



MANAGING CLIMATE CHANGE RISK



Findings of 2010 survey of property and casualty (P&C) insurers operating in Quebec

October 2011



Legal deposit - Library and Archives Canada, 2011 Legal deposit - Bibliothèque et Archives nationales du Québec, 2011

ISBN 978-2-550-63262-7 (printed version) ISBN 978-2-550-63261-0 (on-line version)

This document is available on our website at: www.lautorite.qc.ca.

Also available in French

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INTRODUCTION

In accordance with the powers conferred upon it by its constituting act¹, the mandate of the Autorité des marchés financiers (the "AMF") is to enforce the laws regulating the Québec financial industry. In addition to this compliance role, the AMF's mission includes overseeing the solvency of financial institutions and assisting consumers.

In order to put forward appropriate regulatory solutions to properly fulfill its regulatory role, and with a constant eye towards maintaining a balance between industry growth and consumer protection, the AMF must seek to understand the major issues that may affect each segment of the financial services industry.

One of these major issues that concerns the P&C insurance industry directly is the threat posed by climate change.

It is within this context that in 2010, AMF Solvency decided to carry out a survey of P&C insurers and reinsurers operating in Québec about the impact of climate change.

¹ An Act respecting the Autorité des marchés financiers (R.S.Q., c. A-33.2).

THE AMF AND CLIMATE CHANGE²

Faced with a seeming threat that could jeopardize the physical well-being and the material and financial wealth of consumers, the AMF has the duty to assess the extent to which climate change could affect the operations of insurers, particularly as regards their ability to satisfy their commitments, maintain affordable insurance coverage and remain financially sound.

AMF Solvency has long taken an interest in the issue of climate change. It began several years ago with keeping a watchful eye over the market, and has continued more actively over the years through cooperation and participation in various forums on the subject.

This approach led us to introduce a mandatory question on climate change in the annual automobile insurance rates questionnaire for the years 2008 and 2009. Although this line of business is not as directly tied to the threat of climate change as is home insurance, the primary goal was to take an initial poll within the industry³.

Moreover, the AMF prioritized the issue of climate change at its 2009 annual Rendez-vous⁴. Gathered at a public round table, insurers, reinsurers and experts⁵ agreed that P&C insurers are at the very heart of the climate change issue. They are among those who are the most threatened by it, but, at the same time, they are also among those best qualified to help society adapt and spearhead initiatives to counter the more sudden and devastating effects of climate change.

This finding was also confirmed by the Insurance Bureau of Canada which, again in 2011, identified adaptation to climate change as one of the industry's key strategic issues⁶.

4 Rendez-vous with the AMF, Montréal, September 26, 2009.

² CAUTION: Respondents' statements in this report must not be interpreted as scientific confirmations. Nuances must be drawn. For example, it is still very difficult to prove with a high degree of certainty that the occurrence of a local and isolated extreme event has been caused by global warming. This report includes a section setting out a summary of the scientific literature on climate change (Appendix 4). Another section deals specifically with research findings for Quebec (Appendix 5).

³ The question sought to estimate, on a scale of 1 to 10, the degree of importance placed on climate change and identify its potential impact on automobile insurance practices.

⁵ Alain Bourque, climatologist at the Ouranos Consortium.

⁶ Facts of the General Insurance Industry in Canada", IBC, 2009 ed., and Thompson's World Insurance News, p. 1, May 2, 2011.

OBJECTIVE OF THE SURVEY

Insurers have always been concerned by meteorological swings and the damage they cause. They have dealt with them in the traditional manner and continue to do so with a variety of tried and tested approaches such as premium increases, more restrictive selection and underwriting criteria, more limited and better targeted products, geographic diversification, mapping, reinsurance, and preventive measures.

The objective of our survey was not to verify this aspect; rather, it emerged from our observation that extreme weather events, once scarce, are likely to become increasingly frequent and destructive. Not only have such events become the norm, their incidence is increasing and even appears to be accelerating⁷. We wanted to better understand and measure this growing threat to insurers.

Our focus was to determine how insurers view this threat in terms of governance and risk management and to what extent they are taking this threat into consideration and integrating it in their operations.

We believe that insurers are in the best position to anticipate the impact of climate change on their insureds and on their own financial health. Consequently, this survey was intended to provide greater insight into the steps that insurers, given this privileged vantage point, are now taking to address the issue of climate change.

In particular, we sought to establish the extent to which insurers, on an individual basis:

- were up to date on the issue and concerned by it;
- had identified the associated risks;
- were making efforts to measure the impact of climatic disturbances;
- were taking concrete measures to anticipate such disturbances and adapt thereto;
- were monitoring developments.

Lastly, as indicated in the survey cover letter, the objective of the survey was to generate an overview of this issue, not to determine or judge the situation of individual insurers.

⁷ See the caution in note 2 of this report.

METHODOLOGY⁸

The survey was carried out in the summer of 2010. It was sent to management of all insurers authorized to carry on P&C insurance business in Québec, regardless of their charter (provincial, federal or foreign) or lines of business. The only criterion was that they hold a valid licence.

We took this approach not merely because it was pratical and efficient, but also because it did not assume that climate change impacts only clients of property insurers.

As this is an emerging and poorly defined risk, we did not want to deprive ourselves of information that might be forthcoming from insurers in another line of business also concerned by this issue.

More importantly, the survey was developed to elicit answer quality rather than quantity and therefore consisted of 10 open-ended questions.

For this reason, we chose to make the survey optional. This enabled us to focus on relevant and timely information, thereby facilitating our analysis and ensuring the impartiality of our reading of the findings. The survey was sent out on June 11, 2010. The deadline for receiving answers was August 20, 2010 in order to give insurers sufficient time to answer the questions.

Insurers had the option to provide their answers by e-mail or by regular mail; most opted for e-mail.

Lastly, each insurer could answer individually or provide one answer for the group to which it belonged.

⁸ We gratefully acknowledge Paul Kovacs of the Institute of Catastrophic Loss Reduction for his invaluable advice in developing the questionnaire and our approach.

RESPONSE RATE

As mentioned, the questionnaire was sent to management of all insurers authorized to conduct P&C insurance business in Québec, namely 155 legal entities.

Of that total, we aggregated all the entities belonging to the same group of insurers, because all respondents answered either collectively on behalf of all their companies or with identical answers for each of them individually.

Furthermore, in order to establish a relevant and representative response rate, we only kept answers provided by insurers and groups of insurers that had written personal property insurance during the preceding financial year^o and whose market share in Québec for this line of business was 0.1% or more¹⁰.

Consequently, we estimated that 27 insurers and/ or groups of insurers should have had a sufficient direct interest in the survey. Given that nine insurers answered, the response rate was 33%.



Graph 1

This graph shows the response rate for insurers or groups of insurers whose market share in Quebec for personal property insurance was 0.1% or more in 2009.

⁹ The year 2009.

¹⁰ The exclusion did not have the effect of eliminating any respondents, other than those who had returned forms that had not been completed or those who had answered "not applicable".

¹¹ They represent 99.8% of the personal property market share. The list is in Appendix 2.

Although the number of respondents was small, we believe their answers are sufficiently representative of reality insofar as they constitute 61% of the market share of personal property insurance sold in Québec.



Moreover, had it not been for the lack of response from two major groups of insurers, the rate would have been close to 75%. Without hypothesizing on the reasons for the lack of participation of these players, as well as a few others, we believe they are indicators of the relative novelty of the issue and the uncertainties that surround the risk it represents.

Lastly, we took into account the answers provided by two major reinsurers with a direct interest in this issue. Given their importance and relevance, the thoughts and comments of these two players were incorporated in the findings. It should be noted however that these reinsurers were not counted in establishing the response rate, given that they do not directly write personal property insurance.

Graph 2

This graph shows the response rate of insurers or groups of insurers according to their share of the Québec personal property market for 2009.

RESULTS BY QUESTION

This section refers back to each of the survey questions and presents the answers collectively, with comments.

In some cases, elements of answers to one question were found in the answers to another question or were repeated in several answers given by the same insurer. To ensure consistency and clarity of our findings, in some cases we transferred elements of an answer to the appropriate question and in other cases we referred back to those elements under one or more other questions.

That being said, in order not to distort respondents' answers, the key answers to each question had previously been recorded and summarized¹². This allowed us to identify respondents' original answers and the common information, thereby facilitating our analysis without introducing any bias.

In general, the answers are varied. They offer an interesting qualitative overview of the range of perceptions and practices with respect to managing climate change risks.

¹² See Appendix 3.

How is the issue of severe weather and climate change addressed in your risk management strategy?

The goal of this first question was to learn about and understand how insurers viewed the risk of climate change from an overall and strategic perspective.

The answers are varied and cover a broad spectrum. They revealed that the approaches differ greatly from one insurer to another, as does the emphasis placed on this issue. Save for a minority of respondents, it also appears that there is a certain "discomfort" in the manner the issue is approached.

Two groups of respondents clearly emerged. The first is comprised of respondents who specifically integrate or are in the process of specifically integrating climate change in their risk management strategy, by seeking to address climate risk directly and explicitly. The second group is comprised of respondents who do not consider climate change in a clear and obvious manner, although their answers revealed that they do consider it indirectly. Only one insurer admitted that it did not have any strategy in this regard.

