FOR ENERGY EFFICIENCY (EE):
A Home Energy Rating System

Research Project Final Report
Presented to Industry Canada's
Office of Consumer Affairs

union des consommateurs

June 2010

Report published by:
union des consommateurs

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Acknowledgements
- The Energy Efficiency Committee of Union des consommateurs

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- Me Marcel Boucher

ISBN 978-2-923405-38-3

Union des consommateurs is a member of the International Consumer Organization (ICO), a federation of 234 members from 113 countries.

The masculine is used generically in this report.

Union des consommateurs wishes to thank Industry Canada for helping to fund this research project. The views expressed in this report are not necessarily those of Industry Canada or the Government of Canada.

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UNION DES CONSOMMATEURS, *Strength through Networking*

Union des consommateurs is a non-profit organization whose membership is comprised of several ACEFs (*Associations coopératives d'économie familiale*), *l'Association des consommateurs pour la qualité dans la construction* (ACQC), as well as individual members.

Union des consommateurs' mission is to represent and defend the rights of consumers, with particular emphasis on the interests of low-income households. Union des consommateurs' activities are based on values cherished by its members: solidarity, equity and social justice, as well as the objective of enhancing consumers' living conditions in economic, social, political and environmental terms.

Union des consommateurs' structure enables it to maintain a broad vision of consumer issues even as it develops in-depth expertise in certain programming sectors, particularly via its research efforts on the emerging issues confronting consumers. Its activities, which are nation-wide in scope, are enriched and legitimated by its field work and the deep roots of its member associations in the community.

Union des consommateurs acts mainly at the national level, by representing the interests of consumers before political, regulatory or legal authorities or in public forums. Its priority issues, in terms of research, action and advocacy, include the following: family budgets and indebtedness, energy, telephone services, radio broadcasting, cable television and the Internet, public health, food and biotechnologies, financial products and services, business practices, and social and fiscal policy.

Finally, regarding the issue of economic globalization, Union des consommateurs works in collaboration with several consumer groups in English Canada and abroad. It is a member of Consumers International (CI), a United Nations recognized organization.

1. INTRODUCTION

An energy rating is mandatory in Canada for a wide range of products (household appliances, cars, etc.). Unfortunately, there is no such mandatory rating for homes. This absence is all the more surprising because housing is an essential need that generates a substantial energy expenditure and has great energy-saving potential.

In Canada, there are several initiatives regarding the quality of new buildings to which an energy rating is attributed. However, new homes that receive an energy rating only represent a small fraction of all new constructions. In addition, given the proportion of existing homes sold or rented annually, it would seem logical that an energy rating also be attributed to those homes. Given increasing energy costs, should a Canadian consumer who wants to buy or rent an existing home not also have easy access to standardized information on the energy efficiency of his future home?

The primary purpose of a home energy rating would be to make available to future tenants or buyers information on the energy needs of the desired home. In addition to constituting an advantage for the buyer or tenant concerned about his home's energy performance, the appreciation that would result from better information on energy performance would be a major incentive for doing work to improve home energy efficiency, particularly in the case of rental property owners, who currently have practically no interest in improving the energy performance of their rental units when tenants are the ones paying the energy costs.

We have sought to evaluate, according to existing initiatives and taking costs and benefits into account, the relevance and feasibility of establishing a mandatory home energy rating system in Canada. Based on foreign mandatory energy rating systems and on Canadian home rating initiatives, our research evaluates the elements to be considered in establishing a mandatory energy rating in the residential market. In addition, we have sought to identify various complementary issues, notably public or private incentive programs (by financial institutions, for example) that would deserve to be adapted or developed in Canada in this context.

Accordingly, this study aims to develop a viable energy rating model applicable to the housing stock in Canada and to evaluate the relevance of making that energy rating mandatory for new and existing homes, at the time of signing a lease or buying.

We have limited our study of energy rating systems to those applying to small homes, such as stand-alone and semi-detached single-family houses and small plexes. The case of large rental buildings presents additional technical difficulties – such as evaluating common areas – that do not add relevant elements for assessing the usefulness of establishing a mandatory energy rating system in the residential sector. Thus, when the home energy rating initiatives we have analysed pertained to a set of buildings larger than the types of buildings covered by our study, we have focused on provisions regarding the latter types of buildings.

Chapter two of our report will survey a few foreign mandatory energy rating initiatives for new and existing homes: the Danish model, the European Union's Directive and its implementation in the United Kingdom, France, the State of Oregon's law in the United States and the subsequent EPS pilot project.

No initiative or pilot project has been completed to date in Canada regarding the establishment of a mandatory energy rating system, even though some provinces (notably Ontario and Quebec) have indicated their intention to so proceed.

However, several initiatives pertaining to renovation programs for existing homes and to seals of quality for new homes involve measuring building energy performance by means of the EnerGuide system developed by Natural Resources Canada. A presentation of this Canadian rating system constitutes the third chapter of the present study.

The fourth chapter will detail Canadian incentive programs for improving the energy performance of existing homes. The fifth chapter does the same for Canadian initiatives toward the good energy performance of new buildings.

The following chapter will present the major orientations of the proposed energy rating system and will explain its practices and operation.

A cost-benefit forecasting analysis of the suggested rating system will follow. The cost-effectiveness of the proposed mandatory rating system will be examined from various angles.

After the conclusions, we will formulate a few recommendations in the final chapter.

2. SURVEY OF FOREIGN MANDATORY ENERGY RATING SYSTEMS FOR NEW AND EXISTING HOMES

Home energy ratings are a relatively recent development, but they are proliferating rapidly[1]. Few mandatory initiatives have been in place long enough to have been well documented and evaluated. In Europe, the Danish experience from 1997 to 2006 is a notable exception; it inspired the development of the 2002 European Union Directive that made building energy ratings mandatory among member states. Accordingly, we will first examine the Danish experience.

European Union Directive 2002/91/EC[2] was to be transposed to member states' national laws by January 4, 2006 at the latest and take effect by January 4, 2009 at the latest. Several countries have experienced problems establishing their mandatory rating systems[3], so we will focus on the United Kingdom and France, where implementation took place within the prescribed periods.

To our knowledge, in North America, only Oregon has legislated to establish a mandatory energy rating system for homes. A large-scale pilot project was carried out, and the evaluation report is completed[4]. This will constitute the third experience under study in our research.

2.1 THE DANISH MODEL (1997 TO 2006)

Denmark has a long experience with energy efficiency programs. The first building energy ratings resulted from the *Heat Consultant Scheme* in effect between 1982 and 1996. In 1996, an *Act to promote energy and water saving in buildings*[5] dictated rules for implementing both the *Energy Rating Scheme* (EM), an energy rating system for small buildings (less than 1,500 m^2), and the *Energy Management Scheme for Large Buildings* (ELO), an energy rating system for large buildings. These initiatives came into effect on January 1, 1997.

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[1] For a complete survey of initiatives, see the summary table of **DUNSKY ENERGY CONSULTING**, *Building Energy Labelling Summary* on the website of Earth Advantage, Portland, Oregon, USA, February 2010. [Online] http://www.earthadvantage.org/eps/pdfs/Building%20_Energy_Labeling_Summary_Table_2_14_2010_FINAL.pdf (page consulted on April 5, 2010).

[2] "**Energy efficiency: energy performance of buildings**" page, on the European Union portal Europa, section on the summary of EU legislation, n.d. [Online] http://europa.eu/legislation_summaries/other/l27042_en.htm (page consulted on April 5, 2010).

[3] **DUNSKY ENERGY CONSULTING**, *Cote énergétique obligatoire*, assessment of the international experience, Montreal, April 2009, p. 64. Available on the ftp site of the Agence de l'efficacité énergétique du Québec. [Online] http://www.aee.gouv.qc.ca/RegieEnergie/R-3709-2009/Etude/Cote%20obligatoire%202009-04-06%20(v.finale%20AEE)_v.2003.pdf (page consulted on April 5, 2010).

[4] **Earth Advantage Institute and Conservation Service Group**, *Energy Performance Score – 2008 Pilot*, August 2009, on the website of Earth Advantage, Portland, Oregon, USA. [Online] http://www.earthadvantage.org/eps_2008_pilot_report_fnl1x.pdf (page consulted on March 22, 2010).

[5] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, p. 1. [Online] http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf (page consulted on March 27, 2010).

We will focus on the EM program, since it applied more to residential buildings than to commercial, institutional or apartment buildings, which were generally covered by the ELO system.

The EM program's overall framework fell under the Danish Energy Authority, a government body that was governed by the Danish Ministry of Economic and Business Affairs and was responsible for implementing the rating system and disseminating it to the general public.

The primary objective of that home energy rating was to save energy and water and reduce CO_2 emissions, by informing present and future homeowners about energy-efficient consumption and the energy costs of their residences, in order to promote improved energy efficiency. Collaterally, local economic spinoffs were expected through renovation work undertaken to improve the ratings of evaluated buildings. It should be noted that since the seventies, Denmark has constantly attempted to reduce its dependency on fossil fuels imported from abroad, and to protect itself from fuel price fluctuations[6].

The production of an energy rating report was mandatory during the sale of any new or existing home, and real estate agents were required to present that report to the homebuyer. The report remained valid until the next real estate transaction. Tenants could demand that their owner disclose the report, but it proved difficult to apply this provision[7].

The energy rating report contained two parts[8]:

a) The first part (*The Energy Label*) of the energy rating report provided estimates of a building's electricity consumption (lighting and home appliances), heating energy consumption (room heating and hot water)[9], and related monetary costs. It also presented an estimate of water consumption, as well as data on the heating system's condition and on the building's CO_2 emissions. The residence's energy consumption estimates were presented in physical units per square meter of habitable area[10], and the related monetary costs were indicated on the basis of the prices of energy sources used in the building at the time of its evaluation. Energy and water consumption were estimated on the basis of assumptions regarding the number of occupants, which varied according to the residence's area, and the related monetary costs were indicated on the basis of the prices of energy sources used in the building at the time of its evaluation. Energy and water consumption was estimated on the basis of assumptions regarding the number of occupants and a standard use of those resources. In addition, the estimates took into account the condition of several building components (particularly the heating system). The results classified the building's performance as to heat, electricity

[6] **KJÆRBYE, Vibeke Hansen**, *Does Energy Labelling on Residential Housing Cause Energy Savings?,* AKF, Danish Institute of Governmental Research, Copenhagen, Denmark, December 2008, p. 5. [Online] http://www.akf.dk/udgivelser/2008/pdf/energy_labelling.pdf (page consulted on March 20, 2010).
[7] **Centre Scientifique et Technique du Bâtiment**, *Diagnostic de performance énergétique*, French Government, France, 2005, p. 45.
[8] See Annex 1, LAUSTSEN, Jens H., *Rapport-EM*, Danish Energy Authority, Lisbon, December 2004, pages 11-19. [Online] http://www.p3e-portugal.com/_ficheiros/2/4/23/LDocs/Jens_Laustsen.pdf (page consulted on April 4, 2010).
[9] **Centre Scientifique et Technique du Bâtiment**, *Diagnostic de performance énergétique*, French Government, France, 2005, p. 46.
[10] **SAVE**, *Energy Labelling of Existing Buildings – Final Report*, SAVE, unknown city, July 25, 2001, p. 14, available on the website of European Solar Test Installation. [Online] http://re.jrc.ec.europa.eu/energyefficiency/belas/final_report.pdf (page consulted on April 4, 2010).

and water, in comparison with the performance of similar buildings, and on alphanumeric scales ranging from A1 (the best rating) to C5 (the worst)[11]. The owner or potential buyer could thus evaluate the relative energy efficiency of the home in question.

Energy performance was calculated using software compatible with the era's European thermal performance standard EN832. In cases where buildings were too old and data for evaluating the quality of certain components were lacking or too imprecise, simplifying assumptions had to be developed to yield reasonable estimates. The ratings did not depend on construction code standards.[12]

b) The second part (*The Energy Plan*) of the energy rating report contained information on the condition of heating and air conditioning appliances and of several building components such as exterior walls, windows and doors, the heating system, the ventilation system and air ducts, as well as the insulation. It then suggested renovation work likely to improve the energy efficiency of the components and building.

   The *Plan* detailed the current problems of the components evaluated, in order to inform eventual buyers about the building's overall condition and encourage energy-efficient renovations.

   Cost estimates of suggested renovations and likely annual monetary savings were also presented, along with an estimate of the time necessary to recover the initial investment. The estimated useful life of proposed work was also indicated. A section presented the calculation assumptions used in generating the report's findings.

An inspection quality control system was established. Each evaluation was sent to a central office, and abnormal results were scrutinized. The collected and compiled data also helped evaluate Denmark's housing stock and its renovation needs.

Some evaluations, selected randomly, were redone to check accuracy. Visual inspections were also conducted to confirm the evaluators' findings. The quality control system stipulated that too many inaccuracies or errors could lead to revocation of incorrect inspectors' permits. In the event that major faults were identified, the evaluator was liable for economic losses incurred by the homeowner in question.

The Danish Energy Authority had set up a working committee responsible for developing evaluator training content, issue certifications, ensure quality control and handle consumer complaints. The committee included consumer representatives, owners, real estate agents, architects, engineers, technologists, construction industry representatives, energy distributor representatives and government representatives.

[11] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, p. 15. [Online] http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf (page consulted on March 27, 2010).
[12] **SAVE**, *Energy Labelling of Existing Buildings – Final Report*, SAVE, unknown city, 25 July 2001, p. 20, available on the website of European Solar Test Installation. [Online] http://re.jrc.ec.europa.eu/energyefficiency/belas/final_report.pdf (page consulted on April 4, 2010).

The rating report's cost varied from €300 to €500 and was defrayed by the homeowner. No subsidy was granted, either for the rating or for suggested renovation work[13]. The evaluations were made by private companies, which had to pay the Danish authorities €24 for each completed evaluation report, in addition to annual certification fees for each certified inspector[14]. These amounts covered the program's management fee and the inspectors' training activities, as well as the quality control system.

A) Outcomes[15]

From 1997 to 2002, between 50% et 60% of eligible homes were evaluated and labelled, i.e., about 45,000 to 50,000 homes annually, for a total of 300,000 homes, which represented about 20% of Denmark's residential housing stock. The program's administrative costs were estimated at €750,000 annually (about €15 per evaluation).

One of the reasons why not all homes targeted by the regulations were rated, even though a rating was mandatory, was insufficient dissemination of information about the rating program. A poll revealed that only 43% of homeowners interviewed were aware of the obligation's existence[16].

The program's evaluation[17] indicated that there were no significant differences in the amounts allocated to energy efficiency investments between rated and unrated houses. However, the investments made by homeowners who received an energy efficiency report generally performed better in terms of energy and drinking water.

A quantitative estimate of energy savings made for single-family houses was performed in a recent study[18]. The results were somewhat disappointing: only homes that had a rating of A5 or better and were labelled in the last two years showed tangible reductions in energy consumption. Those reductions in annual consumption were estimated at 8% to 14%.

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[13] **SAVE**, *Energy Labelling of Existing Buildings – Final Report*, SAVE, unknown city, July 25, 2001, available on the website of European Solar Test Installation. p.17. [Online] http://re.jrc.ec.europa.eu/energyefficiency/belas/final_report.pdf (page consulted on April 4, 2010).

[14] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, p. 20. [Online] http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf (page consulted on March 27, 2010).

[15] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, pp. 22-24. [Online] http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf (page consulted on March 27, 2010).

[16] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, p. 22. [Online] http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf (page consulted on March 27, 2010).

[17] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, p. 22. [Online] http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf (page consulted on March 27, 2010).

[18] **KJÆRBYE, Vibeke Hansen**,*Does Energy Labelling on Residential Housing Cause Energy Savings?,* AKF, Danish Institute of Governmental Research, Copenhagen, Denmark, December 2008, 31 pages. [Online] http://www.akf.dk/udgivelser/2008/pdf/energy_labelling.pdf (page consulted on March 20, 2010).

The authors put forward the hypothesis that lower-rated homes had renovation priorities other than energy efficiency.

In a section on the study's limitations, it is noted that non-energy benefits (NEBs)[19], i.e., benefits other than lower energy bills, were not included in the estimates. A common example is the comfort benefit, produced by the so-called "rebound effect": renovations intended to improve energy efficiency reduced the energy costs of maintaining the same comfort level as previously, but the occupant could increase heating and improve his comfort at a lower cost than he would have incurred before the work; this partially or totally reduced energy bill savings.

A consultant report[20] also formulated the hypothesis that homeowners could make energy improvements before selling their homes, i.e., before the energy evaluation, which would explain the poor performances recorded during the statistical evaluation.

B) Recommendations of the Evaluation Report

The rating system evaluation report[21] issued recommendations to improve the system. Notably:

- Laud the rating system's merits when establishing it, rather than focus on its mandatory aspect, so that homeowners may have a good impression rather than perceive the system as an additional burden to bear during real estate transactions;

- Ensure that the evaluation report is easily understandable and that renovation recommendations are presented clearly and plainly;

- Ensure that the quality control system is well established and functional as soon as such an energy rating program comes into effect. Certain cases of flagrant errors having been made shortly after the regulations came into effect were reported in the media, which damaged the program's overall reputation;

- The development of simple and effective software to estimate energy consumption is proposed. More-complex software has been proven not to produce more-accurate results, because the required additional information is often unavailable or inaccurate.

[19] Several other non-energy benefits will be presented in Chapter 7.
[20] **DUNSKY ENERGY CONSULTING**, *Mandatory Energy Efficiency Disclosure and Upgrade Policies for the Northeast U.S.,* Montreal, August 28, 2009, page 25. [Online] http://www.earthadvantage.org/eps/pdfs/neep_report_draft_2009_08_30%20_clean_1.pdf (page consulted on March 16, 2010).
[21] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, pp. 25-26. [Online] http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf (page consulted on March 27, 2010).

2.2 THE EUROPEAN UNION DIRECTIVE

European Directive 2002/91/EC on building energy performance was adopted by the European Parliament in late 2002 and came into effect on January 4, 2003. This directive was to be transposed into the national laws of member countries before January 4, 2006, and the legislation was to take effect by January 4, 2009 at the latest[22].

The primary objective was to improve buildings' energy and environmental performance in order to meet Kyoto protocol targets. In addition, there was an intention to begin harmonizing building ratings throughout the European Union. An energy performance certificate was to be issued mandatorily to each building buyer or tenant, was to include recommendations for cost-effective energy-efficient renovations, and was to enable a comparison with similar buildings.

The buildings targeted by this directive were both residential and commercial. A few exceptions were allowed, such as places of worship, buildings of established architectural merit, seasonal homes, and buildings with a habitable space of less than 50 square meters[23].

With regard to energy performance, what must be evaluated is:

> *"the amount of energy actually consumed or estimated to meet the different needs associated with a standardised use of the building, which may include, inter alia, heating, hot water heating, cooling, ventilation and lighting. This amount shall be reflected in one or more numeric indicators which have been calculated, taking into account insulation, technical and installation characteristics, design and positioning in relation to climatic aspects, solar exposure and influence of neighbouring structures, own-energy generation and other factors, including indoor climate, that influence the energy demand."*[24]

We note that several elements on which the building energy rating would be based are left to the discretion of member states, particularly the inclusion of electrical appliances, but that obligations regarding the building envelope and technical characteristics are more detailed. Heating and ventilation appliances, lighting and water heaters do not have to be among the aspects evaluated. However, regular inspection of heating and ventilation systems is mandatory[25], so that several countries have included those aspects in calculating home energy ratings. Curiously, no obligation is formulated for labelling the environmental performance of buildings, although one of the directive's avowed main objectives was environmental.

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[22] **DUNSKY ENERGY CONSULTING**, *Mandatory Energy Efficiency Disclosure and Upgrade Policies for the Northeast U.S.,* Montreal, August 28, 2009, page 26. [Online] http://www.earthadvantage.org/eps/pdfs/neep_report_draft_2009_08_30%20_clean_1.pdf (page consulted on March 18, 2010).

[23] **DUNSKY ENERGY CONSULTING**, *Mandatory Energy Efficiency Disclosure and Upgrade Policies for the Northeast U.S.,* Montreal, August 28, 2009, page 26. [Online] http://www.earthadvantage.org/eps/pdfs/neep_report_draft_2009_08_30%20_clean_1.pdf (page consulted on March 16, 2010).

[24] Quoted from: Energy performance diagnosis, 2003, page 3, available on the website of Europa. [Online] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:EN:PDF (page consulted on March 16, 2010).

[25] "*Energy efficiency: energy performance of buildings*" page, on the European Union portal Europa, section on the summary of EU legislation. [Online] http://europa.eu/legislation_summaries/other/l27042_en.htm (page consulted on April 5, 2010).

Rapid implementation of this system proved more difficult: 17 countries could not transpose the directive into their respective national laws within prescribed deadlines[26].

Given that the directive was transposed and implemented on schedule in the United Kingdom, we will study its iteration in that country.

2.2.1 The Case of the United Kingdom

With regard to residences, it is mandatory to produce a report titled *Energy Performance Certificate* (EPC) in the United Kingdom during the sale or resale of a home. Related measures took effect between April 6, 2007 and January 4, 2009.

With regard to rentals, the EPC must be presented to any new tenant before the lease is signed. However, a new certificate can be produced only when the certificate's ten-year validity period has expired. It should be noted that when only one of the residence's rooms is rented, there is no obligation to present the energy performance certificate.

In every case, a £200 fine is imposed if the certificate is not included during transactions covered by the regulations.

It was decided that the EPC would provide two measurements: one for energy efficiency and the other one for the residence's ecological impact in terms of carbon emissions.

The evaluation report[27] begins with the building's energy consumption and environmental impact ratings.

The evaluations pertain to the residence's thermal envelope and insulation quality, heating units, lighting, air duct and ventilation systems, and electrical appliances.

The evaluation is standardized on the basis of the number of occupants, which varies according to the residence's area, and on the basis of a standard quantity of energy per presumed occupant. As in the Danish model, the ratings are thus measurements of energy intensity and environmental impact intensity. In the context of home energy ratings, an intensity measurement may be defined as a measurement of the gross quantity of energy used or pollution emissions by square meter of living space[28].

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[26] **DUNSKY ENERGY CONSULTING**, *Cote énergétique obligatoire*, assessment of the international experience, Montreal, April 2009, p. 64. Available on the ftp site of the Agence de l'efficacité énergétique du Québec. [Online] http://www.aee.gouv.qc.ca/RegieEnergie/R-3709-2009/Etude/Cote%20obligatoire%202009-04-06%20(v.finale%20AEE)_v.2003.pdf (page consulted on March 28, 2010).

[27] **Unknown author**, *Energy Performance Certificate*, Standard Assesment Procedure, London, United Kingdom, 2005, on the website of Communities and Local Government of United Kingdom. [Online] http://www.communities.gov.uk/documents/planningandbuilding/pdf/319282.pdf (page consulted on March 28, 2010). The master document is reproduced in Annex 2 (Rapport-EPC.pdf).

[28] For a more general definition, see: **Natural Resources Canada,** *Improving Energy Performance in Canada – Energy Intensity / Energy Efficiency,* Energy Publications – Office of Energy Efficiency, Canada, 2009, page viii. [Online] http://oee.nrcan.gc.ca/publications/statistics/parliament08-09/pdf/parliament08-09.pdf (page consulted on March 28, 2010).

The results are presented in terms of two category systems side by side, one for energy efficiency and the other for environmental impact, with ratings ranging from A (the best) to G (the worst). There are seven of these categories, each presented in a different colour. The two performance ratings, from 0 to 100, are entered in appropriate categories for the building in question.

Energy costs per square meter are presented on the basis of current energy prices, and carbon emissions per square meter are presented as tonnes of CO_2. In both cases, the potential for improving the rating after renovation work is done is also indicated. The average rating of a United Kingdom residence is provided for purposes of comparison with the evaluated building.

A more technical section follows containing energy and environmental impact evaluations of the thermal envelope and heating units, the water heater and lighting (the performance of electrical appliances is not evaluated). These elements receive an evaluation ranging from poor to excellent.

In the following section, improvements are suggested, and their likely impact on energy savings (in energy quantity and money) and on carbon emission reductions are detailed.

The section is subdivided into three parts, according to the necessary costs of suggested work: the first part proposes improvements costing less than £500, and the second part proposes more-costly improvements. A last series of improvements for attaining very high energy performances is also proposed; those improvements are very costly, such as the installation of a solar panel system.

The improvements are suggested only as an indication, and the owner is not obliged to apply them. Financial assistance is available to anyone who wants to do certain renovation work, but it is not related to the production of the energy efficiency evaluation report.

A certification system has been established, and a certified evaluator must make the evaluation. In case of litigation, the owner must first contact the evaluator to attempt to settle the dispute. If the latter persists, the owner must contact the organization responsible for certifying the inspectors. It is possible for an owner to obtain the certificate and evaluate his residence himself.

The price of an energy evaluation, about £100 for an average residence, is borne by the owner. The tenants must be made aware of the residence's evaluation report before signing the lease. Owners are prohibited from charging tenants for the energy efficiency evaluation.

A) Renovation Financial Assistance Programs

The *Landlords Energy Saving Allowance* (LESA) grants tax deductions of up to £1500 for measures to insulate foundations, walls, doors, windows and the heating system[29].

Warm Front[30] is the main program for low-income households. It grants subsidies of up to £3500 (£6000 for residences with an oil heating system). The work can range from insulating crawl spaces to changing the entire heating system. Low-income tenants can apply for a subsidy, even if the owner is not low-income; the owner's approval is required for the work to be done.

2.2.2 The Case of France

In France, the energy efficiency evaluation generates a report titled "Diagnostic de performance énergétique" (DPE). This evaluation and the resulting report have become mandatory for several occasions. They have been mandatory since November 1, 2006 during the sale of a housing unit or a building, whether or not the latter is residential; since July 1, 2007, during the signing of a lease; and they are mandatory for any new building whose building permit was filed after July 1, 2007[31].

For sales or rentals, the owner pays for the evaluation's production and is obliged to include the DPE in the preliminary sales contract or the rental contract, and to present it on demand to any future tenant or buyer[32]. The DPE is valid for 10 years.

The DPE presents two types of measurements, one for energy consumption and the other for greenhouse gas emissions. In both cases, the building is evaluated according to the necessary resources for heating, hot water production and air conditioning.

The energy evaluation must be based on a standardized evaluation method or, optionally in the case of district heating, on the actual average consumption over the last three years. The standardized method must take into consideration input data on the following aspects at minimum:

"

- *the building's or lot's heated areas and exterior walls;*

[29] **Unknown author**, *BN63: Extension of the Landlords Energy Saving Allowance*, HM Revenue & Customs (HMRC), London, United Kingdom, 2007. [Online] http://www.hmrc.gov.uk/budget2007/bn63.htm (page consulted on March 21, 2010).
[30] **Warm Front**, the website's home page, Newcastle, United Kingdom, n.d. [Online] http://www.warmfront.co.uk/ (page consulted on March 21, 2010).
[31] **Unknown author**, *Les économies d'énergie dans le bâtiment – L'ensemble des dispositifs pour améliorer la performance énergétique des bâtiments,* France, n.d., Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer et Agence de l'Environnement et de la Maîtrise de l'Énergie [Online] http://www.rt-batiment.fr/batiments-existants/dpe/presentation.html (page consulted on June 15, 2010).
[32] **Unknown author**, *Les économies d'énergie dans le bâtiment – L'ensemble des dispositifs pour améliorer la performance énergétique des bâtiments,* France, n.d., Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer et Agence de l'Environnement et de la Maîtrise de l'Énergie. [Online] http://www.rt-batiment.fr/batiments-existants/dpe/presentation.html (page consulted on June 15, 2010).

- *the envelope's thermal losses (field and thermal bridges) on the basis of the heat transmission coefficients and translucid or transparent walls in contact with the outside or with unheated rooms;*
- *the influence of joint use with other buildings, traffic, rooms likely to be unheated (cellars, garages, basements), crawl spaces or the natural ground;*
- *the building orientation's influence;*
- *the bays' actual sizes and solar characteristics;*
- *thermal inertia;*
- *the bays' solar protection;*
- *the renewal rate of exhaust air according to the building's ventilation method (natural, controlled mechanical ventilation) and the rooms' airtightness;*
- *a heat exchanger's influence on the air;*
- *the characteristics of heating (room heating and ECS) and cooling (emission, distribution, generation) systems."*[33]

The diagnostician chosen by the owner is responsible for ensuring that the method he uses complies with existing regulations[34]; a non-exhaustive list of software in compliance with those regulations is available on the website of the Agence de l'Environnement et de la Maîtrise de l'Énergie[35].

The building receives two labels, one for energy consumption and the other for pollution emissions. Each one is comprised of seven ratings, from A (the best) to G (the worst), indicated by a range of colours – green associated with rating A and red with rating G. Energy consumption and pollution emission measurements are entered in the appropriate category.

The energy consumption measurement unit is kWh/m^2 annually, and consumption is broken down either per use and final energy, depending on the latter's provenance, or per use only and in primary energy; the latter being the sum of all energy used for producing, transporting and distributing final energy.

Annual fees per use are indicated in euros (€) in every case.

A description of the building follows, focusing on three aspects: the building envelope and the heating and domestic hot water systems. A measurement in kWh/m^2 per year of renewable energy quantities produced by equipment installed inside the residence is indicated.

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[33] **Unknown author,** *Arrêté du 15 September 2006 relatif aux méthodes et procédures applicables au diagnostic de performance énergétique pour les bâtiments existants proposés à la vente en France métropolitaine,* Ministère de l'Emploi, de la Cohésion sociale et du Logement, Journal Officiel de la République Française, France, September 28, 2006, available on the website du Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer et Agence de l'Environnement et de la Maîtrise de l'Énergie [Online] http://www.logement.gouv.fr/IMG/pdf/arrete150906_dpemethodes.pdf (page consulted on June 15, 2010). Our translation.

[34] **Unknown author,** *10 - Logiciels pour réaliser des DPE*, Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer et Agence de l'Environnement et de la Maîtrise de l'Énergie, January 22, 2008, France. [Online] http://www.logement.gouv.fr/article.php3?id_article=6402 (page consulted on June 15, 2010).

[35] **Unknown author,** *Le Diagnostic de Performance Energétique*, Agence de l'Environnement et de la Maîtrise de l'Énergie, n.d. [Online] http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=15028 (page consulted on June 15, 2010).

Afterward, DPE explanations are provided, along with useful advice for the residence to show good energy performance.

The DPE concludes with recommendations for improvement measures and with brief comments.

Web addresses are indicated for use by those seeking further information.

A DPE model for rentals is available on the website of the Agence de l'Environnement et de la Maîtrise de l'Énergie[36].

2.3 THE UNITED STATES

2.3.1 The HERS System

The most prevalent energy rating system used in the United States is the HERS system, whereby the rating, calculated on the basis of standardization assumptions, represents the ratio of energy used by the rated home over energy used by a similar home built according to the building code in effect during the rating process. The ratio is multiplied by 100, and the rating is indicated on a colour scale[37]. A HERS rating is attributed on the owner's initiative and is thus voluntary. A notable exception concerns the city of Santa Fe, where the HERS rating has been mandatory for building new single-family homes since 2008[38].

In rating systems related to building standards, the attributed ratings unfortunately become obsolete as standards evolve, since such ratings will not correspond to newer standards.

Moreover, the HERS rating informs the owner neither about the home's energy consumption nor about the related monetary cost. He therefore has difficulty evaluating the energy costs of his home and determining the necessary investments for cost-effectively improving its energy performance.

[36] **Unknown author,** *Le Diagnostic de Performance Energétique*, Agence de l'Environnement et de la Maîtrise de l'Énergie, n.d. [Online] http://www2.ademe.fr/servlet/getBin?name=F3E281DE738A57FDCED49524F96485D51161182446096.pdf (page consulted on June 15, 2010). The master document is reproduced in Annex 3 (Rapport-DPE.pdf).

[37] See in Annex 4 the document *Etiquette-HERS.pdf*. Available on the website of Residential Energy Services Network, California, United States, no date. [Online] http://ca.resnet.us/ (page consulted on March 22, 2010).

[38] **DUNSKY ENERGY CONSULTING**, *Building Energy Labelling Summary*, on the website of Earth Advantage, Portland, Oregon, USA, February 2010. [Online] http://www.earthadvantage.org/eps/pdfs/Building%20_Energy_Labeling_Summary_Table_2_14_2010_FINAL.pdf (page consulted on April 5, 2010).

2.3.2 ENERGY STAR

The seal of quality for new homes, ENERGY STAR, is awarded to homes whose building energy performance is at least 15% better than that of a building constructed according to building codes in effect during the rating process[39]. The seal itself is even less informative about the building's energy performance than the HERS rating and is predictably as prone to obsolescence as other ratings based on building codes.

2.3.3 OREGON'S LAW AND THE EPS PILOT PROJECT

The State of Oregon's case is different. Building ratings are being established, following a 2009 State Senate law making an energy rating mandatory during the sale of a new building and during the sale or rental of an existing building.[40]

This law aims to increase by 15% the energy efficiency of homes by 2012, compared to their 2009 level. In the longer term, the objective is to build carbon-emission-free buildings by 2030. Currently, carbon emissions from residential buildings in the United States represent 21% of the country's total carbon emissions.

The hope is that through more consumer information about those emissions, energy consumption, which is often generated by fossil fuels in that state, will be reduced.

A subsidiary objective of the mandatory energy rating system is to clarify the information consumers receive about homes' energy consumption and carbon emissions. Currently, the local authorities estimate that consumers receive incomplete and confusing information because of the diversity of existing standards, ratings and quality seals.

The energy rating system will enable existing or future owners to compare the performance of homes, in order to encourage the adoption of measures to improve their performance. An appreciation in the market price of energy-efficient homes should follow, since disclosure of the energy rating will be mandatory.

The effective date of the energy rating system has been set for January 1, 2011 for new and existing residential buildings.

The State of Oregon assigned a working committee to recommend terms and conditions for establishing an energy rating system by taking into consideration the following elements:

- The energy audit's cost.
- The reliability of the rating system in meeting stated energy efficiency objectives.
- An energy rating that is easily interpreted.
- The success of pilot projects or similar energy labelling initiatives carried out in Oregon or other American states.

[39] **ENERGYSTAR**, Features of ENERGY STAR Qualified New Homes, U.S. Environmental Protection Agency/U.S. Department of Energy, no date. [Online] http://www.energystar.gov/index.cfm?c=new_homes.nh_features (page consulted on March 27, 2010).
[40] **Oregon Legislative Assembly**, *Senate Bill 79*, Oregon, United States, 2009. [Online] http://www.leg.state.or.us/09reg/measpdf/sb0001.dir/sb0079.intro.pdf (page consulted on March 27, 2010).

The working group favoured the Energy Performance Score (EPS) rating system, developed by the Earth Advantage Institute; this rating is applicable to both new and existing homes for which a pilot project has been carried out. An evaluation report was presented to the Oregon Energy Trust in August 2009[41].

The EPS system uses gross measurements for energy consumption and CO_2 tonnes for pollution emissions.

This approach differs from that of the HERS system, whose ratings are related to building standards in effect during the rating process, and from that of the Danish model, whereby reported performances are rated in relation to similar homes of the housing stock during the rating process. The Earth Advantage Institute states that presenting a home's relative energy consumption rather than its gross energy consumption distances the resulting information from the objective, which is, in Oregon's case, to improve the energy efficiency of homes and reduce their carbon emissions.

In addition, the evaluation report's conclusions do not recommend presenting energy use per area (i.e., KWh/m^2), a method applied in Denmark as well as the United Kingdom; while the average home uses less energy per m^2 than previously, the size of new homes continues to increase, so that, on average, the total energy consumption of new homes is increasing[42]. Since the objective is to save energy and reduce related carbon emissions, presenting a measurement of energy use intensity instead of total quantity used would be less effective in reaching that objective.

Evaluation software called *Simple* has been developed to enable a quick and relatively accurate evaluation, which takes into account a minimum of important elements to evaluate a building. A comparative study of several evaluation systems has been conducted, and *Simple* has often proven more effective than the other, much more complex systems to which it was compared. Much of the data necessary to the evaluations can in practice be obtained only approximately, so that more-complex software reportedly generates more-serious predictive errors and falsifies the overall results to a greater extent[43].

