CITY OF VANCOUVER

ADMINISTRATIVE REPORT

Date:	May 11, 2004
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Meeting Date:	June 8, 2004

TO: Vancouver City Council

FROM: Chief Building Official in consultation with the Director of Legal Services and the Director of Planning

SUBJECT: Updating the Energy Utilization By-law

RECOMMENDATION

A. THAT Council approve in general the proposed Vancouver Building By-law amendments as outlined in Appendix A.

B. THAT the Director of Legal Services be instructed to bring forward the appropriate by-law changes generally in accordance with Appendix A effective September 1, 2004.

C. THAT Council permit the Chief Building Official, in consultation with the Director of Planning, to relax some requirements of the proposed ANSI/ASHRAE/IESNA Standard 90.1 (ASHRAE 90.1) where in the opinion of these officials enforcement of the ASHRAE 90.1 Standard will result in unnecessary hardship including, without limitation, where the incremental cost of full compliance will exceed the discounted value of future energy savings.

D. THAT Council instruct the Chief Building Official to report back by January 1, 2006 on the feasibility of implementing the requirements that may not fully conform to the referenced IES/ASHRAE 90.1 Standard, and propose by-law amendments accordingly.

GENERAL MANAGER'S COMMENTS

The General Manager of Community Services Group RECOMMENDS approval of A, B, C and D.

COUNCIL POLICY

In 1990, Council approved the establishment of the Energy Utilization Program. The actual amendments to the Building By-law were enacted by Council on August 15, 1991. At the same time, Council approved a least cost strategy for enforcing the requirements by relying upon submission of professional letters of assurances. Since the enactment, the City of Vancouver has been the only municipality in B.C. with an Energy Utilization Program.

On May 2, 2002, Council unanimously approved the motion, proposed by the Federation of Canadian Municipalities to support the Canadian Government's ratification of the Kyoto Protocol.

On March 25, 2003, Council approved an emission reduction target of 20 percent from 1990 levels for the City of Vancouver, subject to evaluation of the implications of the target to ensure it is realistic. On this same date, Council created the Cool Vancouver Task Force and requested that it report back with a report on the components of a Greenhouse Gas Reduction (GHG) Action Plan for both the corporation and the community.

On May 18, 2004 [anticipated date], Council approved the recommendation from the Cool Vancouver Task Force and instructed the Chief Building Official to update the Energy Utilization By-law.

SUMMARY

Staff are recommending to update the Energy Utilization Code referenced in the Vancouver Building By-law (VBBL) from the 1989 edition to the 2001 edition of ANSI/ASHRAE/IESNA Standard 90.1 (ASHRAE 90.1). By updating the ASHRAE 90.1 Standard, the increased energy efficiency performance will directly contribute to the Greenhouse Gas Reduction Action Plan.

In our preliminary consultation with the development industry, design issues were identified pertaining to multi unit residential buildings (MURBs) with a high percentage of glazing which would warrant further review. As such, staff are proposing an implementation plan with a grace period of 15 months to allow for a more gradual change on using this updated standard for the MURBs. This grace period is in line with other reviews on this issue such as the Green Building Strategies and the Multi-Unit Residential Green Building Task Force of the Canada Green Building Council. The intent is not to make the energy utilization regulations so restrictive that it is economically not feasible to propose specific designs, nor to change the urban design of the city by limiting the amount of glass allowed in a building facade.

DISCUSSION

In preparation for the update process, consultations were made through an Industry Ad-Hoc Committee consisting of representatives from the following organizations:

- B.C. Hydro
- Terasen Gas
- Urban Development Institute (UDI)
- B.C. Building Corporation
- Building Owners and Managers Association (BOMA)

- GVRD
- National Research Canada
- Association of Professional Engineers and Geoscientists of B.C.
- Architectural Institute of B.C.
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- Illuminating Engineering Society (IES)

The ad-hoc committee met to review the implications on using ASHRAE 90.1 - 2001 edition vs. ASHRAE 90.1-1989 edition. Presentations were made on current industry standards and what are the areas of concerns if the reference standard is updated. A summary of the ASHRAE 90.1 standards comparison is attached in Appendix B. The discussion was focused on larger residential buildings (Part 3 buildings in the VBBL) and commercial buildings. There is no proposed change for smaller (Part 9) residential buildings. The prescriptive insulation requirements in Part 9 buildings are presently at the maximum for the conventional 4" stud construction. It is considered too onerous at this stage to introduce insulation changes that would affect the standard construction methods of residential Part 9 buildings.