CONSIDERATION OF CLIMATE CHANGE IN RISK MANAGEMENT



Graph 3

This graph shows the number of insurers who integrate climate change directly in their risk management strategies.

Answers from the first group

The majority of respondents, who make up the first group, have integrated climate change in their risk management plan. Most of them consider climate change to be a main risk issue. For instance, one respondent indicated that there is no longer any doubt that the climate is changing and the question is to know how the acceleration of these changes will occur and how severe an impact they will have. Moreover, some stated that senior management is involved in developing a culture of risk management and is clearly defining strategies as well as a governance structure to address climate change. Several other respondents approach climate change as an event of a catastrophic and repetitive nature.

The following list presents the strategy elements identified by respondents who have integrated the risks and consequences associated with severe weather resulting from climate change:

- define risk appetite in connection with reinsurance needs;
- maintain sufficient coverage to deal with catastrophic events, such as the 1998 ice storm;
- maintain surplus capital in excess of the regulatory minimum;
- identify the coverage affected by climate risks;
- assess the impact of climate change on the development of products and services;
- assess the impact of climate change on the management of financial resources and on operations;
- run awareness-raising and prevention campaigns for governments, industry members and the public;
- have an organization-wide greenhouse gas emissions reduction program;
- establish specific strategies within a sustainable development policy;
- understand climate change risks.

Answers from the second group

Two insurers in the second group indicated that they did not incorporate severe weather or climate change directly in their risk management strategy. As an explanation, one of them stated that catastrophe reinsurance coverage is chosen according to exposure to earthquake risks and is deemed to be sufficient to cover climate change-related risks.

At the opposite end of the spectrum, the other insurer stated that it had full confidence in the ability of its insureds to adapt, thereby justifying the fact that it did not have a strategy that captures climate risk either directly or indirectly.

QUESTION 2

What actions have you taken to identify and evaluate climate change-related risks?

Respondents identified several actions. By contrast with the first question, we noted a certain amount of convergence in the answers provided. The following graph presents the actions in decreasing order of frequency, thereby highlighting the importance given to each action undertaken by the respondents.

ACTIONS TO IDENTIFY AND ASSESS CLIMATE CHANGE RELATED RISKS



Graph 4

This graph shows, in order of occurrence, the main actions taken by respondents to identify and assess climate change risks.

Analysis of claim trends and modeling

Analyzing claims in order to determine trends is the primary means for identifying and assessing climate risks. With the exception of one insurer, all respondents stated that information regarding the occurrence of risks is compiled and analyzed through modeling¹³ in order to identify future trends. Reliance on modeling is routine and is used, among other things, to

13 Based on the answers provided, it is difficult to determine whether the trend analysis models are purely backward-looking, namely, founded solely on historical data.

simulate catastrophes, including those which may be provoked by extreme climatic events¹⁴.

Four respondents stated that they go even further and formally evaluate the relationship between climatic events and claims. In particular, they systematically collect and record regional meteorological information, thereby allowing them to refine their models and carry out correlation studies.

Among those who do not seek (or, at the very least, do not mention that they seek) a concrete causal link, one insurer stated that increased losses related to water damage are not necessarily caused by climate change; they may simply be caused by changes in policyholder lifestyles (changing basement usage habits, higher proportions of paved ground, etc.).

None of the respondents specifically attempts to measure quantitatively the connection between the frequency or severity of claims, greenhouse gases (GHG) and temperature increases. Even among the respondents who are the most aware about climate change, there seems to be a limit on doing more than what they are currently doing to improve their forecasts.

Firstly, given the nature of P&C insurance products, the business dynamic of these insurers responds to a relatively short time horizon. Secondly, the study of climate change is a relatively new field requiring highly specialized expertise. For example, although researchers have suspected it for some time¹⁵, it is only quite recently that climatologists have been able to show, through statistical analyses of over 6,000 precipitation stations, that the increased frequency of extreme rainfall in the Northern Hemisphere can be explained if greenhouse gases produced by humans are included as variables in their models¹⁶. In order to illustrate the complexity of modeling aimed at explaining and quantifying, and therefore predicting, claims resulting from climate change, we attempted to set out, in a very simple diagram, the connection between the elements linking the (proven) increase in GHG and, ultimately, the (potential) increase in claims that would result in the long term. (See diagram 1 below.)

Complexity of link between increase in GHG emissions and insurance claims



Diagram 1

Analysis of claims trends. What will the actual trend be, given our knowledge that the concentration of greenhouse gases is increasing exponentially?

Given the inherent short time horizon of property insurance contracts and the complexity of modeling the impact of climate change, the answers provided for the survey as a whole, and for this question in particular, seem to reveal a divergence in the degree

¹⁴ For example, within the scope of dynamic capital adequacy testing. The concept of modeling is also discussed in question 7.

¹⁵ Appendix 4, IPCC.

¹⁶ Study published in the journal Nature, February 17, 2011.

of confidence of respondents regarding their ability to adapt adequately to a future deterioration in claims resulting from climate change.

The following table summarizes these answers in light of the levels of claims analyses, particularly as to the causal relationships, when seeking out trends.

Various types of analysis to measure and link shifts in claims with climate change



Table 1

Various types of claims trends and causal analyses carried out by respondents in order to measure and link shifts in claims to climate change.

As Table 1 shows, four respondents are trying to measure the causal relationship with meteorological phenomena, but none are currently attempting to make a link with GHG.

Exchanges of information with scientific partners

Several respondents referred to the Institute for Catastrophic Loss Reduction (ICLR) which is a key player and their principal source of scientific information about insurance. It should be noted that two other respondents did not mention the ICLR as a partner, but are members of the Institute. They have therefore been added to the number of respondents in graph 4.

Dynamic capital adequacy testing (DCAT)

Three respondents use dynamic capital adequacy testing, a risk management tool, to model, among other things, scenarios relating to the risk of frequency and severity of claims, according to the following situations:

- a major catastrophic event;
- a significant event;
- multiple significant or catastrophic events.

In order to properly interpret the answers provided by all of the respondents, we referred to their DCATs. Thus, even though they did not indicate it in their answers, three other insurers were also included in graph 4 because of the similarity between their respective DCAT analytical approach and those of the three afore-mentioned respondents.

An overview of the DCATs reveals that actuaries use a somewhat traditional approach to assess the non-traditional risks associated with climate change. They rely essentially on historical data (for example, loss ratios or gross losses from preceding years). For this exercise, selecting between a backward-looking model and a forward-looking model becomes very important. In this regard, in his paper "From Risk to Opportunity: 2008 – Insurer Responses to Climate Change", Evan Mills observes that insurers use backward-looking risk management models, and therefore, are unable to take climate change into account¹⁷. This could be an additional explanation for the point raised earlier regarding the difficulty of determining claim trends.

In this regard, in January 2009, in order to help actuaries better analyze risks and improve risk management methods, the Casualty Actuarial Society (CAS) established a Climate Change Committee (CCC). In July 2011, the CCC, in partnership with the Canadian Institute of Actuaries (CIA), the American Academy of Actuaries (AAA) and the Society of Actuaries (SOA), launched the first phase of a research project aimed at developing an index to help raise awareness of the potential risks associated with climate change and the risk management implications within North America and globally. The index would highlight important indicators of climate change such as hurricane intensity, Arctic ice cover, melting of land-based glaciers, wild fires, floods, droughts and temperature extremes¹⁸.

Exchanges of information with industry partners

Slightly less than half of respondents participate in industry committees in order to keep abreast of climate change-related issues and risks. Others are active in professional forums or take part in round table discussions organized by the Insurance Bureau of Canada (IBC).

Specialized multidisciplinary team

One of the respondents indicated that it has created an in-house team of underwriting, insurance coverage and actuarial science professionals to evaluate risks, including those related to climate change. Furthermore, one reinsurer has included experts in windstorms, tropical cyclones and flooding in its risk management unit. Another insurer has set up a team focusing on water damage loss prevention.

Monitoring emerging climate risks

Three respondents have established a monitoring unit to identify, assess, and analyze emerging climate risks.

¹⁷ Excerpt from an official publication of the Canadian Institute of Actuaries: Beyond Risk, Spring-Summer 2010, p. 14.

¹⁸ CAS website: http://www.casact.org/cms/index.cfm?fa=viewArticle&articleID=1050.

List and briefly discuss the risks that severe weather and climate change pose to your company.

We carefully analyzed respondents' answers to this question and their comments, before examining in details each specific risk identified. We observed that most respondents are of the opinion that climate change poses a greater risk to profitability than the risk of a major catastrophe. In other words, they believe that climate change adversely impacts their profitability more than it impacts their solvency. This preponderant impact on profitability rather than solvency is illustrated in the following graph.



Graph 5

This graph shows the preponderance of the profitability risk over the catastrophe risk for most respondents.

From among the specific risks cited most often, pricing and underwriting risk as well as operational risk are the two brought up most often, having been mentioned, respectively, by seven and six respondents. These and other specific risks identified by the respondents are presented in the following graph and discussed in greater detail below.



