

Proposed Changes to the R-2000 Technical Requirements

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Introduction

For more than 20 years, R-2000 has set the standard for energy efficient, comfortable and healthy housing in Canada. With the diffusion of R-2000 technology throughout the industry, it is time to advance the standard to provide a new target. In this paper, CHBA is recommending a series of changes to confirm R-2000 as the comprehensive environmental standard with the most stringent energy efficiency requirements of any environmental label for residential construction in North America. These include changes to the energy target, new requirements for indoor air quality and new credits for water conservation and other items related to resource efficiency.

This paper also recommends a list of housekeeping changes that have accumulated since the last update to the R-2000 Standard as well as a list of items that were considered for inclusion but are not recommended at this time given their complexity or the extent of software development required.

CHBA proposes to further refine the recommended changes through simulations and other testing and cost analysis. CHBA will then consult with interested parties in collaboration with NRCan. These will include R-2000 builders, service providers and delivery agents and will identify the improvements necessary to the delivery infrastructure to ensure effective support to R-2000 builders.

Preamble to the Proposed Changes

The R-2000 Energy Target for any house has been based on the house location, the house size and on the type of fuel being used to heat the home. The Energy Target has been based on the sum of the space heating and domestic hot water heating. In each of space and water heating, an energy “correction” factor has been applied to account for the fuel being used.

In the case of space heating, when the heating system is fuel-fired, the factor is 4.5 MJ and if the heating system is electric resistance (electric furnace or electric baseboard) the factor is 3.6 MJ. This results in the Energy Target for fuel-fired, space heated houses being 25% less stringent than for electrically heated houses. Consequently, electrically heated homes need to be constructed with more insulation and more efficient mechanical systems in order to meet the R-2000 Energy Target.

In the case of water heating, the factor is 6.19 MJ for fuel-fired water heaters and 3.87 MJ for electrical water heaters. This provides an Energy Target for fuel-fired heaters which is 60% less stringent than for an electric heater.

It is important to note that the “correction” factors were not imposed to provide for a technical difference between fuel-fired and electric heating but rather to discourage electrically heated R-2000 homes and electrically heated hot water.

As we look to make R-2000 even more energy efficient by lowering the Energy Target, simulations conducted to develop the proposed changes in this document highlighted the fact that it will become increasingly more difficult for electric resistance heated homes to achieve R-2000 status. If we hope to cut the energy target by 50%, electrically heated homes could only achieve this (using the current equation) by building an advanced envelope and adding an air source heat pump as part of the mechanical system.

CHBA is proposing to make R-2000 fuel neutral. As such, one of the proposed changes is to modify the R-2000 Energy Target calculation so that it is not biasing one fuel source over another. The builder is striving to hit an energy target, regardless of where that energy is coming from. If there are realities of the market place such as pricing of a fuel source, the market will dictate which fuel is to be used based on cost and availability. Therefore, it is not required that R-2000 Technical Requirements bias fuels.

Another recommendation is that R-2000 will target the building envelope for improvement because; a) the builder has control over the envelope and b) it is the envelope which remains unchanged for years. By comparison, the mechanical systems can be removed and replaced in days.

The R-2000 energy target has always been based on space heating + hot water heating. As we move into the future it seems only fitting that R-2000 include all of the energy consumed in the home (where the equipment being supplied is under the control of the builder). Therefore, Energy Targets for lights and air conditioning are proposed to be included in the R-2000 Energy Target, making the Energy Target effectively a whole-house energy target.

With Health Canada announcing a reduction in the limits for radon gas in homes from 800 Bq/m³ to 200 Bq/m³, it is believed that many builders who did not need to build with radon in mind will now be directly affected. Accordingly, is proposing to change the Technical Requirements to ensure that the provision is made allow sub-slab depressurization to be added. While offering a solution to the radon problem, an additional benefit of sub-slab depressurization is to assist with resolving moisture problems in basements. Both the radon and the moisture issues are equally significant in CHBA proposing this for inclusion in R-2000.

Proposed changes are also being presented to improve indoor air quality and increase the choices available to builders in meeting the water conservation and environmental responsibility features.

A Proposed Changes to the Energy Features

Change #1: Make R-2000 Fuel Neutral

Rationale:

R-2000 houses are based on building the most cost effective, energy efficient houses in Canada. It is not the purpose of R-2000 to influence energy supply policy by penalizing one fuel source over another. The objective of R-2000 is to encourage builders to construct the best houses they can. The market place and pricing structures of the various fuel options within that market place will determine the fuel to be used.