In evaluating the ease of transition to use the ASHRAE 90.1 – 2001 version, the committee's consensus is that the design industry is already referencing the performance expectations of the 2001 version, through computer modelling using ASHRAE 90.1 or MNECB.

There is a Federal grant program called "Commercial Building Incentive Program" (CBIP) which is based on the MNECB. A CBIP design must be at least 25% more energy-efficient than the mandatory requirements in the MNECB. For some commercial buildings, the designers may choose to reference the MNECB rather than the ASHRAE 90.1 to qualify for the CBIP grant. We are proposing to accept a building design if it meets the MNECB –CBIP Program without the need of an equivalency proposal since the design will exceed the performance of the ASHRAE 90.1 – 2001 edition.

The performance comparison of the different versions of the standards is summarized in the following:

	ASHRAE 90.1 – 1989 edition	**ASHRAE 90.1– 2001 edition**
ASHRAE 90.1 – 1989 edition	------	10 – 15% better in terms of building types; 13% on average
MNECB 1997	approximately equivalent	if designed to CBIP standards will exceed ASHRAE 90.1 - 2001 edition (+12% on average)

Further consultation sessions were held with a focus group with representatives from the Urban Development Institute on four design issues that were identified earlier with the Ad-hoc Committee. The four issues raised concerns about additional cost, the aesthetics of the building, and feasibility of specific design details.

The four design issues are:

- **Window wall/Curtain wall designs** – curtain wall or window wall designs have always been problematic in providing the R-value that would meet ASHRAE 90.1 requirements. The ASHRAE 90.1 - 1989 edition was not clear on the performance expectations of these wall systems. By adopting the 2001 edition, these performance expectations will be clarified.

  Conventional designs would not meet generally the R-value requirements using ASHRAE 90.1 using the Prescriptive Evaluation Method for an exterior building facade with over 50% glass (gross wall area) without additional insulation and/or higher performance glazing systems. To meet the 2001 Standard, for glazing percentages between approximately 50 – 65%[1] of gross wall areas, there is an estimated incremental cost of 1 – 1.5%[2] increase in capital cost. Most typical high rise residential buildings in City of Vancouver are designed within this range of glazing percentage. However, there will be buildings for which a higher glazing percentage is desired by either the owner/developer or by the City for urban design reasons.

  For high rise residential construction with a glazing percentage of over 65%, the initial findings show that there will be a higher capital cost if a higher performance window wall system is proposed as a stand alone variable. This could be a significant cost depending on the size of building and the amount of glass proposed (a range of 5-10% increase in capital cost is used in the discussion with industry). These buildings may meet the ASHRAE Standard if the life cycle costing method ("Energy Cost Budget Method") is followed under ASHRAE 90.1, where various combinations of the building's envelope, electrical, and mechanical systems are considered.

  For commercial buildings, the issues are slightly different since the amount of glass used is usually not as high as residential buildings. Also, commercial buildings may opt to use the Energy Cost Budget Method of the ASHRAE 90.1 Standard where the increase in construction cost upfront is estimated to be negligible.

  Alternatively, the buildings may be in compliance if the designer uses the MNECB – CBIP equivalent method of evaluation. This evaluation method takes into consideration other increased energy performance of the whole building such as the use of exhaust heat recovery units and Energystar ™ appliances which are not recognized by the ASHRAE 90.1 Standard.

  The means to achieve compliance for multi-unit residential buildings with curtain wall/window wall designs under either the ASHRAE 90.1 – 2001 or MNECB – CBIP method need further review. The implementation plan is proposing to evaluate the level of compliance with submitted building permits over a grace period of 15 months and staff will report back to Council on the findings (further details under "Implementation Plan").

- **Continuous insulation requirement for residential construction** – the ASHRAE 90.1 – 2001 edition now explicitly requires an effective value of R-7.5 of continuous insulation, in addition to R-13 insulation between building frames in the prescriptive evaluation method. This is to account for the thermal bridging that occurs in mass concrete or steel framed construction. This requirement will have cost implications on curtain wall/window wall systems. The technology is available but will require a design change in industry practice. The cost of this increased insulation ranges from

[1] The upper limit of the glazing percentage is dependent on the building footprint, and can range from 65 – 68%

a capital cost saving to an increase of about 1 – 1.5%[2] depending on size of building and construction type. A capital cost savings is possible if alternative construction practices, such as steel framed construction, are opted in lieu of curtain wall designs.

