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Readers of this actuarial report are
encouraged to make comments and
suggestions, which could be used to make
improvements in future reports. The authors
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Ms. Julie Boulet
Minister of Employment and Social Solidarity
25, rue Saint-Amable, 4^e étage
Québec (Québec)

Madam:

I have the honour of transmitting to you the actuarial report as at 31 December 2009, which the Régie des rentes du Québec has caused to be prepared in accordance with section 216 of the *Act respecting the Québec Pension Plan*.

Very truly yours,

ANDRÉ TRUDEAU
Chief Executive Officer and Chair

Mr. André Trudeau
Chief Executive Officer and Chair
Régie des rentes du Québec

Dear Sir:

I have the honour of presenting to you the regular actuarial report of the Québec Pension Plan, which was prepared in accordance with the mandate entrusted to us. The report was prepared as at 31 December 2009, pursuant to the provisions of section 216 of the *Act respecting the Québec Pension Plan*.

A number of people have devoted considerable effort to its realization and we are grateful to them.

Respectfully submitted,

Pierre Plamondon, F.S.A., F.C.I.A.
Chief Actuary

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1. Introduction

In accordance with section 216 of the *Act respecting the Québec Pension Plan*, the Régie des rentes du Québec must cause to be prepared at least once every three years an actuarial report of the Québec Pension Plan. This report was made as at 31 December 2009.

The actuarial report serves to inform the government, contributors and beneficiaries of financial changes in the Plan. To do so, it presents a projection of the Plan's cash inflows and outflows and their effect on the reserve. It serves to guide decision makers in any future review of its funding or some of its provisions.

The data is updated in each actuarial report and the demographic and economic assumptions are adjusted in accordance with any changes that have occurred within the Plan environment.

Additional projections are also given, so as to evaluate the sensitivity of the reserve and the steady-state contribution rate to variations in the main demographic and economic assumptions.

The main actuarial report covers how the Plan is funded, the methodology of the actuarial analysis, the main assumptions made and the results obtained. It is followed by six appendixes, which show changes in the Plan's funding over time, a summary of the main provisions of the *Act*, a detailed description of the assumptions and methodology, changes in the reserve based on the steady-state contribution rate, sensitivity tests on the results and a comparison of the results with those contained in the actuarial report as at 31 December 2006.

2. Plan funding

This section briefly explains how the Plan is funded. Appendix I gives more details on changes in the Plan's funding over time.

At the Plan's inception in 1966, the government adopted a partially funded approach, which is between a pure pay-as-you-go funding scheme¹ and full capital funding.² This method of funding allowed the constitution of a contingency reserve amounting to just a few years of benefits in order to protect the Plan against economic fluctuations. The Plan's funding objective has never been full capital funding of the sort required for private pension plans, which may be terminated at any time.

The fact that the initial contribution rate of 3,6% would have to be increased as time went by was acknowledged in 1966. However, changes in the economic and demographic environments, as well as amendments to the Plan's provisions, created additional upward pressure on the contribution rate. In that context, the contribution rate increased from 3,6% in 1986 to 5,6% in 1996, based on a funding scheme intended to maintain a minimum reserve equal to twice the cash outflows for the following year throughout the projection period.

The 1998 Plan reform caused the contribution rate to increase more rapidly, from 6,0% in 1997 to 9,9% in 2003. The rate is set by law at the 2003 rate for subsequent years. The reform, with its subsequent increase in contribution rates, was intended to ensure stable, long-term funding and to improve fairness between the generations of

contributors. More concretely, the objective was to stabilize the contribution rate so that future generations of workers will make contributions based on the same rate for a similar level of benefits.

The reform made it possible to strengthen the Plan's long-term funding by maintaining a higher funding level. A higher reserve will make it possible not only to reduce the effects of economic fluctuations but also the effects of the significant demographic changes that are expected between now and 2030.

Unlike the Québec Pension Plan, a large number of social security plans in other parts of the world have pure pay-as-you-go funding and therefore accumulate no assets. Because of an aging population, the increase in the number of retirees, compared with the number of workers, has a direct effect on the level of contributions needed to fund such plans. The Québec Pension Plan's partial capital funding makes it possible to reduce that effect because a portion of the investment income generated by the Plan's reserve can be used to offset increased benefits. For that reason, it is important to maintain a sufficient reserve level.

Although the Plan is partially funded, which makes it possible to generate more investment earnings, the main source of funding is still the contributions paid by employers and workers. Changes in the Plan's finances are therefore dependent not only on capital market yields but especially on the demographic and economic changes that may have an impact on the labour market and on the total contributory payroll.

1. In a pure pay-as-you-go funding scheme, the contributions of a given year are used to pay the benefits of the same year.

2. In a fully funded plan, the aggregate contributions made throughout the active life of a group of workers are used to pay all of that group's benefits.

Two indicators of the Plan's financial situation

The Plan's actuarial report makes it possible to monitor the Plan's funding situation. Two indicators are particularly useful in this respect.

The first, which is the **ratio of the reserve at the end of one year to the cash outflows for the following year**, serves to monitor the relative size of the reserve. It indicates if the Plan's funds are sufficient, based on a contribution rate of 9,9%. The funding situation would require particular attention if, over the projection period, the reserve fell below the minimum level targeted prior to the 1998 reform, that is, twice the annual cash outflows.