To produce an energy rating, *Simple* only takes into account 32 elements, compared to over a hundred in the case of other evaluation software. The shorter time necessary for the energy audit thus lowers the latter's cost. *Simple* also reduces the time and cost of training inspectors.

[41] **Earth Advantage Institute and Conservation Service Group**, *Energy Performance Score – 2008 Pilot*, August 2009, on the website of Earth Advantage, Portland, Oregon, USA. [Online] http://www.earthadvantage.org/eps_2008_pilot_report_fnl1x.pdf (page consulted on March 22, 2010).
[42] **Earth Advantage Institute and Conservation Service Group**, *Energy Performance Score – 2008 Pilot*, August 2009, on the website of Earth Advantage, Portland, Oregon, USA, p. 59, graphic 59. [Online] http://www.earthadvantage.org/eps_2008_pilot_report_fnl1x.pdf (page consulted on March 22, 2010).
[43] **Earth Advantage Institute and Conservating Service Group**, *Energy Performance Score – 2008 Pilot*, August 2009, on the website of Earth Advantage, Portland, Oregon, USA, pp. 22-37. [Online] http://www.earthadvantage.org/eps_2008_pilot_report_fnl1x.pdf (page consulted on March 22, 2010).

A survey of stakeholders was conducted recently during the development of the energy rating system; the main observations were the following[44]:

- The EPS concept has considerable appeal for stakeholders.
- The ideal price of an EPS would be $100 with a cap of $200.
- Cost is a major issue and the common language for understanding energy and making improvements.
- The EPS must be presented in a clear and objective manner from a trustworthy source.
- Carbon emissions are relevant and very important to homeowners.
- Homeowners are most familiar with energy use in terms of watts and kilowatt hours.
- Homeowners want information on energy performance and where to make improvements.
- Homeowners thought that their homes were more energy-efficient than preliminary results indicated.
- Home energy auditing helps highlight the need for air and duct sealing.
- Financial incentives (from Energy Trust of Oregon in the state of Oregon) are important for making home energy upgrades about half of the time.

Among the recommendations of the pilot project's evaluation report are the following:

- The rating report's part about suggestions for improvement could be optional.
  - Owners of new homes and those who are not interested in energy-efficiency improvements to their home would likely opt for the energy audit without recommendations for improvements.
  - The audit's cost would thus vary according to the formula chosen.
- The home's energy performance should be expressed in kilowatt-hours used annually under standard conditions. The energy used should be presented according to production sources and related carbon emissions should also be indicated, if applicable. The possibility of making comparisons with similar homes should also be provided for.
- The environmental performance should reflect the home's energy use and should be presented according to the sources used. An indication of the potential reduction of CO_2 emissions through the use of greener energy sources should be included in the report.
- The energy report should indicate an estimate of consumed energy calculated on the basis of the following elements: heating, air conditioning, hot water, lighting and electrical appliances, wall insulation, air ducts and ventilation.
- For existing homes, the report should also contain suggested renovation costs and an estimate of monetary savings that would result from the renovations.
- A Web tool producing an unofficial evaluation should also be made available to encourage owners who do not want to sell their property to evaluate anyway, summarily, their home's energy efficiency and make energy efficiency renovations.
- Software used for producing the evaluation should be the same for new and existing homes.
- Behaviour recommendations could be added in annex to raise occupants' awareness of their home's energy cost and the means to reduce it.
- A system of inspector certification, compliance and quality control should be put in place.
  - Certification will be different for inspectors authorized to issue recommendations.

[44] **Earth Advantage Institute and Conservating Service Group**, *Energy Performance Score – 2008 Pilot*, September 17, 2009, on the website of Earth Advantage, Portland, Oregon, USA, p. 7. [Online] http://www.earthadvantage.org/eps_2008_pilot_report_fnl1x.pdf (page consulted on March 22, 2010).

A) EPS System Operation

The EPS system has three components: the energy audit itself, the EPS rating report, and an analysis report containing suggestions for the evaluated building.

B) EPS Rating Report[45]

The EPS rating report first indicates the building address and the evaluation's reference number. There follows the home's estimated annual energy consumption per energy source, as well as corresponding monetary expenses, and then a calculation of carbon emissions.

The document then presents on a colour scale the building's total annual energy consumption in kilowatt-hours, with energy sources other than electricity having been converted into these units. The building's potential energy consumption, should the owner make renovations to be suggested in the analysis report, is indicated. The section concludes with average home consumption in Oregon, all sizes taken together, along with the state's energy consumption target for a typical building.

The rating report then presents, in the same form, information about the home's carbon emissions.

Information on the building, such as its living space, construction date and number of bedrooms, as well as the energy audit's date, are also provided.

In addition, the rating report presents a few summary explanations of the method used for converting the various thermal units into kilowatt-hours. The state's energy efficiency target is also explained.

The evaluation report suggested adding an identification of the evaluation software to facilitate the latter's follow-up and improvement.

C) Detailed EPS Analysis Report[46]

The EPS analysis report presents an estimate of energy consumption and related monetary cost; explanations of discrepancies that may arise between energy quantities estimated in the EPS rating report and energy quantities actually consumed; a summary of the energy performance of the building's main components; recommendations for renovation and improvement; explanations of proposed improvements; advice on energy-efficient behaviours

[45] **Earth Advantage Institute and Conservation Service Group**, *Energy Performance Score*, August 2009, available on the website of Earth Advantage, Portland, Oregon, USA. [Online] http://earthadvantage.org/eps_score_sheet_existing.pdf (page consulted on March 27, 2010). A prototype of the rating report is presented in Annex 5 (Rapport-Cotation-EPS.pdf).

[46] **Earth Advantage Institute and Conservation Service Group**, *Energy Analysis Report*, September 17, 2008, on the website of Earth advantage, Portland, Oregon, USA. [Online] http://earthadvantage.org/eps_energy_analysis_report.pdf, (page consulted on March 27, 2010. A prototype of the detailed analysis report produced as part of the EPS pilot project is presented in Annex 6 (Rapport-Analyse-EPS.pdf).

that could be adopted; and information about financial incentives available for carrying out suggested improvement work.

A table summarizes the estimated energy consumption and the related monetary expense, according to the main uses: room heating, air conditioning, water heating, lighting and electrical appliances. The costs are presented in terms of energy prices at the time of the evaluation. The same table also indicates the estimated energy consumption and its cost if suggested improvement work is done.

This table is completed by information on the building's estimated carbon emissions and what they could be following renovation work.

The report also presents information to explain discrepancies between consumption estimated by the EPS system and actual consumption. In addition, those discrepancies clarify the conditions under which the EPS evaluation is performed, and they make the evaluated home's occupants more aware of the benefits that could result from adopting sounder energy efficiency behaviours.

A section on the energy performance of some of the building's components briefly explains each one so that laymen may understand how they influence the home's energy consumption. The condition of each component is evaluated and problematic components are identified. This will serve as a guide for the proposed improvements: depending on the costs and benefits involved, renovation or replacement will be suggested for components rated poor, and improvement for those rated average.

The proposed improvements are classified by ascending order of costs necessary to their execution, and an estimate of foreseeable monetary savings is presented.

The report's following section details possible improvements, while explaining how certain components' defects hinder the home's sound energy performance. Read in conjunction with the section on components' energy performance, this section makes it possible to understand the rationale for suggested work.

Among the elements on which the report may issue recommendations are: air leaks, roof and attic insulation, the heating system, the air conditioning system, ventilation ducts, the hot water system, lighting and electrical appliances, wall insulation, foundation insulation, doors and windows.

The section on energy efficiency advice contains suggestions for energy-efficient behaviours, as well as supplementary references (Internet addresses, etc.) regarding home energy efficiency.

Finally, the report provides information on subsidy programs and tax credits associated with home renovation work (names of government programs, telephone numbers, Internet addresses, etc.).

D) Certification and Accreditation of Evaluators

The evaluation report suggested that evaluators be certified, with required qualifications depending on whether or not the evaluator will be authorized to issue renovation suggestions. A link with training dispensed by RESNET, the organization responsible for training HERS rating inspectors, is being considered. That would enable some inspectors to obtain a double certification at a lesser cost.

The establishment of a quality control system is also being considered. First, a program would be set up to ensure that inspectors' training is adequate. Afterward, about 5% of completed inspections would be verified for their accuracy.

E) Creation of a Database

Building energy ratings provide an excellent opportunity to collect information on the housing stock of the jurisdiction concerned. Accordingly, a database of evaluated buildings' features will be built. Among other things, it will enable a comparison of EPS home ratings within a given geographic area.

F) Outcomes

The EPS system is currently being implemented progressively: new and recent buildings can already be evaluated[47]. Several seals of quality for new houses, such as those of Earth Advantage (Silver, Gold or Platinum levels), ENERGY STAR or LEED, already use the EPS rating[48].

G) Financial Incentives

Energy Trust of Oregon offers, for existing homes, a panoply of financial incentives for all kinds of energy improvements[49]. The combined benefits of state subsidies and tax credits offered by Oregon and the federal government are detailed in a brochure available on the website of Energy Trust of Oregon[50]. At this time, those financial incentives are not associated with the EPS rating, but they may well become so once the EPS system is largely implemented.

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[47] **Energy Trust of Oregon**,, *Energy Performance Score,* on the website of Energy Trust, Portland, Oregon, USA. [Online] http://energytrust.org/residential/new-home-solutions/eps.aspx (page consulted on March 27, 2010).

[48] **Energy Trust of Oregon**, *Build energy efficiency into your new home*, site Energy Trust of Oregon, Portland, Oregon, United States, no date [Online] http://energytrust.org/residential/new-home-solutions/ (consulted on April 20, 2010).

[49] **Energy Trust of Oregon**, *Get cash for making energy-saving changes,* on the website of Energy Trust, Portland, Oregon, USA. [Online] http://energytrust.org/residential/incentives/, (page consulted on March 27, 2010).

[50] **Energy Trust of Oregon**, *For home energy improvements,* February 2010, 8 pages, on the website of Energy Trust, Portland, Oregon, USA. [Online] http://energytrust.org/library/forms/HES_DOC_Incentive_Grid.pdf (page consulted on March 27, 2010).

3. ENERGUIDE RATING SYSTEM FOR NEW OR EXISTING HOUSES

EnerGuide is a Canadian government energy-labelling initiative that evaluates the energy consumption of a wide range of products such as air conditioners and refrigerators, as well as vehicle fuel consumption. The EnerGuide logo is a Government of Canada trademark and cannot be reproduced without the latter's permission[51].

The EnerGuide rating is also used for evaluating the energy performance of new and existing houses in Canada.

Because the EnerGuide rating system is omnipresent in various renovation programs for existing homes and in the attribution of seals of quality for new homes, we will study its operation.

3.1 TYPICAL ENERGY RATINGS

The EnerGuide system attributes to a home's energy consumption a rating from 0 to 100; a rating of 100 indicates that a house is energy self-sufficient and requires no exterior energy supply.

The following are typical results of EnerGuide ratings for new homes[52]:

TYPICAL ENERGY RATINGS	
Types of Houses	**Ratings**
New house built in compliance with building code standards	65-72
New house with certain energy efficiency renovations	73-79
New energy-efficient house	80-90
House requiring very little or no energy purchase	91-100

[51] **Office of Energy Efficiency**, *EnerGuide for New Houses: Administrative and Technical Procedures,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 2005, p. 14. [Online] http://oee.nrcan.gc.ca/residential/business/builders-renovators-trades/building/pdf/EGNH-Admin-Tech-Procedures-2005.pdf (page consulted on March 21, 2010).

[52] **Office of Energy Efficiency**, *The EnerGuide Rating,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 18, 2010. [Online] http://oee.nrcan-rncan.gc.ca/residential/business/builders-renovators-trades/building/rating.cfm?attr=12 (page consulted on April 7, 2010).

3.1.1 Standardization Assumptions

The purpose of EnerGuide is to evaluate home energy consumption, on the basis of the occupants' standardized behaviour model, so that the actual behaviour of occupants at the moment of rating does not influence the rating of the home itself.

The rating calculation takes several factors into account:

"*The rating is determined by collecting detailed information about the home's energy systems, construction materials and assembly and inputting that information into an energy simulation modeling program developed by Natural Resources Canada. To factor out the influence of occupants habits (i.e., to measure the way the house itself uses energy, not the energy-using habits of its occupants), standard operating conditions are used in the rating.*
They assume:

- *four occupants in the house*
- *a thermostat setting of 21°C (70°F) on main floors and 19°C (66°F) in the basement*
- *a total domestic hot water consumption of 225 litres per day*
- *lighting and appliance electricity consumption of 24 kilowatt hours per day*
- *a minimum monthly average ventilation rate of 0.35 air change per hour during the heating season.*"[53]

3.1.2 The House as a System

An important feature of the EnerGuide system is that it considers the house as a system, whose whole is greater than its parts. On its website, the Office of Energy Efficiency gives an example of this concept:

> *"New high-efficiency windows won't prevent your home's condensation problems if they are improperly sealed or insulated, the humidifier on the furnace has not been adjusted or if kitchen and bathroom exhaust fans are rarely used or are improperly vented."*[54]

Natural Resources Canada recommends consulting a certified consultant before making energy efficiency renovations of one's home, in order to avoid counterproductive work.

[53] **Office of Energy Efficiency**, *The EnerGuide Rating,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 18, 2010. [Online] http://oee.nrcan-rncan.gc.ca/residential/business/builders-renovators-trades/building/rating.cfm?attr=12 (page consulted on April 7, 2010).
[54] **Office of Energy Efficiency**, *The House as a System,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010. [Online] http://oee.nrcan-rncan.gc.ca/residential/personal/new-homes/upgrade-packages/house-system.cfm?attr=4 (page consulted on March 21, 2010).

3.1.3 Interpretation of the EnerGuide Rating

The EnerGuide rating is based on local building codes in effect at the time of rating.

This procedure makes the rating perishable, since it loses accuracy when the codes are revised. Moreover, the EnerGuide rating, ranging from 0 to 100, is produced logarithmically, so that the closer a home is to the perfect 100% rating, the greater the energy efficiency improvements must be for the building to win points on the EnerGuide scale. For example, a new house with an EnerGuide rating of 67 will consume twice as much energy as a comparable house with a rating of 80[55].

This has the perverse effect of giving owners of average-rated homes the impression that their home is performing relatively well, whereas in fact it is performing relatively poorly.

The EnerGuide rating is standardized according to home size[56], so it measures the home's energy intensity (similarly to what has been done in Denmark and the United Kingdom) and does not predominantly indicate[57] the home's total energy consumption in physical or monetary units.

3.1.4 Roles and Responsibilities

Natural Resources Canada (NRCan) nationally coordinates the use of the EnerGuide rating system for new houses[58].

Because NRCan does not directly train future inspectors, it must publish documentation necessary for service organizations to train accredited inspectors adequately. NRCan must also provide service organizations with adequate and up-to-date procedures and software for them to use the EnerGuide system appropriately.

NRCan is responsible for managing data collection, maintaining a quality control program, and developing EnerGuide promotional strategies nationally.

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[55] **BUCHAN, Don**, *An Assessment of EnerGuide as a Requirement for New Homes*, Canadian Home Builders' Association, Ottawa, Ontario, November 2007, p. 5.
[Online] http://www.chba.ca/uploads/policy%20archive/2007/2007-11-27_03.pdf (page consulted on March 21, 2010).

[56] **BUCHAN, Don**, *An Assessment of EnerGuide as a Requirement for New Homes*, Canadian Home Builders' Association, Ottawa, Ontario, November 2007, p. 5.
[Online] http://www.chba.ca/uploads/policy%20archive/2007/2007-11-27_03.pdf (page consulted on March 21, 2010).

[57] Total kWh consumption is indicated on the EnerGuide label, but in very small characters compared to the principal rating. See Etiquette-EnerGuide.pdf in Annex 7. Document available on the website of Natural Resources Canada, Government of Canada, Ottawa, n.d. [Online] http://oee.nrcan.gc.ca/residentiel/personnel/maisons-neuves/forfaits-amelioration/etiquette.cfm?attr=4 (page consulted on March 21, 2010).

[58] **Office of Energy Efficiency**, *EnerGuide for New Houses: Administrative and Technical Procedures,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 2005, p. 14.
[Online] http://oee.nrcan.gc.ca/residential/business/builders-renovators-trades/building/pdf/EGNH-Admin-Tech-Procedures-2005.pdf (page consulted on March 21, 2010).

4. EXISTING HOME IMPROVEMENT INCENTIVE PROGRAMS IN CANADA

4.1 REIMBURSEMENTS AND TAX CREDITS

Nationally, the main home renovation subsidy program is ecoENERGY Retrofit – Homes[59], in place since January 1, 2007[60]. An EnerGuide evaluation of existing houses is mandatory with regard to eligibility for federal government ecoENERGY subsidies.

Given that the federal government itself does not operate the program, accredited contractors do so in each locality of the country. The program's operation is the same everywhere it is implemented.

The first phase is the home's EnerGuide evaluation. A report is produced on which is drawn a list of subsidies for which the owner is eligible[61]; only the recommendations made on the EnerGuide report may be related to subsidies or tax credits.

Following the initial EnerGuide evaluation, the owner has 18 months to do work and make a second EnerGuide evaluation, with which an EnerGuide advisor verifies the work done and attributes a new EnerGuide rating to the building. If the work is compliant, the owner will be reimbursed part of the cost of the work (the subsidy) by mail within 90 days and will be eligible for tax credits. The maximum subsidy for a single-family house is $5,000[62].

Several provincial and territorial jurisdictions offer financial incentives for home renovations, in addition to those provided by the federal government[63].

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[59] **Office of Energy Efficiency**, *About the Energy Efficiency Evaluation Report,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010. [Online] http://oee.nrcan-rncan.gc.ca/residential/personal/new-homes/upgrade-packages/about-report.cfm?attr=4 (page consulted on March 21, 2010).
See also: **Office of Energy Efficiency**, *Frequently-Asked Questions (FAQ) about ecoENERGY Retrofit – Homes,* on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010. [Online]
http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/questions-answers.cfm?attr=4 (page consulted on March 21, 2010).

[60] Ottawa announced in April that the ecoEnergy Retrofit – Homes Program was temporarily suspended. **Bryden, Joan,** *Ottawa suspend le programme de rénovations écoENERGIE*, in Cyberpresse, Mon toit section, Montreal, Quebec, April 1, 2010.
[Online] http://montoit.cyberpresse.ca/renovation/201004/01/01-4266724-ottawa-suspend-le-programme-de-renovations-ecoenergie.php (page consulted on April 5, 2010).

[61] **Office of Energy Efficiency**, *Grant Table for ecoENERGY Retrofit – Homes,* on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010. [Online]
http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/retrofit-qualify-grant.cfm?attr=4 (page consulted on March 10, 2010)

[62] **Office of Energy Efficiency**, *Frequently-Asked Questions (FAQ) about ecoENERGY Retrofit – Homes,* on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010. [Online]
http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/questions-answers.cfm?attr=4 (page consulted on March 21, 2010).

[63] **Office of Energy Efficiency**, *Complementary Regional Programs with ecoENERGY Retrofit – Homes,* on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010. [Online]

For example, Efficiency New Brunswick, with its "Existing Homes Energy Efficiency Upgrades Program"[64], subsidizes the initial EnerGuide energy evaluation. Afterward the homeowner is given a choice: an additional 20% of the federal subsidy, up to $2,000, or an interest-free loan in the maximum amount of $10,000, reimbursable in 6 years. An additional premium was offered until March 31, 2010, for replacing a heating system with one that performs better.

In Ontario, the government subsidizes 50% of the fees for the home's original EnerGuide inspection, up to $150[65]. Once the energy evaluation is completed, the technician will give the future owner the evaluation report and renovation suggestions. After the proposed work is done, the owner can receive from the province a $5,000 grant in addition to the federal government's $5,000 subsidy[66]. The technician also makes a second EnerGuide evaluation when the work is verified.

Quebec, through the Agence de l'efficacité énergétique and the Rénoclimat program[67] it manages, also adds to the ecoENERGY program, by subsidizing the initial EnerGuide evaluation and granting an additional subsidy according to the home's heating system[68].

http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/provincial-municipal.cfm?attr=4 (page consulted on March 21, 2010).

[64] **Efficiency NB,** *Existing Homes Energy Efficiency Upgrades Program,* Government of New Brunswick, Canada, 2010. http://www.efficiencynb.ca/residential/existinghomes.html (page consulted on March 21, 2010).

[65] Combined table of federal-provincial rebates for Ontario, available on the website of the Ministry of Energy and Infrastructure, Government of Ontario, Toronto, Ontario, November 24, 2009. [Online] http://www.mei.gov.on.ca/en/energy/conservation/ohesp/index.php?page=ohesp-audit (page consulted on March 24, 2010).

[66] Brochure: *It pays to be green*, available on the website of the Ministry of Energy and Infrastructure, Government of Ontario, Toronto, Ontario, November 24, 2009. [Online] http://www.mei.gov.on.ca/en/pdf/conservation/homeenergy/ohesp_brochure_murb-en.pdf (page consulted on March 24, 2010).

[67] RénoClimat page, available on the website of l'Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d. [Online] http://www.aee.gouv.qc.ca/en/my-home/renoclimat/ (page consulted on April 5, 2010).

[68] RénoClimat page, available on the website of l'Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d. [Online] http://www.aee.gouv.qc.ca/en/my-home/renoclimat/financial-assistance/ (page consulted on April 20, 2010).

4.2 PUBLIC MORTGAGE FINANCING

Canada Mortgage and Housing Corporation (CMHC) grants qualifying owners a mortgage loan insurance premium refund of up to 10% and an extended mortgage amortization period without surcharge[69].

The necessary steps to qualify for those programs are the following:

1- An EnerGuide evaluation is requested, including renovation suggestions for improving the home's energy efficiency.
2- The owner applies to CMHC at his financial institution for an extended mortgage amortization period.
3- The owner makes some of the improvements proposed by the EnerGuide evaluator.
4- An EnerGuide advisor confirms that the work done complies with the recommendations made beforehand. To be eligible for the CMHC programs, the house's EnerGuide rating must have increased by at least 5 points and attain at least 40 points.
5- The owner presents his application for a mortgage loan insurance premium refund.

4.3 MORTGAGE FINANCING AND PRIVATE LOANS

Several financial institutions offer loan or mortgage cashbacks that will serve to pay for energy efficiency renovations.

An example of such an initiative is the "HypothÉco"[70] program offered in Quebec by Desjardins – Caisse d'économie solidaire, which gives a cash amount equivalent to 50% of the financial aid offered by *Rénoclimat*, the program of the Agence de l'efficacité énergétique du Québec.

At RBC Royal Bank, the "RBC Energy Saver Loan" offers a $100 cashback or a 1% rate reduction for fixed rate instalment loans of over $5,000[71]. The offer is available notably for purchasing ENERGYSTAR labelled products or for financing renovation work suggested by a home energy audit.

[69] **Canada Mortgage and Housing Corporation**, *Energy-Efficient Housing Made More Affordable with Mortgage Loan Insurance,* on the website of the Canada Mortgage and Housing Corporation, Ottawa, Ontario, n.d. [Online] http://www.cmhc.ca/en/co/moloin/moloin_008.cfm (page consulted on March 25, 2010).
Energy-Efficient Housing Made More Affordable with Mortgage Loan Insurance, on the website of the Canada Mortgage and Housing Corporation, Ottawa, Ontario, n.d.
[70] **Caisse d'économie solidaire Desjardins**, *Découvrez l'hypothÉco*, Montreal, Quebec, 2010. [Online] http://hypotheco.coop/, (page consulted on May 3, 2010).
[71] **Royal Bank of Canada**, *Personal Loans – RBC Energy Saver*, Montreal, Quebec, 2010. [Online] http://www.rbcroyalbank.com/RBC:S98p4Y71A8UAJeCw5AI/products/personalloans/energy-saver-loan.html (page consulted on May 3, 2010).

5 NEW HOME PERFORMANCE INCENTIVE PROGRAMS IN CANADA

New building performance incentive programs may be classified into two categories: those related to seals of quality and those related to purely financial incentives. Seals of quality generally guarantee that a newly built home features greater comfort, better ambient air quality, an extended useful life and good energy performance. Since buying a new home is not simply a matter of cost-benefit calculations, the non-energy advantages of seals of quality make energy-efficient homes appear more attractive.

We will first examine certain national seals of quality for new homes, and then provincial seals of quality. Financial incentives will follow, which may take the form of refunds or tax credits offered by the various levels of government (subsidies), federal government offers of mortgage refinancing or insurance, and various offers or cashbacks from financial institutions.

5.1 NATIONAL SEALS OF QUALITY FOR NEW HOMES

5.1.1 The R-2000 Standard

The main national seal of quality for new homes is the R-2000 Standard, designed by Natural Resources Canada (NRCan) and administered by the Office of Energy Efficiency (OEE). The R-2000 Standard:

> *"…includes requirements related to energy efficiency, indoor air quality and the use of environmentally responsible products and materials. It does not, however, specify exactly how a house must be built.*
>
> *Rather, the R-2000 Standard sets criteria for how an R-2000 home must perform. This leaves the designer and builder free to choose the most effective and economical way to build it."*[72]

Meeting the R-2000 Standard is voluntary. It consists of a series of requirements that go beyond those imposed by local building codes. A certain leeway is allowed as to the means taken to meet those requirements, so long as the final outcome meets performance expectations.

> *"The R-2000 energy target is equivalent to a rating of 80 under the EnerGuide for Houses rating system."*[73]

However, the energy evaluation varies according to weather conditions in the region where the home is built; the objective of 80 on the EnerGuide scale is thus only approximate:

[72] **Office of Energy Efficiency**, *About the R-2000 Standard,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010. [Online] http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/standard/standard.cfm?attr=4 (page consulted on March 22, 2010).

[73] **Office of Energy Efficiency**, *Standard R-2000,* on the website of Natural Resources Canada, Government of Canada, Ottawa, April 1, 2005, page 8. [Online] http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/standard/current/R2000-standard.pdf (page consulted on March 22, 2010).

> *"R-2000 homes must operate within a specific energy budget, based on the characteristics of the home and the climate conditions where it's built. Typically, R-2000 homes need 30 percent less energy to operate than conventional new homes."*[74]

This standard is thus established in relation to building codes in effect when the rating is given. A house that was R-2000 certified 20 years ago will not likely consume 30% less energy than a house built according to current minimum building standards. Likewise, the 80 rating given at the time under the EnerGuide rating system could not be maintained if an audit were conducted today, based on current standards. The label therefore loses significance over time.

Provincial programs, such as the "Manitoba R-2000 Program", occasionally promote the R-2000 Standard[75].

5.1.2 The ENERGY STAR Seal

The ENERGY STAR label (trademark) was created by the United States Environmental Protection Agency (EPA) in 1992. Natural Resources Canada's Office of Energy Efficiency (OEE) promotes the international ENERGY STAR symbol in Canada and has been monitoring its use since 2001. The ENERGY STAR label for new homes has been in circulation since 2005. According to OEE, houses that are ENERGY STAR certified in Canada are at least 30% more energy-efficient than houses built according to the building code's minimal standards[76].

> *"ENERGY STAR® for New Homes is currently available only in Ontario and Saskatchewan and is delivered in the field by a network of regional service organizations."*[77]

In a circular promoting the ENERGY STAR label for new homes[78], we find the following description of its benefits to homeowners:

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[74] **Office of Energy Efficiency**, *About the R-2000 Standard,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010. [Online] http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/standard/standard.cfm?attr=4 (page consulted on March 22, 2010).

[75] *Manitoba R-2000 Home Program!* The website's home page, Government of Manitoba, Winnipeg, Manitoba, n.d. [Online] http://www.r2000manitoba.com/, (page consulted on March 18, 2010).

[76] **Office of Energy Efficiency**, *ENERGY STAR for New Homes,* on the website of Natural Resources Canada, Government of Canada, Ottawa, June 26, 2009. [Online] http://oee.nrcan.gc.ca/residential/personal/new-homes/energystar-new-homes.cfm?attr=4 (page consulted on March 23, 2010).

[77] **Office of Energy Efficiency**, *What Is the ENERGY STAR® for New Homes Initiative?,* document available on the website of Natural Resources Canada, Government of Canada, Ottawa, December 30, 2009. [Online] http://oee.nrcan.gc.ca/residential/business/new-homes/new-homes-initiative.cfm?attr=12 (page consulted on March 22, 2010).

[78] See **Circulaire-ES.pdf** in Annex 8. Document available on the website of Natural Resources Canada, Government of Canada, Ottawa, n.d. [Online] http://oee.nrcan.gc.ca/residentiel/personnel/maisons-neuves/energystar-maisons-neuves.pdf (page consulted on March 22, 2010).

“

- lower energy bills
- improved comfort
- government-backed quality assurance
- lower impact on the environment
- higher resale value”[79]

These benefits of new homes that are ENERGY STAR certified make the symbol more than a measure of energy efficiency – it is a seal of quality. Still, energy efficiency remains crucial to obtaining the ENERGY STAR seal of quality.

The technical specifications for ENERGY STAR certification integrate energy efficiency measures pertaining to the following components and items: heating and air conditioning systems, air ducts, windows, French windows and window wells, walls and ceilings, ventilation and air leaks.

The circular also mentions that interested homeowners can receive the EnerGuide energy performance rating and that: “Although most new homes receive a rating of at least 68, the average ENERGY STAR certified home receives an energy performance rating of at least 77.”[80] In contrast to the R-2000 Standard, the ENERGY STAR label in Canada does not have any energy efficiency target.

5.2 PROVINCIAL SEALS OF QUALITY FOR NEW HOMES

Several provinces, energy distributors and associations of groups working in the residential construction industry have developed new home seals of quality in addition to national seals. Several of those provincial seals are inspired by the R-2000 Standard. Here is a sample of a few of those seals:

5.2.1 In Manitoba

Manitoba-Hydro offers a “New Home Program” that provides for two levels: Silver and gold[81]. There are stringent technical specifications for ensuring quality constructions. The Gold level gives an EnerGuide evaluation free of charge at the end of the work, and qualifies the home for CMHC mortgage insurance and refinancing programs (see section 5.4 on financial incentives for new homes). The Silver level does not make a home eligible for these benefits.

[79] See **Circulaire-ES.pdf** in Annex 8. Document available on the website of Natural Resources Canada, Government of Canada, Ottawa, n.d. [Online] http://dsp-psd.pwgsc.gc.ca/collection_2009/nrcan/M144-176-2009E.pdf (page consulted on March 22, 2010).

[80] **Office of Energy Efficiency**, *ENERGY STAR for New Homes,* on the website of Natural Resources Canada, Government of Canada, Ottawa, June 26, 2009. [Online] http://oee.nrcan.gc.ca/residential/personal/new-homes/energystar-new-homes.cfm?attr=4 (page consulted on March 23, 2010).

[81] **Manitoba Hydro**, *Program Levels, New Home Program,* Winnipeg, Manitoba, n.d. [Online] http://www.hydro.mb.ca/your_home/new_home/levels.shtml (page consulted on March 25, 2010).

5.2.2 In Alberta and British Columbia

The Built Green industry initiative offers home builders and buyers in Alberta and British Columbia a list of measures to include in new homes to save energy. Depending on the measures applied and the EnerGuide rating given a home, the new construction will receive the Bronze, Silver, Gold or Platinum label.

The Bronze label will be attributed to residences awarded an EnerGuide rating of 72 to 74, and a Silver label to those awarded a rating of 75 to 76. The Gold label will be reserved for homes receiving an EnerGuide rating of 77 to 81, and the Platinum rating for those receiving a rating of 82 or over. Houses whose final rating exceeds 77 will qualify for CMHC's low-rate refinancing offers[82].

5.2.3 In New Brunswick

The EnerGuide rating itself serves as a seal of quality in New Brunswick. An EnerGuide rating of 80 qualifies a new house for many subsidies or discounts[83].

The process is as follows: the builder meets a certified energy efficiency advisor and, according to the new building's plans and specifications, the energy efficiency advisor uses simulation software to calculate the home's EnerGuide rating.

On the basis of elements that may have a particularly important incidence on the house's energy efficiency, the advisor may then suggest energy efficiency improvements and inform the builder of corresponding variations in the EnerGuide rating. The advisor provides the builder with an evaluation of proposed costs and measures.

The builder will then meet the new home's buyer to inform him about the various possible options regarding his new home's likely energy performance depending on the choices he will make.

After construction, the builder again asks the energy advisor to audit the work done and submit it to an infiltrometer test.

[82] After April 1, 2010, this requirement will be raised to a rating of 80 on the EnerGuide scale. In this regard, see the page *Energy-Efficient Housing Made More Affordable with Mortgage Loan Insurance,* on the website of the Canada Mortgage and Housing Corporation, Ottawa, Ontario, n.d. [Online] http://www.cmhc.ca/en/co/moloin/moloin_008.cfm (page consulted on March 25, 2010).

[83] **Efficiency NB**, *Program information and financial incentives,* New Homes Program, Efficiency NB, website of the Government of New Brunswick, Saint John, New Brunswick, November 2009, p. 4. [Online] http://www.efficiencynb.ca/residential/program-information.html (page consulted on March 27, 2010).

With the collected data, the advisor may give the new building an official EnerGuide rating. The following information is provided by the report[84]:

- The house's EnerGuide rating and an explanation of the evaluation system.
- A breakdown of the energy quantity used for heading rooms, lighting and the operation of electrical appliances.
- An estimate of electricity, gas or fuel oil consumption for a typical family of four (estimate based on normal temperature and a normal use of lighting, electrical appliances and hot water).
- Recommendations for maintaining the energy efficiency of the house and its main equipment.[85]

5.2.4 In Quebec

Through its Agence de l'efficacité énergétique, Quebec offers the Novoclimat certification[86], which constitutes a package of various energy efficiency measures to give a new building an energy performance at least 25% greater than houses built according to local building codes.

5.3 REFUNDS AND TAX CREDITS

Currently, there are no federal financial incentives for building new energy-efficient houses[87], other than the CMHC's incentives[88]. However, several provinces and territories subsidize the construction of new energy-efficient homes.

In Manitoba, other than the free EnerGuide inspection for Gold certified houses, a cashback of at least $1,000 is offered or, optionally, a $600 discount on Manitoba-Hydro's electricity bill.

In New Brunswick, subsidy programs for new energy-efficient houses are more numerous. Three types of new homes can qualify: R-2000 certified houses, houses with an EnerGuide

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[84] **Office of Energy Efficiency**, *About the Energy Efficiency Evaluation Report,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010. [Online] http://oee.nrcan-rncan.gc.ca/residential/personal/new-homes/upgrade-packages/about-report.cfm?attr=4 (page consulted on March 27, 2010).

[85] An example of such a report is available online. **Office of Energy Efficiency**, *EnerGuide for New Houses: Administrative and Technical Procedures,* on the website of Natural Resources Canada, Government of Canada, Ottawa, January 2005. [Online] http://oee.nrcan.gc.ca/residential/business/builders-renovators-trades/building/pdf/EGNH-Admin-Tech-Procedures-2005.pdf (page consulted on March 21, 2010).

[86] *NovoClimat* page, available on the website of l'Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d. [Online] http://www.aee.gouv.qc.ca/en/my-home/novoclimat/ (page consulted on May 4, 2010).

[87] **Office of Energy Efficiency**, *Frequently-Asked Questions (FAQ) about ecoENERGY Retrofit – Homes,* on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010. [Online] http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/questions-answers.cfm?attr=4 (page consulted on March 21, 2010).

[88] See section 5.4 of the present report in this regard.

rating of 80 or over, and houses with certain mandatory characteristics[89] specified by Efficiency New Brunswick (whatever their EnerGuide rating).

Proposed financial incentives include: a refund of 50% of the cost of the EnerGuide evaluation service, up to $250; a so-called basic subsidy of $1,000 for qualifying houses; and a subsidy of $2,000 to $3,000 to buyers of new homes (or existing ones that meet standards) for the purchase or replacement of the heating system[90].

In Ontario, no subsidy program for building new energy-efficient homes is currently in place, to our knowledge; only a program intended for the commercial and industrial sector, and developed by the Ontario Power Authority, is currently in effect[91].