- **Exhaust heat recovery unit** – this new piece of equipment will be required on air handling units over 5,000 cfm, having over 70% outside air, and with the largest exhaust source accounting for >75% of the total system exhaust. This will most likely affect some extended care designs and parts of other buildings, such as school gyms and theatres, and applications with fume hoods.
- **Water source heat pump** – the pump must have a 2-position valve interlock which is not typically provided. Until this equipment becomes commercially available, we may not be able to mandate this equipment.

The Ad-hoc Committee and the UDI Focus Group discussed the need for education to the designers and contractors and allowing a reasonable grace period to phase in the above 4 design parameters. We are proposing the ASHRAE 90.1- 2001 edition be adopted as a referenced document in the VBBL, with the understanding that the implementation to the specific areas as outlined above will require further review.

The development industry representatives stated they are in support of more energy efficient buildings that provide a healthier living environment. They also cautioned if using a higher performance curtain walls/window wall design is the only solution in order to meet the ASHRAE 90.1 - 2001 Standard for the glass residential towers, the increase in construction cost would prohibit the construction of affordable market housing that uses this design as the profit margins for this type of product are narrow and could not accommodate the additional cost increases.

Staff stress the intent is not to make the energy utilization regulations so restrictive that it is economically not feasible to propose specific designs, nor to change the urban design of the city by limiting the amount of glass allowed in a building facade. As such, staff are recommending a grace period of 15 months to work with the design and development communities to facilitate the four design issues and identify possible construction difficulties upon adoption of the referenced ASHRAE 90.1-2001 Standard. Upon the 15 months grace period, staff will report back to Council if there need to be amendments made to the Energy Utilization Program in order to achieve a balanced outcome.

ALTERNATIVES/OPTIONS

By referencing the ASHRAE Standard 90.1- 2001 version, the current MNECB standard will not be equivalent in performance. It is difficult to draft code wording in the VBBL that would reflect the specific equivalent performance. The proposal is to drop the direct reference of MNECB in the VBBL, with an understanding that a building that is designed to MNECB meeting the CBIP requirements will be acceptable as an alternate approach. This clarification will be made in the Appendix notes of the VBBL.

[2] An estimate of $1.39 - $1.57/sq. ft. gross floor area is used

FINANCIAL IMPLICATIONS

There are no direct financial implications to the City. To meet the performance expectations of the ASHRAE 90.1-2001 Standard, there may be an upfront construction material cost increase to industry for the four design issues as identified earlier, but in many cases (other than MURBs), the cost of compliance with this more modern standard will be reduced. In order to understand the impediments to full compliance with ASHRAE 90.1 - 2001, staff is seeking to collect data to test the feasibility of adopting the new ASHRAE standard particularly as it applies to multi-unit residential buildings with high percentage glazing. As part of a building permit submission, developers will be required to provide data demonstrating how full compliance with ASHRAE would be achieved. This data would be obtained through the creation of complex computer models that would estimate different levels of energy use by a building depending upon variations in the design of the building envelope and variations in internal equipment such as appliances, lighting, heating, cooling and exhaust systems. The UDI have estimated that generating this data for the city could add costs upward of $15,000 to $20,000 to each multi-unit building.

ENVIRONMENTAL IMPLICATIONS

Increasing energy efficiency in buildings will have a direct effect on reducing Greenhouse Gas Emission by decreasing the demands for energy production.

IMPLEMENTATION PLAN

Staff are recommending that the Vancouver Building By-law (VBBL) amendments as generally outlined in Appendix A be adopted on September 1, 2004. This delayed implementation date should facilitate the finer design details of existing building projects in stream. Upon adoption of the 2001 edition of the ASHRAE Standard 90.1, staff are recommending a grace period of 15 months to work with industry on achieving a balanced outcome in the 4 specific areas as identified previously for highrise residential buildings (as defined in the Vancouver Building By-law).

In order to study the possible challenges, the CBO will require all building permits submitted after September 1, 2004 to include an evaluation of the building design in accordance with the energy efficiency standard ASHRAE 90.1 – 2001 edition, but the CBO, in consultation with the Director of Planning, may relax the full compliance of the ASHRAE 90.1 Standard where the incremental cost of full compliance would exceed future discounted energy costs. This is done in the VBBL by an exemption clause [see Appendix A – proposed Sentence 6.4.1.1.(2)].