Graph 6

This graph shows, according to their occurrence, the types of specific risks mentioned by respondents

Pricing and underwriting

Unfavourable climatic experiences may call pricing assumptions into question. Some respondents consider that one of the problems posed by climate change is related to a shift in the nature of claims, primarily due to increased water damage. One of the insurers indicated that traditionally, its pricing and underwriting are structured for fire and theft-related claims, and not for major weather events or water damage. It acknowledged that its current pricing is not necessarily well suited to this new reality. However, it considers that if the changes are gradual and observable, rates can also be adjusted gradually.

Others state that higher costs tend to fluctuate and represent a challenge to adequate long-term product pricing and to maintaining insurance that is affordable for clients.

Some respondents highlighted the fact that the increased frequency and severity of losses, and consequently claims, may originate from various factors indirectly related to climatic events. For example, infrastructures are aging and are more vulnerable to extreme or violent weather events. Most of these infrastructures were assessed on the basis of past statistical data, assuming that the data would be valid in the future. Today, their capacity to withstand climatic events is being challenged by increases in severe weather phenomena.

In Québec, serious concerns have arisen due to changes in the frequency and strength of rainfall events in both urban and rural settings. For example, the events that led to flooding at L'Acadie Circle in Montréal in 2006 and in Rivière-au-Renard in 2007 could become more common. In addition, there has been an increase in the frequency of freeze-thaw cycles which could lead to a faster degradation of infrastructures, such as underground networks, thereby amplifying the risk of flooding¹⁹.

As a result, insurers, acting through lobbying by their industry associations, have strongly recommended to the government that it invest heavily in modernizing municipal infrastructures, particularly aqueducts and sewers, so as to adapt optimally to climate change-related risks²⁰.

Operational risk

This risk centres primarily around a potential work overload to respond to claims for compensation in the event of a catastrophe and the lack of manpower to cope with such a situation.

Inaccuracies in the models used to assess the impact of major weather events are another source of operational risk.

Impact on marketing and business development

Several respondents did not specify how climate change could affect product marketing and business development. However, they did state that concerns regarding pricing, the frequency of claims and the severity of events will lead some insurers to cut back on offering specific forms of coverage or coverage in specific markets, which will affect their business regardless of whether or not they elect to cover these risks through antiselection and according to their ability to distribute the risks.

Lastly, it is possible that the insurance sector will develop products to cover flooding. Severe climatic events and aging infrastructures are contributing to increased flooding. One of the respondents observed that this is putting greater pressure on insurers to provide coverage for this type of claim. This matter is currently under review, in particular by the ICLR²¹. The Institute points out that Canada is one of the only industrialized countries where flood insurance is not offered to individuals. Based on its conclusions, under certain conditions, flooding is insurable and this type of insurance could represent a business opportunity.

Higher reinsurance premiums

Four respondents anticipate higher reinsurance premiums as a result of increased climatic catastrophes.

Reputational risk

One insurer mentioned reputational risk. The company's reputation could be tarnished if our policies and practices are not those of good corporate citizens or if we give people the impression that we are partnering with organizations whose practices harm the environment or are counter to the common good.

During a catastrophe, the inability to service customers when they need it most may also adversely affect reputation.

¹⁹ Learning to Adapt to Climate Change, Ouranos, June 2010, p. 28.

²⁰ Budget 2011-2012 du Québec - Mémoire prébudgétaire, Insurance Bureau of Canada, January 2011.

²¹ Making Flood Insurable for Canadian Homeowners, Institute for Catastrophic Loss Reduction, November 2010.

Moral hazard

For the insurer which mentioned it, one way to reduce this risk is to ensure that clients help minimize the severity of losses by keeping their homes in good condition rather than assuming that their insurance policies will cover all the repairs following certain events.

Other

Since it generates claims, severe weather adversely affects P&C insurers. One insurer provided concrete examples of risks and sources of claims related to home insurance, such as:

- sewer back-up and ground infiltration;
- snow loads and roof infiltrations;
- above-ground pools;
- wind and hail;
- forest fires that can spread to homes; and
- coverage of living expenses in case of an evacuation order.

This insurer also mentioned the risk of hail in automobile insurance.

The majority of insurers indicated that water damage currently represents the principal source of claims, and some suggested that this is the result of an increase in the frequency and severity of precipitation. This is consistent with the research work being carried out, particularly that of Ouranos²².

As regards reinsurers, the findings are somewhat different, given their role and the geographical scope of their operations. The climatic causes leading to claims are tornadoes, winter storms and floods. Regions most at risk are industrialized areas with a high insurance penetration rate.

QUESTION 4

Briefly describe the impact of climate change on your investment strategy.

Investors are factoring more and more environmental matters into their decisions.

In light of the challenges posed by climate change and the financial risks insurers face, we were interested to know whether and how insurers were taking these factors into account when setting their investment strategies.

Most respondents indicated that there was no impact or, at least, they did not see a link between their investment strategy and the impact of climate change.

For a minority, however, there probably is an impact, but it is unknown. The most pragmatic will tend to invest more conservatively, following a precautionary principle to address major climatic events. Looking to improve longer term, others in this minority group of respondents plan to invest more ethically for the future, in line with the principles of sustainable development.

These results are not surprising given that the performance objectives of an investment portfolio in the general insurance industry are not fundamentally different from those of other institutional investors. In this regard, according to recent research on the impact of climate change on asset allocation, additional consideration should be given to exploring what climate change might mean for the underlying determinants of asset-class risk and return, as well as for overall market risk.

²² See Appendix 5.

²³ Mercer, London School of Economics and Vivid Economics, Climate Change Scenarios – Implications for Strategic Asset Allocation, February 2011.

According to this study, the impact of climate change varies significantly across different scenarios, contributing as much as 10% to portfolio risk for a representative asset mix²³.

As mentioned, we are not necessarily surprised at the answers we received to this question. However, as noted by the respondents themselves, the risks associated with climate change could affect their operations more directly than other industries. We would therefore expect a greater awareness of this issue

QUESTION 5

What actions have you taken to raise awareness and encourage policyholders to reduce losses from severe weather and climate hazards?

The majority of insurers reach out to their clients in order to raise awareness. However, their approaches differ and each one uses its own particular methods. The following are some examples:

- sending out loss prevention bulletins and materials;
- taking the opportunity to provide advice at policy renewal time;
- pre-recorded tips in the interactive voicemail system;
- recommendations following a water-related claim originating outside the building;
- questionnaire on claims, coverage restrictions, preventive installation guide;
- education and awareness-raising via a website.

These actions primarily target losses caused by water. However, only one of the respondents explicitly refers to the impact of climate change within the scope of loss prevention education. In other words, the majority of insurers inform their insureds about loss prevention without alluding to global warming and a possible causal link with increased precipitation and, therefore, increased water damage.

As for reinsurers, they build awareness among insurers, particularly by promoting industry level debates, publishing topical articles and research results and continuing to disseminate information and statistics on the risks associated with natural disasters.

What steps have you taken or do you intend to take to engage your key partners in discussion about managing climate risks?

Unlike certain actions mentioned in question 2 above to identify and assess climate change- related risks, such as exchanging information with scientific and industry partners, the purpose of this question was to understand the extent to which respondents involve business partners and other stakeholders in the implementation of their risk management plans.

A few isolated actions were mentioned. Five insurers stated that they involve their reinsurance broker or their reinsurers in reviewing their reinsurance requirements and evaluating alternatives to mitigate risks.

One respondent indicated that external experts might be brought in to help with the increased workload following a catastrophic event.

Another respondent indicated that it partners with the ICLR to develop various programs aimed at:

- improving building codes to support the construction of houses designed to better withstand exceptional meteorological conditions;
- developing business resumption plans in the event of a catastrophe.

QUESTION 7

To what extent does the use of tools, such as computer-assisted models, help you to manage climate-related risks?

The majority of respondents employ models. In addition to the models reported and described in question 2, insurers also use models to simulate catastrophic events in order to determine their reinsurance needs and define required coverage limits.

One insurer stated using a North American thirdparty software to model tornadoes and windstorms, whereas others focus on precipitation patterns²⁴ which they believe are more plausible in Québec:

- freezing rain, extremely snowy winters, rainfalls and hail;
- year-round winds, stormy summers, winters with repeated episodes of freezing rain.

The situation in Québec indeed differs, for example, from that in the United States. Consequently, even the choice and use of natural disaster analysis software can be questioned, because such a tool may underestimate or overestimate climate risk due to inadequate adjustments for the geographical region being analyzed. In this regard, Ouranos offers a unique profile of climate change in Québec. For information and reference purposes, a summary of key findings of the Ouranos' latest studies is presented in Appendix 5.

²⁴ According to their dynamic capital adequacy testing (2009).

In the past year, have your concerns about climate change increased, remained the same or decreased? Explain.

Most respondents consider climate change to be sufficiently important. Although one insurer says it is not at all concerned, all other respondents consider the issue to be worrisome.





Graph 7

This graph shows the importance and changes in respondents' degree of concern with climate change compared with the previous year.

As Graph 7 shows, six respondents are as concerned about climate change as they were the previous year.

Of those respondents in this group who were the least concerned, one insurer answered that it was not particularly worried. Yet another insurer that was as concerned as previous year reported not being overly concerned since no additional risks have come to light. The other respondents in this group, although as concerned as they were last year, reported that they were sufficiently concerned to maintain, consolidate or enhance their actions. In one final group, we placed the reinsurer that was still very concerned along with the three respondents who said that they were more concerned by this issue than they were last year.