5.4 PUBLIC MORTGAGE FINANCING

The conditions and procedure for obtaining from CMHC a 10% mortgage loan insurance premium refund of up to 10% and a 35-year extended mortgage amortization period without surcharge for buying a new or existing energy-efficient house are as follows[92]:

1- The new building must meet one of the following criteria:
   a) The home is a R-2000 home with high energy performance;
   b) The home has an EnerGuide rating of 77 or over;
   c) It has been or will be built as part of an energy-efficient home-building program recognized by CMHC[93];
   d) The energy efficiency of the building in which the condominium unit is located exceeds by 25% the requirements of the Model National Energy Code of Canada for Buildings (MNECB).
2- The future owner applies for mortgage loan insurance from his financial institution.
3- An EnerGuide advisor confirms that the house qualifies according to the above mentioned criteria. An existing house may also be eligible if it meets one of the above mentioned standards of performance. Otherwise, the owner may benefit from CMHC offers for renovations to existing homes.
4- The owner applies for a premium refund.

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[89] **Efficiency NB**, *Checklist developed to help build energy-efficient homes,* New Homes Programs, Efficiency NB, website of the Government of New Brunswick, Saint John, New Brunswick, November 2009. [Online] http://www.efficiencynb.ca/home/efficiency-nb-in-the-news.html#anchor24 (page consulted on February 2, 2010).

[90] **Efficiency NB**, *Program information and financial incentives,* New Homes Program, Efficiency NB, website of the Government of New Brunswick, Saint John, New Brunswick, November 2009, pp. 3-4. [Online] http://www.efficiencynb.ca/residential/program-information.html (page consulted on March 27, 2010).

[91] **Ontario Power Authority**, page *Commercial Sector - Programs, Incentives, Rebates*, on the website of l'Ontario Power Authority, Government of Ontario, Ottawa, Ontario, n.d. [Online] http://business.everykilowattcounts.com/com/programs-incentives-rebates.php?pir=HPNC (page consulted on March 28, 2010).

[92] *Energy-Efficient Housing Made More Affordable with Mortgage Loan Insurance,* on the website of the Canada Mortgage and Housing Corporation, Ottawa, Ontario, n.d. [Online] http://www.cmhc.ca/en/co/moloin/moloin_008.cfm (page consulted on March 25, 2010).

[93] **Canada Mortgage and Housing Corporation**, *CMHC Eligible Energy-Efficient Building Programs,* on the website of the Canada Mortgage and Housing Corporation, Ottawa, Ontario, n.d. [Online] http://www.cmhc.ca/en/co/moloin/moloin_008.cfm (page consulted on March 25, 2010).

5.5 PRIVATE MORTGAGE FINANCING

As in the case of existing homes, several Canadian financial institutions offer more-attractive mortgage loans to buyers who want their new home to be energy-efficient.

At RBC Royal Bank, the "RBC Energy Saver Mortgage"[94] program offers a $300 cashback (certain conditions apply) for an energy efficiency audit of the buyer's future home.

The "HypothÉco"[95] program, offered in Quebec by Desjardins – Caisse d'économie solidaire, offers the buyer of a Novoclimate-certified house a $1,750 cashback if the buyer has signed a mortgage of $100,000 or more.

[94] **Royal Bank of Canada**, *RBC Energy Saver Mortgage,* 2010. [Online] http://www.rbcroyalbank.com/products/mortgages/energy-saver-mortgage.html, (page consulted on May 4, 2010).
[95] **Caisse d'économie solidaire Desjardins**, *Découvrez l'hypothÉco*, 2010. [Online] http://hypotheco.coop/, (page consulted on May 3, 2010).

6 PROPOSED ENERGY RATING SYSTEM

The overview of foreign experiences has shown that there is no mandatory energy rating system that could be considered better in itself or that should be applied universally; various practices have been adopted to meet the objectives set by the different systems. It is therefore necessary to define the objectives and fundamental orientations of the proposed energy rating system before attempting to determine specific practices to be adopted or preferred. The content of the energy rating system will largely result from the choices made as to objectives and orientations; their definition will thus constitute the first task in developing such a system.

Afterward, we will survey a few common practices we found in the foreign rating systems studied, and we will assess the relevance of applying them to our rating system in view of the objectives and orientations set. Additional considerations regarding certain elements that will be included in the suggested rating system will also be addressed.

During the design of the proposed rating model, to verify the relevance and feasibility and measure the interest that such a proposal was likely to raise, we surveyed several stakeholders we presumed might show interest. To that end, we sent invitations to many organizations[96] in fall 2009 to probe their interest in commenting on our project. We received very few positive answers; the Corporation of Master Pipe Mechanics of Quebec expressed interest, and we had a telephone conversation with its representatives. The Bureau de normalisation du Québec and the Corporation des propriétaires immobiliers du Québec Inc. expressed interest in seeing a working document, while the Association provinciale des constructeurs en habitations du Québec - Service technique sent us a few general comments on home energy rating.

In a second round of solicitations made in early 2010, we sent a summary document (reproduced in Annex 9) that presented common home rating system practices to organizations that showed interest in participating in our survey and to potential new stakeholders[97], and that solicited their ideas and reactions. Our invitation asked the interested parties to take position on certain home rating system approaches and practices. However, few organizations agreed to answer our questions directly; some of them said they were interested in seeing a draft of the final version. So we sent a draft research report to them and other organizations, as well as member organizations of the energy efficiency committee of Union des consommateurs. We were able to gather the comments of the Bureau de Normalisation du Québec, NB Power and the energy efficiency committee of Union des consommateurs.

[96] The organizations to which we sent an invitation were the following: Régie du bâtiment du Québec - Normalisation et qualification, Bureau de la normalisation du Québec, American Society of Heating, Refrigerating and Air-Conditioning Engineers (Montreal Chapter), Association Québécoise pour la maîtrise de l'énergie, Association des Inspecteurs en Bâtiments du Québec, Association de la construction du Québec, Commission de la construction du Québec, Corporation of Master Pipe Mechanics of Quebec, Corporation des propriétaires immobiliers du Québec inc., Corporation des entrepreneurs généraux du Québec, Société d'Habitation du Québec, Association d'isolation du Québec, Coalition énergie et développement durable, Canada Green Building Council - Quebec Section, Association provinciale des constructeurs en habitations du Québec - Service technique.

[97] The mailing list included, notably: Hydro-Québec, Société en commandite Gaz Métro, Bureau de normalisation du Québec, Corporation des maîtres mécaniciens en tuyauterie du Québec, Corporation des propriétaires immobiliers du Québec inc.

Some of the orientations or practices were retained while considering the comments of participants in our survey[98].

The present chapter will conclude with a detailed description of the report that would accompany the proposed rating system.

6.1 OBJECTIVES AND MAJOR ORIENTATIONS

Before determining the type and scope of the program that would relevantly be put in place in Canada, it is important to establish the fundamental objectives and orientations of the proposed energy rating system, after which it will be possible to identify the practices that should be favoured in order to follow those orientations and meet those objectives.

We will begin by stating the main objectives that the proposed rating system should set: additional information available to the consumer on his home's energy and environmental performance, as well as a reduction in energy used and in pollution emissions per housing unit.

We will continue with the system's major orientations, i.e., the procedures that should make it possible to meet the fundamental objectives: the proposed rating system's binding effect and scope, as well as a presentation of measures regarding home energy consumption and pollution emissions.

6.1.1 Additional Consumer Information

The primary objective of the home rating system is to inform the consumer about his future home's energy efficiency, so that he may be aware of the monetary and environmental costs related to his energy use.

In a context of rising energy prices, this will be useful information for homeowners concerned with making appropriate home energy efficiency improvements, or for tenants wanting to avoid high and unforeseen energy bills. In addition, responsible consumers will be better able, thanks to such labelling, to choose homes less damaging to the environment.

6.1.2 Improving Home Energy Efficiency and Environmental Performance

Energy use appears poised to become a major issue in the 21st century: world reserves of several fossil fuels (natural gas, oil, coal) are rapidly declining, while the growing appetite of emerging powers (Brazil, Russia, India and China) for those energy sources will likely make future energy prices rise to unprecedented levels.

In Canada, the residential sector consumes about 17% of the energy used annually[99]. A reduction in the energy used in this sector can strengthen the country's energy security; this is an important objective for the home rating system we hope will be established.

[98] Union des consommateurs nevertheless assumes sole responsibility for the final content of this research report.

[99] **Office of Energy Efficiency,** *Energy efficiency developments in Canada, 1990 to 2007*, available on the website of Natural Resources Canada, Government of Canada, August 2009. [Online]

Secondly, it seems appropriate to consider the opportunity of establishing a greenhouse gas (GHG) emissions rating system in addition to the energy rating itself; the three foreign systems studied have done so.

Canada ratified the Kyoto Accord, which provides for a 6% absolute reduction in GHG by 1212 compared to their 1990 level. Canadian buildings (residential and commercial sectors taken together) alone generate about 35% of GHG in Canada[100]. Inserting a measurement of pollution emissions in the rating system would favour investments to reduce those emissions.

It is easy to imagine that certain construction or performance standards could become mandatory to meet those environmental imperatives. In addition, subsidy programs to improve home environmental performance could likely arise in the relatively short term, particularly since GHG emissions are about to be metered in several countries. Creating a database on GHG emissions from the Canadian residential housing stock would be particularly appropriate in this context.

All this strongly militates in favour of a rating system that would cover CO_2 emissions. Accordingly, the proposed rating system will include the objective of reducing home pollution emissions.

6.1.3 Binding Effect and Scope of the Rating System

For a rating system to attain a maximum efficiency level, it is important that the entire housing stock be rated mandatorily. The advantages of a mandatory rating and its systematic disclosure during real estate transactions (sale, resale and rental) are many and well documented[101]. Mandatory disclosure of energy efficiency makes it possible, among other things, to:

- Internalize the value of the energy efficiency of homes in their sale prices, thus providing homeowners with additional incentives for them to invest more to that effect.

- Favour a market transformation for new buildings and publicly promote the good energy efficiency of new homes, with this consideration becoming over time a determining criterion for buyers.

- Reach a large part of the housing stock much more rapidly than would voluntary rating initiatives, which generally have very low penetration rates (often less than 1% annually).

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http://oee.nrcan-rncan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_11_e_4.cfm?attr=0 (page consulted on May 21, 2010).

[100] **COMMISSION DE COOPÉRATION ENVIRONNEMENTALE DE L'AMÉRIQUE DU NORD (CCE),** *Le bâtiment écologique en Amérique du Nord*, Névé Editions, Quebec City, Quebec, March 27, 2008, available on the website of MédiaTerre, Accueil Canada-Québec, Quebec City. [Online] http://www.mediaterre.org/canada-quebec/actu,20080327193323.html (page consulted on April 12, 2010).

[101] **DUNSKY ENERGY CONSULTING**, *Cote énergétique obligatoire*, assessment of the international experience, Montreal, April 2009, pp. 18-33. Available on the ftp site of the Agence de l'efficacité énergétique du Québec. [Online] http://www.aee.gouv.qc.ca/RegieEnergie/R-3709-2009/Etude/Cote%20obligatoire%202009-04-06%20(v.finale%20AEE)_v.2003.pdf

- Establish a symmetry of information on housing energy costs in the rental market, where tenants generally have little information on those costs.

- Set up a database on the energy efficiency of the country's housing stock; this could be useful in many respects (energy consumption and home GHG emissions, data on the condition of new construction, useful information for eventual improvements to building codes).

Given these multiple advantages, we will adopt a position in favour of an energy efficiency system with mandatory disclosure, for the sale, resale or rental of new and existing homes. It is essential that a future buyer be able to compare the energy efficiency and monetary costs of a new home with those of an existing home.

This orientation implies that the rating system must be the same for new and existing homes. Since the primary objective of our rating system is to inform the consumer about the energy efficiency of his future home, different ratings for new or existing homes would needlessly confuse his attempt to compare a new home's performance with that of an existing home, and would hinder us from meeting our primary objective.

6.1.4 Measurements of Energy Consumption and Pollution emissions

Measurements used for calculating consumed energy and pollution emissions as part of an energy rating system are important and closely related to the goals set by the rating system, but without necessarily translating them systematically or perfectly.

Denmark, France and the United Kingdom, which ratified the Kyoto Accord, have adopted energy intensity measurements, i.e., measurements based on quantities of consumed energy and pollution emissions per square meter of living space. However, the area of new homes having increased in recent years, a reduction in energy used per square meter, useful though it may be, will be insufficient to ensure a reduction in total energy used in those new homes. The same applies to pollution emissions.

As for Oregon's EPS pilot project, it reports the gross quantity of energy used per home; this focuses on a total reduction of energy used in a housing unit rather than on a reduction of energy used per square meter. This approach is more effective in meeting the targets of the Kyoto Accord, which, however, the United States has never ratified.

We will opt for an orientation corresponding to Canada's international environmental commitments: measurements of gross quantities of energy and pollution emissions will therefore be used predominantly in our proposed energy rating system.

It remains that intensity measurements may prove useful in some respects: they enable consumers to compare the energy performance of homes of different areas, given that the gross measurement is not very informative in this case; a home of lesser area will likely consume less energy even if it is less efficient, as the intensity measurement would explicitly reveal. In addition, the eventual establishment of a provincial or national energy efficiency target being desirable (even likely in the relatively short term), it will be more consistent to express that target with a measurement of energy intensity, in order, again, to enable a more significant comparison between different size homes and the chosen target. Accordingly, intensity measurements will be used to that effect in the proposed rating system.

The rating system will thus predominantly present gross quantities of energy consumption and pollution emissions, but also, for certain purposes, the energy quantities used per square meter (i.e., kWh/m^2) and GHG quantities released per square meter (i.e., CO_2/m^2).

6.1.5 Objectives and Orientations Chosen

The proposed rating system will aim to inform consumers (homeowners or future tenants and buyers) on the energy efficiency of homes and to reduce the housing stock's energy consumption and pollution emissions.

Certain fundamental orientations should help meet those objectives: the rating system will be mandatory, and disclosure of its report will also be so during the sale, resale and rental of a home. In addition, the rating system will apply both to new and existing buildings and will be the same for all types of housing.

The rating system will pertain to GHG and energy consumption. Measurements of energy consumption and CO_2 emissions will be expressed primarily in used or released gross quantities, but the energy performance report will also present intensity measurements for those two aspects.

6.2 COMMON PRACTICES OF ENERGY RATING SYSTEMS

Certain energy rating practices are so common that they were found in most, if not all, foreign cases studied. While those practices are shared by the programs examined, it remains that they were applied differently from one program to another. We will therefore summarily evaluate the relevance of transposing those practices in the energy rating system proposed for Canada and, if applicable, the appropriate way to do so.

a) The energy evaluation is standardized in order to be independent of occupants' behaviour.
   - This practice is logical, since rating systems are intended to evaluate buildings' energy efficiency, and not the behaviour of current or eventual occupants. We will therefore adopt in the proposed system an evaluation not related to occupants' behaviour.

b) The energy rating report enables a comparison of the evaluated home's performance with those of other homes. In Denmark, the rating system classified a home's performance on a scale in relation to the performance of similar homes. The United Kingdom gives the average rating of the country's homes, while Oregon's EPS system gives the average energy consumption of the state's homes as well as the state's energy target for average home consumption.
   - This practices has the advantage of providing additional information on the relative energy efficiency of the evaluated home. However, the form chosen to do so is highly important: comparing the gross consumption of a given building with that of the average building on a given territory does not appear very relevant to us; homes can be of very different sizes, so comparing a home of a given size with a home of average size does not seem very useful to us. Nor do we recommend an indication of average consumption per m^2 among the housing stock in the province or country, because such a mention would risk weakening the incentives for homeowners to make energy

efficiency improvements to buildings whose performance would be close to average[102]. However, provincial or national energy intensity targets (i.e., kWh/m^2 and CO_2/m^2) could be indicated to encourage homeowners to aim for them. Of course, those targets will be less ambitious than the average consumption per square meter among the housing stock in the given jurisdiction.

c) The rating report indicates the monetary cost that will be entailed by the home's estimated energy expenditure.
   - Since the costs that will be entailed by energy consumption represent the home energy performance that is best understood by homeowners, future buyers or tenants (cf. Section 2.3.3 – Oregon's Law and the EPS Pilot Project), we will also adopt this practice.
   - This choice is in line with the chosen orientation, which consists of presenting as a priority the building's gross energy consumption, given that the energy expenditure's total cost is the product of the gross quantities consumed per energy source and their respective prices.

d) Improvement suggestions that would enable homeowners to improve the home's energy efficiency are included in the energy rating report of existing buildings.
   - Owners or future buyers often misunderstand the improvements that would make their home more energy-efficient and, as demonstrated by the investigation conducted during the development of Oregon's EPS system, they want to be informed of those possibilities. Such a practice, which is likely to facilitate access to practical means of reducing home energy consumption and pollution emissions, appears to us appropriate for the proposed system.
     To that effect, we propose a novelty: the holder of a rating report will be able to use a Web tool to determine what improvements he will decide to make in the first place (see Section 6.3.4 – Creation of a Website and a Database), an automatic update of the rating report indicating to him the gains and savings that those improvements could enable him to obtain.
   - Future owners of a new building who want to obtain a good energy rating will have an interest in agreeing with the contractor so that the future home's plans and specifications lead to obtaining a high energy performance. The process could be inspired by what is currently done in New Brunswick, where the EnerGuide rating serves as a seal of quality for new homes (see Section 5.2.3 - In New Brunswick).

e) An approximation of monetary savings that could be entailed by improvement work is indicated in the case of existing buildings.
   - Because it is likely to raise current or future owners' awareness of the economic benefits of energy efficiency improvement work, this practice will be incorporated in the proposed rating system. Again, the Web tool detailed in Section 6.3.4 will be useful for examining the foreseeable monetary costs and benefits of improvement work.

f) An inspector accreditation and quality control system has been put in place (or will be in the case of Oregon).
   - Such a measure is indispensable for the proposed rating system to be objective and not inclined to favour conflicts of interest and for the public to trust this program. The

[102] **Centre Scientifique et Technique du Bâtiment**, *Diagnostic de performance énergétique*, French Government, France, 2005, p. 25.

mishaps of Denmark's initial implementation and the recommendations of the subsequent evaluation report confirm the importance of these requirements.

6.3 ADDITIONAL ELEMENTS AND CLARIFICATIONS

This section details a few other elements of the proposed energy rating system, whose report will comprise two distinct parts – one on the home's energy efficiency as such and the other on suggestions for possible improvements.

This information will be presented in a document that will be given to the homeowner and that the latter will be obliged to communicate to any eventual buyer or tenant. Each document will carry a unique alphanumeric code to identify it.

6.3.1 Presentation of the Home's Energy Performance

Energy consumption and pollution emissions will be indicated prominently on the basis of gross quantities used or released. The home will be evaluated on that basis.

The presentation of the home's total energy expenditure will be subdivided according to usage (room and water heating, air conditioning, lighting and electrical appliances) and energy source used for those purposes (electricity, natural gas, fuel oil, propane). This will enable the homeowner to be precisely aware of the provenance of his energy consumption.

The prices of the various sources of energy at the time of the home's evaluation will also be indicated. By multiplying the quantities of energy types used by their respective prices, the homeowner will be able to determine his total monetary expenditure for the energy he uses and to identify expensive energy sources and uses.

6.3.2 Performance Calculations and Inputs

The quantities appearing on the energy rating report will be estimated using software designed for that purpose, and data collected on-site during the energy audit will serve as inputs in calculating energy performance.

The inputs used should include data on: the heating system, air conditioning, the hot water system, lighting and electrical appliances, wall insulation, air ducts and ventilation, as well as secondary heating sources (i.e., wood stove). The average local temperature (possibly modulated by heating degree days) will also be used as an input in forecasting energy consumption.

Calculation software requiring a limited number of parameters, such as "Simple" in Oregon's EPS pilot project, will be used.

It will be important to indicate on the rating report the home components on which data was used for establishing performance calculations. This will later make it possible to evaluate their condition and energy efficiency in order to suggest appropriate improvements. It will be reminded that the quantities are estimated according to conventional use of the building.

6.3.3 Renovation or Improvement Suggestions

Renovation suggestions will be detailed per home components; this will enable the homeowner to understand which of his home's components have a negative effect on its energy consumption, and to know which components are in good condition and energy-efficient and which ones require improvements or replacement. Monetary costs and benefits will be evaluated by means of the Web tool, whose operation is explained in the next Section.

6.3.4 Creation of a Website and Database

Since energy prices are largely volatile, it is important to enable co-owners to recalculate the energy consumption cost after substantial price variations. In addition, in case national or provincial energy efficiency targets are established and then increased, it seems appropriate for homeowners to be able to compare their home's energy performance with the new targets in effect.

To that end, a website for re-updating the energy efficiency report will be launched. The energy efficiency reports will be stored in an electronic database accessible on the Web. By entering his report's specific alphanumeric code, the homeowner of future buyer will be able to re-update the report with current energy prices and current energy efficiency targets established by government authorities, and even to download, for example, an updated PDF version of the report.

A tool will be developed on the website to enable homeowners to evaluate which energy efficiency improvements they want to prioritize; those improvements have different costs, return on investment times and services lives. Depending on the owner's financial availability and priorities, he will be able to find the sequence of energy efficiency improvements that is most cost-effective to carry out for his home.

6.4 PRESENTATION OF THE ENERGY PERFORMANCE REPORT (EPR)

The EPR's suggested presentation results from what was mentioned above: a first part presenting the home's energy performance results, i.e., energy consumption and CO_2 emissions, and a second part on proposals for modifications to various components in view of improving the home's energy performance.

The following pages present an approximate description of the energy rating report. The presentation we propose is inspired by the one used in the EPS pilot project, because the rating system we suggest is more similar to those developed in Europe.

The building's address and the report's alphanumeric code will be indicated visibly in the heading for purposes of identification and reference, as well as the date of the audit. The software used for the evaluation will also be identified, along with the evaluator's coordinates.

6.4.1 First Part: The Energy Efficiency Evaluation

For this first part, we opt for a presentation that facilitates the reading of essential data, with the help of tables making it easier to understand the data.

First, the home's estimated aggregate consumption in kWh is presented. The reported quantities of energy sources other than electricity are transposed in kWh by means of conversion factors whose details will appear later in the report. The monetary cost of total energy consumption is shown beside, in bold characters to highlight it.

A summary table, visually imposing, follows and details the measurements and uses of energy per production source; those energy sources are expressed in their natural physical units (kWh, m^3, litres). Energy prices in effect at rating time are clearly indicated, and the cost of each use is calculated.

The address of the website that may be consulted to re-update this part of the report appears afterward.

Information on carbon emissions is also presented in natural units (tonnes of CO_2, for example) in a summary table indicating the home's estimated pollution emissions per energy source and per use. The emissions total appears in bold characters to emphasize its importance visually.

On a colour scale, from green (the best consumption) to red (the worst consumption), the home's estimated energy consumption per square meter, and the national or provincial target, are presented after the two tables. Under this scale is expressed as a percentage the difference (positive or negative) between the home's energy consumption per square meter and the national or provincial targets. A similar scale regarding pollution emissions, as well as the percentage difference between the home and the targets, follows the first scale.

Cautions are issued about inevitable differences between energy quantities estimated during the evaluation and those that may actually be consumed. A section summarily explains how energy consumption was calculated, including a few explanations on standardization assumptions and modelling. The conversion factors used for converting under a common denominator (kWh) the main energy sources are identified. Explanations recalling that CO_2 emissions vary considerably according to electricity production source are presented.

This part is completed by a justification of provincial or national targets, by home carbon emission statistics and by brief advice on more-efficient behaviours that can help improve a housing unit's energy performance.

6.4.2 Second Part: Detailed Analysis and Recommendations

The report's second part presents the condition and efficiency of the building's various components, along with suggestions for improving, if applicable, the energy efficiency of some of its components.

This part of the report essentially addresses the economic aspect of energy efficiency: potential savings, modifications that could be made to the building and its components, the likely costs of those modifications, direct and indirect subsidy programs that can help owners make the modifications, etc.

To make it easier to understand, this part of the report begins with a summary of the performance of the various components that affect energy consumption.

Various proposals for energy improvements are detailed and classified in increasing order of costs and/or of the ratio of economic benefits over costs. Estimates, in natural physical units and in money, of the savings likely to be generated by the modifications, are presented. It is suggested to consult the Web tool to explore the various possible improvements.

Another summary table appears, based on the same model as the previous one, and giving estimated measurements of the energy that will be used per production source and use; those measurements are expressed in their natural physical units (kWh, m^3, litres) and in related monetary amounts, if the owner or buyer makes some of the proposed improvements.

The home's estimated energy consumption per square meter if the owner or buyer makes some of the proposed improvements is indicated, as well as the national or provincial target, again on a colour scale from green (the best consumption) to red (the worst). Under that scale again appears the difference between the home's energy consumption and pollution emissions per square meter and the national or provincial targets following the suggested improvement work.

In the print version of the rating report, only improvements costing less than $3,000[103] will be part of the estimated reduction in energy consumption. Using the Web tool, the homeowner can evaluate the precise impact of all the improvement possibilities open to him.

A section describing the inspectors' accreditation processes and the quality control will follow. A Web address and a telephone number appear where the owner can ask for additional explanations or justifications of the evaluation received by his building.

Provincial and federal financial incentives, subsidies and tax credits are detailed, along with, if applicable, their relations with proposed renovations or improvements. The Web addresses of relevant federal and provincial programs are added, as well as appropriate telephone numbers.

The report concludes with a suggestion to update the report and recalls the updating procedure.

[103] This threshold is arbitrary; in any case, the owner will have access to all possibilities for improvement by consulting the Web tool.

7. COST/BENEFIT FORECASTING MODEL

To our knowledge, no cost/benefit analysis has been performed on the economic impacts of establishing a mandatory home energy rating system. However, several studies have been conducted on related subjects such as: the link between a home's energy rating and its market value[104], the incidence of a mandatory energy rating on the energy consumption of the homes concerned[105], the effect of government subsidies on undertaking renovation or improvement work regarding energy performance[106], the quantification of energy savings resulting from renovation work[107], and the quantification of the value of additional information available to consumers when the energy rating is mandatorily disclosed[108].

The cost/benefit forecasting model as a result of implementing the proposed rating system will therefore be exploratory, and various assumptions or approximations will be used for calculation purposes.

It is important first to specify that the viewpoints from which those costs and benefits will be calculated are those of the federal government and Canadian consumers.

The basic assumptions on which the cost and benefit calculations will be done are as follows:

- The energy rating report will be paid for by the homeowner.

  This approach is in line with the common practices of the rating systems studied, and was found in each of those systems.

- The energy rating report will be at full cost to the consumer (the owner), i.e., it will include all necessary costs for the development and operation of the rating system, including the costs of design, marketing, the energy audit, the database's creation, the website and the quality control system.

  As with the Danish experience, during the production of the rating report the inspectors will have to pay a percentage of their inspection revenues in order to cover the system's administrative fees.

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[104] **BROUNEN, Dirk et Nils KOK,** *On The Economics of Energy Labels in the Housing Market*, Maastricht University, Netherlands, November 2009, 32 pages. [Online] http://urbanpolicy.berkeley.edu/greenbuilding/brounenkok.pdf (page consulted on May 14, 2010).

[105] **KJÆRBYE, Vibeke Hansen**, *Does Energy Labelling on Residential Housing Cause Energy Savings?,* AKF, Danish Institute of Governmental Research, Copenhagen, Denmark, December 2008, 31 pages. [Online] http://www.akf.dk/udgivelser/2008/pdf/energy_labelling.pdf (page consulted on March 20, 2010).

[106] **SHORROCK, L.D.**, *An analysis of the effect of Government grants on the uptake of home insulation measures*, ELSEVIER, Amsterdam, United Kingdom, Energy Policy 27, number 3 (March 1999), pp. 155-171.

[107] **HASSET, Kevin and Metcalf, Gilbert**, *Measuring the Energy Savings From Home Improvements Investments: Evidence from Monthly Billing Data,* February 1997, available on the website of Tufts University's Economics Department. [Online] http://ase.tufts.edu/econ/research/documents/prior2000/papers1997-01.pdf (page consulted on May 14, 2010)

[108] **GILMER, Robert,** *Energy labels and economic search: An example from the residential real estate market*, ELSEVIER, Amsterdam, United Kingdom, Energy Policy 11, number 3 (July 1989), pp. 213-218.

- Our assumption will be that all homes will be evaluated as early as the first year of the program's establishment.

  This assumption aims to simplify calculations, because certain parameters of the forecasting model will vary over time, such as future energy prices of monetary values attributed to reducing pollution emissions. For the purpose of forecasting costs and benefits, it is easier to use the same set of data for those values.

- We will assume that owners who undertake improvement work following receipt of the rating report will do so immediately, so that resulting energy savings will appear as soon as the program is established.

  This assumption also aims to simplify calculations for the purpose of our forecasts, by not spreading over time the benefits of the proposed rating system.

7.1 COSTS AND BENEFITS TO THE FEDERAL GOVERNMENT

On the basis of the above assumptions, we can forecast that the costs to the federal government will be nil, since they will be paid in full by the consumer owners. However, the benefits to the federal government may be substantial: should the established system generate tangible energy savings, several choices offered to energy producers appear to benefit the Government of Canada in all cases considered.

For example, if energy savings are made and energy producers retain the same production capacities, this energy saved in the residential sector can be used in other sectors of the economy or even resold outside the country, thus increasing Canada's gross domestic product. Since the federal government's tax revenues are directly related to the gross domestic product, the federal government will benefit from increased tax revenues, which can in turn be reinvested in aid programs for improving the energy efficiency of residential buildings.

Again with the prospect that energy producers will take advantage of the generated savings to reduce their production, it will be possible to dismantle one or more electricity-producing nuclear power plants. A serious incident in one of those plants, while unlikely due to the stringent standards for those facilities in Canada, remains possible; such an incident would provoke a national, even continental catastrophe. The Three Mile Island[109] and Chernobyl[110] incidents give an idea of the devastating effects that such a tragedy would have on Canadian soil. The Canadian Nuclear Safety Commission (CNSC) takes this possibility very seriously[111]. Dismantling a few of those plants would reduce the risk of such an incident occurring. The costs of inspecting the plants would be saved and the risks to the Canadian population would be diminished.

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[109] **Unknown author**, *L'accident nucléaire de Three Mile Island*, on the website Wikipedia.fr, version of April 18, 2010. [Online] http://fr.wikipedia.org/wiki/Three_Miles_Island#L.27accident_nucl.C3.A9aire_de_Three_Mile_Island (page consulted on April 29, 2010).

[110] **Unknown author**, *Catastrophe de Tchernobyl*, on the website Wikipedia.fr, version of April 26, 2010. [Online] http://fr.wikipedia.org/wiki/Catastrophe_de_Tchernobyl (page consulted on April 29, 2010).

[111] **Unknown author**, *Les CANDU présentent un risque*, on the website of Société Radio-Canada, Montreal, Quebec, March 4, 2010. [Online] http://www.radio-canada.ca/nouvelles/National/2010/03/04/002-CANDU-risque-CCSN.shtml, (page consulted on April 29, 2010).

Moreover, GHG emissions are closely related to energy use, particularly when energy is produced by using a fossil fuel. In the event that energy producers reduce the quantity of energy produced by means of fossil fuels, the country's overall GHG emissions will be reduced, which will enable Canada to improve its outcomes in this regard. This would benefit Canada's image internationally, where environmental outcomes have been growing in importance for several years.

In addition, the eventual establishment of international carbon trading will give Canada the opportunity to cash in on future reductions in pollution emissions. Using a few working assumptions, we evaluated that the monetary value of reduced CO_2 emissions would be $2.7 billion[112] for Canada.

The project's total value from the Canadian government's viewpoint is much greater, but the benefits from energy producers' uses of the extra energy, from a reduced nuclear risk and from a better international reputation are difficult to quantify. We think the value of $2.7 billion put forward is a floor that underestimates the total benefits.

Given the multiple benefits to it, the federal government can only win by establishing a mandatory energy rating system fully paid for by consumers.

7.2 COSTS AND BENEFITS TO CONSUMERS

The analysis is more complex from consumers' point of view, because it must be ensured that their benefits from the establishment of the proposed mandatory energy rating system exceed the costs that they alone will bear. Since several essential parameters for calculating a cost/benefit forecasting model are unknown and must be based on projections for coming years (for example, future energy prices), the following analysis will be exploratory and will attempt to evaluate, using conservative assumptions, the net present value (NPV)[113] per home of the mandatory energy rating system proposed for homes.

The benefit calculation can be broken down into several parts. First there are energy benefits, i.e., economic benefits from reducing energy bills, and then there are non-energy benefits, i.e., increased comfort (from the consumer using savings to raise the average temperature – the so-called "rebound effect"), reduce health problems (from improved indoor air quality thanks to the work done), reduced fire hazards, etc. Environmental benefits such as reduced atmospheric pollution, as discussed in the "Costs and Benefits to the Federal Government" Section, would of course also benefit consumers.

The net present value per home will be defined as follows: the sum of benefits to homeowners having improvement work done is discounted over the useful life of the work; the initial investments are then subtracted from that amount. The result of this calculation is multiplied by the household participation rate, and from this result is subtracted the cost of the energy audit, to obtain the net present value (NPV) per home of the energy rating project (whether or not the owner makes energy efficiency investments).

[112] Detailed assumptions and calculations are presented in Annex 10.
[113] Regarding the concept of net present value, refer to the website **Wikipedia,** *Net present value*, May 12, 2010. [Online] http://en.wikipedia.org/wiki/Net_present_value (page consulted on May 14, 2010).

We must therefore make several assumptions about the parameters entering into the above calculation. Assumptions will be made on: the cost of the energy audit, the percentage of owners who will have improvement work done on their home, the average cost per home of improvement work, the average quantity of energy saved per home, the useful life of the work, future energy prices, the discount rate[114] and an estimate of the rebound effect. We will justify those assumptions in turn.

7.2.1 Costs

The evaluation report of Oregon's EPS pilot project has demonstrated that it is possible to develop a reliable energy audit model based on a limited number of parameters; this reduces auditing time and thus the rating report's production cost. Accordingly, it is quite possible that the proposed energy audit will cost less than the current EnerGuide audit. However, to avoid underestimating the rating report's full cost, to be borne by the consumer, the cost of an EnerGuide evaluation – currently $300[115] – will be used for the calculations.

7.2.2 ENERGY BENEFITS

To estimate energy benefits, it will be necessary to determine the proportion of homeowners who will follow suggestions for improvement (what we will call "the participation rate").

Two data sources give us two estimates of the participation rate. During the April 1998 to October 2000 evaluation of the "EnerGuide for Houses" program[116], the forerunner of the ecoEnergy program, it was established that 70% of households who had received a pre-work EnerGuide evaluation (called type "A" evaluation in the report) did renovation work afterward. In addition, 50% of remaining households said they wanted to undertake improvement work in the future, so that the evaluation report's authors concluded that:

> *"Through the quality assurance telephone interview completed in March 2000, it was determined that over 85% of recipients of "A" evaluations have already or intend to follow through on the recommendations."*[117]

Moreover, the evaluation report of the Danish experience indicated that over 45% of homeowners who had received an evaluation had work done in the following year[118], despite the

[114] For a definition of the discount rate, refer to the website **Wikipedia,** *Discounting – Discount rate*, April 24, 2010. [Online] http://en.wikipedia.org/wiki/Discounting (page consulted on May 14, 2010).
[115] RénoClimat page – *Energy evaluation*, available on the website of the Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d. [Online] http://www.aee.gouv.qc.ca/mon-habitation/renoclimat/evaluation-energetique/#c46 (page consulted on April 29, 2010).
[116] **Natural Resources Canada**, *Evaluation of the Energuide for Houses Program*, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 2010. [Online] http://www.nrcan.gc.ca/evaluation/reprap/2001/energuide-eng.php (page consulted on May 14, 2010).
[117] **Natural Resources Canada**, *Evaluation of the Energuide for Houses Program*, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 2010. [Online] http://www.nrcan.gc.ca/evaluation/reprap/2001/energuide-eng.php (page consulted on May 14, 2010).
[118] **LORENZEN, Kirstine for COWI**, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003, p. 26. [Online]

initial mishaps of the program's implementation (see Section 2.1 – The Danish Model (1997 to 2006) - Recommendations).