Administrative Implications:

This is a major change for R-2000 conceptually.

It will also require modifications to the HOT2000 software, specifically the equations which are responsible for determining the R-2000 Energy Target.

Builder Implications:

This modification to the energy target will allow builders to concentrate on the building envelope. The best envelope design will be the same for oil, gas, electric or wood heating systems.

Change #2: Reduce the R-2000 Energy Target by 50-60%

Rationale:

The R-2000 Standard is updated on a continuous basis and it needs to maintain its leadership position. R-2000 sets the national benchmark for energy efficient housing in Canada. Standard building practice, provincial regulations and other energy programs are producing houses which are approaching the energy consumption targets of R-2000. It is time to move the standard forward. It is the goal of this proposed change to move the envelope of R-2000 houses to the maximum practical limit at this time. It is believed that this will encourage building envelopes similar to those used on the EQUilibrium houses.

It is the goal of CHBA that R-2000 homes be energy “net zero” at some point in the future. This is being achieved with periodic upgrades to R-2000 as the industry demonstrated that upgrades are feasible. It is not expected that upgrades will happen every year, but rather that upgrades will occur at 3-5 year intervals.

Administrative Implications:

The implications will be large and will require considerable effort to ensure that the Energy Target is practical. While on the surface it seems to require a simple change to the software, many simulations at various locations in Canada will be required in order to ensure that the Energy Target chosen is feasible.

Currently, the R-2000 energy target is calculated as the space heating target + the water heating target. The new R-2000 Energy Target would be approximately = one half the existing target.

It should also be pointed out that the work to date has only involved detached housing. The performance of attached housing will be very different and likely require a different Energy Target. Attached, multi-unit housing will require a similar approach as is being proposed here for detached housing. It is proposed that attached housing be dealt with separately.

Builder Implications:

This modification to the energy target will change how builders achieve the R-2000 targets. The following table illustrates, for example, the types and magnitude of changes we might expect to see in the field. This table is based on the EQilibrium house being constructed in Ottawa. Also, it should be noted that the scenario described below is only one option as to how a builder might meet the Energy Target and it should not be considered as the only option.

| R-2000 House Meeting Current Targets | R-2000 With New Targets |
|--|--|
| R-40 attic insulation | R-60 attic insulation |
| R-22 main walls | R-14+16+14 main walls |
| R-12 full height basement | R-20+10+10 basement walls full height |
| R-31 exposed floor over garage | R31+16 exposed floor over garage |
| No sub-slab | R-10 under basement slab |
| Windows double glazed, low e | Windows triple glazed low e and argon |
| Sealed combustion hot water tank and high efficiency DHW | 90% gas boiler combo with air source heat pump |
| HRV 62% at 0C | HRV 81% at 0C |

Change #3: Add an Electrical Energy Consumption Target for Lights

Rationale:

The R-2000 Program has encouraged the use of energy-efficient lighting for many years and R-2000 Builders have been at the forefront in this area. In the past, the options were limited for specialized fixtures and lamps. There is now a variety of options and the lighting industry is working towards offering fixtures for all applications. Energy-efficient lighting has been identified as one of the means to reduce the electrical load in homes and the federal government plans to mandate the use of energy-efficient lighting in Canada. While some issues need to be addressed, it is time that R-2000 set a target for energy-efficient lighting.

Administrative Implications:

The lighting target would need to be set. Modifications to the HOT2000 software are required. The software will need to allow for a number and type of lighting fixtures to be used as well as allow for a duration-of-use profile. Both the common Compact Fluorescent Lights (CFL) and the newer Solid State Lighting (SSL) using LED technology should be considered.

Builder Implications:

It is expected that builders will install CFLs or SSLs. In cases where builders are supplying energy efficient lighting, there will be no change to their current practice. The key advantage of adding this target for builders will be their ability to use the savings at meeting the energy target for lighting to trade off on the tighter space and water heating targets.

Change #4: Add Cooling/Air Conditioning Energy to the Target**Rationale:**

Mechanical cooling is more common in homes today and needs to be accounted for in the design of energy efficient homes. Consumers are expecting that an energy efficient house is taking into account all of the builder supplied features of which air conditioning is one.