These three respondents in fact provided the most indepth explanations to support their answers:

- observed increase in claims due to extreme weather;
- more frequent extreme climatic events that are affecting previously unaffected and unexpected areas;
- increased volatility of results from year to year;
- increasing difficulty in adopting risk mitigation policies and strategies while meeting clients' needs.

It is however both disquieting and interesting to see that the two insurers that were highly concerned about this threat were among the group of respondents that are taking the most active interest in climate change.

Does your company have a plan to assess, reduce or offset its greenhouse gas emissions? If so, please summarize.

With the exception of two insurers and one reinsurer, all respondents have taken steps to reduce or curb GHG emissions. Their initiatives primarily involve transportation, building management and physical resources.

ACTIONS TO REDUCE GREENHOUSE GASES



Graph 8

Principal actions taken by respondents to limit greenhouse gas (GHG) emissions.

Insurers are also building employee awareness about transportation. Various measures have been proposed and implemented within their organizations:

- promoting carpooling and the use of public transport;
- introducing an automobile fleet policy to improve gasoline consumption (purchase of energy-efficient vehicles);
- limiting travel and business trips;
- favouring electronic communications and videoconferencing.

Other measures involve reducing office energy costs and using greener technologies:

- obtaining LEED certification;
- improving energy efficiency (heating and electricity);
- encouraging the use of renewable energy (such as solar panels on roofs);
- purchasing renewable energy certificates to offset electricity consumption, in an effort to become carbon neutral.

A few respondents go even further, taking actions that have a positive effect on the environment.

Although their impact is minimal, these actions do develop an environmental culture and awareness:

- creating a team to reduce the organization's internal environmental impact;
- reducing paper consumption;
- planting trees;
- setting up a waste management program (for example, recycling computer equipment, ink cartridges and batteries).

Lastly, certain insurers provide incentives to their clients by offering insurance discounts for hybrid vehicle purchases, paperless banking and green mortgage loans.

Does your company produce a Corporate Social Responsibility Report that includes disclosure about your management of climate risks?

Slightly more than half of the respondents stated that they cover climate risk in their social responsibility reports, primarily by outlining their actions to combat greenhouse gases, such as those described under question 9.





Graph 9

Respondents with a social responsibility plan that incorporates climate change

An overview of the social responsibility plans reveals that only one respondent explicitly and concretely addresses the issue of adapting to climate change.

SUMMARY TABLE

The following table summarizes information provided by respondents to most of the survey questions. This table is not exhaustive and is intended merely to provide a quick comparison of respondents.

	1	0	0		E C		-7	0		10	1.1
		2	3	4	5	6		8	9	10	
Direct integration of climate change in ERM											
Measurement of claim trends											
Causal relationship between claims and climatic events											
Exchanges with industry partners											
Exchanges with scientists		Х				x				x	
DCAT		X				x				х	
Monitoring of emerging climate risks											
Involvement of partners in the climate risk management process											
Modeling		Х				x				х	
Concern about climate change											
Actions to reduce GHG											
Social responsibility report and climate change		Х				X				X	

COMPANY (OR GROUP OF COMPANIES)

X = Mentioned

- N = Not concerned S = Same degree of concern

G = Greater concern

OBSERVATIONS AND FINDINGS

- Looking at the answers as a whole, we noted a varied and very broad spectrum of perceptions and approaches with respect to this issue. Climate change risk is generally admitted, whether quite directly or indirectly. Moreover, the attitudes noted run the gamut from an almost total wait-and-see approach to exemplary proactivity.
- Most insurers have integrated climate change into their risk management plan and have taken it into account when formulating their strategy. From among those who are the most proactive and forward-looking in this group, the emerging risk of climate change has a formal place within their governance structure. However, and this is the case for a majority of them, climate change is perceived and addressed first and foremost in a traditional manner as an event of a catastrophic and repetitive nature. For a minority however, the matter is quickly dismissed, as they rely on reinsurance coverage already considered sufficient.
- While certain respondents indicated their reliance on the traditional tool of catastrophe reinsurance to protect themselves against this risk, they admitted, paradoxically, that the risk threatens their profitability rather than their solvency.
- The insurers surveyed did not factor the impact of climate change into their investment strategy. However, according to a recent study, since this risk could account for up to 10% of typical investment portfolio risk as well as directly affect insurers' profitability, we can expect to see insurers take a growing interest in this issue.
- With the occasional exception, insurers seem to be relying on industry associations to initiate measures to manage this risk. Many of them discuss the issue, but few truly involve their partners in order to examine the issue and take concrete action.
- Based on the responses obtained, it is difficult to determine whether the models used by insurers

are tailored to deal with the real nature of severe bad weather such as experienced in Québec. For example, certain insurers mentioned the use of existing models in order to simulate hurricanes, tornadoes and windstorms, although their principal risks relating to water damage originate mainly from other weather phenomenon typical to Québec.

- With respect to the two questions relating to greenhouse gases and sustainable development, most insurers have made commendable efforts towards curbing greenhouse gases and implementing sustainable development measures. However, we estimate that for a minority, these actions are intended to bolster their corporate brand and do not concretely mitigate the impact of climate change or improve their ability to meet their clients' needs.
- Lastly, when asked to express their degree of concern about climate change as compared to the previous year, only three respondents indicated that they were more concerned. It is both interesting and disquieting to note that of these three insurers were the two that were most actively monitoring the issue.

CONCLUSION

As indicated at the beginning of this report, the objective of the survey was to gain a better understanding of insurers' awareness about the threat of climate change and the extent to which they are building this issue into their governance structure and operations.

Given the nature of the survey and its questions, we expected a relatively low response rate. Nonetheless, we were surprised that certain insurers did not respond to the survey. Given their size and reach, we believe their participation would have enhanced the survey's findings and the analysis of the data.

We were, however, pleasantly surprised by the diversity and wealth of the answers provided. As the goal of the exercise was to obtain factual and concrete information about what is happening in the field, we believe our objective was attained.

In addition to presenting the answers as provided by the respondents, we condensed and analyzed their answers in order to highlight the most important elements. We also attempted to describe the current state of climate change science in non-technical language²⁵ and, where possible, to make a link with the respondents' observations and answers. We believe this report can serve as a relevant tool to engage insurers more actively on this issue and enable them to better understand and manage the related risks. Lastly, given what we have learned from the survey answers and our analysis, the AMF must continue to monitor the issue. The flooding in Sainte-Flavie at the end of 2010 and more recently in the Montérégie region is a reminder of the unpredictable and disastrous effects of climate disruptions. Inadequate coverage constitutes a problem for insureds and a reputational risk for insurers. Providing adequate coverage could be financially significant—even catastrophic—for certain insurers.

Therefore, a second survey is considered. It will be different and might address new and more specific aspects such as governance and management of climate change risk based on existing guidelines, integration in the DCAT, insurers' ability and strategies to adapt, actions to mitigate the risk. The survey could also specifically address the quantification of this risk.

²⁵ For reference purposes, our report also includes a bibliography of the principal documents we consulted, as well as a summary of certain reports prepared by the IPCC and Ouranos, as mentioned above (Appendices 4 and 5).

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APPENDIX 1 - LETTER AND QUESTIONNAIRE

Québec City, June 11, 2010 To all P&C insurers operating in Québec Subject: Climate Change Survey

Dear Sir/Madam:

At its fourth Rendez-vous with the AMF, held in the fall of 2009, the Autorité des marchés financiers (AMF) hosted a workshop on climate change and its impact on the property & casualty (P&C) insurance industry.¹

Insurers, reinsurers and experts who attended the workshop reiterated how P&C insurers are at the centre of the climate change threat and, at the same time, how they are the best qualified to help society adapt and to spearhead the response to this threat.

At the end of the workshop, the AMF reaffirmed its commitment to monitor the situation closely so as to help maintain regulation in support of effective management of climate risks and thereby ensure the continued viability of the P&C insurance market. This survey is a logical next step in this commitment.

Expected Impact of Climate Change

It is noteworthy and reassuring that, over the past several years, the matter of adapting to climate change has topped the list of industry strategic issues. This is not surprising. According to the latest Insurance Bureau of Canada (IBC) annual report, insurance claim payments stemming from natural disasters, when adjusted for inflation, have doubled every five to ten years since the 1950s². This trend certainly seems unlikely to improve, and will continue to be a major concern for the insurance industry and their policyholders.

For insurers, the proliferation of increasingly severe climate-related events will invariably impact the costs of claims and reinsurance, thereby affecting their profitability and putting further pressure on capital positions.

If nothing is done, consumers may well be paying higher premiums for more limited coverage with increasingly restrictive insurance conditions. In the worst-case scenario, access to insurance in some regions could be compromised.

As a regulatory body, the AMF has the duty to maintain adequate access to insurance coverage for consumers, while ensuring a suitable solvency framework for insurers. In light of the impending impact of this threat, the AMF is of the opinion that it must gain a better understanding of the risk that severe weather and climate change poses to consumers and insurers, and determine the extent to which this issue is a concern for insurers as well as their current and planned course of action to adapt to the situation.