The participation rate used for the forecasting model will be 50%. This conservative assumption will prevent us from overestimating energy savings made by consumers, even while taking as a given that the implementation of the mandatory energy rating program will succeed.

The evaluation of the "EnerGuide for Houses" program indicates that the average value of renovation work done was $3,826 (in year 2000 dollars)[119], which is equivalent to $4,592 in 2010, given that the cumulated inflation rate from 2000 to 2009 was approximately 20%[120]. The evaluation report mentions that:

> *"The quality assurance telephone interview also asked about the expenditures that had been made on renovations undertaken after the EnerGuide visits. The weighted average expenditure on renovations completed was $3,826/house although this may not all be on energy efficiency renovations."*[121]
> *(Emphasis ours)*

In attributing a cost of $4,592 per participating household for energy efficiency improvement work, we thus overvalue those costs, since part of the costs paid by participants in the "EnerGuide for Houses" program were for considerations other than energy savings (for example, for sanitary or aesthetic reasons). Our assumption will therefore reduce the estimated overall cost-effectiveness of energy efficiency work in the view of consumers. At this time, it is assumed that no aid or financing program will be established and that the owner will bear those costs alone, as was the case for the "EnerGuide for Houses" program until 2005.

The energy savings resulting from the work should now be estimated. In the evaluation report of the "EnerGuide for Houses" program, those savings were evaluated at 27GJ per home annually[122], i.e., about 7500 kWh annually[123]. However, according to data provided by the Agence de l'efficacité énergétique du Québec, annual savings generated by participants in the *Rénoclimat* program (and thus the current ecoEnergy program; see Section 4.1 – Refunds and

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http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf, (page consulted on March 27, 2010).

[119] **Natural Resources Canada**, *Evaluation of the Energuide for Houses Program*, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 2010. [Online] http://www.nrcan.gc.ca/evaluation/reprap/2001/energuide-eng.php (page consulted on May 14, 2010).

[120] **Statistics Canada**, *Consumer Price Index, historical summary (1990-2009),* on the website of Statistics Canada, Government of Canada, Ottawa, March 2010. [Online] http://www40.statcan.ca/l01/cst01/econ46a-eng.htm (page consulted on May 14, 2010), author's calculations.

[121] **Natural Resources Canada**, *Evaluation of the Energuide for Houses Program*, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 2010. [Online] http://www.nrcan.gc.ca/evaluation/reprap/2001/energuide-eng.php (page consulted on May 14, 2010).

[122] **Natural Resources Canada**, *Evaluation of the Energuide for Houses Program*, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 2010. [Online] http://www.nrcan.gc.ca/evaluation/reprap/2001/energuide-eng.php (page consulted on May 14, 2010).

[123] **National Energy Board**, *Energy Conversion Tables*, Government of Canada, National Energy Board, Calgary, Alberta, April 2004 [Online] http://www.neb.gc.ca/clf-nsi/rnrgynfmtn/sttstc/nrgycnvrsntbl/nrgycnvrsntbl-eng.html, (page consulted on May 14, 2010), author's calculations.

Tax Credits) will be in the order of 17GJ[124,125], i.e., about 4700 kWh annually. So we will attribute 4700 kWh to the generated savings in order to obtain, again, an estimate of expected benefits that is as cautious as possible. Those benefits are those that result from a lower energy bill and should not be confused with non-energy benefits, whereby the occupant raises his comfort level at a lower cost following improvement work. The useful life attributed to savings generated by improvement work done will be 20 years (see Annex 9 for a discussion of this assumption).

Future energy prices by the end of the work's useful life constitute of course an important parameter for estimating the monetary value of energy savings. Certain renowned economists, including Jeff Rubin, former chief economist at CIBC Bank, believe that the price of a barrel of oil may reach US$200 by 2012[126]. Such an increase would likely have a major ripple effect raising the prices of other forms of energy. However, we will retain more-cautious forecasts of future energy prices, i.e., the forecasts used by the Ontario government to estimate that province's long-term economic prospects[127], with a barrel of oil valued at $130 in 2030 – about double the price at forecast time[128]. The same document mentions that natural gas prices should more than double by 2030. We will therefore retain the assumption that energy prices will double by 2030 (the last year of the useful life of suggested improvement work). This implies a 3.5% nominal annual rate of increase[129], and an 1.5% actual increase in energy prices if inflation over this period is at the median point (2%) of the Bank of Canada's inflation-control target[130].

The initial energy prices used are the latest available for the residential sector in Canada[131], i.e., those of 2007, and will be weighted by the part of the energy sector of origin (electricity, natural

[124] **Agence de l'efficacité énergétique du Québec**, *Tableau 1: Coût de revient et résultats du TCTR par secteur d'activité pour les programmes de l'Agence et des distributeurs d'énergie,* available on the website of la Régie de l'énergie du Québec, January 2010, p. 1. [Online] http://www.regie-energie.qc.ca/audiences/3709-09/RepDDRAEE_3709-09/B-16_AEE-4Doc3-REV_Tableau1_3709_05jan10.pdf, (page consulted on May 14, 2010).

[125] **Agence de l'efficacité énergétique du Québec**, *Tableau de répartition par P/A*, available on the website of la Régie de l'énergie du Québec, October 2009, p. 9. [Online] http://www.regie-energie.qc.ca/audiences/3709-09/Demande_3709-09/B-1_AEE-4Doc2-3_3709_02oct09.pdf, (page consulted on May 14, 2010), author's calculations.

[126] **DÉCARIE, Jean-Philippe,** *Le baril de pétrole à 200$, ça s'en vient!*, Rue Frontenac, Montreal, Quebec, February 11, 2010. [Online] http://ruefrontenac.com/jpdecarie/17791-jeff-rubin-petrole, (page consulted on May 14, 2010).

[127] **Ontario Ministry of Finance,** *Ontario's Long-Term Report on the Economy, Chapter 2: Long-Term Ontario Economic Projection,* Government of Ontario, Ministry of Finance, January 22, 2010. [Online] http://www.fin.gov.on.ca/en/economy/ltr/2010/ch2.html (page consulted on May 14, 2010).

[128] The forecasts appear to have been made in mid-2009 – see Graphic 7 in: **Ontario Ministry of Finance,** *Ontario's Long-Term Report on the Economy, Chapter 2: Long-Term Ontario Economic Projection,* Government of Ontario, Ministry of Finance, January 22, 2010. [Online] http://www.fin.gov.on.ca/en/economy/ltr/2010/ch2.html (page consulted on May 14, 2010).

[129] In the economics jargon, the nominal rate is approximately the sum of the real rate and the inflation rate. In this regard, see **Wikipedia,** *Real interest rate,* March 31, 2010. [Online] http://en.wikipedia.org/wiki/Real_interest_rate (page consulted on May 14, 2010).

[130] **Bank of Canada,** *About the Bank – Inflation-Control Target,* Montreal, Quebec, September 2009. [Online] http://www.bankofcanada.ca/en/backgrounders/bg-i3.html (page consulted on May 14, 2010).

[131] **Office of Energy Efficiency,** *Residential Energy Prices and Background Indicators – Year 2007*, on the website of Natural Resources Canada, Government of Canada, Natural Resources, Ottawa, Ontario, December 7, 2009. [Online] http://oee.nrcan-rncan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_18_e_4.cfm?attr=0 (page consulted on May 14, 2010).

gas or heating oil) due to the quantities consumed[132] in the residential sector over this period. By using EEO's conversion factors to convert data on natural gas and heating oil into kilowatt-hours[133], the average price we obtain for energy consumed in the residential sector is 7.054 ¢/kWh.

Finally, a real discount rate of 4% will be used for discounting future benefits, which implies a nominal rate of about 6% - well above the nominal annual interest rates of Canada premium bonds, which were at 1% for a 10-year maturity in the latest issue, beginning in 2009[134].

We now have in hand all the necessary elements for evaluating from consumers' viewpoint the cost-effectiveness of the mandatory energy rating project.

Given the above mentioned assumptions and parameters, which constitute our basic scenario, we calculated a net discounted value of about $62 per real estate transaction. This amount may seem low, but again, for all the parameters and assumptions used, we chose the most conservative possible values so as not to overestimate the gains associated with the proposed project, and we assumed that the homeowner alone will bear renovation costs, although the government is sure to accumulate benefits and will eventually be able to fund part of the work. To estimate the gains that would result from more-optimistic values for certain parameters, we will proceed to a short sensitivity control[135] of the results. We will consider the variation in average net discounted value per transaction according to future energy prices.

The retained assumption of the $130 price of a barrel of oil in 2030 implies a 1.5% annual escalation of its actual price; afterward we attributed that escalation to the other energy sources. As mentioned, some forecasters think the price of a barrel of oil will reach $200 as early as 2010, which implies an astronomical price by 2030. Accordingly, we will consider the impact of a faster escalation of real energy prices than the one we assumed in our basic scenario. As an indication, $190 for a barrel of oil in 2030 – a price that is about three times higher than the initial price in 2009 used by the Ontario government in its long-term economic forecasts, but that rises much less rapidly than in Jeff Rubin's more alarmist forecasts – generates an escalation of the real price in the order of 3.5% annually[136]. Moreover, in considering a broader range of

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[132] **Office of Energy Efficiency,** *Residential Secondary Energy Use by Energy Source and End-Use – Year 2007*, on the website of Natural Resources Canada, Government of Canada, Natural Resources, Ottawa, Ontario, December 7, 2009. [Online] http://oee.nrcan-rncan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_1_e_4.cfm?attr=0 (page consulted on May 14, 2010).

[133] **National Energy Board**, Energy Conversion Tables, Calgary, Alberta, April 2004. [Online] http://www.neb.gc.ca/clf-nsi/rnrgynfmtn/sttstc/nrgycnvrsntbl/nrgycnvrsntbl-eng.html (page consulted on May 14, 2010), author's calculations.

[134] **Government of Canada,** *Canada Premium Bonds Annual Interest Rates,* March 30, 2010. p. 3. [Online] http://csb.gc.ca/wp-content/uploads/2009/03/s92_cpb.pdf (page consulted on May 14, 2010).

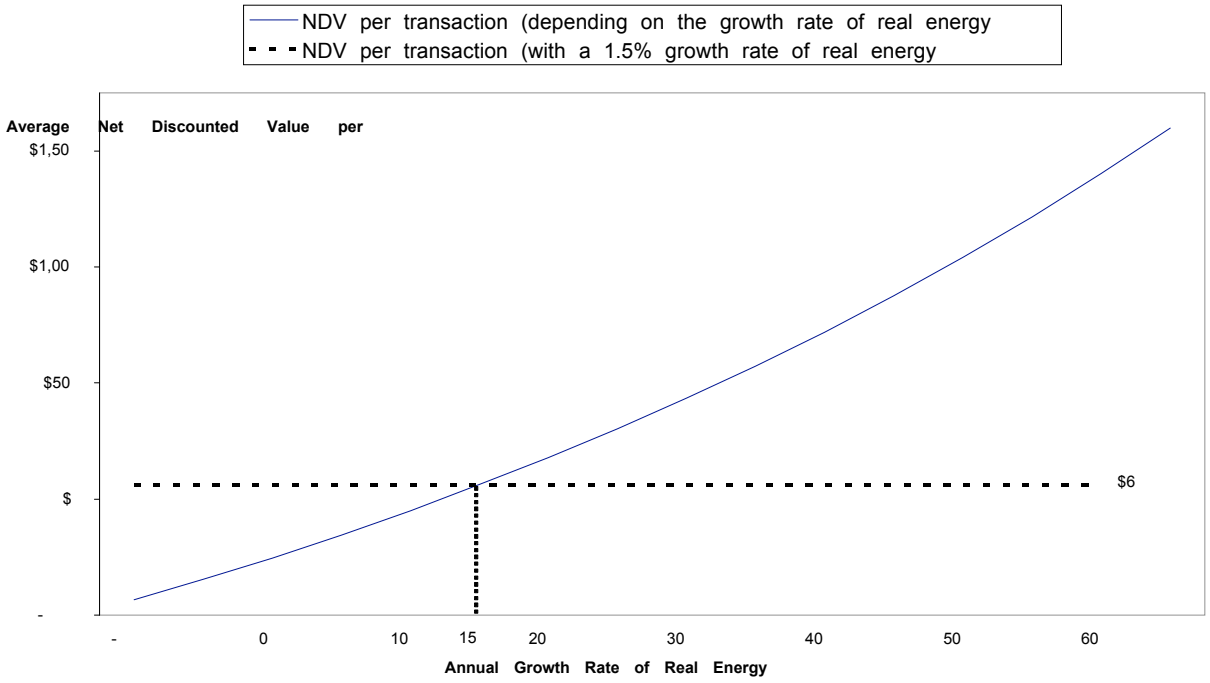
[135] Regarding the concept of sensitivity control,refer to **Wikipedia,** *Analyse du cycle de vie – contrôle de sensibilité,* April 7, 2010. [Online] http://fr.wikipedia.org/wiki/Analyse_du_cycle_de_vie#Contr.C3.B4le_de_sensibilit.C3.A9, (page consulted on May 14, 2010).

[136] A 3.0% rate of increase in real energy prices is used in a recent cost/benefit study of energy efficiency renovation work. **PAGE, Ian,** *Cost benefits of sustainable housing retrofits,* Beacon Pathway Limited, New Zealand, April 2009, p. 32. [Online] http://www.beaconpathway.co.nz/images/uploads/Final_Report_TE106(19)Cost_Benefits_of_Sustainable_House_Retrofits.pdf (page consulted on May 14, 2010).

future energy prices, we will examine the case where the price of a barrel of oil reaches $330 in 2030; the annual real price increase would then be 6.5%.

The (blue) curve in Graphic 1 visually illustrates the impact of the annual increase in real energy prices on the average net discounted value per real estate transaction (i.e., whether or not the homeowner has improvement work done) according to the proposed model of mandatory home energy rating when all the other parameters retain the same values as in the basic scenario.

Graphic 1. Average Net Discounted Value per Real Estate



The greater the annual rate of increase in real energy prices, the greater the energy savings, so that the net discounted value per real estate transaction increases. In particular, if the annual rate of increase in real energy prices is higher than 1.5% – the value retained in the reference scenario –, the average net discounted value per home will rapidly exceed $62. The average net discounted value per home will be $573 for a 3.5% annual rate of increase in real energy prices (which implies a price of $190 for a barrel of oil by 2030) and about $1,600 for a price of $330 for a barrel of oil by 2030.

7.2.3 Non-Energy Benefits

Non-energy benefits (NEBs) are other than those related to reduced energy bills as a result of energy efficiency improvement work. The two main types of non-energy benefits generally considered are those related to increased comfort (the occupant being henceforth able to increase his home's comfort at lesser cost, either by heating more in winter or by air conditioning more in summer) and those related to reduced GHG emissions, which we discussed in analysing benefits to the government.

In other words, the energy benefits calculated above do not include all realizable energy savings, because part of the latter are recovered by the user increasing his comfort level.

The scientific literature recognizes the difficulty of estimating the value of comfort-related benefits, given their eminently subjective nature[137]. Estimates of the quantities of energy saved that are recovered to raise home comfort range, in proportion to energy benefits, from 12%[138] to 18%[139] and up to 21.5%[140] according to various authors' estimates. We will retain the number that is at the bottom of the range of available estimates, i.e., 12%, to remain cautious in evaluating the comfort benefit.

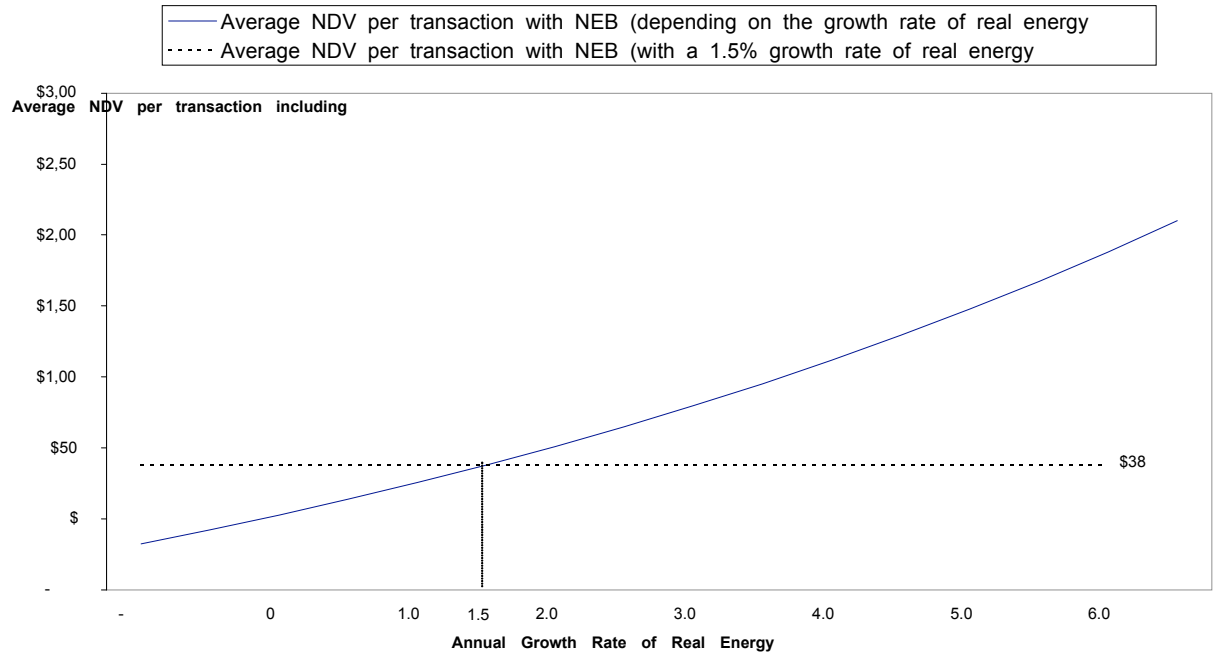
In retaining the assumptions and parameters of our reference scenario, we calculated that the average net discounted value per real estate transaction (i.e., whether or not the homeowner makes the energy efficiency improvements suggested by the audit) is $480 when benefits due to increased comfort are included in the calculation of benefits.

[137] **CLINCH, J.Peter and HEALY, D. John,** *Cost-benefit analysis of domestic energy efficiency*, ELSEVIER, Amsterdam, United Kingdom, Energy Policy 29, numéro 2 (January 2001), p. 120.
[138] **RIGGERT, Jeff,** *An Evaluation of the Energy and Non-energy impacts of Vermont's Weatherization Assistance Program,* on the website of Vermont Department for Childrens and Families*,* TecMRKT Works, Wisconsin, United States, November 1999, p. 59. [Online] http://dcf.vermont.gov/sites/dcf/files/pdf/oeo/1999Energy_Non-EnergyImpactsofWeatherization.pdf, (page consulted on May 18, 2010).
[139] **CLINCH, J. Peter and John D. HEALY,** *Cost-benefit analysis of domestic energy efficiency*, **ELSEVIER, Amsterdam**, United Kingdom, Energy Policy 29, number 2 (January 2001), p. 121, author's calculations.
[140] **PAGE, Ian,** *Cost benefits of sustainable housing retrofits,* Beacon Pathway Limited, New Zealand, April 2009, p.16 and following, author's calculations. [Online] http://www.beaconpathway.co.nz/images/uploads/Final_Report_TE106(19)Cost_Benefits_of_Sustainable_House_Retrofits.pdf, (page consulted on May 14, 2010).

Graphic 2 illustrates the effect of including non-energy benefits on the rating project's net discounted value per real estate transaction. We note that the average net discounted value per transaction is positive for almost all considered rates of increase in real energy prices; and that the average net discounted value per real estate transaction can prove very high – $953 if the price of a barrel of oil rises to $190 in 2030, and $2,100 if the price of oil reaches $330 in 2030.

This indicates that by including certain non-energy benefits, the mandatory energy efficiency project is cost-effective for all consumers over an entire range of future energy prices.

Graphic 2. Average Net Discounted Value Including Non-Energy Benefits per Real Estate



7.2.4 Homeowners on a Modest Budget

Although we have demonstrated that the mandatory energy rating system appears cost-effective for homeowners as a whole, some of them may not be able to benefit from the system, given that the benefits will arise only if a homeowner makes investments to improve his building's structure or equipment. Indeed, homeowners on a modest budget generally do not have the means to invest in energy efficiency improvement work, even if it is cost-effective financially – a lack of short-term resources deprives them of the long-term benefits of an immediate investment. A recent study provides in this regard an overview of the scale of the problem: data from 1998 to 2005 of the "EnerGuide Program for Houses" program indicate that only 3.8% of participants with an annual income of less than $40,000 participated in the program, whereas those households represented 31% of the Canadian population[141].

[141] **MARUEJOLS, Lucie and David L. RYAN,** *Generalizing Home Retrofit Program Results to Non-Participants*, May 2009, available on the website of Canadian Building Energy End-Use Data and Analysis Centre, p. 24. [Online]

Given the benefits that the mandatory energy rating system would provide to the Canadian government, it appears reasonable that the latter reinvest part of this appreciation in a program of financial assistance to people of modest income who want to improve their home's energy efficiency. Similar financial assistance programs are already established in some Canadian provinces, such as New Brunswick[142], and in several American northeastern states, such as Vermont.

In the case of Vermont, the program's cost-effectiveness has been evaluated, and the results indicate that the energy cost/benefit ratio is 1.53 and increases to 5.03 when non-energy benefits are included in the calculation; that is, each dollar invested in the program generates total benefits evaluated at $5.03[143].

7.2.5 Tenants and Homeowners

For tenants who will pay their home's energy bill, it goes without saying that having access to standardized information on the energy consumption and bill of a desired home confers a definite advantage. This avoids nasty surprises when the home is poorly insulated and the energy bill higher than what they could normally expect. In addition, when the work is done, those tenants will likely see their energy bill reduced.

For rental building owners who do not live in their building, it remains that they will have substantial incentives to invest in energy efficiency improvement, because several studies demonstrate that good home energy performance increases a building's value, which will be reflected in its sale price[144]. Moreover, the tenants' lower energy bills can likely be recovered in part by the homeowner through a slightly higher rent, which will enable him to recover the amounts invested in improvements generating those savings for tenants. It thus seems that rental building owners would benefit from making energy efficiency improvements following the establishment of an energy rating that is mandatorily disclosed before a lease is signed.

http://www.cbeedac.com/publications/documents/SelectivityprobleminEGH_001.pdf, (page consulted on May 14, 2010).

[142] **Government of New Brunswick,** *Energy Efficiency Retrofit Program for Low Income Households,* on the website of the Executive Council Office, CNB, Supply and Services – Social Development, Government of New Brunswick, Fredericton, New Brunswick, May 16, 2010. [Online] http://app.infoaa.7700.gnb.ca/gnb/Pub/EServices/ListServiceDetails.asp?ServiceID1=19556&ReportType1=ALL (page consulted on May 16, 2010).

[143] **DALHOFF, Gregory,** *An Update of the Impacts of Vermont's Weatherization Assistance Program,* on the website of Vermont Department for Childrens and Families*,* Dalhoff Associates, Wisconsin, United States, February 2007, pp. ES1-ES2. [Online] http://dcf.vermont.gov/sites/dcf/files/pdf/oeo/2007ImpactofVTWeatherizationProgram.pdf (page consulted on May 15, 2010).

[144] **BROUNEN, Dirk and KOK, Nils,** *On The Economics of Energy Labels in the Housing Market*, Maastricht University, Netherlands, November 2009, 32 pages. [Online] http://urbanpolicy.berkeley.edu/greenbuilding/brounenkok.pdf (page consulted on May 14, 2010).

7.3 LIMITS TO THE SCOPE OF THE FINDINGS

The findings of this cost/benefit forecasting analysis demonstrate the potential importance of benefits of all kinds to consumers and the Canadian government. It should be recalled, however, that it is a forecasting analysis and that, by its nature, it is based on certain parameters whose values can only be estimated or assumed. In addition, the results are, as we indicated, the fruit of certain working assumptions. In any case, we think we were cautious in not overestimating the potential of the mandatory home energy rating project. It remains that the results depend on those forecasts or assumptions and that the estimated benefits are not guaranteed.

8. CONCLUSIONS

This study aimed at evaluating the relevance and feasibility of establishing a mandatory home energy rating system in Canada and identifying various complementary issues, notably regarding public or private incentive programs that would deserve to be adapted or developed as part of the proposed rating system.

To that end, we did an overview of certain foreign mandatory energy rating models of interest, in Europe and in the State of Oregon in the United States. In Denmark, the first mandatory home rating initiatives date from about 15 years. European Union Directive 2002/91/EC imposed on member countries the establishment of a mandatory home rating system beginning on January 4, 2009. The State of Oregon also legislated in 2009 to implement such a system. Australia also took this path. Mandatory building energy ratings thus constitute a major trend internationally, given that buildings generally release between 35% and 40% of a country's GHG emissions.

In Canada, at this time, there are no mandatory energy efficiency initiatives in place, although the Ontario government and the Agence de l'efficacité énergétique du Québec have announced their intention to establish such a program in their respective provinces.

The current Canadian situation of incentives for good home energy performance is fragmented. For new constructions, several seals of quality with important energy efficiency components are available, including, mainly, the R-2000 Standard developed by Natural Resources Canada or seals inspired by it, and the American Energy Star seal of quality that the Energy Efficiency Office promotes and of which it monitors the use. The R-2000 family's seals generally require a certain energy performance measured by the Canadian EnerGuide energy audit system and the rating of the same name.

In the case of existing homes, the EnerGuide rating system is used by multiple home energy subsidy or improvement programs on a national scale in order to establish subsidies to which homeowners will be eligible. Generally, provincial governments enhance the federal government's ecoEnergy Retrofit – Homes program[145]. The amount of subsidies granted depends on the work done, which must, for homeowners to receive financial assistance, be in line with work recommended during the pre-work energy efficiency audit.

Canada thus has a voluntary energy rating system, whose rating is necessary for obtaining certain seals of quality for new homes, as well as government subsidies for carrying out energy efficiency work. However, disclosure of the EnerGuide rating obtained is not mandatory during home sales or rentals.

[145] As we indicated earlier, the federal government's ecoEnergy Retrofit – Homes Program is temporarily suspended: **Bryden, Joan,** *Ottawa suspend le programme de rénovations écoENERGIE*, in Cyberpresse, Mon toit Section, Montreal, Quebec, April 1, 2010.
[Online] http://montoit.cyberpresse.ca/renovation/201004/01/01-4266724-ottawa-suspend-le-programme-de-renovations-ecoenergie.php (page consulted on April 5, 2010).

In the foreign systems studied, disclosure of the energy rating was mandatory during home sales or resales. Only the Danish experience of the mid-nineties did not impose disclosure during the rental of housing units, but the subsequent European Directive made such disclosure mandatory; this was also the case for the State of Oregon's EPS pilot project.

In view of these international trends in mandatory home energy ratings, and Canada's international environmental commitments, it is obvious to us that implementing such a mandatory rating system with mandatory disclosure for home sales, resales and rentals is necessary. In addition, since the ultimate goal of this approach is not only to save energy, but also to reduce GHG emissions, the rating system should have a component related to pollution emissions justifying its characterization as an ecological rating system.

In our overview of foreign models, we highlighted the practices that seem most effective. Apart from the usual recommendations for a standardized rating making the rating independent from the behaviour of occupants, we suggested that the system to be established in Canada be based mainly on home energy consumption in absolute terms, i.e., the resulting rating report will prominently indicate the necessary kWh energy quantity for ordinary home use and related monetary amounts. This differs from ratings used in the United Kingdom and France, and from the current Canadian EnerGuide rating, which express home performance on the basis of energy consumed per square meter. We think the difference is important.

In emphasizing home energy efficiency consumption, the aim is to reduce the housing stock's total energy consumption, which avoids giving favourable ratings to large new constructions that may be relatively energy-efficient, but consume more energy because of their large area. However, we retained the calculation and mention of energy consumed per square meter, in order to enable a comparison with a national or provincial energy-intensity target that the federal government should announce and the provinces add to.

A novelty is introduced in our rating system: the possibility of re-updating one's home evaluation by means of a dedicated website. Due to the great volatility of energy prices and the possible revision of national or provincial energy efficiency targets, a homeowner who wants to obtain an up-to-date report can do so easily with this tool. This seems important to us, because energy prices have a direct impact on the cost-effectiveness of energy efficiency investments.

Similarly to what is done in the foreign systems we studied, we combine the mandatory home energy rating with proposals to improve the building evaluated. Given the similarity of this aspect of the system we propose and the current resources already available in Canada, particularly concerning the EnerGuide system, we think it possible to develop at low cost a new energy efficiency audit model, and related software, that will take into account a limited number of elements in order to produce the energy efficiency evaluation report at low cost. Such an approach has been taken successfully in Oregon's EPS pilot project by means of home energy consumption simulation software called "Simple".

The cost/benefit forecasting analysis of the proposed energy rating system suggests opportunities for interesting economic benefits. To reduce the prospective aspect of the analysis, we systematically chose conservative values for variables that were not known with certainty, thus voluntarily underestimating the potential gains of the mandatory energy rating project. The balance sheet of evaluation costs, energy efficiency investments and lower home energy bills reveals that the economic benefits to the consumer appear greater than the costs over a wide range of result-sensitive parameters, such as the real growth rate of energy prices during the useful life of energy efficiency improvement work.

When non-energy benefits, such as the increased comfort of participating owners, are added to lower energy bills, we obtain average net benefits per home (whether or not the homeowner makes the energy efficiency improvements suggested during the audit) that are clearly more substantial.

From the viewpoint of consumers as a whole, who will pay all the costs related to the suggested rating system, the project seems clearly profitable. Without having to fund the program directly, the Government of Canada will reap a panoply of benefits following the establishment of the mandatory home rating system: part of the energy consumed can increase its tax revenues and the Canadian gross domestic product; closing certain nuclear power plants can be considered, thus limiting inspection expenses and the risks of catastrophe; a reduction in pollution emissions can be profitable to Canada through an international system for the exchange of polluting rights (we estimated these profits to be $2.7 billion at minimum) and will restore the country's international image regarding its environmental policies.

We conclude that the Government of Canada should restore the "ecoEnergy Retrofit – Home" program[146] it recently suspended and establish a subsidy system for homeowners on a modest budget, who generally do not have the financial means to take advantage of the major opportunities for cost-effective home energy efficiency investments.

Establishing a mandatory home energy rating system in Canada is required. The result will be a country in better economic and ecological condition, and fairer, if profits are more equitably shared between Canadian consumers.

[146] Ottawa announced in April that the federal government's ecoEnergy Retrofit – Homes Program was temporarily suspended: **Bryden, Joan,** *Ottawa suspend le programme de rénovations écoENERGIE*, in Cyberpresse, Mon toit Section, Montreal, Quebec, April 1, 2010. [Online] http://montoit.cyberpresse.ca/renovation/201004/01/01-4266724-ottawa-suspend-le-programme-de-renovations-ecoenergie.php, (page consulted on April 5, 2010).

9. RECOMMENDATIONS

With regard to the establishment of a mandatory home rating system:

- **Whereas** mandatory home ratings constitute a general trend internationally;
- **Whereas** Canada has pledged to implement the Kyoto Accord;
- **Whereas** homes release substantial pollution emissions;
- **Whereas** home ratings help increase energy efficiency investments;
- **Whereas** a mandatory home energy rating system could be established at no cost to the federal government;
- **Whereas** a mandatory home energy rating system would likely generate substantial benefits – both economic and non-energy – to Canadian consumers as a whole as well as governments;
- **Whereas** a mandatory home energy rating system would likely improve Canada's image internationally;

Union des consommateurs recommends:

1. That the federal government put in place a mandatory home energy rating system;

With regard to the mandatory home energy efficiency system:

- **Whereas** mandatory-disclosure home ratings constitute an important source of information on a home's energy consumption for any future tenant or buyer of a home;
- **Whereas** mandatory-disclosure home ratings constitute an important source of information on a home's environmental performance for any future tenant or buyer of a home;
- **Whereas** the information that could thus be available to consumers would likely enable them to lower energy consumption and greenhouse gases;
- **Whereas** all the foreign practices surveyed include an environmental aspect in their rating system;
- **Whereas** only a mandatory system can enable this information to be disseminated to all consumers;
- **Whereas** indicators of absolute levels of energy consumption and pollution emissions are more effective in reducing absolute energy consumption and pollution emissions in the residential real estate sector;
- **Whereas** the transmission of this information to all stakeholders, along with monetary equivalencies of the data, is the method most likely to be understood by consumers;
- **Whereas** only a system applied uniformly to new and existing buildings, and to buildings for sale or rent, is likely to produce information useful to consumers for purposes of comparison;
- **Whereas** energy rating systems based on existing building standards lose their reference value over time and as those standards evolve;
- **Whereas** consumers need improvements to be indicated to them in order to make their homes more energy-efficient;
- **Whereas** the energy efficiency evaluation would be an ideal opportunity to identify and measure those potential improvements and their effects;

Union des consommateurs recommends:

2. That the energy rating system be mandatorily disclosed during the sale, resale or rental of any home;
3. That the mandatory energy rating system be based on indicators of the evaluated homes' absolute levels of energy consumption and pollution emissions;
4. That the energy rating system give monetary equivalencies of the evaluated homes' standardized energy consumption;
5. That the mandatory energy rating system be the same for new and existing homes;
6. That the mandatory energy rating system not be based on local building standards;
7. That improvement proposals be issued in the energy rating report;

With regard to the establishment of targets for home energy savings and reduced pollution emissions:

- **Whereas** a homeowner's comparison of his home's energy performance with an ambitious national target is likely to motivate him to make more energy efficiency investments;
- **Whereas** that comparison makes sense only when it includes all homes irrespective of their size;
- **Whereas** energy prices are a major factor in the decision to make energy efficiency investments and that energy prices are volatile;

Union des consommateurs recommends:

8. That the federal government issue pollution emission reduction targets for homes;
9. That those targets be measurements of energy consumed per square meter and of pollution emissions;
10. That the federal government ensure that national targets are an integral part of the mandatory energy rating report;
11. That the federal government periodically revise those targets in order to maintain incentives for home energy efficiency investments;
12. That the energy rating report be capable of being updated on the Internet and that current energy prices and national energy efficiency targets thus be re-updated;

With regard to a home energy efficiency renovation assistance system:

- **Whereas** a mandatory home energy rating system would likely generate substantial economic benefits to the Government of Canada;
- **Whereas** the proposed home energy rating system would entail no direct costs to the Canadian government;
- **Whereas** various renovation-assistance incentive programs increase energy efficiency investments;
- **Whereas** homeowners on a modest budget generally do not have the means to invest in energy efficiency improvement work, even if it is financially cost-effective;
- **Whereas** the federal government has suspended the "ecoEnergy Retrofit – Homes" assistance program;

Union des consommateurs recommends:

13. That the federal government restore the "ecoEnergy Retrofit – Homes" assistance program;

14. That the federal government, to ensure that all Canadian households can benefit from spin-offs from the mandatory energy rating system, reinvest part of the appreciation to establish a Canada-wide program of assistance to the energy efficiency improvement of the homes of households on a modest budget;
15. That the federal government coordinate its home energy efficiency improvement programs with those of provinces having already established such programs;
16. That provincial governments that do not have home energy efficiency improvement assistance programs establish such programs, particularly assistance programs for the homes of households on a modest budget.