Currently, air conditioning is handled in the Environmental Features pick-list by stipulating a minimum Seasonal Energy Efficiency Rating (SEER) or Energy Efficiency Rating (EER) on equipment when the builder selects this item from the pick list. The inclusion of the new cooling target would effectively mandate that when provided, energy-efficient air conditioning systems will be used in R-2000 homes.

Administrative Implications:

The cooling target would need to be set. Modifications to the HOT2000 software are required. HOT2000 currently calculates the cooling energy requirements and presents this information. It is proposed that an R-2000 air conditioning energy target needs to be established in much the same way as the R-2000 space heating target has been established, that is, based on the cooling degree days at the location and the volume of the house. Various areas across Canada have climatic zones that would be affected by this change, the same areas where buyers would be expected to want air conditioning and builders would be expected to offer it.

Therefore, with changes 2 to 4 described above, the new R-2000 Energy Target would now become:

R-2000 Energy Target = space heating + water heating + lighting + air conditioning.

This would result in the removal of Item 13) "Cooling Systems" from the current Environmental Features Pick List.

Builder Implications:

This change will only affect builders who are installing mechanical cooling systems. With the changes the builders will be making to their homes to meet the heating target, it is unlikely that this requirement on the builder will be more onerous than using one of the more energy efficient air conditioning systems currently available on the market. It is recommended that energy savings on this target can be traded off on other target areas.

Change #5: Add a Renewables Package**Rationale:**

As the R-2000 requirements move to reduce the energy target, many builders will look to renewable energy sources to assist in meeting the energy goals. Currently, these calculations must be done by hand to account for the energy produced using these technologies. The renewables package will include solar hot water, solar air heating (ventilator pre-heat), photovoltaics, wind and wood heating. With utilities offering such programs as the Standing Offer Program in Ontario, where the utility will pay for each kWhr produced by wind and photovoltaics, builders may decide to take advantage of these programs.

The purpose of this change is to allow builders to calculate the energy credit more easily when they decide to use these technologies.

Administrative Implications:

The HOT2000 software will need to be changed to include these features or a procedure will need to be developed to allow a second simulation program (such as RETSCREEN) to be used to determine the amount of energy being produced by the renewable package, so it can be credited to meeting the R-2000 Energy Target.

As noted earlier, one of the recommendations of this paper is to make R-2000 fuel neutral. In so doing, the energy for the house can come from any fuel source, including renewable sources. The challenge with this recommendation will be to ensure that the builder receives credit for the use of renewable energy systems. The structure of this credit has yet to be defined and there are a number of questions which arise and will need to be addressed. These include, but are not limited to:

- Will the fact that transmission losses are minimal for site generated power be recognized?
- How will the wood energy contribution be determined? Will wood from wood waste such as pellets be credited differently than logs?
- Will wood burning be credited as being carbon neutral in terms of green house gas emissions?

Builder Implications:

Builders will be encouraged to use renewables as a means of meeting the building energy target because energy credits will be more directly known at the design stage.

Builders/designers will be able to use the simulation tools to estimate quickly the benefits offered by using a renewable energy package. The change to the software will be done in much the same way as adding an air source heat pump or switching to triple glazed windows is currently done.

Change #6: Add Drain Water Heat Recovery**Rationale:**

As with renewables, builders may look to heat recovery technologies to assist in meeting the energy targets. Currently, these calculations must be done by hand.

The purpose of this change is to allow builders to calculate the energy credit more easily when they decide to use these drain water heat recovery systems.

Administrative Implications:

The HOT2000 software will need to be changed to include this feature or a procedure will need to be developed to determine the amount of energy being recovered.

While devices such as these are available “off the shelf” for heat recovery from drain water, they may not have a nationally recognized approval and as such effort will be required to ensure that builders across the country have equal choice in the technologies they use.

Builder Implications:

Builders will be encouraged to use drain water heat recovery technologies as a means of meeting the building energy target because energy credits will be known at the design stage.

B Proposed Changes to the Indoor Air Quality Features

Change # 1: IAQ Section to Make the Provision for Sub-Slab Depressurization Mandatory

Rationale:

Note: This is currently IAQ Pick List item # 8.