^{1 &}quot;Climate change and its impact on the insurance industry," Rendez-vous with the AMF, October 26, 2009.

^{2 &}quot;Facts of the general insurance industry in Canada," Insurance Bureau of Canada, 2009, p. 8.

Survey

To better understand the impact of climate risks on insurers' operations, the AMF is conducting a survey of all P&C insurers operating in Québec.

Specifically, the AMF seeks to establish the extent to which insurers:

- are knowledgeable about this issue and up to date;
- are concerned about climate change;
- are assessing its significance for their operations;
- are taking steps to gauge the related impacts;
- are taking concrete measures to adapt;
- are monitoring developments.

Although this survey is being conducted on a voluntary basis, the AMF encourages the widest industry participation possible. The objective is to generate an overview of this issue, not to determine or judge the situation of insurers.

Survey responses will be compiled and processed in the strictest confidence, as will any excerpts that may be used in a report of conclusions or any future publication.

The deadline for receiving completed surveys is August 20, 2010. Responses will be analyzed in the weeks that follow. The AMF intends to release its findings and conclusions later on in the fall.

Survey response method

Please answer the questions as clearly and concisely as possible. If you need to support your answers, we suggest that you attach excerpts of documents or internal reports. You can also provide references to specific sections of your website containing the pertinent information.

Remember to identify the company (or group of companies) in respect of which the survey has been completed, as well as the name and contact information of the person responsible.

Should you have any questions or require further clarification, please contact Denis Poirier at denis.poirier@ lautorite.qc.ca.

Please send your responses by August 20, 2010 to Murielle Picard:

By e-mail: sondageamfcc@lautorite.qc.ca

By regular mail: Autorité des marchés financiers Direction des normes et vigie Place de la Cité, Tour Cominar 2640, boulevard Laurier – 3° étage Québec (Québec) G1V 5C1

Yours truly,

Julien Reid, Director, Standards and Business Intelligence

Encl.

Climate Change Survey

- 1. How is the issue of severe weather and climate change addressed in your risk management strategy?
- 2. What actions have you taken to identify and evaluate climate change-related risks?
- 3. List and briefly discuss the risks that severe weather and climate change pose to your company.
- 4. Briefly describe the impact of climate change on your investment strategy.
- 5. What actions have you taken to raise awareness and encourage policyholders to reduce losses from severe weather and climate hazards?
- 6. What steps have you taken or do you intend to take to engage your key partners in discussion about managing climate risks?
- 7. To what extent does the use of tools, such as computer-assisted models, help you to manage climaterelated risks?
- 8. In the past year, have your concerns about climate change increased, remained the same or decreased? Explain.
- 9. Does your company have a plan to assess, reduce or offset its greenhouse gas emissions? If so, please summarize.
- 10. Does your company produce a Corporate Social Responsibility Report that includes disclosure about your management of climate risks?

NAME OF COMPANY OR GROUP OF COMPANIES:
PERSON RESPONSIBLE:
TITLE/FUNCTION:
TELEPHONE:
E-MAIL:
DATE COMPLETED:

APPENDIX 2 - LIST OF INSURERS AND GROUPS OF INSURERS

PERSONAL PROPERTY

INSURERS AND GROUPS OF INSURERS	Written premiums (thousands of dollars)	Market share (percentage)
DESJARDINS	392, 421	21.1
INTACT	299, 157	
GROUPE PROMUTUEL	178, 150	
AXA	169, 882	
CAPITALE	167, 099	
AVIVA	137, 587	
TD ASSURANCES	86, 356	
COOPERATORS	78, 594	
SSQ	52, 853	
INDUSTRIELLE ALLIANCE	48, 104	
ALLSTATE	39, 525	
СНИВВ	38, 089	
ECONOMICAL	33, 780	
GARANTIE	25, 327	
WAWANESA	22, 530	
GROUPE LEDOR	18, 738	
INNOVASSUR	18, 685	
RBC	11, 734	
LLOYD'S	9, 697	
ESTRIE-RICHELIEU	9, 561	
OPTIMUM	5, 654	
ALPHA	5, 622	
CHARTIS	4, 605	
JEVCO	2, 083	
DOMINION	1, 146	
SECURICAN	1, 051	
Royal & SUN Alliance	1.868	

Table 1

List of insurers and/or groups of insurers retained to determine the survey response rate; i.e., those whose share of the Québec personal property market was 0.1% or more in 2009. The names have been abbreviated. Their full corporate names are available on the AMF website.

APPENDIX 3 — SUMMARY RESPONSES

This appendix presents the key elements of respondents' original answers to each question.

Question 1

How is the issue of severe weather and climate change addressed in your risk management strategy?

Company 1

Integrated risk management with indirect consideration of climatic impact in accordance with two visions, namely, risk of catastrophe (severity) and risk of gradual degradation (increased frequency of events). All of this while giving particular consideration to the effect on operations.

Company 2

Our approach to managing climate change risk is four-pronged:

- sufficient reinsurance coverage for major catastrophic events as well as for a series of lesser weather events;
- maintenance of surplus capital in excess of the target MCT ratio;
- segregation of coverage likely to be affected by climate change (water damage) in home insurance contracts;
- prevention measures among clients.

Company 3

Climate change is formally approached within the integrated risk management process which requires the participation by everyone in the organization. Employees must review and understand risks and identify means to mitigate them. Climate change is a major issue.

Company 4

Losses related to climate change are acknowledged through an observed drop in earnings due to the greater frequency and severity of water-related losses. This trend is recognized in pricing reviews. Given that catastrophes resulting from climate change are seen as being smaller in scope than those resulting from earthquakes, there is no attempt to identify the real causes.

Company 5

Through the application of our comprehensive integrated risk management policy and program (to satisfy IRM guideline requirements).

Company 6

Climate change is a long-term, top-of-mind issue. Therefore, a specific strategy built around four pillars has been established to integrate climate change-related risks.

- understanding through research;
- developing products and services, including weather-based risk transfer solutions, mechanisms for insuring catastrophic risks and specific reinsurance plans, such as retrocession;
- participating actively in forums on GHG and climate change;
- reducing its own GHG emissions.

Monitoring of natural disasters.

Company 8

- The issue of severe weather, which is not taken into account in operations, is addressed in the corporate risk management plan.
- dynamic model worded in business language, well defined across the organization, at every level;
- overall, climate change is included in environmental risk management priorities
- the reinsurance program incorporates climate change based on our risk appetite and in light of recent climatic variations. Frequency and severity of events are taken into account.

Company 9

- Taken into account through each of the five elements of its risk management strategy: operational risk, market risk, governance, regulation and compliance;
- aware that risk is increasing, weather scenarios are included in the Disaster Recovery Plan;
- purchase of reinsurance in the event of multiple weather or catastrophic events.

Company 10

- Included in the integrated risk management (IRM) process;
- one of 12 main risk issues;
- a specific strategy is established within its comprehensive sustainable development policy;
- overall approach: adopting risk mitigation policies, programs and strategies while meeting our clients' needs.

Company 11

The strategy relies primarily on insureds' great ability to adapt.

Question 2

What actions have you taken to identify and evaluate climate change-related risks?

Company 1

Primarily focused on compensation, the actions are:

- the evaluation does not focus on climate change per se, but on exposure to the following two risks: catastrophes and decline in technical profitability;
- targeted and specific analyses of types of losses to determine potential claims and responses;
- monitoring and classification incidents by region.

Company 2

- Use of the existing multidisciplinary team which manages insurance risks;
- specific coding of losses by type in order to identify trends;
- participation in and use of information from industry (IBC) and scientists (ICLR);
- use of DCAT.

- Monitoring of results by type of loss and region in order to identify trends and changing patterns;
- modeling of losses stemming from tornadoes and windstorms;
- simulation of events similar to the 1998 ice storm.

Company 4

This risk is not assessed separately, but is included in the analysis of the various perils covered.

Company 5

- Participation on several industry committees;
- contribution of reinsurers in order to develop a perspective on the issue and model the impact of catastrophes and other climate change-related events;
- use of DCAT.

Company 6

- Systematic assessment of climate risks steered by three formal committees:
 - Sustainability and Political Risk Management.
 - Emerging Risk Management.
 - Catastrophe Perils.
- research program in collaboration with universities aimed at generating data to enhance its understanding of climate risk and assess the impact on its portfolio of business;
- analysis of future trends.

Company 7

Separate department dedicated to monitoring trends related to natural catastrophes and their changing patterns.

Company 8

- When applying the enterprise risk management plan, we carry out:
 - an ongoing assessment of climate trends;
 - an analysis of product-related data;
 - an assessment of changes in product design and underwriting rules;
 - a pricing review.
- review of scientific research carried out by the ICLR for purposes of incorporating it into the analysis of claim trends;
- regular reviews of book of business in order to identify historical trends regarding claims frequencies and any potential correlation with environmental changes and major storms.

Company 9

- Use of generalized linear modeling (GLM) to identify and isolate areas with weather-related losses;
- risk assessments by region;
- explicit planning and tracking of various weather events.

- Twice-yearly review of the risk profile related to this issue through integrated risk management (IRM);
- simulation of catastrophic climate change-related scenarios (in DCAT);
- when products, rates and underwriting rules are modified in response to climate change-related risks, internal audit conducts an independent review of controls and processes as part of its audit of operating risks.