MEDIAGRAPHY

AGENCE DE L'EFFICACITÉ ÉNERGÉTIQUE DU QUÉBEC

NovoClimat page, available on the site of the Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d.
http://www.aee.gouv.qc.ca/en/my-home/novoclimat/

RénoClimat page, available on the site of the Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d.
http://www.aee.gouv.qc.ca/en/my-home/renoclimat/

RénoClimat page, available on the site of the Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d.
http://www.aee.gouv.qc.ca/en/my-home/renoclimat/financial-assistance/

RénoClimat page – *Évaluation Énergétique*, available on the site of the Agence de l'efficacité énergétique, Government of Quebec, Quebec City, Quebec, n.d.
http://www.aee.gouv.qc.ca/en/my-home/renoclimat/energy efficiency-audit-prior-to-renovations/

Table 1: Coût de revient et résultats du TCTR par secteur d'activité pour les programmes de l'Agence et des distributeurs d'énergie, available on the website of the Régie de l'énergie du Québec, January 2010.
http://www.regie-energie.qc.ca/audiences/3709-09/RepDDRAEE_3709-09/B-16_AEE-4Doc3-REV_Tableau1_3709_05jan10.pdf

Tableau comparatif des hypothèses des programmes de l'AEÉ – Rénoclimat travaux, available on the website of the Régie de l'énergie du Québec, Montreal, Quebec, October 2008.
http://www.regie-energie.qc.ca/audiences/3671-08/RepDDR_AEE_3671-08/B-28_AEE-10Doc1-Annexe-14-1_3671_24oct08.pdf

Tableau de répartition par P/A, available on the website of the Régie de l'énergie du Québec, October 2009.
http://www.regie-energie.qc.ca/audiences/3709-09/Demande_3709-09/B-1_AEE-4Doc2-3_3709_02oct09.pdf

OREGON LEGISLATIVE ASSEMBLY, *Senate Bill 79*, Oregon, United States, 2009.
http://www.leg.state.or.us/09reg/measpdf/sb0001.dir/sb0079.intro.pdf

UNKNOWN AUTHOR, *10 - Logiciels pour réaliser des DPE*, Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer et Agence de l'Environnement et de la Maîtrise de l'Énergie, January 22, 2008, France.
http://www.logement.gouv.fr/article.php3?id_article=6402

UNKNOWN AUTHOR, *BN63: Extension of the Landlords Energy Saving Allowance*, HM Revenue & Customs (HMRC), London, United Kingdom, 2007.
http://www.hmrc.gov.uk/budget2007/bn63.htm

UNKNOWN AUTHOR, *Arrêté du 15 septembre 2006 relatif aux méthodes et procédures applicables au diagnostic de performance énergétique pour les bâtiments existants proposés à la vente en France métropolitaine,* Ministère de l'Emploi, de la Cohésion sociale et du Logement, Journal Officiel de la République Française, France, September 28, 2006, available on the website of the Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer et Agence de l'Environnement et de la Maîtrise de l'Énergie.
http://www.logement.gouv.fr/IMG/pdf/arrete150906_dpemethodes.pdf

UNKNOWN AUTHOR, *Energy Performance Certificate*, Standard Assessment Procedure, London, United Kingdom, 2005, on the website Communities and Local Government of the United Kingdom.
http://www.communities.gov.uk/documents/planningandbuilding/pdf/319282.pdf

UNKNOWN AUTHOR, *Le Diagnostic de Performance Energétique*, Agence de l'Environnement et de la Maîtrise de l'Énergie, n.d.
http://www2.ademe.fr/servlet/getBin?name=F3E281DE738A57FDCED49524F96485D51161182446096.pdf

UNKNOWN AUTHOR, *Les CANDU présentent un risque*, on the website of the Société Radio-Canada, Montreal, Quebec, March 4, 2010.
http://www.radio-canada.ca/nouvelles/National/2010/03/04/002-CANDU-risque-CCSN.shtml

UNKNOWN AUTHOR, *Les économies d'énergie dans le bâtiment – L'ensemble des dispositifs pour améliorer la performance énergétique des bâtiments,* France, n.d., Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer et Agence de l'Environnement et de la Maîtrise de l'Énergie.
http://www.rt-batiment.fr/batiments-existants/dpe/presentation.html

BANK OF CANADA, *About the Bank – Inflation-Control Target,* Montreal, Quebec, September 2009.
http://www.bankofcanada.ca/en/backgrounders/bg-i3.html

ROYAL BANK OF CANADA

Personal Loans – RBC Energy Saver, Montreal, Quebec, 2010.
http://www.rbcroyalbank.com/RBC:S98p4Y71A8UAJeCw5AI/products/personalloans/energy-saver-loan.html
RBC Energy Saver Mortgage,
2010.http://www.rbcroyalbank.com/products/mortgages/energy-saver-mortgage.html

BROUNEN, Dirk and Nils KOK, *On The Economics of Energy Labels in the Housing Market*, November 2009, 32 pages.
http://urbanpolicy.berkeley.edu/greenbuilding/brounenkok.pdf

BROUNEN, Dirk and KOK, Nils, *On The Economics of Energy Labels in the Housing Market*, Maastricht University, Netherlands, November 2009, 32 pages. [Online]
http://urbanpolicy.berkeley.edu/greenbuilding/brounenkok.pdf (page consulted on May 14, 2010).

BRYDEN, Joan, *Ottawa suspend le programme de rénovations écoENERGIE*, dans Cyberpresse, section Mon toit, Montreal, Quebec, April 1, 2010.
http://montoit.cyberpresse.ca/renovation/201004/01/01-4266724-ottawa-suspend-le-programme-de-renovations-ecoenergie.php

BUCHAN, Don, *An Assessment of EnerGuide as a Requirement for New Homes*, Canadian Home Builders' Association, Ottawa, Ontario, November 2007.
http://www.chba.ca/uploads/policy%20archive/2007/2007-11-27_03.pdf

CAISSE D'ÉCONOMIE SOLIDAIRE DESJARDINS, *Découvrez l'hypothÉco*, Montreal, Quebec, 2010.
http://hypotheco.coop/

CENTRE SCIENTIFIQUE ET TECHNIQUE DU BÂTIMENT, *Diagnostic de performance énergétique*, French government, France, 2005.

CLINCH, J.Peter and John D. HEALY, *Cost-benefit analysis of domestic energy efficiency*, ELSEVIER, Amsterdam, United Kingdom, Energy Policy 29, number 2, January 2001.

COMMISSION DE COOPÉRATION ENVIRONNEMENTALE DE L'AMÉRIQUE DU NORD (CCE), *Le bâtiment écologique en Amérique du Nord*, Névé Éditions, Quebec City, Quebec, March 27, 2008, available on the website of MédiaTerre, Accueil Canada-Québec, Quebec City.
http://www.mediaterre.org/canada-quebec/actu,20080327193323.html

DALHOFF, Gregory, *An Update of the Impacts of Vermont's Weatherization Assistance Program,* on the website of the Vermont Department for Children and Families*,* Dalhoff Associates, Wisconsin, United States, February 2007.
http://dcf.vermont.gov/sites/dcf/files/pdf/oeo/2007ImpactofVTWeatherizationProgram.pdf

DÉCARIE, Jean-Philippe, *Le baril de pétrole à 200$, ça s'en vient!*, Rue Frontenac, Montreal, Quebec, February 11, 2010.
http://ruefrontenac.com/jpdecarie/17791-jeff-rubin-petrole

DUNSKY ENERGY CONSULTING

Building Energy Labelling Summary, on the website of Earth Advantage, Portland, Oregon, USA, February 2010.
http://www.earthadvantage.org/eps/pdfs/Building%20_Energy_Labeling_Summary_Table_2_14_2010_FINAL.pdf

Cote énergétique obligatoire, assessment of the international experience, Montreal, April 2009, available on the ftp site of the Agence de l'efficacité énergétique du Québec.
http://www.aee.gouv.qc.ca/RegieEnergie/R-3709-2009/Etude/Cote%20obligatoire%202009-04-06%20(v.finale%20AEE)_v.2003.pdf

Mandatory Energy Efficiency Disclosure and Upgrade Policies for the Northeast U.S., Montreal, August 28, 2009.
http://www.earthadvantage.org/eps/pdfs/neep_report_draft_2009_08_30%20_clean_1.pdf

EARTH ADVANTAGE INSTITUTE AND CONSERVATION SERVICE GROUP

Energy Analysis Report, September 17, 2008, on the website of Earth advantage, Portland, Oregon, USA.
http://earthadvantage.org/eps_energy_analysis_report.pdf

Energy Performance Score – 2008 Pilot, August 2009, on the website of Earth Advantage, Portland, Oregon, USA.
http://www.earthadvantage.org/eps_2008_pilot_report_fnl1x.pdf

Energy Performance Score, August 2009, available on the website of Earth advantage, Portland, Oregon, USA.
http://earthadvantage.org/eps_score_sheet_existing.pdf

EFFICIENCY NEW BRUNSWICK

Program information and financial incentives, New Homes Program, Efficiency NB, website of the Government of New Brunswick, Saint John, New Brunswick, November 2009.
http://www.efficiencynb.ca/residential/program-information.html
Checklist developed to help build energy-efficient homes, New Homes Programs, Efficiency NB, website of the Government of New Brunswick, Saint John, New Brunswick, November 2009.
http://www.efficiencynb.ca/home/efficiency-nb-in-the-news.html#anchor24
Existing Homes Energy Efficiency Upgrades Program, Government of New Brunswick, Canada, 2010.
http://www.efficiencynb.ca/residential/existinghomes.html

ENERGYSTAR, Features of ENERGY STAR Qualified New Homes, U.S. Environmental Protection Agency/U.S. Department of Energy, no date.
http://www.energystar.gov/index.cfm?c=new_homes.nh_features

ENERGY TRUST OF OREGON

Build energy efficiency into your new home, site Energy Trust of Oregon, Portland, Oregon, United States, no date.
http://energytrust.org/residential/new-home-solutions/
Energy Performance Score, on the website of Energy Trust, Portland, Oregon, USA.
http://energytrust.org/residential/new-home-solutions/eps.aspx
Get cash for making energy-saving changes, on the website of Energy Trust, Portland, Oregon, USA.
http://energytrust.org/residential/incentives/
For home energy improvements, February 2010, 8 pages, on the website of Energy Trust, Portland, Oregon, USA.
http://energytrust.org/library/forms/HES_DOC_Incentive_Grid.pdf

EUROPA

Energy efficiency: energy performance of buildings page, on the European Union portal Europa, section on the summary of EU legislation, n.d.
http://europa.eu/legislation_summaries/other/l27042_en.htm
Energy performance diagnosis, 2003, page 3, available on the website of Europa. [Online]
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:EN:PDF

GILMER, Robert, *Energy labels and economic search: An example from the residential real estate market*, ELSEVIER, Amsterdam, United Kingdom, Energy Policy 11, number 3, July 1989.

GOVERNMENT OF CANADA, *Canada Premium Bonds Annual Interest Rates,* March 30, 2010.
http://csb.gc.ca/wp-content/uploads/2009/03/s92_cpb.pdf

GOVERNMENT OF NEW BRUNSWICK, *Energy Efficiency Retrofit Program for Low Income Households,* on the website of the Executive Council Office, CNB, Supply and Services – Social Development, Government of New Brunswick, Fredericton, New Brunswick, May 16, 2010.
http://app.infoaa.7700.gnb.ca/gnb/Pub/EServices/ListServiceDetails.asp?ServiceID1=19556&ReportType1=ALL

HASSET, Kevin and Gilbert METCALF, *Measuring the Energy Savings From Home Improvements Investments: Evidence from Monthly Billing Data,* February 1997, available on the website of the Economics Department of Tufts University.
http://ase.tufts.edu/econ/research/documents/prior2000/papers1997-01.pdf

KJÆRBYE, Vibeke Hansen, *Does Energy Labelling on Residential Housing Cause Energy Savings?,* AKF, Danish Institute of Governmental Research, Copenhagen, Denmark, December 2008, 31 pages.
http://www.akf.dk/udgivelser/2008/pdf/energy_labelling.pdf

LAUSTSEN, Jens H., *Rapport-EM*, Danish Energy Authority, Lisbon, December 2004.
http://www.p3e-portugal.com/_ficheiros/2/4/23/LDocs/Jens_Laustsen.pdf

LORENZEN, Kirstine for COWI, *Danish Experience in Energy Labelling of Buildings*, Laustsen & Lorenszen, COWI & Danish Energy Authority, Denmark, 2003.
http://web.archive.org/web/20040418222241/www.opet-building.net/downloads/publications/WP1/cowi_label.pdf

MARUEJOLS, Lucie and David L. RYAN, *Generalizing Home Retrofit Program Results to Non-Participants*, May 2009, available on the website of Canadian Building Energy End-Use Data and Analysis Centre.
http://www.cbeedac.com/publications/documents/SelectivityprobleminEGH_001.pdf

MINISTRY OF ENERGY AND INFRASTRUCTURE

Brochure: *It pays to be green*, available on the website of the Ministry of Energy and Infrastructure, Government of Ontario, Toronto, Ontario, November 24, 2009.
http://www.mei.gov.on.ca/en/pdf/conservation/homeenergy/ohesp_brochure_murb-en.pdf
Combined table of federal-provincial rebates for Ontario, Government of Ontario, Toronto, Ontario, November 24, 2009.
http://www.mei.gov.on.ca/en/energy/conservation/ohesp/index.php?page=ohesp-audit

ONTARIO MINISTRY OF FINANCE, *Ontario's Long-Term Report on the Economy, Chapter 2: Long-Term Ontario Economic Projection,* Government of Ontario, Ministry of Finance, January 22, 2010.
http://www.fin.gov.on.ca/en/economy/ltr/2010/ch2.html

MANITOBA HYDRO, *Program Levels, New Home Program,* Winnipeg, Manitoba, n.d.
http://www.hydro.mb.ca/your_home/new_home/levels.shtml

MANITOBA R-2000 HOME PROGRAM! The website's home page, Government of Manitoba, Winnipeg, Manitoba, n.d.
http://www.r2000manitoba.com/

OFFICE OF ENERGY EFFICIENCY

About the R-2000 Standard, on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010.
http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/standard/standard.cfm?attr=4

Residential Secondary Energy Use by Energy Source and End-Use – Year 2007, on the website of Natural Resources Canada, Government of Canada, Natural Resources, Ottawa, Ontario, December 7, 2009.
http://oee.nrcan-rncan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_1_e_4.cfm?attr=0

What Is the ENERGY STAR® for New Homes Initiative?, document available on the website of Natural Resources Canada, Government of Canada, Ottawa, December 30, 2009.
http://oee.nrcan.gc.ca/residential/business/new-homes/new-homes-initiative.cfm?attr=12

EnerGuide for New Houses: Administrative and Technical Procedures, on the website of Natural Resources Canada, Government of Canada, Ottawa, January 2005.
http://oee.nrcan.gc.ca/residential/business/builders-renovators-trades/building/pdf/EGNH-Admin-Tech-Procedures-2005.pdf

ENERGY STAR for New Homes, on the website of Natural Resources Canada, Government of Canada, Ottawa, June 26, 2009.
http://oee.nrcan.gc.ca/residential/personal/new-homes/energystar-new-homes.cfm?attr=4

Energy efficiency developments in Canada, 1990 to 2007, available on the website of Natural Resources Canada, Government of Canada, August 2009.
http://oee.nrcan-rncan.gc.ca/organisme/statistiques/bnce/apd/tableauxguide2/res_00_11_f_4.cfm?attr=0

Frequently-Asked Questions (FAQ) about ecoENERGY Retrofit – Homes, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010.
http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/questions-answers.cfm?attr=4

Information on the Energy Efficiency Evaluation Report, on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010.
http://www.oee.nrcan.gc.ca/residential/personal/grants.cfm?attr=4

The EnerGuide Rating, on the website of Natural Resources Canada, Government of Canada, Ottawa, January 18, 2010.
http://oee.nrcan-rncan.gc.ca/residential/business/builders-renovators-trades/building/rating.cfm?attr=12

Standard R-2000, on the website of Natural Resources Canada, Government of Canada, Ottawa, April 1, 2005.
http://oee.nrcan.gc.ca/residential/personal/new-homes/r-2000/standard/current/R2000-standard.pdf

Residential Housing Stock and Floor Space, on the website of Natural Resources Canada, Government of Canada, Ottawa, Ontario, December 7, 2009.
http://oee.nrcan-rncan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_11_e_4.cfm?attr=0

Residential Energy Prices and Background Indicators – Year 2007, on the website of Natural Resources Canada, Government of Canada, Natural Resources, Ottawa, Ontario, December 7, 2009.
http://oee.nrcan-rncan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_18_e_4.cfm?attr=0
Complementary Regional Programs with ecoENERGY Retrofit – Homes, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010.
http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/provincial-municipal.cfm?attr=4
Grant Table for ecoENERGY Retrofit – Homes, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 31, 2010.
http://oee.nrcan.gc.ca/residential/personal/retrofit-homes/retrofit-qualify-grant.cfm?attr=4
The House as a System, on the website of Natural Resources Canada, Government of Canada, Ottawa, January 7, 2010.
http://oee.nrcan-rncan.gc.ca/residential/personal/new-homes/upgrade-packages/house-system.cfm?attr=4

NATIONAL ENERGY BOARD, Energy Conversion Tables, Calgary, Alberta, April 2004.
http://www.neb.gc.ca/clf-nsi/rnrgynfmtn/sttstc/nrgycnvrsntbl/nrgycnvrsntbl-eng.html

ONTARIO POWER AUTHORITY, page *Commercial Sector - Programs, Incentives, Rebates*, on the website of the Ontario Power Authority, Government of Ontario, Ottawa, Ontario, n.d.
http://business.everykilowattcounts.com/com/programs-incentives-rebates.php?pir=HPNC

PAGE, Ian, *Cost benefits of sustainable housing retrofits,* Beacon Pathway Limited, New Zealand, April 2009.
http://www.beaconpathway.co.nz/images/uploads/Final_Report_TE106(19)Cost_Benefits_of_Sustainable_House_Retrofits.pdf

RESIDENTIAL ENERGY SERVICES NETWORK, *Etiquette-HERS.pdf* document. Available on the website of Residential Energy Services Network, California, United States, no date.
http://ca.resnet.us/

Natural Resources Canada
Improving Energy Performance in Canada – Energy Intensity / Energy Efficiency, Energy Publications – Office of Energy Efficiency, Canada, 2009, page viii.
http://oee.nrcan.gc.ca/publications/statistics/parliament08-09/pdf/parliament08-09.pdf
Evaluation of the Energuide for Houses Program, on the website of Natural Resources Canada, Government of Canada, Ottawa, March 2010.
http://www.nrcan.gc.ca/evaluation/reprap/2001/energuide-eng.php

RIGGERT, Jeff, *An Evaluation of the Energy and Non-energy impacts of Vermont's Weatherization Assistance Program,* on the website of Vermont Department for Children and Families, TecMRKT Works, Wisconsin, United States, November 1999.
http://dcf.vermont.gov/sites/dcf/files/pdf/oeo/1999Energy_Non-EnergyImpactsofWeatherization.pdf

SHORROCK, L. D., *An analysis of the effect of Government grants on the uptake of home insulation measures*, ELSEVIER, Amsterdam, United Kingdom, Energy Policy 27, number 3, March 1999.

CANADA MORTGAGE AND HOUSING CORPORATION
Energy-Efficient Housing Made More Affordable with Mortgage Loan Insurance, on the website of the Canada Mortgage and Housing Corporation, Ottawa, Ontario, n.d.
http://www.cmhc.ca/en/co/moloin/moloin_008.cfm
CMHC Eligible Energy-Efficient Building Programs, on the website of the Canada Mortgage and Housing Corporation, Ottawa, Ontario, n.d.
http://www.cmhc-schl.gc.ca/en/co/moloin/moloin_011.cfm

SAVE, *Energy Labelling of Existing Buildings – Final Report*, SAVE, unknown city, July 25, 2001, available on the website of European Solar Test Installation.
http://re.jrc.ec.europa.eu/energyefficiency/belas/final_report.pdf

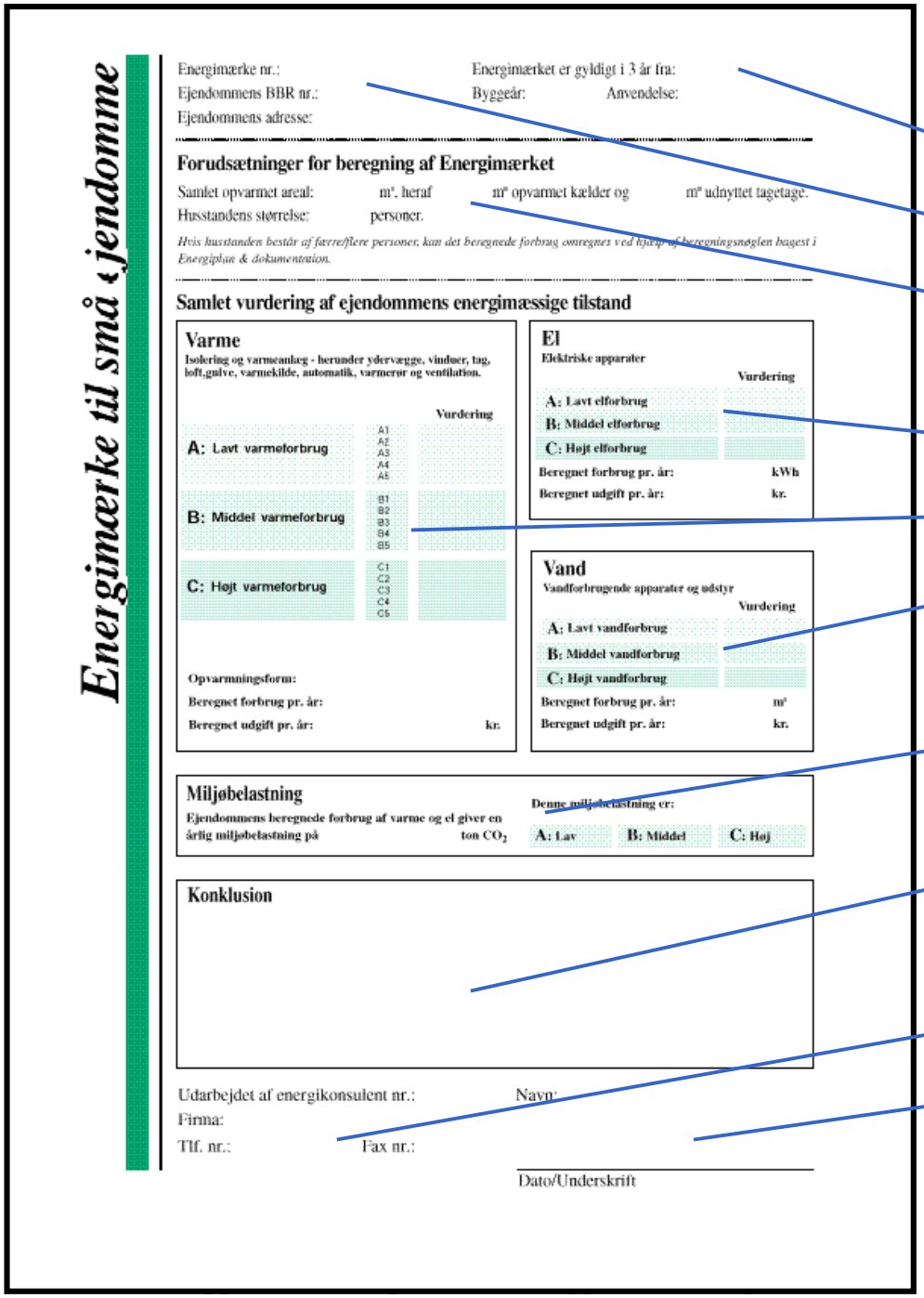
STATISTICS CANADA, *Consumer Price Index, historical summary (1990-2009),* on the website of Statistics Canada, Government of Canada, Ottawa, March 2010.
http://www40.statcan.ca/l01/cst01/econ46a-eng.htm

NATIONAL ROUND TABLE ON THE ENVIRONMENT AND THE ECONOMY
Chapter 2.1.3, Policy Certainty Beyond the Short Term Is Central, Government of Canada, Ottawa, Ontario, August 2009. http://www.nrtee-trnee.com/eng/publications/getting-to-2050/2-1-3-getting-to-2050.php
Chapter 2.1.3, Policy Certainty Beyond the Short Term Is Central – Table 3, Government of Canada, Ottawa, Ontario, August 2009.
http://www.nrtee-trnee.com/eng/publications/getting-to-2050/2-1-3-getting-to-2050.php

WARM FRONT, the website's home page, Newcastle, United Kingdom, n.d.
http://www.warmfront.co.uk/

WIKIPEDIA.FR
Actualisation – Taux d'actualisation, April 24, 2010 version.
http://fr.wikipedia.org/wiki/Actualisation#Taux_d.27actualisation
Analyse du cycle de vie – contrôle de sensibilité, April 7, 2010 version.
http://fr.wikipedia.org/wiki/Analyse_du_cycle_de_vie#Contr.C3.B4le_de_sensibilit.C3.A9
L'accident nucléaire de Three Mile Island, April 18, 2010 version.
http://fr.wikipedia.org/wiki/Three_Miles_Island#L.27accident_nucl.C3.A9aire_de_Three_Mile_Island,
Catastrophe de Tchernobyl, April 26, 2010 version.
http://fr.wikipedia.org/wiki/Catastrophe_de_Tchernobyl
Taux d'intérêt réel, March 31, 2010 version.
http://fr.wikipedia.org/wiki/Taux_d%27int%C3%A9r%C3%AAt_r%C3%A9el
Net discounted value, May 12, 2010 version.
http://fr.wikipedia.org/wiki/Valeur_actuelle_nette

ANNEX 1 – EM REPORT



Energimærke til små ejendomme

Energimærke nr.: Energimærket er gyldigt i 3 år fra:
Ejendommens BBR nr.: Byggeår: Anvendelse:
Ejendommens adresse:

Forudsætninger for beregning af Energimærket

Samlet opvarmet areal: m². heraf m² opvarmet kælder og m² udnyttet tagetage.
Husstandens størrelse: personer.

Hvis husstanden består af færre/flere personer, kan det beregnede forbrug omregnes ved hjælp af beregningsnøglen bagest i Energiplan & dokumentation.

Samlet vurdering af ejendommens energimæssige tilstand

Varme
Isolering og varmeanlæg - herunder ydervægge, vinduer, tag, loft,gulve, varmekilde, automatik, varmerør og ventilation.

Vurdering

A: Lavt varmeforbrug	A1 A2 A3 A4 A5	
B: Middel varmeforbrug	B1 B2 B3 B4 B5	
C: Højt varmeforbrug	C1 C2 C3 C4 C5	

Opvarmningsform:
Beregnet forbrug pr. år:
Beregnet udgift pr. år: kr.

El
Elektriske apparater

Vurdering

A: Lavt elforbrug	
B: Middel elforbrug	
C: Højt elforbrug	

Beregnet forbrug pr. år: kWh
Beregnet udgift pr. år: kr.

Vand
Vandforbrugende apparater og udstyr

Vurdering

A: Lavt vandforbrug	
B: Middel vandforbrug	
C: Højt vandforbrug	

Beregnet forbrug pr. år: m³
Beregnet udgift pr. år: kr.

Miljøbelastning
Ejendommens beregnede forbrug af varme og el giver en årlig miljøbelastning på ton CO_2

Denne miljøbelastning er:

A: Lav	B: Middel	C: Høj

Konklusion

Udarbejdet af energikonsulent nr.: Navn:
Firma:
Tlf. nr.: Fax nr.:

Dato/Underskrift

Date

Identification of building

Assumptions for labelling

Labelling of Electricity

Labelling of Heating

Labelling of Water

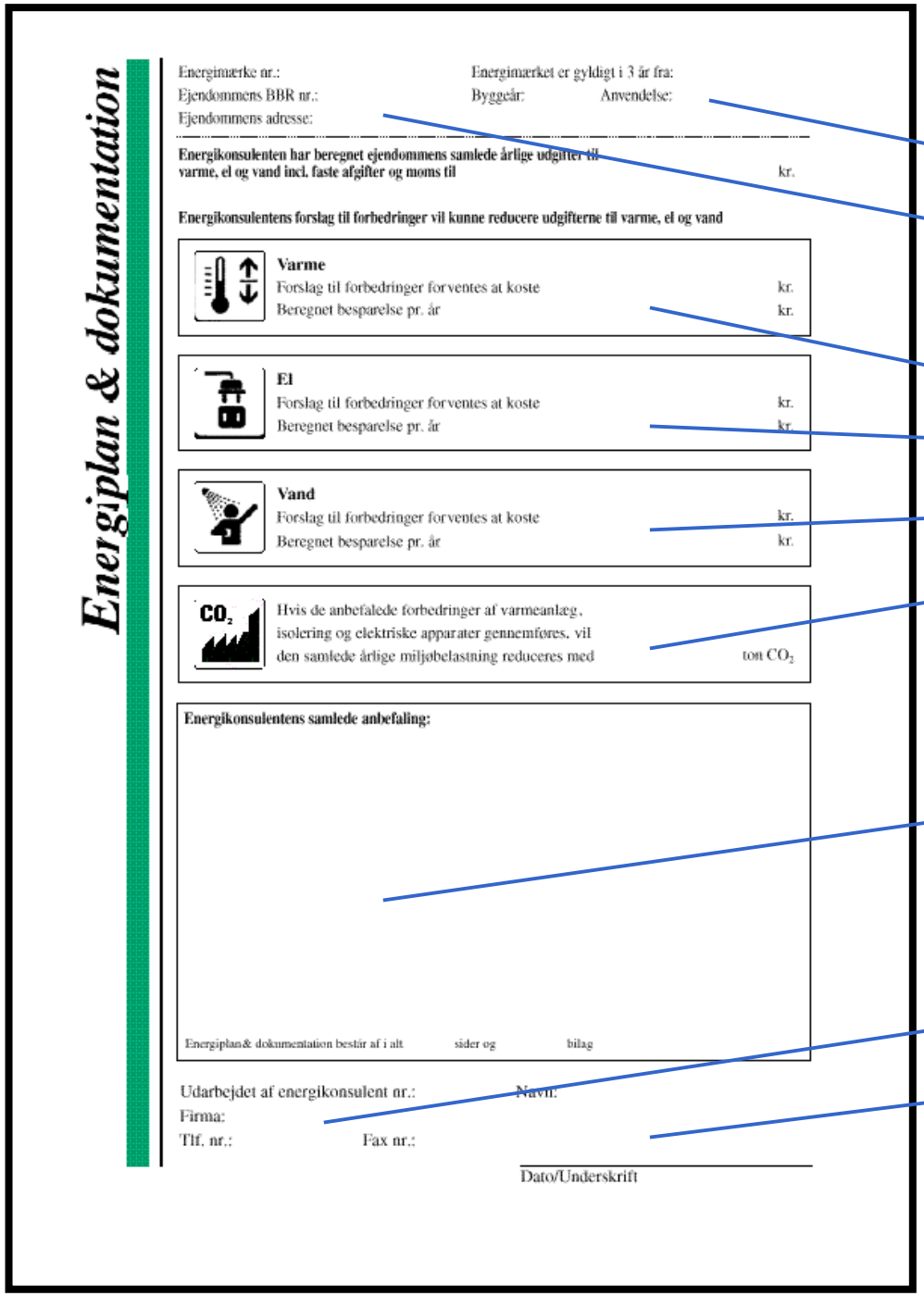
Environmental Impact

Conclusion

Identification of consultant

Signature

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Energimærke nr.: Energimærket er gyldigt i 3 år fra:
Ejendommens BBR nr.: Byggeår: Anvendelse:
Ejendommens adresse:

Energikonsulenten har beregnet ejendommens samlede årlige udgifter til varme, el og vand incl. faste afgifter og moms til kr.

Energikonsulentens forslag til forbedringer vil kunne reducere udgifterne til varme, el og vand

Varme
Forslag til forbedringer forventes at koste kr.
Beregnet besparelse pr. år kr.

El
Forslag til forbedringer forventes at koste kr.
Beregnet besparelse pr. år kr.

Vand
Forslag til forbedringer forventes at koste kr.
Beregnet besparelse pr. år kr.

CO_2
Hvis de anbefalede forbedringer af varmeanlæg, isolering og elektriske apparater gennemføres, vil den samlede årlige miljøbelastning reduceres med ton CO_2

Energikonsulentens samlede anbefaling:

Energiplan& dokumentation består af i alt sider og bilag

Udarbejdet af energikonsulent nr.: Navn:
Firma:
Tlf. nr.: Fax nr.:

Dato/Underskrift

Date

Identification of building

Proposals Heating

Proposals Electricity

Proposals Water

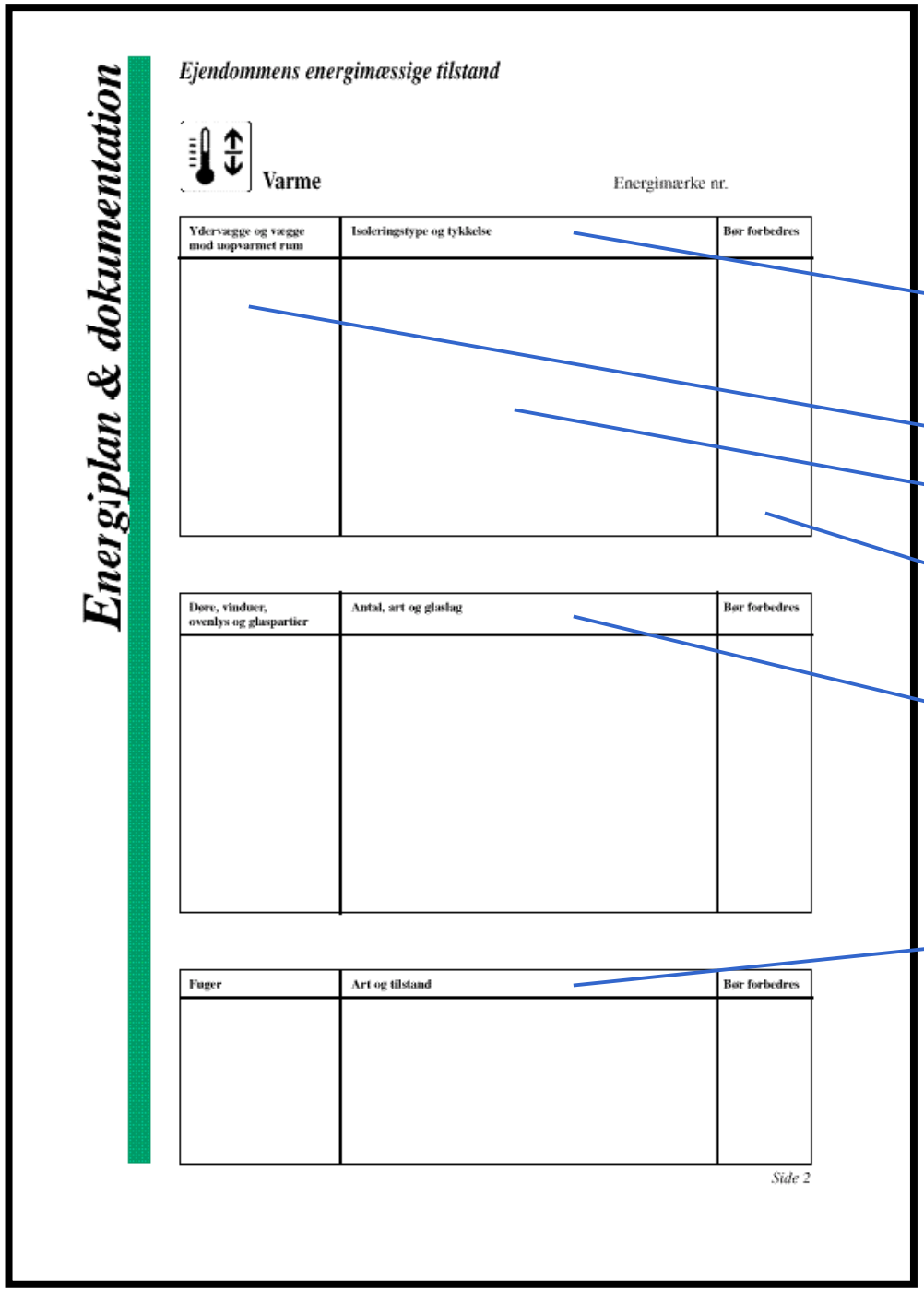
Reduction of CO_2

Overall recommendation

Identification of consultant

Signature

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Ejendommens energimæssige tilstand

Varme

Energimærke nr.