Health Canada has reduced the limits for radon from 800 Bq/m³ to 200 Bq/m³. This is a significant reduction and it will result in many areas across Canada requiring radon mitigation systems to be installed. Radon entry into homes was a prime consideration when the R-2000 Standard was originally developed. The testing and research available at that time led to the inclusion of maximum depressurization levels in R-2000 homes of -10 Pa. As research has further demonstrated the presence and danger of radon in Canadian homes, it is time for R-2000 to take a more aggressive stance on the issue.

Further supporting this move, CMHC has reported that it is possible for houses anywhere in Canada to test positive for radon levels above the new Health Canada guidelines. CMHC has advised that the house does not need to be in a “High Radon Potential Zone” to test above the limits. It is not possible to predict if a house will have a radon problem before it is constructed.

Administrative Implications:

The R-2000 Technical Requirements is recognizing that radon (and other soil gases) is an important health-related issue and that it can be an issue anywhere in Canada. There will be a need to produce fact sheets, training manuals and to deliver training to R-2000 professionals. The pick list will need to be updated, as the provision for Sub-Slab Depressurization becomes a mandatory requirement.

Builder Implications:

Builders would be required to provide for future sub-slab depressurization systems on all houses with basements and/or crawl spaces. This would require poly under the slab and sealing of the slab penetrations and the slab to wall connections, and provision for venting the sub-slab crushed rock. Slab on grade houses would require the poly and sealing, but be exempt from providing the vent because the drainage layer beneath the slab will vent to atmosphere. Fans would not need to be installed. Only the sealing and the sub-slab piping would be required with the pipe which passes through the basement floor slab capped.

Additional Note:

IQA Pick List Item 9 b) states: “Provide control measures to isolate a crawl space or space beneath a basement floor so as to minimize the transmission of moisture and soil gases into the occupied space.”

By making the provision for sub-slab depressurization mandatory, the moisture control benefits of this system can be met by connecting the system and where this is done current pick list item # 9 b) will have been met.

Experience in the USA with sub-slab depressurization systems has demonstrated the added benefit being an effective moisture control system. The benefit is in the drying of the concrete slab which will reduce the humidity level in the basement, which also reduces the air conditioning load.

Change # 2: Add a Mandatory Requirement for Duct Sealing

Rationale:

Duct sealing has been a best practice measure recommended in the CHBA Builders' Manual for over 20 years. The ductwork for heat recovery ventilators has commonly been sealed in R-2000 homes to ensure proper delivery of fresh air and the exhaust of stale air from wet rooms. On-site testing of homes, including R-2000 homes, has found ductwork to be leaky, which results in a number of performance related issues. The benefits of sealing ductwork include:

- Adequate air circulation in remote areas of the home including the second floor
- Proper delivery to all rooms
- The ability to properly balance forced-air heating systems

Administrative Implications:

This is a prescriptive requirement and not a performance requirement. R-2000 has tried to minimize prescriptive requirements. A new inspection may be required at the pre-drywall stage. Testing of the ductwork is not expected to be required.

Builder Implications:

All duct joints and elbow and duct seams would need to be sealed with aluminum metal tape or approved duct mastic.

Change # 3: Add a Mandatory Requirement for Cold Air Returns to be Hard Ducted

Rationale:

On-site testing of homes, including R-2000 homes, has found ductwork to be leaky, which results in a number of performance related issues. The benefits of hard ducting of cold air returns includes:

- Adequate air return from remote areas of the home, including the second floor
- Reduce depressurization of the basement or mechanical room caused by unsealed returns
- Reduced chance of back-drafting of spillage susceptible appliances.

Administrative Implications:

This is a prescriptive requirement and not a performance requirement. R-2000 has tried to avoid excessive prescriptive requirements. A new inspection may be required at the pre-drywall stage. Testing of the ductwork is not expected to be required.

Builder Implications:

All horizontal and vertical duct runs would need to be hard ducted and sealed.

C Proposed Changes to the Water Conservation Features

Change #1: Add a Water Conservation Pick List

Pick List would include:

- Install the storage water heater within a 10m pipe run of all bathrooms and kitchen.

(Rationale: Reduces water consumption waiting for hot water to arrive at the tap. It also has some energy saving benefits.)

- Install an on-demand water heater for remote locations.

(Rationale: For locations distant from the hot water tank (mud room, laundry), supply only a cold water line to that application and use an on-demand heater. Water conservation accrues due to instant hot water.