Company 11

No answer or did not answer the question.

Question 3

List and briefly discuss the risks that severe weather and climate change pose to your company.

Company 1

From an operational perspective as regards management of the catastrophe plan:

- decline in technical profitability: increased administrative costs, number of claims and costs associated with such claims;
- catastrophe: threat to operational continuity.

Company 2

Higher frequency and severity of claims for the following risks:

- home:
 - sewer back-ups;
 - ground and roof infiltrations;
 - snow loads;
 - above-ground pools;
 - wind, hail, forest fires.
- commercial:
 - floods;
 - sewer back-ups;
 - ground and roof infiltrations;
 - snow loads;
 - wind, hail.
- automobile:
 - hail.

- Increased water-related damage threatening company profitability and earnings stability;
- availability of reinsurance at an affordable cost;
- operational risk stemming from the greater workload in the event of a catastrophe;
- the risk of water-related damage, amplified by climate change, was identified as the greatest threat to earnings stability, affecting the following three risk categories: products, insurance and business.

Company 4

- Traditionally, pricing and underwriting are structured for fire and theft-related claims and, as a result, are not necessarily well suited to the new reality of major weather events or water damage. Insofar as these changes are gradual and observable, this does not pose a large problem;
- for rarer, major events, premiums could be insufficient;
- drop in earnings of some business lines.

Company 5

- Unexpected evolution of climate changes or other catastrophes;
- unfavourable experience in regard to pricing assumptions;
- model inaccuracies and estimate errors;
- operational risks (due to operational interruptions in emergency situations);
- default of a reinsurer.

Company 6

- Risk from tropical storms (cyclones), winter storms and floods;
- snow storms, ice storms, wild fire and drought;
- the regions most at risk are located in the industrial and coastal areas with a high insurance penetration rate.

Company 7

Higher reinsurance premiums with resulting impact on profitability.

Company 8

- Operating risk: constant vigilance with respect to process management so as to always be ready to meet clients' needs. In particular, having sufficient staff and contractors for emergency situations;
- underwriting risk: financial loss arising from poor product design, poor risk selection or poor pricing;
- claims-related risks: unforeseen increase in the frequency of claims;
- moral hazard risk: poor home maintenance by insureds.

Company 9

- May impact the ability to serve customers when they need it most (reputation and operational risks);
- increased claims frequency and severity;
- increased costs and expenses following a catastrophe;
- more forest fires;

- impact on profitability;
- business interruption (business recovery plan);
- higher reinsurance premiums.

- Climate change and weather-related events have a direct impact on claims. It becomes harder to strike a balance between raising settlement costs and providing affordable insurance for clients.
- Here are the risks we see:
 - Inadequate pricing of emerging risks;
 - products do not meet new needs;
 - cutback on offerings of specific forms of coverage or in specific markets, which will affect the insurer's business, whether or not it elects to cover these risks through antiselection and according to its ability to distribute the risks;
 - increased financial exposure (due to the frequency and severity of such catastrophes);
 - additional pressure due to aging infrastructure;
 - increased flooding, putting greater pressure on insurers to provide coverage for this type of claim;
 - increased power outages resulting indirectly in other losses;
 - allocation of additional resources to disaster management: planning for business continuity, settling claims, etc., thereby raising costs;
 - higher reinsurance premiums;
 - pressure on food and water supplies (economic pressure, climate refugees);
 - threat to our reputation.

Company 11

No answer or did not answer the question.

Question 4

Briefly describe the impact of climate change on your investment strategy.

Company 1 No analyses, no changes, no instructions. Company 2 Responsible investment contemplated. Company 3 None. Company 4 Selection of very low-risk assets, no connection to climate change. Company 5 None.

- Responsible investment;
- selection of very low-risk assets, no connection to climate change.

Company 7

Impact not known.

Company 8

No answer or did not answer the question.

Company 9

Conservative investment strategy, no connection to climate change, except for ensuring adequate shortterm liquidity to fund the impact of severe weather.

Company 10

Employ a conservative investment management and closely track current trends. As such, the company is looking at ways to better incorporate environmental, social and governance issues. For the future, the company anticipates that its climate risk investment strategy will bring:

- a better understanding of the issues and risks;
- the development of a risk assessment system to be incorporated into the investment process;
- the active promotion of information and achievements about its climate risk practices.

Company 11

None.

Question 5

What actions have you taken to raise awareness and encourage policyholders to reduce losses from severe weather and climate hazards?

Company 1

Awareness-raising and prevention through newsletters about water damage.

Company 2

- Material on preventing water damage and losses caused by snow loads;
- recommendations following a water-related claim originating outside the building.

Company 3

- Underwriting rules that favour good property maintenance;
- communication of prevention tips to policyholders via the website.

Company 4

- When renewing policies, policyholders are sent documents to help them protect themselves from water damage;
- prevention tips on the introductory page of home insurance contracts;
- pilot test to encourage the installation of a comprehensive home protection system.

- Message and advisory role of agents with respect to clients: awareness-raising regarding water damage and clarification of needs;
- prevention tips during on-hold message: maintain buildings and check roofs and water heaters to prevent water damage;
- national awareness campaign and participation in industry initiatives to raise consumer awareness.

Company 6

- Publication of an annual report on natural and human disasters;
- organization and hosting of awareness events to promote and encourage public debate.

Company 7

Provide information on natural disasters.

Company 8

- Education and awareness-raising through the Internet;
- prevention tips during on-hold message.

Company 9

- Questionnaire regarding water damage, coverage restrictions, preventive guide;
- water loss prevention team;
- education and awareness-raising through the Internet.

Company 10

Education and awareness-raising through:

- website;
- paper and electronic newsletters;
- newspaper columns.

Company 11

Insureds are already aware of the issue of climate change.

Question 6

What steps have you taken or do you intend to take to engage your key partners in discussion about managing climate risks?

Company 1

- Reinsurance broker establishes needs;
- service levels for disaster situations negotiated in advance with suppliers.

Company 2

No answer or did not answer the question.

Company 3

Use of external experts during catastrophic events.

No answer or did not answer the question.

Company 5

Contribution of reinsurers in order to develop a perspective on the issue and model the impact of catastrophes and other climate change-related events.

Company 6

- Involvement in university research;
- publications, presentations, dialogue with governments, participation in events and forums on the issue and use of electronic media.

Company 7

Active participation in the ICLR.

Company 8

Inclusion of specific commitments regarding compliance with environmental laws in major contracts signed with service providers

Company 9

- Partnerships with various environmental organizations;
- quarterly meetings with key reinsurers;
- collaboration with principal brokers on research projects studying the impact of climate change.

Company 10

Partners with the ICLR on various programs aimed at:

- improving building codes to support the construction of houses designed to better withstand;
- developing business recovery plans in the event of a catastrophe;
- with the help of its reinsurance broker, measures potential exposure to severe storms;
- developing a sustainable purchasing policy and code of conduct for suppliers.

Company 11

Solicit advice from reinsurers with expertise in analyzing the impact of climatic events.

Question 7

To what extent does the use of tools, such as computer-assisted models, help you to manage climate-related risks?

Company 1

Computer models to assess reinsurance needs.

Company 2

- Simulation of hail and freezing rain events to determine reinsurance needs;
- statistical and geographical modeling for each type of climate change-related loss.

Company 3

Use of software to determine catastrophic loss limits arising from tornadoes and windstorms.

Use of computer models to quantify exposure to climate events (for information purposes only).

Company 5

Modeling of natural disasters and other climate change-related events.

Company 6

- Natural disaster experts design and maintain probabilistic hazard models, which are based on historical events, in order to identify future trends;
- these findings are then included in the risk assessment models and underwriting processes.

Company 7

Modeling of natural disasters.

Company 8

- One of our building inspection partners conducts surveys that help us evaluate pricing;
- he also provides technology and services that enable users to manage natural disaster insurance risks such as earthquakes, hurricanes and windstorms as well as the products used, such as weather derivatives, and corporate risk management for the P&C insurance sector. We use it for modeling natural disasters and other climate change-related events.

Company 9

Models of the extreme weather events are at an early stage of development, and therefore, of limited use. Our efforts include:

- using a generalized linear model for pricing and assessment of impacts related to water-related damages;
- identifying and assessing risk of severe weather events by region;
- establishing and reviewing our probable maximum loss using software (through our reinsurance broker);
- using a risk mapping visualization tool.

Company 10

- measuring potential exposure to severe storms with the help of the reinsurance broker;
- collection of in-house data on types of claims, the circumstances surrounding severe weather events, and the associated geocodes;
- using an in-house system to determine aggregated risk exposure;
- combining our data with external data on historical weather-related events (such as floods and violent winds) to better identify at-risk areas, manage exposure levels and demand premiums tailored to specific hazards.

Company 11

The use of models is unnecessary given the ability of our insureds to adapt.

Question 8

In the past year, have your concerns about climate change increased, remained the same or decreased? Explain.

Company 1

Constant and significant concern for several years.

Company 2

Greater concern, after taking a position on sustainable development.

Company 3

As concerned, but do not expect any decrease in weather-related claims in the near future.

Company 4

The situation has not changed very much, but we still consider it in our analysis.

Company 5

Same level of concern.

