profitability of putting the product or specific versions on the market.

Tie-in to other software

Asked if energy and costing software should be tied into other software products 60% indicated yes. Builders were quite evenly split in suggesting a tie in with estimating and CAD programs. Designers were fairly uniform in their suggestion. Inspectors favoured CAD tie-in over others. *(fig. 21)*

Although sixty percent of respondents indicated an interest in tying this product in with other

Figure 21 Integration with other Software



software products, this should be the last feature to consider for program completion. It could be reserved for a future version, as it would be important to release a fully functional software package to which upgrades can be added at a later time.

The history of software development has been that the programs are released, and enhancements, error corrections, and modifications are made based on user feedback, development of new information, and platform capacity. Current versions of both operating systems and individual software packages are significantly different, more refined versions that those originally released. It would be more important to develop a user base for a core program first, then consider integration with other software as a later upgrade. Part of this can be explained by technological changes, as well as immense complexity of trying to resolve all elements prior to release. The more complex the software, the more difficult and time consuming it is to have all elements resolved prior to release.

7. SALES AND MARKETING

The software program must be fully implemented under Windows, requires good documentation and on-line help. It must be easy to use, provide a reasonable reaction time for data acquisition and calculations, and provide excellent printed and screen reports.

The key features for the program should be decided on and "signed off" to complete the first marketable version. It should be remembered that newer versions which can generate upgrade revenue and provide customer service can be released at a later date, as has been the practice in the software industry. The program feature "sign off" is required to plan marketing materials.

SALES POTENTIAL

With the average interest in this type of product at 6.6 out of 10 and 59 percent of respondents interested in purchasing this type of product within two years, a reasonable justification for the saleability of this type of product has been established. However, this interest level is associated with an average price of $272 suggested by the survey respondents. If the price was set at $544 then it would be fair to say that the interest level could be as low as 3.3 thereby classifying the product as non-marketable.

The interest level figures are really only valid in the spring of 1994. If it takes one to two years to complete a marketable version of the software it is obvious that those with any real interest may have already purchased a competing product. As this is not an expanding market, but a highly specialized segment, the product sales potential drops dramatically with the time taken to bring the product to market. It should be kept in mind that currently 46% of HOT2000 users have no interest in purchasing this product, and that the total number of HOT 2000 users is only about 700.

Even if a new version that is significantly better than the competition and costs less is completed within two years, it will be difficult to sell to those that purchased competing products, as the learning curve with time spent is an investment they do not want to repeat.

However, the time to develop the software into a true Windows program ready for marketing would be at least one year, at a probable cost of about $200,000. plus extra work for quality control testing and data base verification (plus marketing costs).

VERSION OPTIONS

The program is currently designed to perform energy analysis and costing. If it is decided to proceed with the software, it may be worth considering producing two versions, one for energy analysis only and one as originally designed. The energy analysis program could be priced lower to attract sales of the product that would be lost to those not wanting to spend extra for a costing feature they do not require. This could also simplify the use of the program and make it more marketable for building Inspectors who could use it as a compliance tool for performance energy codes.

However, there is a negative factor for producing an energy analysis version, as the competition is greater and most users already use HOT2000.

Consideration might be given to a junior or "Lite" version aimed at the home owner market. There are over 9 million households in Canada and over 83 million in the USA. It is estimated that by the year 1999 there will be an average of 2.3 computers in every house hold in North America. This could be a lower priced product marketed similar to a tax preparation program in that there is a new version every year with the latest data base information (i.e. 1994 Home Owner's Energy program).

Pricing for a home owner version would have to be very low, with a retail price of $49.95 to $99.95 maximum. To be profitable a mass marketing effort would be required to sell tens of thousands of copies. The viability of such an option was not considered in this review, but is merely being presented as an option that might be considered.

DISTRIBUTION

Technical products are suited to marketing through a select small group of agents that are involved in the industry or even a single agent. This would keep the price at a reasonable figure and increase the marketability of the product. A home owner version may require marketing through the normal distribution channels.