- Install Energy Star® water conserving appliances when the builder supplies appliances.

(Rationale: Energy Star appliances are water conserving and energy efficient.)

- Insulate all hot water piping.

(Rationale: Reduces water consumption waiting for hot water to arrive at the tap. It also has some energy saving benefits.)

- When installing irrigation systems use low-volume, non-spray irrigation system (drip irrigation, bubblers, drip emitters, soaker hose).
- When installing irrigation systems, use a zoned irrigation system separating turf and bedding areas.
- Collect and use rainwater as permitted by local Codes.
- Collect and use greywater as permitted by local Codes.
- Landscape with plants and grasses which have low water requirements.
- Installing walkways and driveways that promote water absorption rather than run-off.
- When the builder provides an outdoor swimming pool a cover will be provided to reduce heat loss and water evaporation.

Administrative Implications:

R-2000 currently mandates low flow showerheads, faucets and low flush toilets. This enhances the water conserving features of the Standard and includes both indoor and outdoor features that the builder can pick from. Pick Lists and Inspection Forms would need to be modified.

Builder Implications:

The builder would be required to **pick 2** items from the Water Conservation Pick List.

D Proposed Changes to the Environmental Responsibility Features

Change #1: Add On-site Construction Waste Management to the Pick List

Rationale:

Canadian homes are reported to send an average of 2 tones of waste to landfill sites for each new home constructed. R-2000 should recognize builders who control their waste stream.

Suggested wording:

“ Provide dedicated on-site bins for wood, cardboard, metal and scrap as part of a written, corporate, on-site construction waste management plan. This can include on-site grinding of appropriate wood scrap and land-clearing waste as mulch.”

Administrative Implications:

Update the pick list and supporting materials. Discussion should be undertaken as to the feasibility of expanding this requirement so that a portion of the waste is used on site in for mulch, a heat sink in walls, or as crushed drainage material around foundations.

Builder Implications:

This change provides builders with more options on the pick list. Builders would need to prepare a corporate construction waste management plan and implement it should they decide to select this item.

Change #2: Add Use of Wood From Sustainable Forests to the Pick List

Rationale:

R-2000 should recognize builders who use wood and wood based products where the wood is produced through sustainable forestry practices.

Suggested Wording

“Use wood certified by credible third party sources as being from forests managed using sustainable forestry practices.” (An example would be “The Canadian Standards Association’s Sustainable Forest Management Systems Standards CAN/CSA Z809”).

Administrative Implications:

Add to the pick list.

Builder Implications:

This change provides builders with more options on the pick list. Builders would need to ask for, and keep on file, documentation verifying that the wood comes from sustainable forestry practices should they decide to select this item.

Change #3: Add Use of Wood Conserving Technologies to the Pick List

Rationale:

R-2000 should recognize builders who use techniques and technologies to conserve wood.

Suggested Wording

“Builder may use any of the following technologies or techniques and receive a credit as one item each to go towards meeting the pick list requirement. The item chosen must be used substantially (80% or more) for the given application:

- Use of advance framing techniques to reduce lumber
- Use of finger-jointed framing lumber
- Use of finger-jointed or recycled material for trim boards
- Use of engineered floor trusses”.

Administrative Implications:

Add to the pick list.

Builder Implications:

This change provides builders with more options on the pick list.

E House-Keeping / Corrections Needed for the Current Version

Section 1.3 Other Applicable Documents, Commentary:

Update the web address for the NRCan R-2000 website.

Section 2.2 Multi-Unit Buildings, Commentary:

Update the web address for the NRCan R-2000 website and ensure the 'current compliance procedures' are clearly defined on the website.

Section 4.4 Window Performance Requirements:

The minimum ER ratings defined in the R-2000 Standard need to be updated to reflect changes made to CSA A440.2. This will reflect the fact that all ratings are now based on positive values to make it easier to compare the energy-performance of windows.

Section 5.1.3 Domestic Water Heaters:

Review stated minimums to ensure they meet or exceed current regulations. Remove the reference to insulation blankets since they are not recommended by manufacturers due to safety concerns. Add a requirement for tankless water heaters.

Section 5.2.1 Design, Installation and Balancing of Ventilation Systems:

Update reference to the 2005 National Building Code. This could also go further and require the use of timers rather than on/off switches of dehumidistats.