Ydervægge og vægge mod uopvarmet rum	Isoleringstype og tykkelse	Bør forbedres

Døre, vinduer, ovenlys og glaspartier	Antal, art og glaslag	Bør forbedres

Fuger	Art og tilstand	Bør forbedres

Side 2

Outer Walls

Type of construction

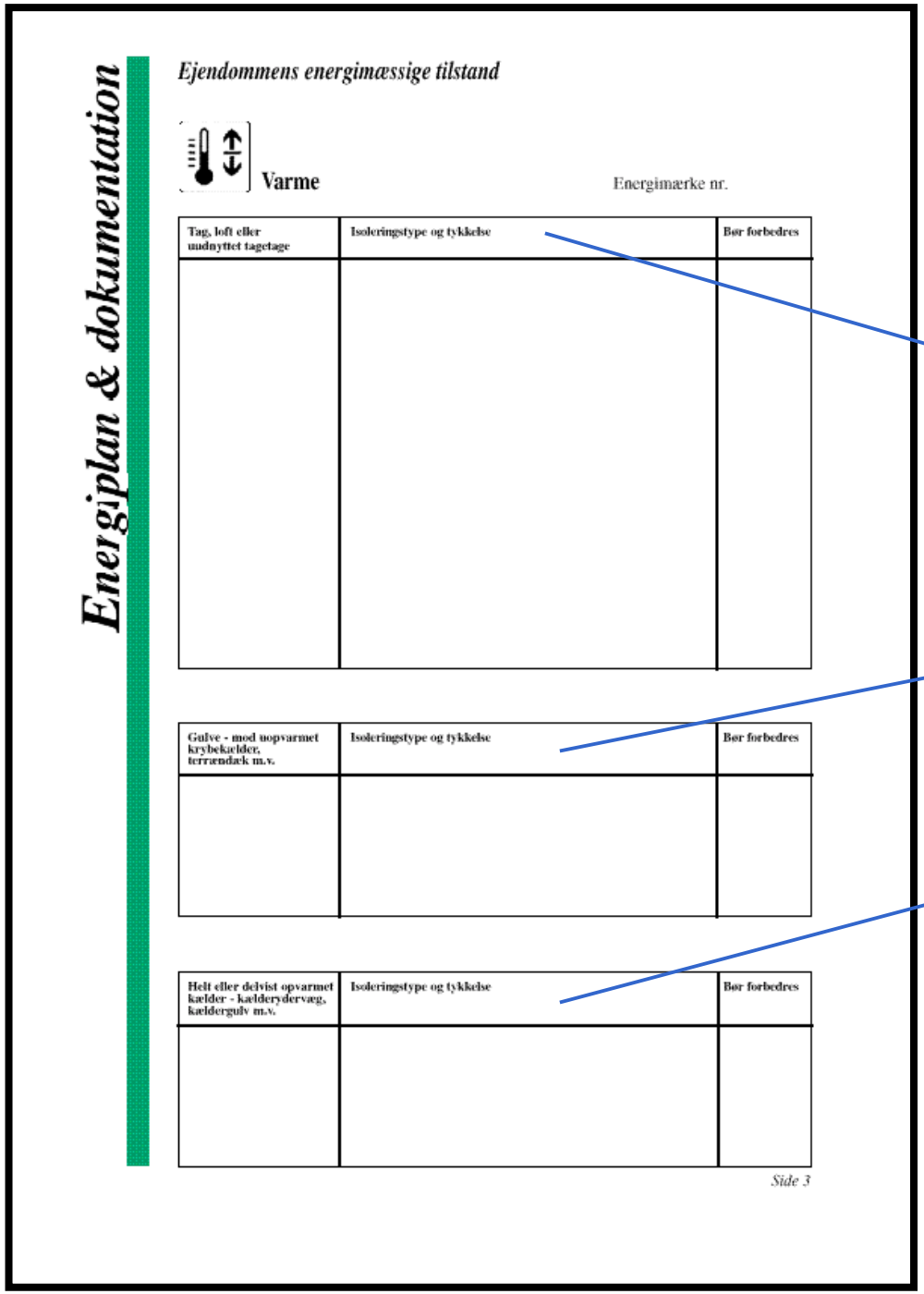
Insulation, kind, type

Should be improved ?

Windows, doors

Clearances

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Ejendommens energimæssige tilstand

Varme

Energimærke nr.

Tag, loft eller uudnyttet tagetage	Isoleringstype og tykkelse	Bør forbedres

Gulve - mod uopvarmet krybekælder, terrændæk m.v.	Isoleringstype og tykkelse	Bør forbedres

Helt eller delvist opvarmet kælder - kælderydervæg, kældergulv m.v.	Isoleringstype og tykkelse	Bør forbedres

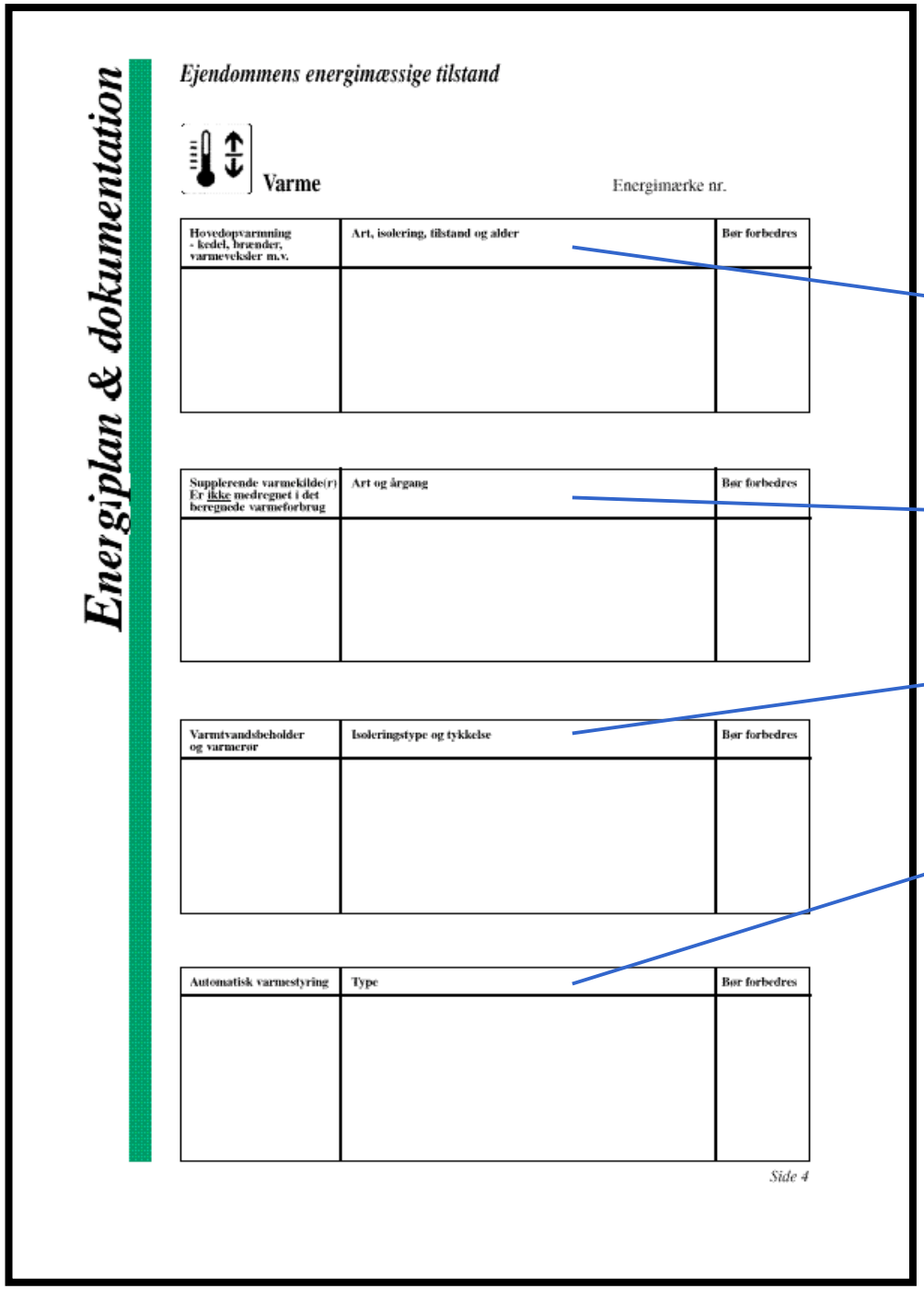
Side 3

Ceiling, attic, roof

Floors, ground deck

Partly heated cellar

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Ejendommens energimæssige tilstand

Varme

Energimærke nr.

Hovedopvarmning - kedel, brænder, varmeveksler m.v.	Art, isolering, tilstand og alder	Bør forbedres

Supplerende varmekilde(r) Er ikke medregnet i det beregnede varmeforbrug	Art og årgang	Bør forbedres

Varmtvandsbeholder og varmerør	Isoleringstype og tykkelse	Bør forbedres

Automatisk varmestyring	Type	Bør forbedres

Side 4

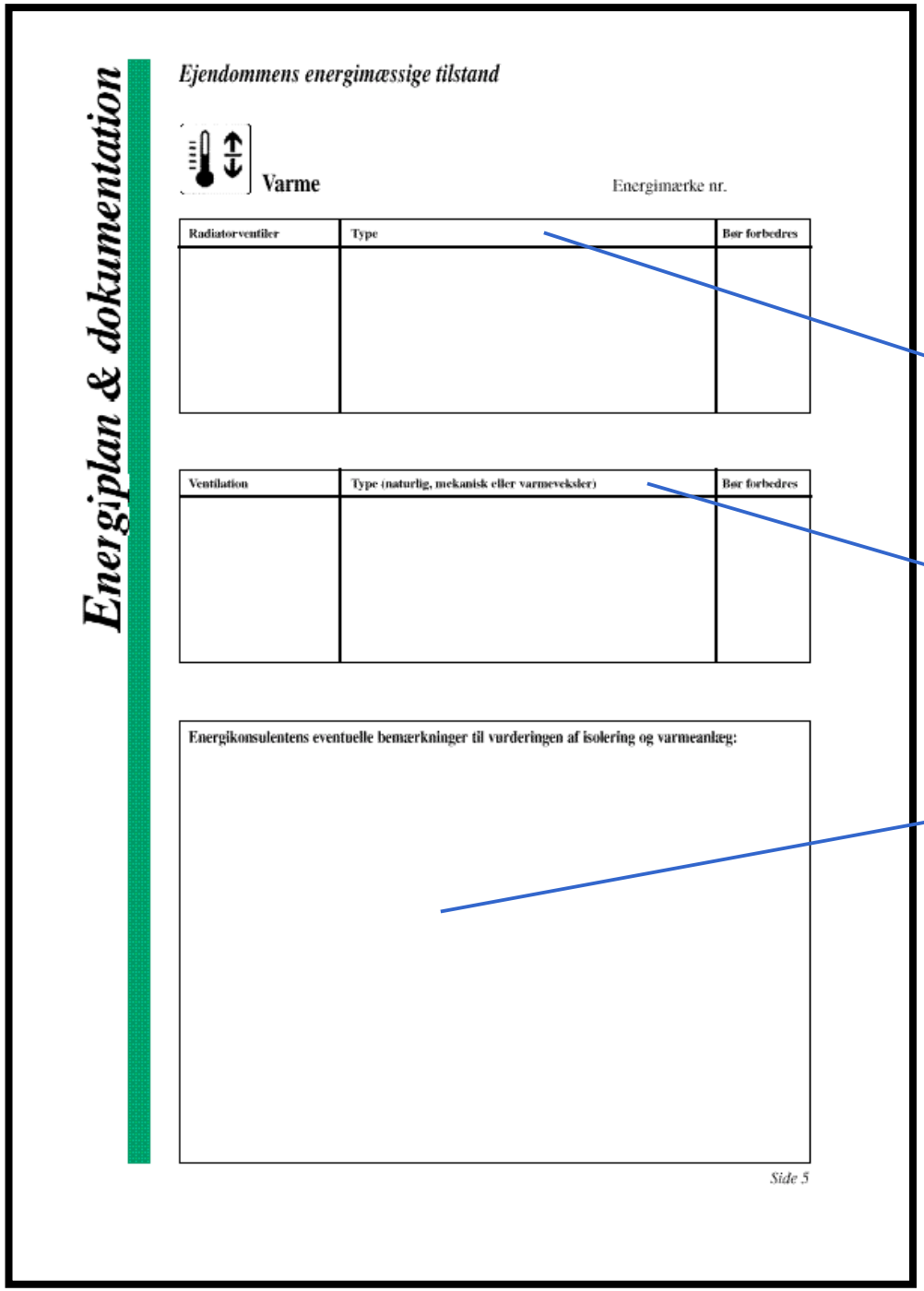
Main Heating

Supplementary Heating

Hot Water Tank, Heat Pipes

Automatic heat control

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Ejendommens energimæssige tilstand

Varme

Energimærke nr.

Radiatorventiler	Type	Bør forbedres

Ventilation	Type (naturlig, mekanisk eller varmeveksler)	Bør forbedres

Energikonsulentens eventuelle bemærkninger til vurderingen af isolering og varmeanlæg:

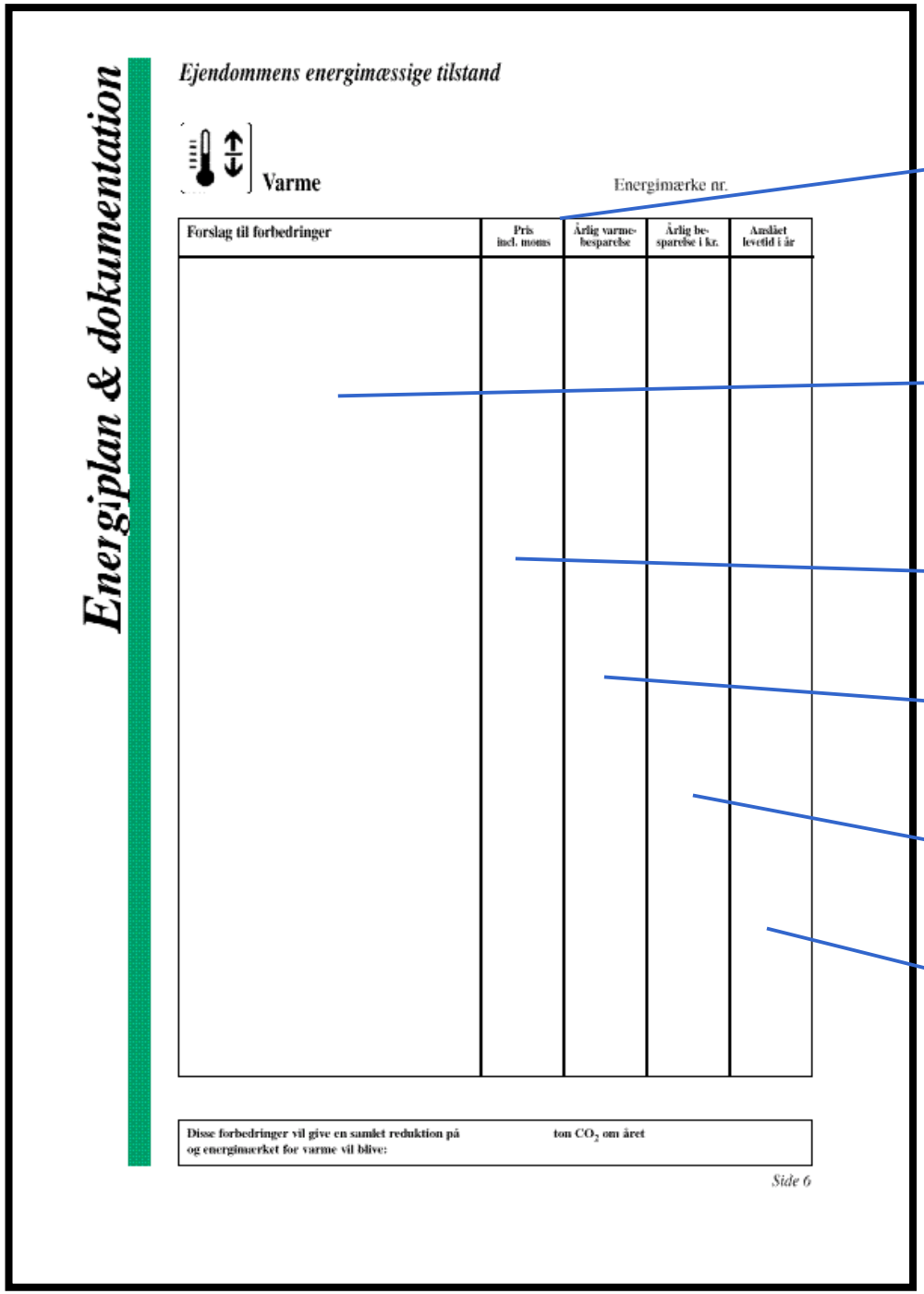
Side 5

Radiator Valves

Ventilation

Remarks on Insulation and Heating System

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Ejendommens energimæssige tilstand

Varme

Energimærke nr.

Forslag til forbedringer	Pris incl. moms	Årlig varme-besparelse	Årlig be-sparelse i kr.	Anslået levetid i år

Disse forbedringer vil give en samlet reduktion på ton CO_2 om året og energimærket for varme vil blive:

Side 6

Energy Plan Heating

Recommendation for Improvements

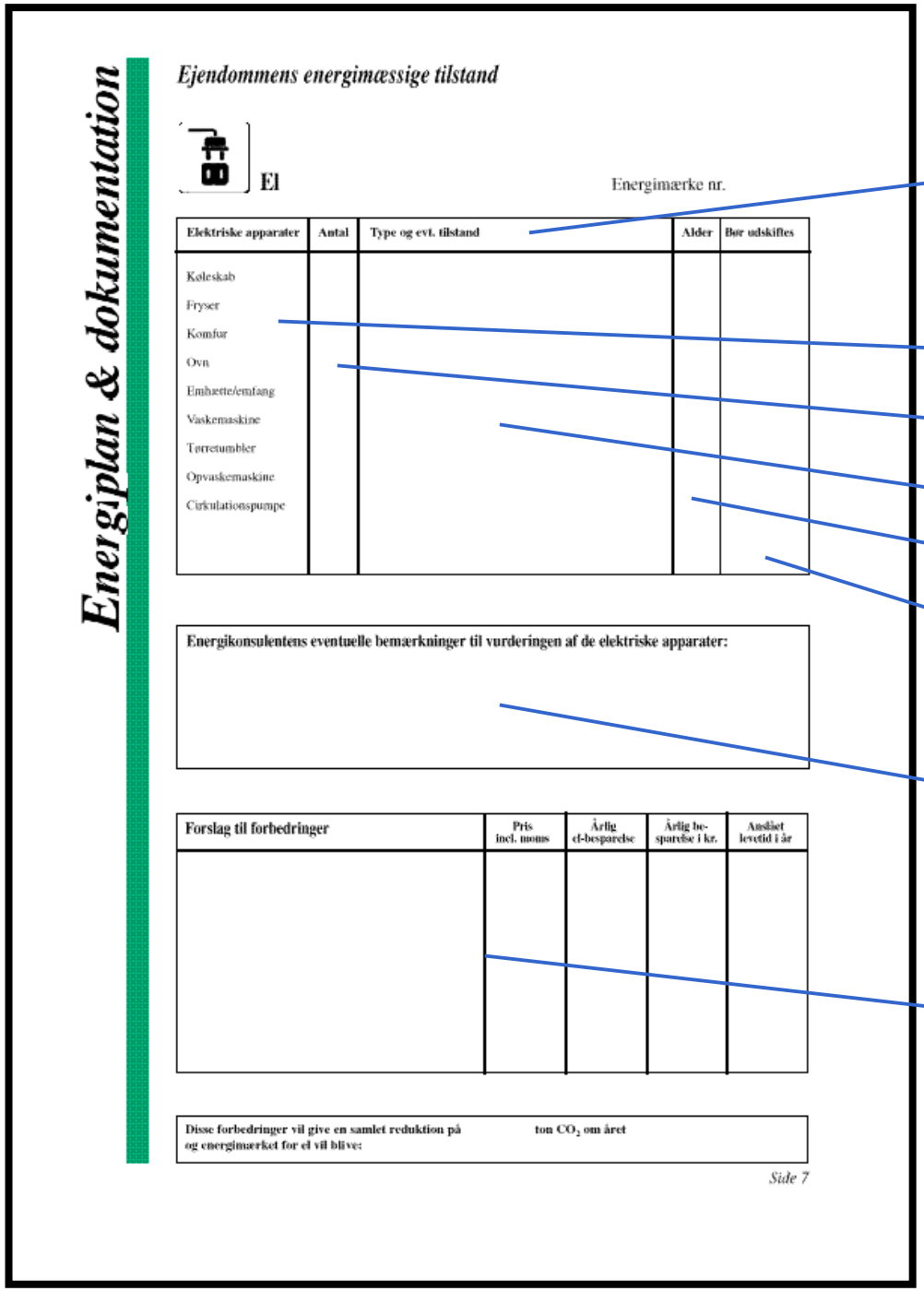
Investment, price in DKK

Annual heat savings

Annual savings in DKK

Estimated lifetime in years

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Ejendommens energimæssige tilstand

El

Energimærke nr.

Elektriske apparater	Antal	Type og evt. tilstand	Alder	Bør udskiftes
Køleskab				
Fryser				
Komfur				
Ovn				
Emhætte/emfang				
Vaskemaskine				
Tørretumbler				
Opvaskemaskine				
Cirkulationspumpe				

Energikonsulentens eventuelle bemærkninger til vurderingen af de elektriske apparater:

Forslag til forbedringer	Pris incl. moms	Årlig el-besparelse	Årlig be-sparelse i kr.	Anslået levetid i år

Disse forbedringer vil give en samlet reduktion på ton CO_2 **om året og energimærket for el vil blive:**

Side 7

Registration of Electric Appliances and ...

Appliances

Number included in sale

Type and condition

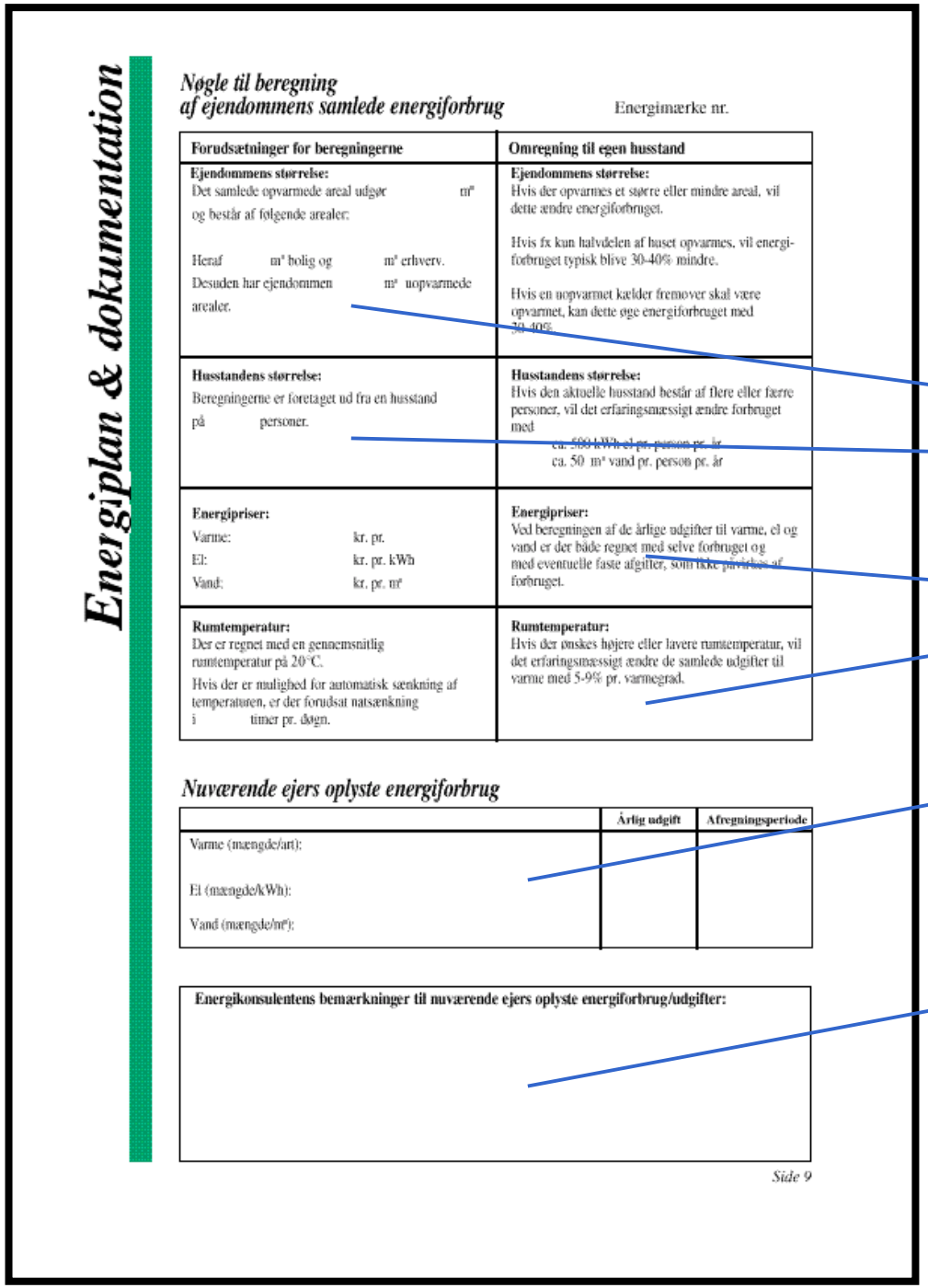
Age

Should be replaced ?

Remarks to Electric Appliances and Consumption

Energy Plan Electricity

DANISH ENERGY AUTHORITY



Energiplan & dokumentation

Nøgle til beregning af ejendommens samlede energiforbrug

Energimærke nr.

Forudsætninger for beregningerne	Omregning til egen husstand
Ejendommens størrelse: Det samlede opvarmede areal udgør m² og består af følgende arealer: Heraf m² bolig og m² erhverv. Desuden har ejendommen m² uopvarmede arealer.	**Ejendommens størrelse:** Hvis der opvarmes et større eller mindre areal, vil dette ændre energiforbruget. Hvis fx kun halvdelen af huset opvarmes, vil energiforbruget typisk blive 30-40% mindre. Hvis en uopvarmet kælder fremover skal være opvarmet, kan dette øge energiforbruget med 30-40%
Husstandens størrelse: Beregningerne er foretaget ud fra en husstand på personer.	**Husstandens størrelse:** Hvis den aktuelle husstand består af flere eller færre personer, vil det erfaringsmæssigt ændre forbruget med ca. 500 kWh el pr. person pr. år ca. 50 m³ vand pr. person pr. år
Energipriser: Varme: kr. pr. El: kr. pr. kWh Vand: kr. pr. m³	**Energipriser:** Ved beregningen af de årlige udgifter til varme, el og vand er der både regnet med selve forbruget og med eventuelle faste afgifter, som ikke påvirkes af forbruget.
Rumtemperatur: Der er regnet med en gennemsnitlig rumtemperatur på 20°C. Hvis der er mulighed for automatisk sænkning af temperaturen, er der forudsat natsænkning i timer pr. døgn.	**Rumtemperatur:** Hvis der ønskes højere eller lavere rumtemperatur, vil det erfaringsmæssigt ændre de samlede udgifter til varme med 5-9% pr. varmegrad.

Nuværende ejers oplyste energiforbrug

	Årlig udgift	Afregningsperiode
Varme (mængde/art):		
El (mængde/kWh):		
Vand (mængde/m³):		

Energikonsulentens bemærkninger til nuværende ejers oplyste energiforbrug/udgifter:

Side 9

Key for Calculations of overall energy consumption

Assumptions for the Calculation

Remarks, Conversions to own household

Present owners information about energy consumption

Energy Consultants Remarks on present owners information

DANISH ENERGY AUTHORITY

ANNEX 2 – ECP REPORT

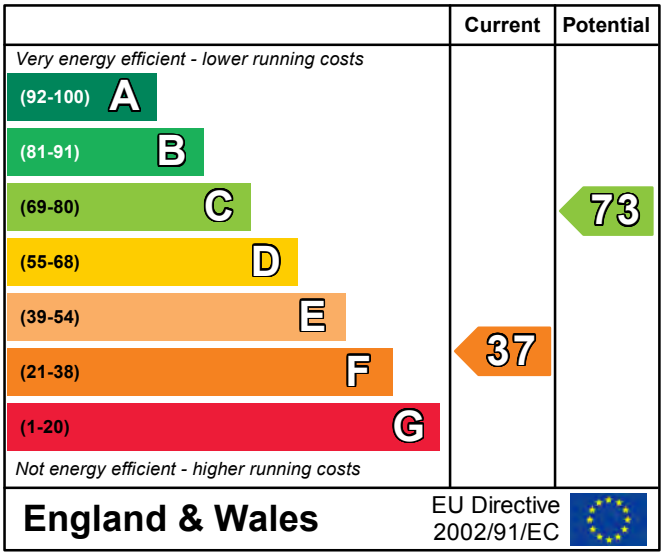
Energy Performance Certificate

17 Any Street,
Any Town,
County,
YY3 5XX

Dwelling type:	Detached house
Date of assessment:	02 February 2007
Date of certificate:	[dd mmmm yyyy]
Reference number:	0000-0000-0000-0000-0000
Total floor area:	166 m²

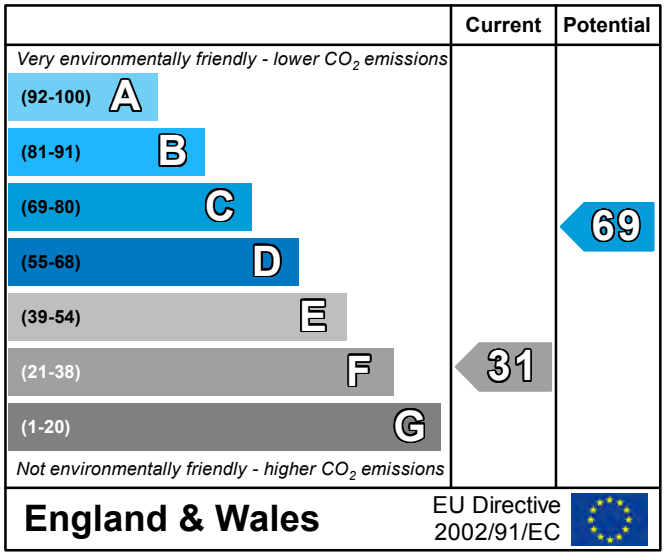
This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m² per year	178 kWh/m² per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

For advice on how to take action and to find out about offers available to help make your home more energy efficient, call **0800 512 012** or visit **www.energysavingtrust.org.uk/myhome**

About this document

The Energy Performance Certificate for this dwelling was produced following an energy assessment undertaken by a qualified assessor, accredited by [scheme name], to a scheme authorised by the Government. This certificate was produced using the RdSAP 2005 assessment methodology and has been produced under the [regulations]. A copy of the certificate has been lodged on a national register.

Assessor's accreditation number:	[accredition number]
Assessor's name:	[assessor name]
Company name/trading name:	[company name]
Address:	[company address] [address continued]
Phone number:	[phone]
Fax number:	[fax]
E-mail address:	[e-mail]
Related party disclosure:	[disclosure]

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from our website at [website address] together with details of their procedures for confirming authenticity of a certificate and for making a complaint.

About the bulding's performance ratings

The ratings on the certificate provide a measure of the building's overall energy efficiency and its environmental impact, calculated in accordance with a national methodology that takes into account factors such as insulation, heating and hot water systems, ventilation and fuels used. The average energy efficiency rating for a dwelling in England and Wales is band E (rating 46).

Not all buildings are used in the same way, so energy ratings use 'standard occupancy' assumptions which may be different from the specific way you use your building. Different methods of calculation are used for homes and for other buildings. Details can be found at www.communities.gov.uk.

Buildings that are more energy efficient use less energy, save money and help protect the environment. A building with a rating of 100 would cost almost nothing to heat and light and would cause almost no carbon emissions. The potential ratings in the certificate describe how close this building could get to 100 if all the cost effective recommended improvements were implemented.

About the impact of buildings on the environment

One of the biggest contributors to global warming is carbon dioxide. The way we use energy in buildings causes emissions of carbon. The energy we use for heating, lighting and power in homes produces over a quarter of the UK's carbon dioxide emissions and other buildings produce a further one-sixth.

The average household causes about 6 tonnes of carbon dioxide every year. Adopting the recommendations in this report can reduce emissions and protect the environment. You could reduce emissions even more by switching to renewable energy sources. In addition there are many simple every day measures that will save money, improve comfort and reduce the impact on the environment, such as:

- Check that your heating system thermostat is not set too high (in a home, 21°C in the living room is suggested) and use the timer to ensure you only heat the building when necessary.
- Make sure your hot water is not too hot - a cylinder thermostat need not normally be higher than 60°C.
- Turn off lights when not needed and do not leave appliances on standby. Remember not to leave chargers (e.g. for mobile phones) turned on when you are not using them.

Visit the Government's website at www.communities.gov.uk to:

- Find how to confirm the authenticity of an energy performance certificate
- Find how to make a complaint about a certificate or the assessor who produced it
- Learn more about the national register where this certificate has been lodged
- Learn more about energy efficiency and reducing energy consumption

Recommended measures to improve this home's energy performance

17 Any Street,
Any Town,
County,
YY3 5XX

Date of certificate: [dd mmmm yyyy]
Reference number: 0000-0000-0000-0000-0000

Summary of this home's energy performance related features

The following is an assessment of the key individual elements that have an impact on this home's performance rating. Each element is assessed against the following scale: Very poor / Poor / Average / Good / Very good.

Element	Description	Current performance	
		Energy Efficiency	Environmental
Walls	Cavity wall, as built (no insulation)	Poor	Poor
Roof	Pitched, 250 mm loft insulation	Good	Good
Floor	Solid, no insulation (assumed)	–	–
Windows	Partial double glazing	Poor	Poor
Main heating	Boiler and radiators, mains gas	Average	Average
Main heating controls	Programmer, room thermostat and TRVs	Average	Average
Secondary heating	None	–	–
Hot water	From main system, no cylinderstat	Poor	Poor
Lighting	Low energy lighting in 75% of fixed outlets	Very good	Very good
Current energy efficiency rating		F 37	
Current environmental impact (CO_2) rating			F 31

Recommendations

The measures below are cost effective. The performance ratings after improvement listed below are cumulative, that is they assume the improvements have been installed in the order that they appear in the table.

Lower cost measures (up to £500)	Typical savings per year	Performance ratings after improvement	
		Energy efficiency	Environmental impact
1 Cavity wall insulation	£411	E 53	E 46
2 Low energy lighting for all fixed outlets	£11	E 53	E 46
Sub-total	£422		
Higher cost measures (over £500)			
3 Hot water cylinder thermostat	£102	D 58	E 51
4 Replace boiler with Band A condensing boiler	£323	C 73	C 69
Total	£847		
Potential energy efficiency rating		C 73	
Potential environmental impact (CO_2) rating			C 69

Further measures to achieve even higher standards

The further measures listed below should be considered in addition to those already specified if aiming for the highest possible standards for this home.

5 Replace single glazed windows with low-E double glazing	£40	C 75	C 71
6 Solar photovoltaics panels, 25% of roof area	£49	C 77	C 74
Enhanced energy efficiency rating		C 77	
Enhanced environmental impact (CO_2) rating			C 74

Improvements to the energy efficiency and environmental impact ratings will usually be in step with each other. However, they can sometimes diverge because reduced energy costs are not always accompanied by a reduction in carbon dioxide (CO_2) emissions.

About the cost effective measures to improve this home's performance ratings

Lower cost measures (typically up to £500 each)

These measures are relatively inexpensive to install and are worth tackling first. Some of them may be installed as DIY projects. DIY is not always straightforward, and sometimes there are health and safety risks, so take advice before carrying out DIY improvements.

1 Cavity wall insulation

Cavity wall insulation, to fill the gap between the inner and outer layers of external walls with an insulating material, reduces heat loss. The insulation material is pumped into the gap through small holes that are drilled into the outer walls, and the holes are made good afterwards. As specialist machinery is used to fill the cavity, a professional installation company should carry out this work, and they should carry out a thorough survey before commencing work to be sure that this type of insulation is right for this home. They should also provide a guarantee for the work and handle any building control issues. Further information can be obtained from National Cavity Insulation Association (http://dubois.vital.co.uk/database/ceed/cavity.html).