MARKETING / ADVERTISING - BASIC ELEMENTS

A brochure to assist in sales and marketing of the product is needed. A basic brochure would be double sided, colour printing and "Z" folded so that it can fit into a #10 envelope. Use of screen displays is highly recommended. The flyer should promote the benefits of the product more than the features.

Before placing any paid advertising a press release to all industry papers and magazines should be issued. A good press release will enable a writer to produce an article about the product and its benefits without having to use the program. The release should include the price of the product and details regarding availability. As this is a sophisticated technical product it may be an advantage to arrange demonstrations for reviewers rather than sending out product for review.

Use of a direct mail campaign to identified prospective end users is recommended before a more general advertising campaign. It should include enough information (attractive screen shots, benefits, press quotes etc..) to enable the user to make a buying decision and an order form. The order form should be a separate page that can be faxed back to the sales department for fulfilment. Use of a toll free 1-800 number should be considered.

Paid advertising should be placed in trade magazines and papers. Ad content may vary as to the target audience for each trade paper.

8. RECOMMENDATIONS

Technical

The LCC software concept is sound but a number of problems have been noted in the execution of the intent of the program, so before a Beta version for testing is ready, a number of technical revisions have to be undertaken.

The software must be fully implemented under Windows, with full mouse support and should allow multi-tasking. The IBM or compatible PC is the dominant platform (78%) while only 13% use the MAC.

The current documentation package was written for an earlier version and is not suitable for use with the current version. Good documentation and on-line help is required. It must be easy to use, provide a reasonable reaction time for data acquisition and calculations, and provide excellent printed and screen reports.

The program must be compared more extensively with other programs and be checked against monitored results with actual weather files to verify all the calculation modules.

Inputs should be verified by the program, as they are being made or prior to running the calculations, so that the user does not find out that simple input errors where made only after calculations are done.

An optional longer printout format is needed, to show all inputs.

Data bases must be complete and accurate at the time of product release and must allow user modification. The data-bases must be completely reviewed as information is not complete, and do not reflect many of the current construction assemblies in use today. A BBS could be used to update users with newer database files. The database should run concurrently with, or be part of the analysis mode, so that changes can be made as the program is being run, without the need to exit the program.

Marketing

Customer support for this type of product is essential. Customer support polices and procedures must be clearly defined, and may have to be charged for. Consideration should be given to provide customer support through a bulletin board system (BBS). A BBS could also be used to update users with new database files and program patches.

There are no programs that directly compete with the CMHC LCC software. This provides an opportunity to introduce a new product; but on the other, there may be a good reason why nobody has ever done this, as the cost database would be outdated as soon as it was released, due to regional/seasonal/personal variations in prices.

With the average interest in this type of product at 6.6 out of 10 and 59% of respondents interested in purchasing this type of product within two years, a reasonable justification for the saleability of this type of product has been established, with an average price of $272. However, given the limited number of users of HOT-2000 (despite the support of the R-2000 Program), the total number of potential purchasers of a product like CMHC LCC is small.

The interest level figures are valid at the time of the survey (spring of 1994). If it takes one to two years to complete a marketable version of the software those with any real interest may have already purchased a competing product.

A significant proportion of builders and inspectors indicated plans to purchase energy analysis software within 2 years. Builders indicated an interest in purchasing costing software within 2 years. Designers had little interest in purchasing such software.

The program is currently designed to perform energy analysis and costing, but it may be worth considering producing two versions, one for energy analysis only and one as originally designed. The energy analysis program could be priced lower. This could simplify the use of the program and make it more marketable for building Inspectors who could use it as a compliance tool for performance energy codes.

We feel that it is premature at this stage of development of the software to discuss marketing options for the software. Given the present shape of the software package and the number of other software packages available, a major investment will have to be made in order to develop the CMHC LCC into a viable, ready to use package. It will also require a major marketing effort to support a stand alone software package. We are of the opinion that the window of opportunity for this type of software may have already passed by.

If there is interest at CMHC to pursue with the LCC software development, it is our opinion that it may be more useful to investigate taking some components, such as the code comparisons or costing elements, and tying them to existing software such as HOT-2000.