Section 5.2.2 Ventilation Equipment:

Update the web address for the NRCan R-2000 website and ensure the noted information is posted on the website.

Section 5.3 Wood-Burning Appliances, 5.3.1 Requirements:

Update the references to listed standards.

Section 5.5 Carbon Monoxide Detectors:

The intent was to remove this requirement from the R-2000 Standard once it had been adopted in Provincial Codes. This requirement is included in the Ontario Building Code and all jurisdictions that have adopted the 2005 NBC requirements for CO detectors (9.32.3.9). The main difference is the R-2000 Standard calls for the alarms to be hard-wired and the NBC permits the use of battery operated alarms. Need to determine if it has been adopted in all jurisdictions and/or if there are any issues that should be addressed before it is removed.

Section 5.7 Unvented Combustion Appliances:

Remove the following sentence from the commentary section: “Interlocking the range hood control to the gas range is suggested, provided it meets the manufacturer’s installation instructions”.

Section 7.1 Air Quality, Commentary:

Update the web address for the NRCan R-2000 website.

Appendix A, Indoor Air Quality Features, Carpeting The following text, provided by the Canadian Carpet Institute and the Carpet and Rug Institute, is suggested:

“Carpeting and carpet cushion – Except as noted, carpeting and carpet cushion used together in the house shall meet either of the following criteria:

the carpet shall be labelled under the Canadian Carpet Institute’s Green Label Program, and the carpet cushion shall be labelled under the Carpet and Rug Institute’s Green Label Program: or

a non-Green Label carpet and/or a non-Green Label carpet cushion shall cover no more than 50 percent of the interior living area. In this case, the interior floor area does not include the basement floor area.

The following floor coverings are exempt: wool or cotton area rugs, and carpeting that has latex-free backing. These exempt floor coverings shall not be glued to the floor.”

Appendix A, IAQ Features, Air Filtration:

The reference to ‘ASHRAE average dust spot efficiency’ should be revised to refer to a minimum MERV rating and the reference to an electronic air cleaner should be removed. Electronic air cleaners generate ozone and are not recommended by CMHC. Should consider including electrostatic air filters in place of electronic. The following text is proposed:

2. Air filtration - One of the following shall be installed:
 - a) A medium-efficiency air filter with a minimum MERV rating (yet to be determined) installed where air-circulating, heating, cooling or heat recovery ventilation systems are used; or
 - b) An air filtration system (e.g., activated carbon, catalytic air cleaners, etc.) in the forced-air system ductwork that is capable of removing gaseous contaminants from the air.

Appendix A, IAQ Features, Vinyl Flooring.

Replace with the following:

Sheet Flooring – All sheet flooring shall be either linoleum or synthetic vinyl tile. Sheet Flooring shall not be used.

Appendix A, IAQ Features, Particleboard Underlayment:

Check to ensure the referenced standard is still current.

Appendix A, IAQ Features, Sub-slab depressurization System:

This option could be expanded to include more specific requirements, including on-site testing. In any case, the language needs some revision since radon is a soil gas.

Appendix A, IAQ Features, Indoor Moisture Control (d):

Remove the ‘or’ from the end of the sentence.

Environmental Features, Insulation:

Replace with the following:

Insulation - As a minimum, use entirely in the attic and the main walls or the basement walls.

1. Glass Fibre Insulation - Meets or exceeds the requirements of the Environmental Choice Program for raw material from recycled glass (a minimum of 45 percent recycled content).
2. Cellulose Insulation - Meets or exceeds the requirements of the Environmental Choice Program for raw material from recycled paper (a minimum of 80 percent recycled content).
3. Mineral Fibre Insulation - Meets or exceeds the requirements of the Environmental Choice Program for recycled raw material (Batt, Blanket or Board Type - a minimum of 35 percent recycled content).
4. Loose-fill or spray applied – a minimum of 50% recycled content.
5. Insulation Made from Plastic - Meets or exceeds the requirements of the Environmental Choice Program for recycled content.

Environmental Features:

If the recommendation to add a cooling target to the R-2000 Energy Target is implemented, the current table is removed. If the cooling target is not added, the minimum SEER and EER ratings for A/C units and heat pumps need to be updated.