2 Low energy lighting

Replacement of traditional light bulbs with energy saving recommended ones will reduce lighting costs over the lifetime of the bulb, and they last up to 12 times longer than ordinary light bulbs. Also consider selecting low energy light fittings when redecorating; contact the Lighting Association for your nearest stockist of Domestic Energy Efficient Lighting Scheme fittings.

Higher cost measures (typically over £500 each)

3 Cylinder thermostat

A hot water cylinder thermostat enables the boiler to switch off when the water in the cylinder reaches the required temperature; this minimises the amount of energy that is used and lowers fuel bills. The thermostat is temperature sensor that sends a signal to the boiler when the required temperature is reached. To be fully effective it needs to be sited in the correct position and hard wired in place, so it should be installed by a competent plumber or heating engineer.

4 Band A condensing boiler

A condensing boiler is capable of much higher efficiencies than other types of boiler, meaning it will burn less fuel to heat this property. This improvement is most appropriate when the existing central heating boiler needs repair or replacement, but there may be exceptional circumstances making this impractical. Condensing boilers need a drain for the condensate which limits their location; remember this when considering remodelling the room containing the existing boiler even if the latter is to be retained for the time being (for example a kitchen makeover). Building Regulations apply to this work, so your local authority building control department should be informed, unless the installer is registered with a competent persons scheme[1], and can therefore self-certify the work for Building Regulation compliance. Ask a qualified heating engineer to explain the options.

About the further measures to achieve even higher standards

Further measures that could deliver even higher standards for this home.

5 Double glazing

Double glazing is the term given to a system where two panes of glass are made up into a sealed unit. Replacing existing single-glazed windows with double glazing will improve comfort in the home by reducing draughts and cold spots near windows. Double-glazed windows may also reduce noise, improve security and combat problems with condensation. Building Regulations apply to this work, so either use a contractor who is registered with a competent persons scheme[1] or obtain advice from your local authority building control department.

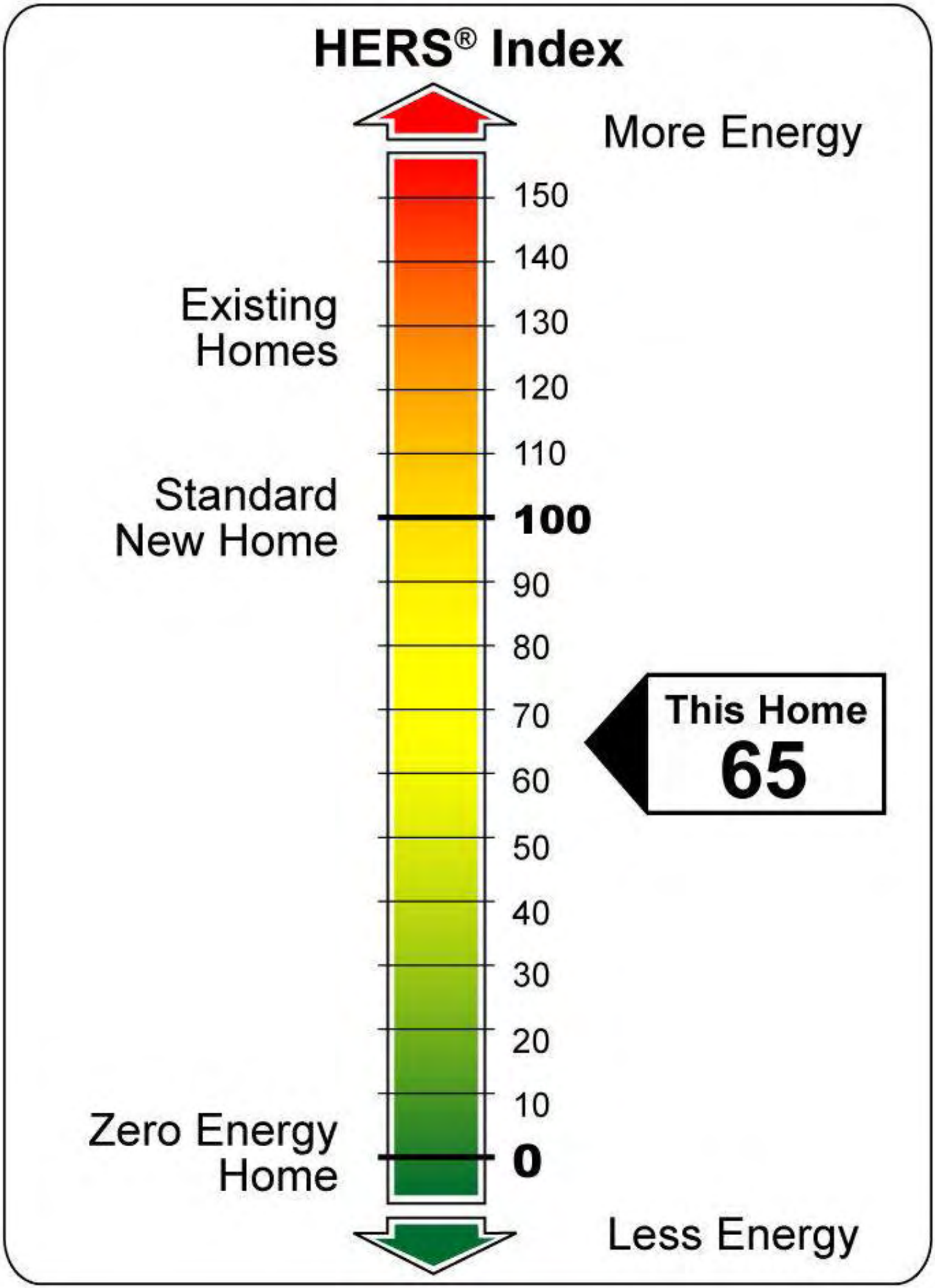
[1] For information on competent persons schemes enter "existing competent person schemes" into an internet search engine or contact your local Energy Saving Trust advice centre on 0800 512 012.

6 Solar photovoltaics (PV) panels

A solar PV system is one which converts light directly into electricity via panels placed on the roof with no waste and no emissions. This electricity is used throughout the home in the same way as the electricity purchased from an energy supplier. The Solar Trade Association has up-to-date information on local installers who are qualified electricians and any grant that may be available. . Planning restrictions may apply in certain neighbourhoods and you should check this with the local authority. Building Regulations apply to this work, so your local authority building control department should be informed, unless the installer is registered with a competent persons scheme[1], and can therefore self-certify the work for Building Regulation compliance. Ask a suitably qualified electrician to explain the options.

[1] For information on competent persons schemes enter "existing competent person schemes" into an internet search engine or contact your local Energy Saving Trust advice centre on 0800 512 012.

ANNEX 3 – DPE REPORT


HERS® Index
More Energy
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Existing Homes
Standard New Home
Zero Energy Home
This Home
65
Less Energy

ANNEX 4 – HERS LABEL

Diagnostic de performance énergétique – logement (6.1)

N° : Valable jusqu'au : Type de bâtiment : Année de construction : Surface habitable : Adresse :	Date : Diagnostiqueur : Signature :
Propriétaire : Nom : Adresse :	**Propriét. des installations communes** (s'il y a lieu) : Nom : Adresse :

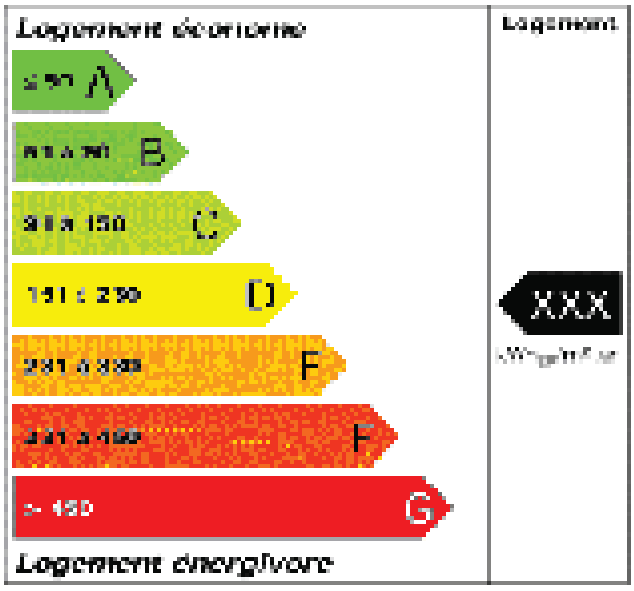
Consommations annuelles par énergie

obtenus par la méthode ....., version ....., prix moyens des énergies indexés au

	Consommations en énergies finales	Consommations en énergie primaire	Frais annuels d'énergie
	détail par énergie et par usage en kWh_{EP}	détail par usage en kWh_{EP}	
Chauffage	kWh_{EP}	kWh_{EP}	**€ TTC**
Eau chaude sanitaire	kWh_{EP}	kWh_{EP}	**€ TTC**
Refroidissement	kWh_{EP}	kWh_{EP}	**€ TTC**
CONSOMMATIONS D'ÉNERGIE POUR LES USAGES RECENSÉS	kWh_{EP}	kWh_{EP}	**€ TTC**

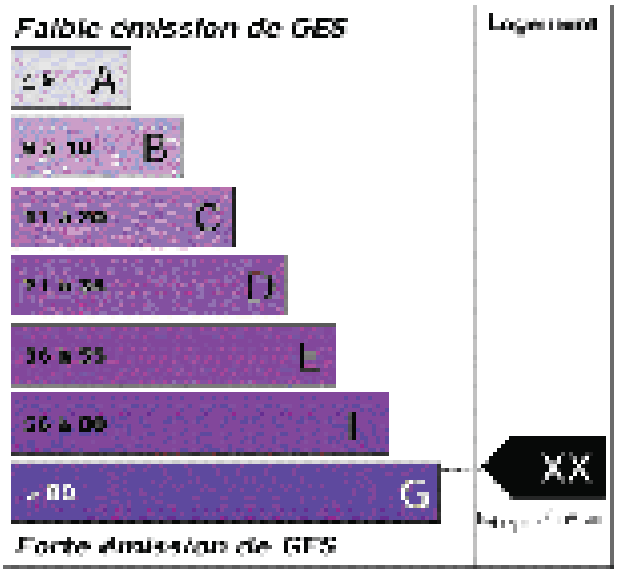
Consommations énergétiques
(en énergie primaire)
pour le chauffage, la production d'eau chaude sanitaire et le refroidissement

Consommation conventionnelle : $kWh_{EP}/m^2.an$



Émissions de gaz à effet de serre (GES)
pour le chauffage, la production d'eau chaude sanitaire et le refroidissement

Estimation des émissions : $kg\ eqCO_2/m^2.an$



Diagnostic de performance énergétique – logement (6.1)

Descriptif du logement et de ses équipements

Logement	Chauffage	Eau chaude sanitaire
Murs :	**Système :**	**Système :**
Toiture :	**Emetteurs :**	
Menuiseries :	**Inspection > 15 ans :**	
Plancher bas :		
Énergies renouvelables	Quantité d'énergie d'origine renouvelable	**$kWh_{EP}/m^2.an$**
Type d'équipements présents utilisant des énergies renouvelables :		

Pourquoi un diagnostic

- Pour informer le futur locataire ou acheteur ;
- Pour comparer différents logements entre eux ;
- Pour inciter à effectuer des travaux d'économie d'énergie et contribuer à la réduction des émissions de gaz à effet de serre.

Consommation conventionnelle

Ces consommations sont dites conventionnelles car calculées pour des conditions d'usage fixées (on considère que les occupants les utilisent suivant des conditions standard), et pour des conditions climatiques moyennes du lieu.
Il peut donc apparaître des divergences importantes entre les factures d'énergie que vous payez et la consommation conventionnelle pour plusieurs raisons : suivant la rigueur de l'hiver ou le comportement réellement constaté des occupants, qui peuvent s'écarter fortement de celui choisi dans les conditions standard.

Conditions standard

Les conditions standard portent sur le mode de chauffage (températures de chauffe respectives de jour et de nuit, périodes de vacance du logement), le nombre d'occupants et leur consommation d'eau chaude, la rigueur du climat local (température de l'air et de l'eau potable à l'extérieur, durée et intensité de l'ensoleillement). Ces conditions standard servent d'hypothèses de base aux méthodes de calcul. Certains de ces paramètres font l'objet de conventions unifiées entre les méthodes de calcul.

Constitution des étiquettes

La consommation conventionnelle indiquée sur l'étiquette énergie est obtenue en déduisant de la consommation d'énergie calculée, la consommation d'énergie issue éventuellement d'installations solaires thermiques ou pour le solaire photovoltaïque, la partie d'énergie photovoltaïque utilisée dans la partie privative du lot.

Énergie finale et énergie primaire

L'énergie finale est l'énergie que vous utilisez chez vous (gaz, électricité, fioul domestique, bois, etc.). Pour que vous disposiez de ces énergies, il aura fallu les extraire, les distribuer, les stocker, les produire, et donc dépenser plus d'énergie que celle que vous utilisez en bout de course.
L'énergie primaire est le total de toutes ces énergies consommées.

Usages recensés

Dans les cas où une méthode de calcul est utilisée, elle ne relève pas l'ensemble des consommations d'énergie, mais seulement celles nécessaires pour le chauffage, la production d'eau chaude sanitaire et le refroidissement du logement. Certaines consommations comme l'éclairage, la cuisson ou l'électroménager ne sont pas comptabilisées dans les étiquettes énergie et climat des bâtiments.

Variations des des conventions de calcul et des prix de l'énergie

Le calcul des consommations et des frais d'énergie fait intervenir des valeurs qui varient sensiblement dans le temps. La mention « prix de l'énergie en date du... » indique la date de l'arrêté en vigueur au moment de l'établissement du diagnostic. Elle reflète les prix moyens des énergies que l'Observatoire de l'Énergie constate au niveau national.

Énergies renouvelables

Elles figurent sur cette page de manière séparée. Seules sont estimées les quantités d'énergie renouvelable produite par les équipements installés à demeure et utilisées dans la maison.

Diagnostic de performance énergétique – logement (6.1)

Conseils pour un bon usage

En complément de l'amélioration de son logement (voir page suivante), il existe une multitude de mesures non coûteuses ou très peu coûteuses permettant d'économiser de l'énergie et de réduire les émissions de gaz à effet de serre. Ces mesures concernent le chauffage, l'eau chaude sanitaire et le confort d'été.

Chauffage

- Régulez et programmez : La régulation vise à maintenir la température à une valeur constante, réglez le thermostat à 19 °C ; quant à la programmation, elle permet de faire varier cette température de consigne en fonction des besoins et de l'occupation du logement. On recommande ainsi de couper le chauffage durant l'inoccupation des pièces ou lorsque les besoins de confort sont limités. Toutefois, pour assurer une remontée rapide en température, on dispose d'un contrôle de la température réduite que l'on règle généralement à quelques 3 à 4 degrés inférieurs à la température de confort pour les absences courtes. Lorsque l'absence est prolongée, on conseille une température "hors-gel" fixée aux environs de 8°C. Le programmateur assure automatiquement cette tâche.
- Réduisez le chauffage d'un degré, vous économiserez de 5 à 10 % d'énergie.
- Éteignez le chauffage quand les fenêtres sont ouvertes.
- Fermez les volets et/ou tirez les rideaux dans chaque pièce pendant la nuit.
- Ne placez pas de meubles devant les émetteurs de chaleur (radiateurs, convecteurs,...), cela nuit à la bonne diffusion de la chaleur.

Eau chaude sanitaire

- Arrêtez le chauffe-eau pendant les périodes d'inoccupation (départs en congés,...) pour limiter les pertes inutiles.
- Préférez les mitigeurs thermostatiques aux mélangeurs.

Aération

Si votre logement fonctionne en ventilation naturelle :

- Une bonne aération permet de renouveler l'air intérieur et d'éviter la dégradation du bâti par l'humidité.
- Il est conseillé d'aérer quotidiennement le logement en ouvrant les fenêtres en grand sur une courte durée et nettoyez régulièrement les grilles d'entrée d'air et les bouches d'extraction s'il y a lieu.
- Ne bouchez pas les entrées d'air, sinon vous pourriez mettre votre santé en danger. Si elles vous gênent, faites appel à un professionnel.

Si votre logement fonctionne avec une ventilation mécanique contrôlée :

- Aérez périodiquement le logement.

Confort d'été

- Utilisez les stores et les volets pour limiter les apports solaires dans la maison le jour.
- Ouvrez les fenêtres en créant un courant d'air, la nuit pour rafraîchir.

Autres usages

Eclairage :

- Optez pour des lampes basse consommation (fluocompactes ou fluorescentes).
- Évitez les lampes qui consomment beaucoup trop d'énergie, comme les lampes à incandescence ou les lampes halogènes.
- Nettoyez les lampes et les luminaires (abat-jour, vasques...) ; poussiéreux, ils peuvent perdre jusqu'à 40 % de leur efficacité lumineuse.

Bureautique / audiovisuel :

- Éteignez ou débranchez les appareils ne fonctionnant que quelques heures par jour (téléviseurs, magnétoscopes,...). En mode veille, ils consomment inutilement et augmentent votre facture d'électricité.

Électroménager (cuisson, réfrigération,...) :

- Optez pour les appareils de classe A ou supérieure (A+, A++,...).

Diagnostic de performance énergétique – logement (6.1)

Recommandations d'amélioration énergétique

Sont présentées dans le tableau suivant quelques mesures visant à réduire vos consommations d'énergie.
Les consommations, économies, efforts et retours sur investissement proposés ici sont donnés à titre indicatif et séparément les uns des autres.
Certains coûts d'investissement additionnels éventuels (travaux de finition, etc.) ne sont pas pris en compte.
Ces valeurs devront impérativement être complétées avant réalisation des travaux par des devis d'entreprises.
Enfin, il est à noter que certaines aides fiscales peuvent minimiser les coûts moyens annoncés (subventions, crédit d'impôt, etc.). La TVA est comptée au taux réduit de 5,5 %.

Mesures d'amélioration	Nouvelle consommation conventionnelle	Effort d'investissement	Économies	Rapidité du retour sur investissement	Crédit d'impôt
					%
					%
					%
					%
					%
					%
					%

Légende Économies	Effort d'investissement	Rapidité du retour sur investissement
☆ : moins de 100 € TTC/an	€ : moins de 200 € TTC	⏱⏱⏱⏱ : moins de 5ans
☆☆ : de 100 à 200 € TTC/an	€€: de 200 à 1000 € TTC	⏱⏱⏱ : de 5 à 10 ans
☆☆☆ : de 200 à 300 € TTC/an	€€€: de 1000 à 5000 € TTC	⏱⏱ : de 10 à 15 ans
☆☆☆☆ : plus de 300 € TTC/an	€€€€: plus de 5000 € TTC	⏱ : plus de 15 ans

Commentaires :

Les travaux sont à réaliser par un professionnel qualifié.

Pour aller plus loin, il existe des points info-énergie : http://www.ademe.fr/particuliers/PIE/liste_eie.asp

Vous pouvez peut-être bénéficier d'un crédit d'impôt pour réduire le prix d'achat des fournitures, pensez-y ! www.impots.gouv.fr

Pour plus d'informations : www.ademe.fr ou www.logement.gouv.fr

ANNEX 5 – EPS RATING REPORT

ENERGY PERFORMANCE SCORE

EPS

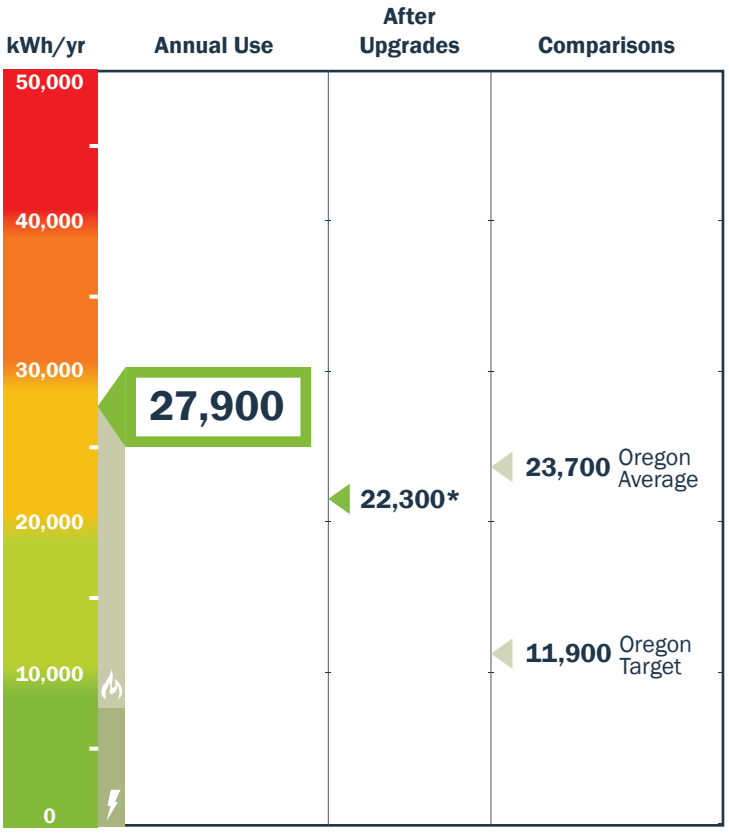
Address: 1234 Elm St, Portland, OR 97212

Reference Number: 410000000

Energy Use:	27,900 kWh/yr	**$1,640**
Electric:	8,900 kWh/yr	$730
Natural Gas:	650 therms/yr	$910

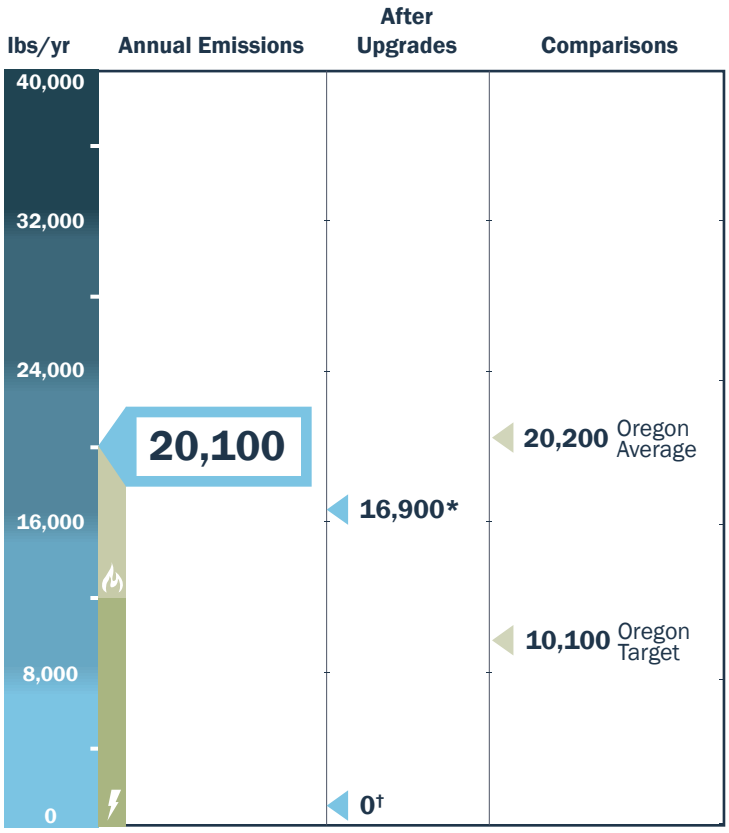
Carbon Emissions:	20,100 lbs/yr
Electric:	12,500 lbs/yr
Natural Gas:	7,600 lbs/yr

Energy Use



*See Recommended Upgrades

Carbon Emissions



*See Recommended Upgrades
†With energy from renewable sources

This score measures the total energy use (electricity, natural gas, propane, heating oil) of this home for one year. The lower the score, the less energy required for normal use. Actual consumption and costs may vary.

Measured in kilowatt hours per year (kWh/yr).

This score measures the total carbon emissions based on the annual amounts, types, and sources of fuels used in this home. The lower the score, the less carbon is released into the atmosphere to power this home.

Measured in pounds of carbon per year (lbs/yr).

Size :	2,025 s.f.	**Audit Date :**	9/17/2008
Type :	Single-family	**Auditor :**	Earth Advantage Institute
Bedrooms :	4		Portland, OR
Year Built :	1958		*E. Storm*

earth advantage institute

Visit www.energytrust.org/EPS for tips to maximize energy savings

What is the Energy Performance Score?

A Third-Party Certified Score The Energy Performance Score is calculated based on an energy audit of a home. Anyone may use the EPS assessment methodology for evaluating the energy performance and upgrades of a home, but only a certified EPS auditor has been trained and qualified to conduct an EPS. A third-party certified EPS can only be issued by a certified EPS auditor who does not have any material interest in the energy work that will be, or has been, performed on the home. Certified EPSs can be found on the Web site.

Energy Use Calculation

The energy score is based on a home's shape, size, insulation levels, air leakage, heating and cooling systems, major appliances, lighting, and hot water heating. Occupancy, behavior, indoor temperature, and regional weather are standardized to calculate normal energy use. A home's actual energy use will vary with behavior, weather, and changes to the home.

Carbon Emissions Calculation

The carbon score is based on the greenhouse gas emissions for the annual amounts, types, and sources of fuels used in the home. For electricity, the carbon emissions are based on electricity consumed and the mix of sources used by the serving utility. For natural gas, heating oil, and propane, carbon emissions are based on the therms or gallons used in the home.

Measurements Defined

Electricity is measured in kilowatt hours (kWh). Natural gas is measured in therms. Oil and propane are measured in gallons (gal). Units of energy can be converted from one to another.

1 kWh of energy equals

ten 100-watt light bulbs burning for one hour.

1 therm of natural gas	=	**29.3 kWh**
1 gallon of heating oil	=	**43.9 kWh**
1 gallon of propane	=	**28.0 kWh**

Example of calculating a home's annual energy use

Electricity use: 8,900 kWh/yr	=	**8,900 kWh/yr**
Natural gas use: 650 therms X 29.3	=	**19,045 kWh/yr**
Total energy used per year	=	**27,945 kWh/yr**

Energy Costs - Fuel costs are based on prices at the time the EPS is issued and do not include taxes, surcharges, or fees for renewable energy.

After Upgrades for existing homes indicates the improvement in the predicted energy use and carbon emissions if the lower and higher cost Recommended Energy Upgrades are implemented.

Built to Code for new homes indicates the predicted energy use and carbon emissions of this same home if it was built to code minimums for insulation, windows, air leakage, and with standard mechanical systems.

With energy from renewable sources indicates the carbon emissions produced with a subscription to the most popular renewable energy programs available through the utilities servicing this home. Check with your utilities to learn more about these options.

Oregon Average This is the average energy use of households in Oregon as of 2006.

Oregon Target This is equivalent to 50% of the Oregon Average, and represents the state's energy and carbon goals.

ANNEX 6 – EPS ANALYSIS REPORT

ENERGY ANALYSIS REPORT

Energy Performance Score

Reference Number: 410000000 **Date:** 9/17/08

Contents

- Annual Estimated Energy Use and Fuel Costs
- Comparing Your Utility Bills with the EPS Score
- Summary of Energy Performance Related Elements
- Recommended Energy Upgrades
- Energy Upgrade Descriptions
- No- and Low-Cost Energy-Saving Strategies
- Financial Incentives

Annual Estimated Energy Use and Fuel Costs

	Current Home			After Upgrades		
	Energy	**Fuel Cost***	**Carbon**	**Energy**	**Fuel Cost***	**Carbon**
Heating	650 therms	$910.00	7,565 lbs.	488 therms	$683.00	5,680 lbs.
Cooling	0 kWh	$0.00	0 lbs.	0 kWh	$0.00	0 lbs.
Water Heating	2,907 kWh	$238.00	4,078 lbs.	2,907 therms	$238.00	4,078 lbs.
Lighting & Appliances	5,994 kWh	$492.00	8,409 lbs.	5,103 kWh	$419.00	7,179lbs.
Total (Rounded-off)	**27,900 kWh**	**$1,640.00**	**20,100 lbs.**	**22,300 kWh**	**$1,340.00**	**16,900 lbs.**

*Fuel costs are based on prices at the time the EPS is issued and do not include taxes and surcharges.

Comparing Your Utility Bills with the EPS Score

You can determine how your households's energy use compares to the estimated average use for your home by comparing the energy totals on your utility bills with the EPS.

If the totals from your utility bills are

- **similar** to the EPS, you are using an average amount of energy for your home.
- **higher** than the EPS, you are using more energy than average for your home. Reasons for this may include housing more people than average in the home, using appliances more than average, or behaviors that use more hot water, electricity, and heating than average. There may be no- and low-cost ways that you can use to save energy.
- **lower** than the EPS, you are using less energy than average for your home. Reasons for this may include housing fewer people than average in the home, using appliances less than average, or behaviors that use less hot water, electricity, or heating than average.

To calculate your actual energy use, you will need to know the amount of energy that you used for each fuel type in your home for a full year. This information is available on your utility bills. You can visit the EPS Web site to use the online calculator, or calculate the amount manually using the formulas on the back of the EPS score sheet.

Summary of Energy Performance Related Elements

Element	Description	Current Performance Poor • Average • Good
Air Leakage How tight your home is against air leaks.		
Ceiling & Attic The amount of insulation above the ceiling or in the roof.		
Walls The amount of insulation inside the walls.		
Floors The amount of insulation below the floors.		
Windows The insulation value and tightness of the windows.		
Heating How efficient is the heating system.		
Cooling How efficient is the cooling system.		
Ducts How well sealed and insulated are the ducts.		
Water Heating How efficient and insulated is the hot water system.		
Lights and Appliances How efficient are the lighting and appliances.		

Notes

Recommended Energy Upgrades

These recommended upgrades will improve the energy performance of this home. The cost for the upgrades will vary with the size and complexity of the home and the scope of work required. The Approximate Annual Savings are based on the estimated energy reductions with each upgrade.

	Typical Cost Range	Approximate Annual Savings
Lower-Cost Upgrades (under $1,000)		
Air Sealing		
Attic/Ceiling Insulation		
Duct Sealing		
Duct Insulation (in unconditioned space)		
Appliances		
Other		
Higher-Cost Upgrades (over $1,000)		
Heating System Upgrade		
Cooling System Upgrade		
Water Heater Upgrade		
Solar Water Heater		
Wall Insulation		
Other		
Additional Upgrades These upgrades have a considerably longer financial payback than those listed above.		
Windows		
Solar PV		

Energy Upgrade Descriptions

Lower-Cost Upgrades

Air Sealing Air sealing is one of the most cost-effective energy upgrades you can make and should be done before installing insulation. Cold air can infiltrate small cracks and openings during the winter, while hot outdoor air can overheat your home in the summer resulting in drafts, moisture, and indoor air quality issues.

There are many types of air leaks and many strategies for sealing them. You can undertake this work yourself or hire a contractor who can use a blower door to identify and measure the effectiveness of various air sealing measures.

After your home is sealed, it is important to make sure that there is adequate ventilation to maintain proper indoor air quality and to prevent back drafting of combustion appliances. A certified EPS auditor or qualified professional will identify any potential problems due to insufficient ventilation.

Ceiling & Attic Insulation Attic or ceiling insulation is one of the most cost-effective upgrades you can make and should be done after air sealing in the attic. Attic or ceiling insulation slows heat loss through the roof in the winter and also slows heat gain through the roof in the summer. The insulation is usually installed on the floor of an unfinished attic (the ceiling of the finished room below) and under the roof if the attic space is finished.

Insulation is measured with an R-value, and the higher the R-value, the more effective the insulation value. Insulation is made of different materials and comes in several forms: batts, loose-fill or blown-in, foam, and rigid. Each type of insulation varies in terms of advantages, applications, and pricing.

Duct Sealing and Insulation Heating and cooling duct work that leaks into unconditioned space can be a major source of energy loss. Sealing and insulating your ducts helps to save energy by more effectively directing the heat or cooling to desired locations. Insulating ducts in semi-conditioned spaces such as basements may or may not be necessary depending on the circumstances.

Ducts should be sealed before insulating.

Appliances Older appliances can use significantly more energy than newer, energy efficient appliances. Look for ENERGY STAR refrigerators, freezers, dishwashers, clothes washers, and air conditioners. Even within ENERGY STAR there are more and less efficient models and you should look for the most efficient appliance that fits your budget and needs. If you consider the full life cycle costs, more efficient appliances often make up for any difference in price within a few years of operation.

Higher-Cost Upgrades

Heating System Upgrade Older, poorly maintained, and less efficient furnaces and heat pumps use more energy than newer, high-efficiency models. You may achieve energy savings by upgrading your system. Additionally, you should have your existing system periodically inspected to identify potential problems and extend the life of your system.

When upgrading a heating system, you should also have any connected duct system inspected for air leaks and appropriate upgrades.

Water Heater Upgrade The life cycle of water heaters is approximately 12-15 years. If your water heater is older, consider replacing it with a newer, more efficient one. All new tank water heaters have a built-in insulation layer to conserve energy. Solar water heating may also be an option: it can provide as much as 75% of your hot water needs and offers significant savings over time.

Solar Water Heater Installing a solar water heater on a roof that receives adequate sunlight can be a relatively cost-effective means of reducing your energy costs over the long term. These systems can preheat the water going to your hot water heater and significantly reduce, and at times eliminate, the need for additional water heating.

Wall Insulation Insulating walls will help you to keep heat inside your home during the winter and slow heat gain into your home during the summer. Retrofitting walls with insulation is generally more work and more costly than insulating an attic ceiling or a floor. Walls may be

insulated from the outside or inside and this is more easily accomplished during remodeling work which involves removal of or painting either of these surfaces.

More Energy and Carbon Savings

Windows Older windows can be responsible for draughts and heat loss in winter and heat gain in summer. They can significantly impact your comfort and energy use for heating and cooling. Storm windows can help eliminate some of these issues. High efficiency, double paned, low-e, argon-filled windows with insulated frames can help save energy and make rooms more comfortable and quieter.

Solar Electric Panels Solar electric panels, also called photovoltaic (PV) panels, are an option for homeowners who would like to produce their own electricity from the sun. There are many resources available to determine whether this is a viable option for this home and what financial incentives are available.

No- and Low-Cost Energy-Saving Strategies

No-Cost Strategies

In addition to the energy upgrades that you make to your home, here are steps that you can take to lower your energy use and bills.

Heating & Cooling

Turn down the heat. A good energy-saving setting when you are at home is 67-68 degrees and 55 degrees at night or when you are away. Each degree you lower your thermostat saves an estimated 2 percent on your heating bill. In summer, turn off you heating system or raise the thermostat setting to save on air conditioning.

Higher heat is not faster heat. Turning the thermostat higher will not warm your house faster; it just wastes energy. Lowering the air conditioning setting won't cool your house faster either.

Capture free solar heat. On cooler days, open curtains to catch the heat from the sun and warm your home.

Block the sun in hot weather. To keep your home cool, adjust window coverings to block the sun's hot summer rays. In the evening, open windows to catch cool breezes. Be sure attic vents and soffit vents are not blocked since this will allow hot air to escape your attic.

Water Heating

Lower your water heater thermostat to 120 degrees, or the lowest setting that is acceptable to you for bathing and dishwashing.

Wash laundry in cold water whenever possible. Ninety percent of energy used for washing laundry goes toward heating water. Only run the washer when you have a full load.

Use the dishwasher energy-saver mode and run the dishwasher only when it is full.

Don't let the hot water run while shaving or washing dishes.

Turn off hot water during vacations. Turn your water electric heater off at the breaker panel if you are leaving town for more than a couple of days. But don't do this during freezing weather. If you have a natural gas water heater, turn it to the "low" or "vacation" setting, but do not turn it off.

Generally

Eliminate Phantom Loads. Many home electronics such as computers, televisions, and battery chargers use energy when not in use or turned off. By unplugging these or plugging them into a power strip that can be turned off, you can ensure that no power is being used when these items are not in use.

Hang your clothes outside to dry whenever possible to reduce the use of your energy-intensive electric or gas dryer.

Close your fireplace damper when your fireplace is not in use (but first allow the fireplace to cool completely). If you have fireplace doors, keep them closed.