The owners are encouraged to provide their best effort to meet the new standard where possible, and to make improvements to their building design where there are opportunities. Staff will issue an interpretive bulletin on what would be considered acceptable for building permit issuance during this grace period. The acceptance criteria during the grace period will include various factors such as the local climate zones and life cycle cost evaluations. Proposed buildings in the Southeast False Creek area where sustainability efforts are further encouraged may have a higher expectation on meeting the ASHRAE 90.1 – 2001 Standard than other buildings, but this is yet to be determined and will be done so in conjunction with the land owners in Southeast False Creek as part of their green building program.

Staff will collect data from the various compliance models to test the feasibility on the design issues as identified earlier. Staff will report back by the grace period on the findings. The Chief Building Official will recommend rescinding the exemption clause upon the end of the grace period, and may recommend new by-law clauses, **and** if necessary, **extend the grace period** depending **upon the data collected and** the outcome of the findings.

CONCLUSION

This report is proposing to update the energy utilization requirements affecting new construction of larger residential buildings (Part 3) and commercial buildings that are regulated under Part 6 of the Vancouver Building By-law. The proposal to update the reference standard ASHRAE 90.1 is consistent with other City and Provincial initiatives on energy utilization and sustainable development.

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Appendix A

Add to Table 2.7.3.2. after ANSI/ASHRAE 62 – 1999

ANSI/ASHRAE/ IESNA	90.1-2001	Energy Standard for Buildings Except Low-Rise Residential Buildings	6.4.1.1.(1)

Delete Sentences 6.4.1.1. (1) and 6.4.1.2. (1), and replace with Sentence 6.4.1.1. (1) and (2) as follows:

6.4.1.1. Design Requirements

(1) Except as permitted in Sentence (2), all buildings referenced in Sentence 2.1.2.1.(1) and Sentence 9.25.1.1.(3) shall comply with the energy efficient design requirements of ANSI/ASHRAE/IESNA 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings". [See Appendix A-6.4.1.1. (1)]

(2) If the Chief Building Official, in consultation with the Director of Planning, is of the opinion that enforcement of the ANSI/ASHRAE/IESNA 90.1 Standard will result in unnecessary hardship including, without limitation, the incremental cost of full compliance exceeding the discounted value of future energy savings, the Chief Building Official, in consultation with the Director of Planning may relax the requirements of Sentence 6.4.1.1.(1).
[see Appendix A – 6.4.1.1.(2)]

6.4.1.2. DELETE

Add Appendix notes

A-6.4.1.1.(1) Previous edition of the Energy Utilization By-law references the standards "ASHRAE/IES 90.1" and the "Model National Energy Code of Canada for Buildings 1997" (MNECB). By updating the ASHRAE/IES standard to the 2001 edition, the MNECB became less stringent and the direct reference is deleted. There are buildings where the design may reference the MNECB rather than the ASHRAE/IES 90.1 standard to qualify for a Federal grant program called "Commercial Building Incentive Program" (CBIP). A MNECB - CBIP must meet the mandatory requirements in the MNECB by at least 25% more energy-efficient. As such, any building that is designed under MNECB to meet the CBIP grant will be accepted as an equivalent performance without an equivalency application.

A-6.4.1.1.(2) The CBO may request additional data to support the non-compliance. The energy models should, at a minimum, meet the previously referenced ASHRAE 90.1-1989.

Appendix B

[provided for reference by J. Sanguinetti, P.Eng., Keen Engineering Inc.]

ASHRAE Standard 90.1 Summary

The following summary information has been put together to help explain the benefits, use, and changes that have been implemented into ASHRAE 90.1, Energy Standard for Buildings, since it's introduction of the 1989 version. Specific analysis has been made with respect to the 2001 version of the standard compared with the 1989 version.

ASHRAE 90.1 Background

In 1999 ASHRAE released a new standard to supercede the existing 1989 edition of Standard 90.1. The basis of this new release has changed and several improvements to the standard were implemented. While the 1989 performance criteria were based on professional judgement, the 1999 criteria are based on a cost effectiveness and life cycle cost analysis. Another significant improvement and benefit of the 1999 version is that it was written to be easier to implement and understand than the 1989 version.

National Mandates for 90.1

On July 15, 2002, the US Department of Energy (DOE) announced that the 1999 edition of AHRAE 90.1 is more efficient than the 1989 version. Based on this determination, all states must implement proven state energy codes that are equivalent or better than the performance requirements of ASHRAE 90.1-1999. Certification of this compliance is required by July 15, 2004. The DOE is currently in the process of reviewing the 2001 version of the standard. If it is determined that 2001 is more effective, then it will similarly come into effect as a national mandate in the US.