F Other Potential Changes for Consideration

During the course of this review a number of potential changes were considered but were decided not to be included in the recommendations for this upgrade to the R-2000 Standard. Although it is believed that the time may not be right for these ideas at this point, it was felt that they should not be lost and be considered for the next iteration. For this reason, these potential changes are provided below.

Energy Related

- **Add Electrical Energy Load Profiling and Give Credit for Peak Load Shifting**

Rationale:

Time-of-use metering and time-of-use billing will soon give rise to significant financial savings for homeowners who have the ability to manage their energy loads and time shift significant energy consumption into the off-peak hours. R-2000, being a leading edge energy standard, should recognize the impact of load shifting and peak load reduction and offer a credit to builders who provide features and equipment which will allow homeowners to do so if they wish to.

Administrative Implications:

At the design stage, the HOT2000 software will likely need to be changed to an hour by hour simulation tool to allow for adequate prediction of the electrical energy profile. This will be further needed to demonstrate the effects of the load shifting.

Alternatively, the compliance path for this item could be based on estimated home operational costs. A technique for estimating the % of the load shifted to off-peak hours could be estimated and using the peak/off-peak energy costs, an estimated savings could be generated. A minimum % savings would be deemed to show that this requirement had been met.

Builder Implications:

In the field, builders will likely begin by offering various control strategy changes such as timers on high load appliances including clothes driers and hot water tanks. These are expected to be similar in nature to programmable thermostats which will basically allow the homeowner to program the hours of use of the appliance so that maximum savings can be realized. Later on, we are likely to see changes to the house design to allow for higher thermal mass materials being used on the south side to collect and store thermal energy for 1-2 days and the ability to draw on these energy storage reserves when needed to supply heat to the rest of the house during peak periods. It is expected that design features for thermal storage will be part of the house control package as offered by the builder and not readily changeable by the homeowner, while appliance control systems will be provided by the builder but will be programmed by the homeowner to meet the needs of their lifestyle.

- **Change the Target So the Actual House is Used as a Reference House**

Rationale:

The energy consumption of the house is calculated differently than the energy target. The energy consumption is determined using HOT2000 software with an exact geometric description of the home with detailed information about all the component assemblies and using month by month weather data and energy balance equations. The R-2000 energy target is based on a simple function of the volume of the house and the heating degree days of the location which adjust the target to the consumption of a reference home in a 6000 degree day climate.

Administrative Implications:

There is still a need for a reference house but the question here is whether the current R-2000 reference house is still appropriate? If for example, the same house geometry built to a provincial code might be a more appropriate reference from which to generate the R-2000 Energy Target. For example, the R-2000 Energy Target could be the estimated consumption of the house built to the provincial code multiplied by 0.5, thereby making the R-2000 house energy consumption 50% less than that of a local code built house of the same geometry.

If a decision is made to change the way the target is calculated, there will be a number of changes needed to the HOT2000 software and a multitude of simulations performed to investigate the effects.

Builder Implications:

The builder will now have a better reference point by which to promote and sell their homes. Since the R-2000 target would be based on the a geometrically identical house built to the local code requirements, the builder can promote their home as using 50% less energy than the same house built to the local code.

- **Correct the House Size Bias in the HOT2000 Simulation**

Rational:

The HOT2000 simulation tool has a number of areas where designers have complained about the calculation techniques. One such area is the surface area and volume changes with the size of the home. Large homes have an advantage over smaller homes when meeting the R-2000 Energy Target even though the R-2000 Energy Target offers a 40 square meter offset to allow for this.

Administrative Implications:

This has been a long-standing issue. As such it is believed that this correction is not as easy to implement as it might seem or it would have been done by now. It is not clear what the potential barriers might be for this change.

Builder Implications:

Builders will not be penalized for building smaller houses. The simulation software will be more reflective of how houses actually operate in the field.

Water Related Potential Changes

- Use innovative waste water technologies as permitted by local Codes (any technology which reduces drain field area compared with traditional stone and pipe).
- Use water-tight and corrosion resistant septic tanks and water storage tanks.

Rationale:

We should be returning water to the aquifer with the same quality it had when it was removed.

Environmental Responsibility Related Potential Changes

- All dimensioned lumber to be 2x8 or smaller.
- Fill materials (when brought on to the site) such as topsoil may contain approved industrial by-products such as foundry sand, biosolids, compost, etc.

Rationale:

To expand the options for builders to select from the pick list. Raising awareness of issues within the builder community.