Low-Cost Strategies

Use a programmable thermostat. Older, manual thermostats are often not as accurate as new electronic models, and they require that you manually set them back each night. Some programmable thermostats have smart features such as preprogrammed "night" and "vacation" energy-saving settings that lower the temperature automatically. Different heating systems require different thermostats. Check the owner's manual to be sure that your thermostat and heating system work effectively together.

Eliminate unnecessary lights and replace incandescent bulbs with energy-saving compact fluorescents (CFLs) or LED lights. You can save at least 75% of the energy used for lighting. CFLs that emit a warm color similar to incandescent bulbs (soft white color) and that turn on more quickly are now available. It is important to handle and recycle broken and burned out CFLs appropriately as they contain small amounts of mercury. Motion detectors, occupancy sensors, and timers can eliminate unnecessary lighting outside and in infrequently used rooms.

Install high-efficiency showerheads and faucet aerators. New showerheads are required to meet a 2.5 gallon per minute standard; the lower the number, the more you will save. If you have a pre-1992 showerhead, it could be using 5.5 gallons of water per minute or more. Look for low-flow aerators of 2.5 gallons or less to fit bathroom and kitchen faucets.

Put bathroom ventilation fans on a timer or on a humidity sensor which will automatically switch off the fan when the room is dry.

Use air movement to cool people during hot days. When it's warm, use natural ventilation or window and ceiling fans to keep cool. Remember that fans cool people, not rooms. If these are insufficient, consider installing a whole house fan which will vent warm air from the home and pull in cooler outside air throughout the house at night.

Plant trees, bushes, and trellises that block unwanted sun in the winter. Strategically located plants on the east, west, and south sides of a house can provide natural cooling through shade. Deciduous plants will shade in summer and allow more light in winter. Plants can also form windbreaks to protect your home from winter winds. Be sure to plant away from the house so you do not trap moisture against the building.

Financial Incentives See web site for more sources of financial assistance.

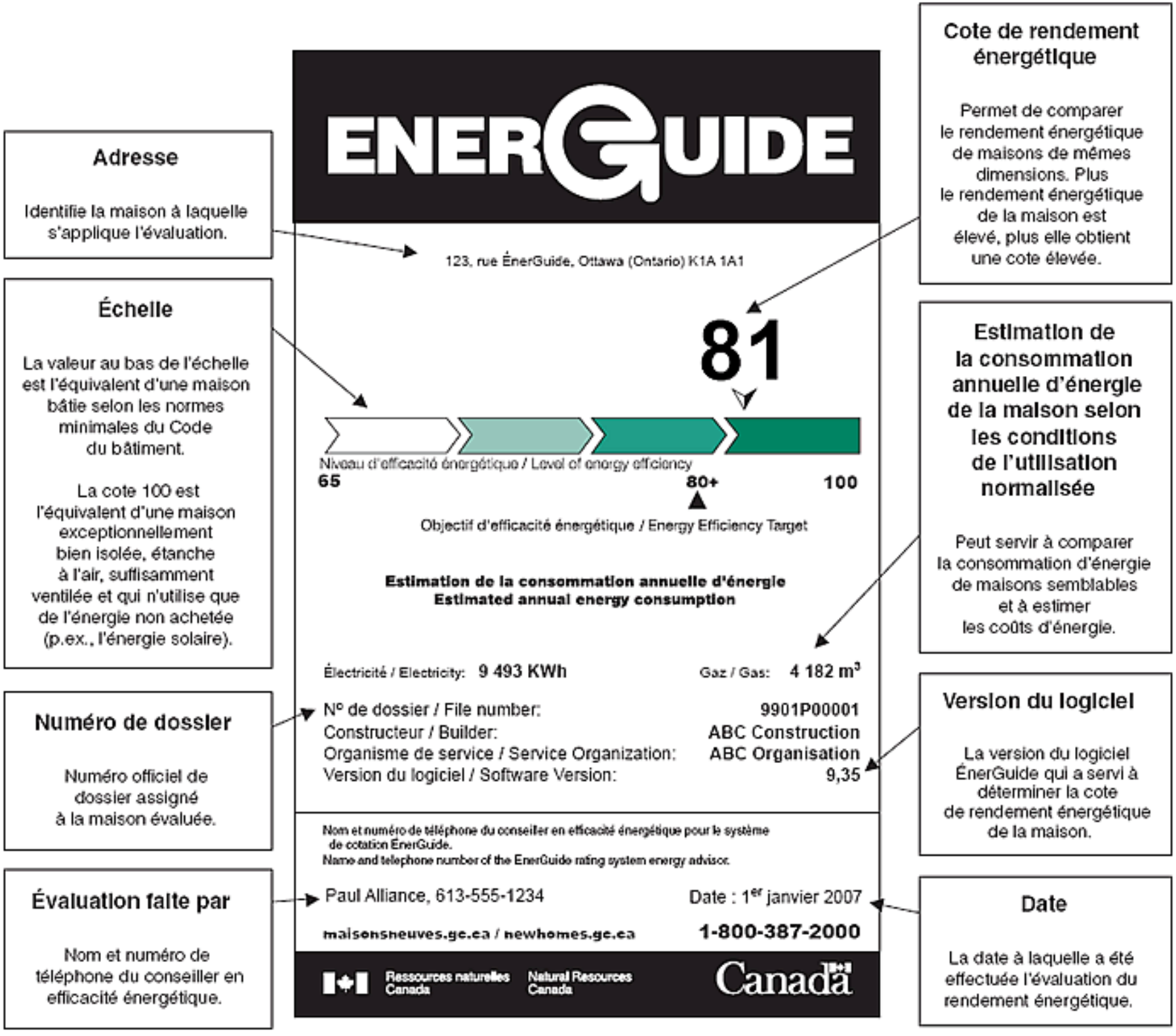
Energy Trust of Oregon Incentives Energy Trust of Oregon, Inc. is a nonprofit that provides the customers of Portland General Electric, Pacific Power, NW Natural, and Cascade Natural Gas with energy conservation information, assistance, and financial incentives. Incentives information includes those offered through Energy Trust, the state of Oregon tax credits, and ENERGY STAR. Energy Trust maintains a list of trade ally contractors who perform an array of energy efficiency work. Visit the Energy Trust Web site to learn about available resources related to energy upgrades. 1-866-368-7878 or www.energytrust.org/

State of Oregon Tax Credits and Loans You may qualify for Oregon Residential Energy Tax Credits on your personal income tax when you purchase qualifying energy efficient technology www.oregon.gov/ENERGY/CONS/RES/RETC.shtml

You can also learn about low interest loans. 1-800-221-8035 or www.oregon.gov/ENERGY/LOANS/selphm.shtml

Federal Tax Credits Home improvement tax credits are now available for home improvements placed in service from January 1, 2009, through December 31, 2009. Also available are tax credits for qualified solar water heating and photovoltaic systems placed in service from January 1, 2006, through December 31, 2016. www.energystar.gov/index.cfm?c=products.pr_tax_credits#s2

ANNEX 7 – ENERGUIDE LABEL


ENERGUIDE
123, rue ÉnerGuide, Ottawa (Ontario) K1A 1A1
81
Niveau d'efficacité énergétique / Level of energy efficiency
65
80+
100
Objectif d'efficacité énergétique / Energy Efficiency Target
Estimation de la consommation annuelle d'énergie
Estimated annual energy consumption
Électricité / Electricity: 9 493 KWh
Gaz / Gas: 4 182 m³
N° de dossier / File number: 9901P00001
Constructeur / Builder: ABC Construction
Organisme de service / Service Organization: ABC Organisation
Version du logiciel / Software Version: 9,35
Nom et numéro de téléphone du conseiller en efficacité énergétique pour le système de cotation ÉnerGuide.
Name and telephone number of the EnerGuide rating system energy advisor.
Paul Alliance, 613-555-1234
Date : 1er janvier 2007
maisonsneuves.gc.ca / newhomes.gc.ca
1-800-387-2000
Ressources naturelles Canada
Natural Resources Canada
Canada
Adresse
Identifie la maison à laquelle s'applique l'évaluation.
Échelle
La valeur au bas de l'échelle est l'équivalent d'une maison bâtie selon les normes minimales du Code du bâtiment.
La cote 100 est l'équivalent d'une maison exceptionnellement bien isolée, étanche à l'air, suffisamment ventilée et qui n'utilise que de l'énergie non achetée (p.ex., l'énergie solaire).
Numéro de dossier
Numéro officiel de dossier assigné à la maison évaluée.
Évaluation faite par
Nom et numéro de téléphone du conseiller en efficacité énergétique.
Cote de rendement énergétique
Permet de comparer le rendement énergétique de maisons de mêmes dimensions. Plus le rendement énergétique de la maison est élevé, plus elle obtient une cote élevée.
Estimation de la consommation annuelle d'énergie de la maison selon les conditions de l'utilisation normalisée
Peut servir à comparer la consommation d'énergie de maisons semblables et à estimer les coûts d'énergie.
Version du logiciel
La version du logiciel ÉnerGuide qui a servi à déterminer la cote de rendement énergétique de la maison.
Date
La date à laquelle a été effectuée l'évaluation du rendement énergétique.

ANNEX 8 – ES CIRCULAR

ENERGY STAR®
pour les
maisons neuves

Depuis 2001, l'Office de l'efficacité énergétique de Ressources naturelles Canada (RNCan) fait la promotion au Canada du symbole international de haute efficacité ENERGY STAR et en vérifie l'utilisation.

Les produits sur lesquels on retrouve ce symbole permettent d'économiser de l'énergie et de l'argent, et aident à protéger l'environnement.

Tout produit ou appareil affichant le symbole ENERGY STAR offre un rendement énergétique optimal et satisfait aux exigences rigoureuses en matière de consommation d'énergie.

Quelles sont les maisons neuves homologuées ENERGY STAR?

En 2005, RNCan a élargi la portée de l'initiative ENERGY STAR pour y inclure les habitations neuves éconergétiques. Les habitations neuves ENERGY STAR sont environ de 30 à 40 p. 100 plus éconergétiques que celles construites selon les normes minimales du code du bâtiment. Pour les propriétaires, cela se traduit par une baisse substantielle des coûts des services publics.

Quels en sont les avantages?

Voici quelques-unes des spécifications éconergétiques des habitations neuves ENERGY STAR

- meilleure isolation
- fenêtres au rendement énergétique supérieur
- meilleur calfeutrage
- systèmes de chauffage, d'eau chaude et de climatisation plus efficaces
- conduits de ventilation scellés qui assurent une meilleure répartition de l'air
- appareils électroménagers ENERGY STAR (s'ils sont fournis par le constructeur)

Les nouveaux propriétaires profiteront des avantages suivants

- factures d'énergie moins élevées
- meilleur confort
- contrôle de la qualité endossé par le gouvernement
- moins d'effets néfastes sur l'environnement
- valeur de revente plus élevée

À quel point une maison homologuée ENERGY STAR est-elle éconergétique?

energy
ENERGY STAR
HAUTE EFFICACITÉ
HIGH EFFICIENCY

Les constructeurs ou les propriétaires de maisons homologuées ENERGY STAR peuvent également recevoir une notation de rendement énergétique – la notation ÉnerGuide – afin de comparer et d'évaluer la consommation d'énergie de la maison.

Afin de déterminer le rendement énergétique de la maison (sur une échelle de 0 à 100), un conseiller qualifié entre dans la maison et effectue des tests. Une fois qu'il a terminé, il fournit une notation ÉnerGuide et un rapport à l'intention du propriétaire décrivant le niveau d'efficacité énergétique de la maison. Bien que la plupart des maisons neuves reçoivent une cote d'au moins 68, la maison moyenne homologuée ENERGY STAR reçoit une cote de rendement énergétique d'au moins 77. Par conséquent, lorsqu'une maison neuve porte le symbole ENERGY STAR, vous savez qu'il s'agit d'une maison éconergétique qui recevrait une excellente cote ÉnerGuide.

Si vous voulez obtenir la cote de rendement énergétique d'une maison homologuée ENERGY STAR, communiquez avec votre entreprise de services afin de trouver un évaluateur de rendement énergétique dans votre région.

ENERGY STAR et l'environnement

De nos jours, 17 p. 100 de l'énergie consommée au Canada est destinée aux habitations. Chaque fois que nous consommons de l'énergie provenant de combustibles fossiles comme le charbon, le mazout et le gaz naturel, nous produisons des émissions de gaz à effet de serre qui contribuent aux changements climatiques. L'achat d'une habitation neuve ENERGY STAR est tout indiqué, puisque celle-ci permet de diminuer les émissions de gaz à effet de serre d'approximativement trois tonnes par année!

Offre-t-on une aide financière aux acheteurs d'habitations neuves?

La Société canadienne d'hypothèques et de logement (SCHL) offre un remboursement correspondant à 10 p. 100 de la prime d'assurance-prêt hypothécaire à l'emprunteur qui achète ou construit une habitation éconergétique. Pour être admissible au remboursement, cette dernière doit satisfaire à certaines exigences minimales d'efficacité énergétique. Pour plus d'information, visitez le site Web de la SCHL à l'adresse schl.ca, ou composez le 1-800-668-2642.

Avec qui communiquer?

Si vous êtes intéressé à devenir un constructeur accrédité ENERGY STAR, ou si vous voulez acheter une maison ayant la notation ENERGY STAR, visitez notre site Web energystarhomes.gc.ca afin de trouver les coordonnées de votre entreprise de services.

Si votre entreprise est enregistrée et fournit des matériaux ou des services à des propriétaires de maisons neuves homologuées ENERGY STAR, vous pouvez utiliser l'appellation ou le symbole ENERGY STAR dans votre publicité. Visitez notre site Web energystarhomes.gc.ca afin de trouver les coordonnées de votre entreprise de services.

Pour commander des publications sur l'efficacité énergétique des maisons neuves, composez le 1-800-387-2000.

L'office de l'efficacité énergétique de Ressources naturelles Canada
Engager les Canadiens sur la voie de l'efficacité énergétique à la maison, au travail et sur la route

Papier recyclé N° d'inventaire M27-01-2367

Ressources naturelles Canada Natural Resources Canada
Canada

ANNEX 9 – UC-EE SUMMARY DOCUMENT

DOCUMENT SYNTHÈSE

Pratiques courantes et principaux éléments à considérer afin d'établir un système de cotation énergétique des habitations

Notre projet vise à évaluer la possibilité et la pertinence d'établir un système de cotation énergétique à divulgation obligatoire lors de la vente ou de la location des habitations résidentielles. Une telle cotation permettrait d'informer les acheteurs et locataires de la performance énergétique de leur future habitation et de valoriser davantage la bonne performance énergétique de celles-ci. Des suggestions de rénovation pourraient vraisemblablement s'ajouter au rapport de cotation, en vue d'entraîner des investissements supplémentaires en efficacité énergétique.

Le rapport final présentera un survol des pratiques établies dans différents systèmes de cotation énergétique à divulgation obligatoire des habitations résidentielles mis en place à l'étranger et proposera une initiative canadienne en ce sens. S'il n'y a pas de pratiques qui soient meilleures en soi ou universelles quant à l'implantation d'un tel système, les façons de faire établies le sont en fonction des objectifs visés et peuvent être évaluées sur la base de leur capacité à les atteindre de façon efficiente. Ces objectifs et ces différentes pratiques fournissent par conséquent un vaste éventail de possibilités au législateur.

L'identification des divers éléments et aspects à prendre en considération afin de réussir une implantation fructueuse d'un système de cotation énergétique visant les bâtiments neufs et existants dans le secteur résidentiel sera donc importante, et la détermination des objectifs poursuivis deviendra essentielle.

Définition du périmètre réglementaire et arrimage avec les mesures légales existantes

Il importe de définir en premier lieu les habitations résidentielles qui seront visées par la réglementation et celles qui en seront exclues ainsi que les critères sur la base desquels seront effectués ces choix. Par exemple: Y aura-t-il un nombre maximal de pieds carrés au-delà duquel le bâtiment n'est plus considéré comme ayant une vocation résidentielle? Une superficie minimale en deçà de laquelle le bâtiment pourrait être exempté sera-t-elle établie?

Serait-il nécessaire d'introduire quelques exceptions, notamment pour les habitations classées comme historiques, les lieux de culte et les bâtiments de nature provisoire?
Certains pays ont mis sur pied un registre national des bâtiments indiquant la vocation (commerciale ou résidentielle) des locaux. Si un tel registre existe dans la juridiction considérée, serait-il pertinent de s'y référer afin de cibler les bâtiments visés par la réglementation?

Le système de cotation s'appliquera-t-il à la fois aux habitations existantes et aux habitations nouvelles? Le système cotation devrait-il (et pourrait-il) alors s'appuyer sur les mêmes critères?

La cote énergétique devra permettre une comparaison aisée de la performance énergétique de tous les bâtiments. Pour ce faire, il faudra s'assurer de ne pas multiplier les étiquettes et les cotes, ce qui risquerait de confondre le consommateur. Dans cette optique, en regard de la cotation des bâtiments neufs, serait-il judicieux d'utiliser la même cote de performance énergétique pour le système de cotation obligatoire que celle qui est employée pour l'attribution

des sceaux attestant la qualité des nouveaux bâtis ou celle utilisée lors de l'attestation de gains d'efficacité énergétique découlant de rénovations subventionnées selon la performance?

Dans le même ordre d'idées, il serait probablement préférable d'arrimer la cotation énergétique des bâtiments neufs avec les normes minimales de construction du bâtiment plutôt que de permettre un enchevêtrement avec celles-ci.

Conseils de rénovation à la cotation énergétique des bâtiments existants?

En vue d'entraîner une augmentation de l'efficacité énergétique, des suggestions de rénovation en ce sens pourraient vraisemblablement s'ajouter à la cotation proprement dite des bâtiments existants.

Si tel est le cas, il faudra déterminer comment les économies potentielles seront présentées et quels seront les coûts des mesures proposées. Attendu que l'apport de suggestions de rénovation peut inciter les propriétaires occupants à entreprendre des travaux d'amélioration de leur résidence, il faudra s'assurer que les bénéfices éventuels apportés par ce volet supplémentaire en valent l'effort additionnel.

Si le programme vise aussi bien les habitations existantes que les habitations neuves, la cotation des maisons neuves devrait-elle elle aussi présenter des propositions d'amélioration à l'efficacité énergétique de l'immeuble? Serait-il possible de suggérer des travaux d'amélioration avant le début de la construction plutôt que par la suite? Un programme de cotation énergétique pourrait-il le permettre?

À quel niveau de désagrégation doit-on présenter l'énergie consommée?

Certaines utilisations de l'énergie sont pratiquement inélastiques, c'est-à-dire que leur usage n'est pas compressible. La cote énergétique doit-elle identifier séparément l'énergie utilisée pour l'éclairage, celle pour chauffer l'eau, ainsi que celle nécessaire au chauffage et la climatisation des locaux?

La source la plus importante de consommation énergétique est celle impliquant le chauffage des locaux. Serait-il pertinent d'identifier séparément l'énergie utilisée à cet effet? Ceci nécessiterait l'inspection des systèmes de chauffage lors de l'évaluation des bâtiments. Il faut garder à l'esprit qu'il sera toujours possible pour un ménage d'ajouter des sources de chauffage secondaire ou d'appoint. Conséquemment, il pourrait être utile de fournir des informations sur la consommation énergétique des appareils utilisés à ces fins en sus de l'audit énergétique de l'habitation.

La cote énergétique doit-elle tenir compte du comportement des habitants des bâtiments?

Il faudra décider comment on normalise le mesurage de la consommation énergétique : en particulier, la cote énergétique devra-t-elle tenir compte du comportement des habitants?

Une « cotation simplifiée », basée sur la consommation réelle passée des habitants du bâtiment en question (i.e. la facture énergétique) plutôt que sur un audit de la performance énergétique

du bâtiment en tant que tel, a été utilisée dans certains pays afin d'accélérer l'adoption de la cote énergétique.

Serait-il envisageable et souhaitable de combiner ces deux mesures afin que l'étiquette énergétique soit aussi complète que possible?

Quels sont les paramètres qui devront être normalisés pour le calcul de la cote énergétique?

Plusieurs paramètres doivent être standardisés afin de permettre une cotation sur des bases uniformes et de garantir que les résultats soient comparables d'un bâtiment à l'autre. Par exemple, qu'elle sera la température intérieure choisie pour l'évaluation? Doit-elle être la même indépendamment du niveau d'isolation de l'habitation? Il semble raisonnable de croire que la température intérieure d'une habitation puisse être corrélée avec son niveau d'isolation thermique. Est-ce que la capacité du réservoir d'eau chaude devrait également être standardisée?

Plus l'évaluation énergétique sera raffinée, plus il sera possible d'élaborer des conseils précis et détaillés afin de favoriser d'éventuelles rénovations ou améliorations du bâtiment. Ces deux facteurs impliqueront cependant un coût plus élevé pour l'audit énergétique. Identifier le bon dosage de coûts et bénéfices de la précision de l'évaluation et des conseils apportés devient alors primordial.

S'ils sont de nature plutôt technique, ces paramètres devront être clairement définis avant la mise en application du système de cotation.

Sur quelle échelle présente-t-on la consommation énergétique de l'habitation?

Plusieurs avenues sont possibles pour présenter la consommation énergétique : mesurer la seule quantité d'énergie utilisée, en unités physiques (par exemple, en kWh), ou utiliser le coût de l'énergie utilisée.

Si l'on choisit de présenter les coûts, il faudra tenir compte de la volatilité des prix de l'énergie. Plus la période de validité de la cote de performance énergétique s'allonge, plus la possibilité que les prix de l'énergie fluctuent considérablement augmente, et plus la mesure de coûts risque de devenir désuète pour une même consommation énergétique du bâtiment. Les implications seront importantes dans le cas des locations

Un autre élément à considérer est celui des habitations utilisant plusieurs sources d'énergie. Comment attribue-t-on à chaque source d'énergie sa part de la consommation énergétique de l'habitation? La biénergie constituant une assurance contre les mouvements des prix relatifs de l'énergie, il est possible que les parts des sources d'énergie utilisées varient en raison des mouvements de leurs prix respectifs, le consommateur utilisant davantage la source d'énergie présentement la moins coûteuse.

Dans le cas des suggestions de travaux de rénovation, doit-on indiquer une estimation des montants nécessaires aux divers investissements et la valeur actualisée des économies d'énergie escomptées? Dans la mesure où l'on répond par l'affirmative à ces questions, il serait

conséquent de présenter une estimation des coûts monétaires de la consommation énergétique de l'habitation de façon à pouvoir évaluer le rendement des travaux à entreprendre.

Donnera-t-on uniquement une valeur numérique ou échelonnera-t-on les résultats par catégories alphanumériques ou par l'entremise d'un système graphique? Doit-on comparer la consommation de l'habitation évaluée avec la consommation théorique d'une maison de référence?

Dans la mesure où l'on joint des suggestions de travaux pour rénover les habitations existantes, il faut vérifier si la présentation des résultats influe sur les travaux réalisés. Il est peu probable qu'un propriétaire entreprenne des travaux, s'il n'est pas certain que le grade de cotation de son habitation augmente à la suite de son investissement. Le système de cotation devra posséder une précision suffisante afin que les gains énergétiques découlant de la réalisation des travaux de rénovation suggérés se reflètent dans la cote énergétique ainsi obtenue.

Si l'on présente les résultats sur la base des unités physiques d'énergie nécessaire afin de maintenir un confort constant, les habitations localisées dans les zones plus froides se verront attribuer de moins bonnes cotes énergétiques; cela aurait-il pour effet de dévaluer les habitations de ces régions, advenant que la performance énergétique du bâtiment dût se refléter dans le prix de vente sans égard à la réalité climatique locale, ou l'effet serait-il neutre, attendu que les comparables seraient forcément soumis à la même réalité climatique? Afin de moduler la cote énergétique selon la région climatique, serait-il envisageable d'utiliser le nombre de degrés/jour de chauffe (DJC) spécifique à chaque région?

Quels éléments devraient être présentés sur l'étiquette?

La consommation énergétique du bâtiment évalué, ainsi que les coûts et les économies escomptées concernant les suggestions de rénovation dans le cas des habitations existantes prendront-ils une place prépondérante sur l'étiquette délivrée?

Selon les objectifs du législateur, il est possible d'ajouter d'autres mesures à celles visant à quantifiant la performance énergétique des habitations. Par exemple, si on devait étendre à des objectifs environnementaux plus larges la portée réglementaire, on pourrait rajouter à la cote énergétique sur l'étiquette une mesure des émissions de gaz à effet de serre (GES), une mesure de la part d'énergie renouvelable dans la dépense énergétique ou de la consommation annuelle de litres d'eau potable.

Mise en place d'un système d'inspection et de conformité

La mise en place d'un système de cotation obligatoire entraînera le besoin d'un bassin d'inspecteurs qualifiés, nécessaire afin de pouvoir émettre une cotation à un nombre important d'habitations annuellement. De plus, il faudra s'assurer de mettre sur pied un système de vérification et de conformité afin de garantir la qualité des audits énergétiques.

Un problème risque de se présenter lors de l'instauration de l'obligation réglementaire où le nombre d'inspections demandées pourrait s'avérer très grand tandis que le nombre d'inspecteurs qualifiés pourrait être insuffisant. Il faudra prévoir la formation d'un nombre important d'inspecteurs dans un laps de temps possiblement assez court.

Afin d'amoindrir ce problème, serait-il possible de procéder à une mise en application progressive de la réglementation? On pourra par exemple, rendre obligatoire la cotation énergétique des bâtiments existants uniquement dans les cas de vente et revente dans un premier temps.

Dispositions légales

Quelles sont les dispositions légales du système de cotation énergétique? La cotation d'un bâtiment par un agent accrédité est-elle garantie? Quelles garanties seraient offertes relativement à l'efficacité des travaux de rénovation suggérés et à leur effet sur la cote énergétique, ou quant à l'estimation du prix des travaux suggérés?

Des règles d'éthique particulières devraient-elles être élaborées en vue d'assurer que les inspecteurs n'aient pas de liens d'affaires avec des courtiers immobiliers ou des entrepreneurs? Ces règles devraient-elles être modulées en fonction des régions (dans les petites localités, le nombre de courtiers et d'inspecteurs sera vraisemblablement limité)?

Pour quelle période de temps la cote énergétique d'un bâtiment est-elle valide? Une nouvelle cotation devrait-elle n'être exigée qu'au terme d'une période donnée (à chaque dix ans, par exemple) ou devrait-elle faire l'objet d'une mise à jour lors de chaque location ou revente du bâtiment?

Financement

Qui paye pour les inspections? Est-ce l'acheteur, le vendeur, le gouvernement ou l'industrie? Donnera-t-on des subventions pour la cotation énergétique ou la réalisation des travaux de rénovation suggérés?

Les autres frais du programme (administration, formation des évaluateurs, etc.) devraient-ils être assumés par les propriétaires des immeubles ou par les gouvernements?

Les programmes de subventions existants qui visent l'amélioration de l'efficacité énergétique des immeubles devraient-ils être arrimés au programme de cotation ou être remplacés par des programmes plus ciblés? Qu'en est-il des programmes existants qui visent à subventionner l'obtention de sceaux de qualité pour les maisons neuves? Des hypothèques à taux réduits devraient-ils être octroyées pour les habitations neuves performantes ou des prêts à taux réduits devraient-ils être octroyés pour entreprendre des rénovations améliorant sensiblement la cote énergétique du bâtiment?

Économies d'échelle et cotation groupée pour certains logements

Des économies d'échelle peuvent être réalisables pour certains groupes d'habitations. Dans le cas des immeubles locatifs, serait-il raisonnable d'attribuer la même performance énergétique à tous les logements de l'immeuble en ne testant qu'un seul logement représentatif? Un tel système serait-il possible dans un parc d'habitations neuves construites sur un même modèle?

ANNEX 10 – DETAILED COST/BENEFIT CALCULATIONS

Costs and Benefits to the Federal Government

This annex details assumptions and calculations of costs and benefits to the federal government from establishing the proposed energy rating system.

The concept used is that of net discounted value (NDV)[147]. Given the assumptions stated above, the federal government incurs no cost and receives benefits from avoided carbon emissions. To determine the NDV, it will suffice to discount the value of related treasury cash flows, because we assume that the avoided emissions are convertible into cash on the carbon stock exchange.

To calculate the NDV, it is necessary to estimate or take as a working hypothesis the parameters entering into the following calculation:

We take the average quantity of CO_2 avoided per home, and multiply that quantity by future CO_2 prices over the useful life of improvement work done. Afterward, we add those products by discounting them. We multiply this result by the percentage of homes for which the owner will have improvement work done, and then by the number of homes in Canada, and the NDV will thus be found regarding the monetary value related to avoided carbon emissions. We will comment on each of the assumptions retained.

We begin the discussion with an analysis of the assumption regarding average quantities of carbon avoided per home. During the "EnerGuide for Houses" program (a forerunner of the current "ecoEnergy Retrofit – Homes" program), an evaluation report[148] had estimated the reductions in CO_2 emissions resulting from energy efficiency improvement work at 1.4 tonne annually per home. To produce a cautious estimate, we will round this number down to 1.0 tonne of CO_2 per participating home.

We will retain a useful life of 20 years for the savings generated by improvement work done; this is at the low end of useful lives generally recognized for this type of program[149], since energy distributors often use useful life assumptions of 25 or even 30 years for work of similar nature. The useful life we retain will again avoid overestimating the gains attributable to energy efficiency improvements that may be done.

Future prices of a tonne of CO_2 are most uncertain. However, we note that according to the analysis of the National Round Table on the Environment and the Economy, the price of a tonne

[147] Regarding the concept of net discounted value, refer to **Wikipedia,** *Net present value*, May 12, 2010. [Online] http://en.wikipedia.org/wiki/Net_present_value (page consulted on May 14, 2010).
[148] **Natural Resources Canada**, *Evaluation of the Energuide for Houses Program,* on the website of Natural Resources Canada, Government of Canada, Ottawa, Ontario, March 2010. [Online] http://www.nrcan.gc.ca/evaluation/reprap/2001/energuide-eng.php (page consulted on May 14, 2010).
[149] **Agence de l'efficacité énergétique du Québec**, *Tableau comparatif des hypothèses des programmes de l'AEÉ – Rénoclimat travaux,* available on the website of la Régie de l'énergie du Québec, Montreal, Quebec, October 2008, p. 1. [Online] http://www.regie-energie.qc.ca/audiences/3671-08/RepDDR_AEE_3671-08/B-28_AEE-10Doc1-Annexe-14-1_3671_24oct08.pdf (page consulted on May 14, 2010)

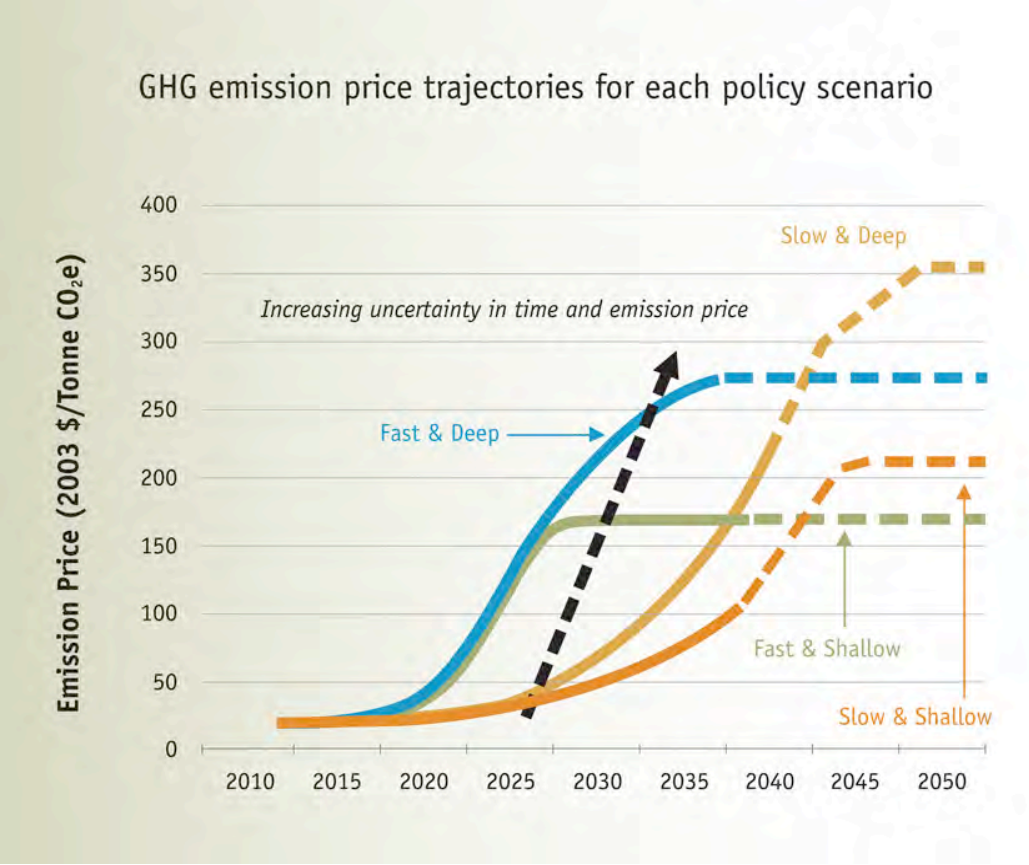
of carbon should be relatively high if it is to constitute a tool enabling Canada to meet its pollution emission reduction targets:

> *"Another important observation is that a strong, economy-wide price signal is required - regardless of pathway - to get at the substantial GHG reductions contemplated for 2050 (Figure 3). The modelling suggests that GHG prices in the range of $190 to $240 (in 2003 Canadian dollars) per tonne of carbon dioxide-equivalent (CO_2e) are required to attain a reduction of 45% from 2005 levels by 2050 if Canada were to meet the target using domestic actions only. These price ranges are similar to GHG emission prices reported in other studies. For example, the latest study by the IPCC (2007) suggests that GHG prices in the range of US$15 to $130/tonne CO_2e are required to attain a global reduction of approximately 20% from 2005 levels by 2050."*[150]

The Round Table also provides price trajectories per tonne of pollution emissions as a carbon dioxide equivalent (CO_2e), in various scenarios for attaining the GHG emission targets that Canada has set for itself. Those trajectories are illustrated in the table below:

[150] **National Round Table on the Environment and the Economy,** *Chapter 2.1.3, Policy Certainty beyond the Short Term Is Central,* Government of Canada, Ottawa, Ontario, August 2009. [Online] http://www.nrtee-trnee.com/eng/publications/getting-to-2050/2-1-3-getting-to-2050.php, (page consulted on May 18, 2010)

Table 3
GHG Emission Price Trajectories for Each Policy Scenario[151]



We have retained a current price of $15 per tonne of CO_2 and of $130 by 2030 (which implies a real growth rate of approximately 9.4%), which again appears to be at the low end of prices considered by the Round Table. We have used a real discount rate of 4%[152]. The net discounted value of avoided carbon emissions will be, according to these parameters, about $516 per participating home.

Considering that the Canadian housing stock contains about 10,418,000 homes[153], and that one out of two owners will have energy efficiency improvements done[154], the benefits to the Canadian government will be about $2.7 billion upon completion (when the entire housing stock has been rated).

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[151] **National Round Table on the Environment and the Economy,** *Chapter 2.1.3, Policy Certainty Beyond the Short Term Is Central – Table 3,* Government of Canada, Ottawa, Ontario, August 2009. [Online] http://www.nrtee-trnee.com/eng/publications/getting-to-2050/2-1-3-getting-to-2050.php (page consulted on May 18, 2010).

[152] See the "Costs and Benefits to Consumers – Energy Benefits" section herein for a discussion of this assumption.

[153] **Office of Energy Efficiency,** *Residential Housing Stock and Floor Space,* on the website of Natural Resources Canada, Government of Canada, Ottawa, Ontario, December 7, 2009. [Online] http://oee.nrcan-rncan.gc.ca/corporate/statistics/neud/dpa/tableshandbook2/res_00_11_e_4.cfm?attr=0 (page consulted on May 14, 2010).

[154] See the "Costs and Benefits to Consumers – Energy Benefits" section herein for a discussion of this assumption.