Preliminary use of the 2001 version of 90.1 has shown that the corrections and addenda to the 1999 version have been incorporated into the 2001 version making it the most current and concise version of the 90.1 standard.

It should be noted that the Canadian national energy code, known as the Model National Energy Code for Buildings (MNECB) is based on the 1989 version of ASHRAE 90.1. There are; however, minor adjustments that have been made to the MNECB to be more specific to the Canadian locations and climates that the 1989 version of 90.1 did not specifically address. With that said, the MNECB is still approximately 10% less energy efficient when compared with the performance requirements of ASHRAE 90.1-1999.

Release of 90.1-2001

Addenda to the 1999 version of 90.1 have concluded with the release of the 2001 version of the standard. This version includes all of the approved addenda to the 1999 version of the standard. The addenda consist largely of clarifications and corrections to errors, as the 90.1 standard is regarded as a continuously working document that is always being reviewed. Current addenda under review by the technical committees continue to include minor clarifications but there are several significant improvements that are also being reviewed. Some of the more significant improvements are discussed in the following text.

Internal Lighting Allowances

Addendum G of ASHRAE 90.1-2001 represents a complete revision and update of the maximum lighting power density (LPD) values allowed for different building types. The review that encouraged these changes in allowable lighting densities included a comprehensive review including data on fluorescent fixture light loss factors, space type characteristics of new commercial construction, revised lighting level recommendations as published in the IESNA Lighting Handbook (9th edition), and efficient equipment availability.

The allowable LPD values for both the Building Area Method and the Space-by-Space Method have been revised. Some of the changes made to the Building Area Method values include reducing the Office LPD from 14 W/m2 (1.3 W/ft2) to 11 W/m2 (1.0 W/ft2) and the School/University LPD from 16 W/m2 (1.5 W/ft2) to 13 W/m2 (1.2 W/ft2). The Space-by-Space Method tables have been completely revised and also offer a significant decrease in the allowable LPD values when compared with ASHRAE 90.1-1999.

With the use of currently available technology, these new LPD values can be easily achieved on new construction projects without impacting standard local practices or significantly affecting construction costs.

External Lighting Allowances

Addendum Q recognises that the external lighting allowances were poorly described and detailed. In this addendum, more detail is being added to the 2001 standard to regulate external lighting power allowances.

Energy Compliance Calculations

The Energy Cost Budget method (Chapter 11) is used to demonstrate compliance with the standard only. Because of the way that it is set up, it can not accurately estimate the margin, or "energy savings", by which a building is better than the standard. This type of analysis is required by some agencies such as the US Green Building Council to help with certification programs such as LEED™. **Addendum E** is being reviewed to include an appendix to the Energy Cost Budget method that describes a rating method to specifically address this requirement.

Speaking in terms of code compliance only and not *energy savings*, the Energy Cost Budget method can be an expensive and time-consuming method to demonstrate compliance with ASHRAE 90.1-1999 requirements. A more "prescriptive" simulation path is also being proposed for buildings that do not require detailed simulation to demonstrate compliance using a simplified approach to the Energy Cost Budget method.

Energy Simulations

As part of the Energy Cost Budget method of showing compliance with ASHRAE 90.1-2001, energy simulations must be performed by software that can reliably show compliance. **Addendum P** recognises that the capabilities and quality of output of simulation software must be more clearly defined to accomplish this best. Software testing standards are being referenced to address this issue.

The Future of 90.1-2001

Other addenda are under review to correct typographic errors, to introduce new types of equipment and building construction features, to add clarity to the standard and to update references to other standards. The next release of ASHRAE 90.1 is planned for 2004 and will likely include all approved addenda to the 2001 version.

1989 version vs. 2001 version

Compared to the 1989 standard, the 2001 standard is:

- Equivalent in building envelope performance requirements
- Has increased stringency for mechanical system performance
- Has increased stringency for lighting systems

The 2001 release is being actively developed and improved based on comments from outside agencies and individuals. This version, including the upcoming 2004 version, promises to save both money and energy as its performance requirements have been based on economic life cycle cost analyses and more current industry practices over the 1989 version.

The new format also makes implementation and use far easier than before. Continuous input from outside agencies and through a public review process helps ensure that the standard is current and adequate for current real world needs.

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