Company 6

Significant and ongoing concern

Company 7

Same level of concern. At headquarters, the unit dedicated to the issue of climate change has raised concerns about increased losses.

Company 8

Still concerned

Company 9

Increasingly concerned as we have seen first hand an increase in property damage and the costs associated with extreme weather.

Company 10

Increasingly concerned.

Devastating storms seem to be more frequent and affect previously unaffected areas where no such storms had ever been expected. We know from experience that over the last 10 years, the number of catastrophic events and associated claims has increased, resulting in increasing volatility from one year to the next. The data gathered in the industry point to the same conclusions.

Company 11

Same level of concern. No additional risk has arisen to enrich our thinking.

Question 9

Does your company have a plan to assess, reduce or offset its greenhouse gas emissions? If so, please summarize.

Company 1

No. But we are taking some steps such as reducing travel and planting trees.

Company 2

No official plan, but a few steps are being taken such as videoconferencing and employee shuttles.

Company 3

Yes, by introducing a number of sustainable development initiatives:

- forming a committee to promote environmentally responsible behaviours;
- promoting employee carpooling;
- offsetting CO2 emissions produced by vehicles in its fleet;
- adopting a policy in favour of green buildings aiming for LEED certification.

Company 4

Yes. This plan is described in our 2009 corporate activity and responsibility report.

Company 5

A plan is being prepared.

Company 6

Yes. Reducing our carbon footprint is one of the four pillars of our climate change strategy. Our current objective is to reduce CO2 emissions intensity/employee by 45% and energy intensity/employee by 20%. As an incentive to staff, we introduced a subsidy program a few years ago.

Company 7

No.

Company 8

Yes, we just reached our carbon neutral goal this year by:

- reducing our energy consumption (more fuel-efficient automobile fleet; choice of lower energy-consuming lighting, heating and air conditioning systems;
- neutralizing the remaining carbon emissions by generating carbon offset credits through investments, in cooperation with social-minded partners;
- promoting new sources of renewable energy. For example, we have purchased renewable energy certificates corresponding to the electricity consumption of all of our operations and network.

Company 9

Yes.

- Measures its footprint on a quarterly basis;
- quantifiable reduction targets on an annual basis;
- tracks its carbon footprint through a web-based reporting tool;
- team comprised of employees to develop green initiatives.

Yes. In 2008, the company determined its carbon footprint based on the preceding year data, measuring its GHG emissions in four areas:

- power use in its main office buildings;
- the corporate fleet;
- air travel;
- paper consumption;

To date, the company has cut its emissions by 12% through group-wide initiatives.

Company 11

No.

Question 10

Does your company produce a Corporate Social Responsibility Report that includes disclosure about your management of climate risks?

Company 1 No. Company 2 Yes. Company 3 No. Company 4 Yes. Company 5 No. Company 6 Yes. Company 7 No. Company 8 Yes. Company 9 Yes, since 10 years ago. Company 10 Yes. Company 11 No.

APPENDIX 4 - SYNTHESIS OF THE SCIENTIFIC RESEARCH OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

The Intergovernmental Panel on Climate Change (IPCC)¹

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in order to assess scientific information on climate change, assess the environmental and socioeconomic impacts of climate change and formulate realistic response strategies. The IPCC is comprised of hundreds of scientific experts from various countries on all continents.

Increased Temperatures

Ever since the Earth has had an atmosphere, its climate has fluctuated. While unusual climatic conditions routinely arise, the most recent observations indicate certain "anomalies". In this regard, the level of carbon dioxide is historically exceptionally high and is changing rapidly and exponentially. Another observation shows that recent global temperatures are the highest they have ever been for at least the last 150 years, if not the last millennium (graphs 1 and 2).



Historical global temperatures.

¹ All information, graphs and tables have been excerpted directly from IPCC documents.



Graph 2



Graph 2 shows temperature fluctuations in the Northern Hemisphere. Average temperatures for the period from 1961 to 1990 are used are a reference. Instrumental meteorological records shown in black are limited due to the absence of technology as of a certain period in time. To reconstruct prior temperatures, the alternatives, shown as coloured lines, correspond to an analysis of temperature-sensitive proxy records such as:

- the width and density of a tree ring;
- the isotopic composition of various elements in ice, such as the oxygen-16 isotope;
- the chemical composition of a growth band in corals.

The study of ice cores, through boreholes collected over thousands of metres, shows the existence of considerable variations in temperature over the last million years. These are glacial cycles, during which the global mean temperature might vary by 3 °C between ice ages and relatively warmer interglacial periods. During glacial periods, there were kilometres of ice and snow above Québec.² This provides a glimpse of the potential global impact of a variation of a few degrees Celsius. However, analyses show that, at the end of a glacial cycle, temperature increases occur gradually over approximately 5,000 years. Even data going much further back in time do not show variations in temperature as rapid as those of our contemporary warming.

² From the website of the department of geology and geological engineering of the Université Laval: http://www2.ggl.ulaval.ca/personnel/ bourque/s5/5.5.quaternaire.html.

Causes

It is possible to measure the impact of elements likely to affect the climate, such as carbon dioxide and other compounds with properties that cause a greenhouse effect. This measure is referred to as radiative forcing and is expressed in "Watts per square metre". Radiative forcing measures how the energy balance of the Earth-atmosphere system is influenced. It evaluates the impact of changes in the energy balance by comparing incoming (full-spectrum) solar radiation and outgoing (infrared) radiation within the Earth's atmosphere. Earth's temperature fluctuates based upon this energy balance. Positive forcing results in a net increase in the energy balance and, consequently, the system gets warmer. Negative forcing is the contrary and results in cooling.

Global temperatures have varied even before the existence of phenomenal increases in greenhouse gases produced by humans, including through the burning of fossil fuels. Ice ages occurred over millions of years. Ice ages are caused by a phenomenon known by climate scientists as Milankovitch cycles. These cycles are regular variations in solar radiation linked to the Earth's orbit around the sun.

In addition to solar cycles, explosive volcanic eruptions occasionally eject large amounts of dust and sulphate aerosol high into the atmosphere, temporarily shielding the Earth. These particles reflect sunlight back to space. Natural forcing measures the impact of natural processes such as solar radiation and volcanic eruptions while anthropogenic forcing stems from human activity.



Graph 3

Summary of the principal components of the radiative forcing of climate change.

Climate can be influenced by forcings caused by various human or natural sources (graph 3). The values represent the forcings in 2005 relative to the start of the industrial era (about 1750). Human activities cause significant changes in long-lived gases, ozone, water vapour, surface albedo³, aerosols and contrails⁴. The only increase in natural forcing of any significance between 1750 and 2005 occurred in solar irradiance. The thin black line attached to each coloured bar represents the range of uncertainty for the respective value.

Greenhouse gases have a considerable impact on net radiative forcing. The following exercise reproduces, through modeling, the observed global temperature increase based on natural forcings combined with anthropogenic forcings. The comparison is to cases of natural forcing only.

³ The fraction of solar radiation reflected by a surface or object, often expressed as a percentage. Snow-covered surfaces have a high albedo, the surface albedo of soils ranges from high to low, and vegetation-covered surfaces and oceans have a low albedo. The Earth's planetary albedo varies mainly through varying cloudiness, snow, ice, leaf area and land cover changes.

⁴ Aircraft produce persistent linear trails of condensation ("contrails") in regions that have suitably low temperatures and high humidity. Contrails are a form of cirrus cloud that reflect solar radiation and absorb infrared radiation.

Graph 4a) presents global average surface temperatures over the course of the 20th century. The black line indicates observations and the yellow curves show the simulations produced by different climatic models. These are based on natural and human factors. The mean of all these runs is also shown (thick red line). Temperature anomalies are shown relative to the 1901 to 1950 mean. Vertical grey lines indicate the timing of major volcanic eruptions. Graph 4b) is based on the same process, but excludes anthropogenic forcings.



Graph 4

Global mean surface temperature anomalies.

Based on this demonstration, in particular the IPCC states with a high degree of certainty that temperature increase is associated with an increase in greenhouse gases. In order to simulate the increase in temperature over the most recent decades, models must incorporate anthropogenic forcings.

Furthermore, models and observations also show warming in the lower part of the atmosphere (the troposphere) and cooling higher up in the stratosphere. This is another "fingerprint" of change that reveals the effect of human influence on the climate. If, for example, an increase in solar output had been responsible for the recent climate warming, both the troposphere and the stratosphere would have warmed.

Lastly, the more the planet warms, the more it releases CO2 trapped in its soils and oceans.

Projections

The quantitative estimates provided by the models and used to make projections about future climate change are reasonably reliable. The models are based on well understood physical principles. Furthermore, they are able to simulate current and past climate change phenomena. The following graph shows projected temperature variations by region, using natural forcings alone or natural and anthropogenic forcings combined.



Graph 5

Continental surface temperature anomalies: Observations and projections.

The blue and green bands represent simulations generated by several independent models using only natural forcing. The pink and yellow bands represent the same exercise, but with anthropogenic forcings included. The black line represents current and past observations. The width of the bands indicates the 5th to 95th percentile range of the simulations.

Extreme Events

There are clues indicating that changes in climate extremes are to be expected as the climate warms in response to increasing atmospheric greenhouse gases resulting from human activity. However, determining whether a specific, single extreme event is due to a specific cause, such as increasing greenhouse gases, is difficult, if not impossible, for two reasons:

- extreme events result from a combination of factors, and;
- even when the climate is stable, a wide range of extreme events is a normal occurrence.

On the other hand, generally speaking and overall, data show that changes are occurring in the amount, intensity, frequency and type of precipitation. The El Nino and North Atlantic Oscillation phenomena have considerable influence over the natural variability of precipitation. More precipitation now falls as rain rather than snow in northern regions. Widespread increases in heavy precipitation events have been observed, even in places where amounts have decreased. Certain regions have also experienced increases in the occurrences of both droughts and floods. Through the principles of thermodynamics, increased temperatures allow the atmosphere to hold a greater amount of water vapour. This increase also speeds up evaporation over the oceans. Be it theory, climate model simulations or empirical data, all confirm that warmer climates lead to more intense precipitation events.

However, observations prove that changes of severe, low range weather events (such as tornadoes, hail and thunderstorms) are often localized and too geographically dispersed to draw any general conclusions.

The IPCC has prepared a summary table (see next page) of observed phenomena and attributes a likelihood that a trend occurred in recent years, a likelihood of human contribution and a likelihood of a future trend. These data correspond to global averages. There are variations from one region to another. For example, in Québec, the change in precipitation was the principal change observed. The main conclusions of Ouranos concerning the situation prevailing in Québec are presented in Appendix 5.

PHENOMENON AND DIRECTION OF TREND	Likelihood that trend occurred in late 20th century (typically post-1960)	Likelihood of a human contribution to observed trend	Likelihood of future trend based on projections for 21st century using SRES* scenarios		
Warmer and fewer cold days and nights over most land areas	VERY LIKELY	LIKELY	VIRTUALLY CERTAIN		
Warmer and more frequent hot days and nights over most land areas	VERY LIKELY	LIKELY (NIGHTS)	VIRTUALLY CERTAIN		
Warm spells / heat waves: Frequen- cy increases over most land areas	LIKELY	MORE LIKELY THAN NOT	VERY LIKELY		
Heavy precipitation events. Fre- quency (or proportion of total rainfall from heavy falls) increases over most areas	LIKELY	MORE LIKELY THAN NOT	VERY LIKELY		
Area affected by droughts increases	LIKELY IN MANY REGIONS SINCE 1970S	MORE LIKELY THAN NOT	LIKELY		
Intense tropical cyclone activity increases	LIKELY IN SOME REGIONS SINCE 1970S	MORE LIKELY THAN NOT	LIKELY		
Increased incidence of extreme high sea level (excludes tsunamis)	LIKELY	MORE LIKELY THAN NOT	LIKELY		

Assessment of human impact on recent and projected future trends

*SRES, IPCC Special Report on Emission Scenarios.

Table 1

Recent trends, assessment of human influence on the trend and projections for extreme weather events for which there is an observed late-20th century trend (Source: IPCC)

Note on Table 1

Where uncertainty in specific outcomes is assessed using expert judgment and statistical analysis of a body of evidence (e.g. observations or model results), then the following likelihood ranges are used to express the assessed probability of occurrence:

- virtually certain (likelihood >99%);
- extremely likely (likelihood >95%);
- very likely (likelihood >90%);
- likely (likelihood >66%);
- more likely than not (likelihood >50%);
- about as likely as not (likelihood of 33% to 66%);
- unlikely (likelihood <33%);
- very unlikely (likelihood <10%);
- extremely unlikely (likelihood <5%);
- exceptionally unlikely (likelihood <1%).

For more information about some remaining ambiguities, please refer to the Intergovernmental Panel on Climate Change's Technical Summary, which sets out a serie of robust findings and key uncertainties.

APPENDIX 5 - THE OURANOS CONSORTIUM: SITUATION IN QUÉBEC

Ouranos

Ouranos is a consortium that brings together some 250 scientists and professionals from different disciplines. It focuses on two main themes: climate sciences and impacts and adaptation. Its members include Environment Canada, the Université du Québec à Montréal, the Université Laval, McGill University and the Institut national de la recherche scientifique (INRS).

Ouranos mission is to acquire and develop knowledge on climate change, its impact and related socioeconomic and environmental vulnerabilities, in order to inform decision makers about probable climate trends and advise them on identifying, assessing, promoting and implementing local and regional adaptation strategies.

Ouranos carries out detailed analyses in a Québec-specific context.

Changes in Québec

In general, temperatures throughout the territory of Québec are expected to rise, and more markedly in winter than in summer. There will be significant changes in precipitation.

It appears that, in southern Québec in summer, the quantity of precipitation will be substantially the same. However, results of models indicate a lengthening of the season conducive to thunderstorms as well as an increase in intense rainfall events.

In winter, the number of snowfalls will decrease while winter rain will be more frequent. The quantity of precipitation per event will also increase for snowfalls and winter rain. Winter mild spells will also be more frequent.

Precipitation

In Québec, winter precipitation will intensify in the future. While the increased frequency will be less evident in summer, precipitation during this season will nevertheless be the most abundant or even extreme.

The findings of certain studies show that winter mild spells and winter rains are more frequent in the southern part of the province, resulting in a decrease in the thickness of snow cover. Winter conditions will be more complex due to the presence of several types of precipitation. This could increase the probability of a crisis such as the 1998 ice storm.

It is possible that snowmelt hastens the onset and reduces the intensity of spring floods. It is conceivable that, over a certain time horizon, there will be less flooding resulting from high water in the southern and coastal areas of the province.

Storms

Analyses show that the impact of climate change could multiply the number of severe weather events during the summer, because a warmer and more humid climate favours the occurrence of thunderstorms and intensifies their effect. This results in instability, because areas that were previously somewhat spared are now being affected.

In the North American coastal regions, mid-latitude cyclones will continue to occur, accompanied by high wind speeds, intense precipitation and large waves. By analyzing major storm trajectories, simulation-based projections indicate a decreased occurrence of cyclones along the Canadian coast and decreased intensity of weak depressions in the region. This will result in a lower number of storms, but they will probably be stronger.

Models suggest that Québec will not experience a greater number of hurricanes than previously, nor will there be any substantial change in the geographical distribution of hurricanes. However, doubts persist regarding the intensity of such hurricanes.

Average and Maximum Wind Speed Over 24 Hours

Excluding strong winds caused by the observed increase in extreme precipitation, average wind speeds and wind gusts will remain as they are now for the next 20 years, regardless of the season or region.

In the Gulf of St. Lawrence, observations based on wind speed analyses from 1953 to 2002 even indicate a decrease in average wind speeds, extremes and variability.

Summary of Climate Change and Its Potential Impact

Drawn from an IPCC table, simulations and a review of the scientific literature, the following table shows the main effects of climate change and their likelihood of occurrence in Québec. The table is derived from a study whose authors also summarized the expected impact of each climate event on buildings⁵. It should be noted that these changes will not occur uniformly throughout Québec and that their impact could differ from one region to another.

⁵ M. Aubé, C. Drolet, A. Matte, M.-F. Sottile, "Changements climatiques - vulnérabilité et adaptation des immeubles", Ouranos and Corporation d'hébergement du Québec, Montréal, 2011, p. 36.

Climate change	Likelihood	Expected impact*
Increased minimum temperatures, particularly in the north, in winter	ALMOST CERTAIN	
Increased maximum temperatu- res, particularly in the south, in summer	VERY LIKELY	 increased number and surface area of heat islands increased number and duration of heat waves increased frequency and duration of droughts thawing of permafrost subsidence and landslides in the north deterioration of air quality deterioration of water quality increased occurrence of a humidex above 40
Increased precipitation in winter, particularly in the north	ALMOST CERTAIN	
Decreased precipitation in the summer in the south and increased evaporation	VERY LIKELY	 deterioration of air quality increased occurrence of a humidex above 40 increased frequency and duration of droughts deterioration of water quality
Decreased accumulation of snow on the ground	VERY LIKELY	
Sea level rise	LIKELY	
More intense precipitation	LIKELY	 more frequent violent weather flooding, drainage problems and potable water management problems. landslides coastal erosion increased runoff and erosion of agricultural land larger summer floods

Potential impact of climate change in Québec

*Not all impacts have been listed. Those included are those set forth in the following matrix.

Table 1

Likelihood and expected impact of climate change in Québec.

The afore-mentioned study establishes, through the use of a matrix, the potential impacts described above on various components of a building.

Building vulnerability profile

EXPECTED IMPACT	Infrastructure	Superstructure	Envelope	Roof	Building interior	Plumbing	HVAC*	Electricity	Site development
More frequent freeze-thaw cycles			Х	Х					Х
Increased water content of snow									
More frequent and longer heat waves									
Increased urban heat island effect									
More frequent and longer droughts									
Increased occurrence of humidex > 40%									
Thawing of permafrost									
Deterioration of air quality									
Deterioration of water quality									
Floods									
Coastal erosion									
Landslides									
More frequent violent weather									

*Heating, ventilation, and air conditioning

Table 2

Theoretical building vulnerability profile due to the impact of the climate changes identified in the preceding table. Vulnerability is expressed as a change in the current average situation as a function of exposure and sensitivity.