The second indicator is the **steady-state contribution rate**, which is used to determine the Plan's long-term funding stability. This indicator is the contribution rate for future years that would be required to maintain a constant ratio of the reserve to annual cash outflows over the long term.

If the steady-state contribution rate was applied as of the third year of the projection period, the reserve would generate sufficient investment income to make up the difference that appears when contributions do not cover cash outflows. The reserve would therefore increase at the same rate as cash outflows and maintain the long-term stability of the ratio of the reserve to annual cash outflows.

These two indicators (the level of the reserve over the long term and the steady-state contribution rate) must therefore be considered when determining whether to make changes to the Plan. The consultation that is required by law every six years would therefore provide an opportunity to discuss the measures necessary to restore balance to the Plan's funding.

3. Methodology

The valuation of a public plan like the Québec Pension Plan consists of projecting the cash inflows and outflows of coming years so as to be able to estimate changes in the reserve, which varies from one year to the next as a function of the difference between the Plan's cash inflows and outflows.

Projections of cash inflows and outflows

The analysis used for this report was based on an actuarial model for projecting demographic and economic factors so as to determine the level of future cash inflows and outflows. The model requires a number of data, in particular, data on the Plan's contributors and beneficiaries, as well as the establishment of several assumptions. The actuarial analysis was made in accordance with the provisions of the Plan as defined in the *Act respecting the Québec Pension Plan* and described in Appendix II of this report.

The method used consists in projecting the population of Québec on the basis of assumptions made for fertility, migration and mortality. The projected population, based on the number of persons in each age group, serves to determine both the population that contributes to the Plan and the population eligible for the Plan's various benefits.

Contributions and investment income make up the Plan's cash inflows. For each year in the projection period, total contributions are determined from the total contributory payroll and the contribution rate prescribed by law. The total payroll is estimated on the basis of the projected rates of participation in the Plan and future pensionable earnings. Investment earnings are calculated on the basis of yield assumptions for the different types of investment.

Cash outflows are made up of the benefits paid out and administration costs. Benefits are projected using assumptions based on the population's eligibility rates for the various benefits, the probability of the occurrence of an event giving entitlement to a pension and the historical record of the contributors' earnings. These parameters are projected using assumptions based mainly on the Plan's experience. Administration costs are projected on the basis of the Régie des rentes du Québec's budgets and the agreement with Revenu Québec on the collection of contributions.

Since 2003, the *Act respecting the Québec Pension Plan* has prescribed a contribution rate of 9.9%. Therefore, the assumptions and results presented in the following sections make it possible to measure changes in the reserve on the basis of this rate. It is thus possible to verify whether, based on the assumptions made, the contributions collected plus investment income will be sufficient to fund cash outflows and ensure a sufficient reserve at the end of the projection period.

Projection period

To adequately evaluate the Plan's future financial situation, it is important to project cash inflows and outflows beyond the minimum period of 30 years prescribed in the *Act*. The projection period must make it possible to fully understand the extent of the demographic transformation that will occur between 2010 and 2030 because of the massive numbers of baby boomers who will reach retirement age. That phenomenon will have an important impact on the Plan because of the large increase in the number of beneficiaries.

The selected projection period extends over a period of 51 years to 2060. At the end of the period, the number of retirees will have reached a degree of stability, which makes it possible to determine the steady-state contribution rate. This period will also allow the inclusion of the majority of the baby-boom effects on the Plan's funding. This projection period is also consistent with the projection periods of the actuarial analyses of the Plan produced since 1988, which extended over a minimum 50-year period.

This projection period of around 50 years is sufficient for the purposes of the actuarial analysis. However, the uncertainty associated with the projections in an actuarial report increases over time. As we go further into the projection period, the number of contributors and the profile of earnings for future retirees depend more and more on the assumptions made. Furthermore, a small but recurring yearly fluctuation in the difference between cash inflows and outflows may significantly affect the level of the reserve accumulated over the long term. Finally, the use of the steady-state contribution rate serves as a means to assess the stability of long-term funding of the Plan within the 50-year period.

4. Assumptions

The production of an actuarial report requires making assumptions on the demographic and economic environment as well as a certain number of assumptions specific to the Plan's experience. This section describes the main assumptions made for this analysis. Appendix III provides more information on this subject and Table 12 presents a summary of the demographic and economic assumptions that have the greatest influence on the report's results.

Since the purpose of the actuarial report is to analyse the Plan's financial situation by forecasting the changes in the Plan's cash inflows and outflows until 2060, the assumptions must be made from a long-term perspective. The assumptions take into account historical trends without giving unjustified importance to recent situations that may be the result of a specific conjuncture.

In addition to historical data and historical trends, several elements are taken into account in the elaboration of assumptions, including the opinion and forecasts of experts,³ comparisons with the assumptions made by other public plans at the national and international level as well as public policy with respect to inflation, immigration and other areas. The report is based on data as at 31 December 2009, that were available in March 2010 at the latest.

Each assumption made represents the authors' best estimate of population and economic changes and in particular, variables that affect benefits. Furthermore, being interrelated, the assumptions form a coherent

whole. For example, they must take into account the interrelations between demographic factors and economic factors.

Although assumptions are determined in a reasonable manner, there will be differences between the future reality and assumptions made. These differences may have an effect on the financial situation of the Plan upwardly or downwardly, compared with the results of this actuarial analysis. They will be analyzed and taken into account in subsequent actuarial analyses.

4.1 Demographic assumptions

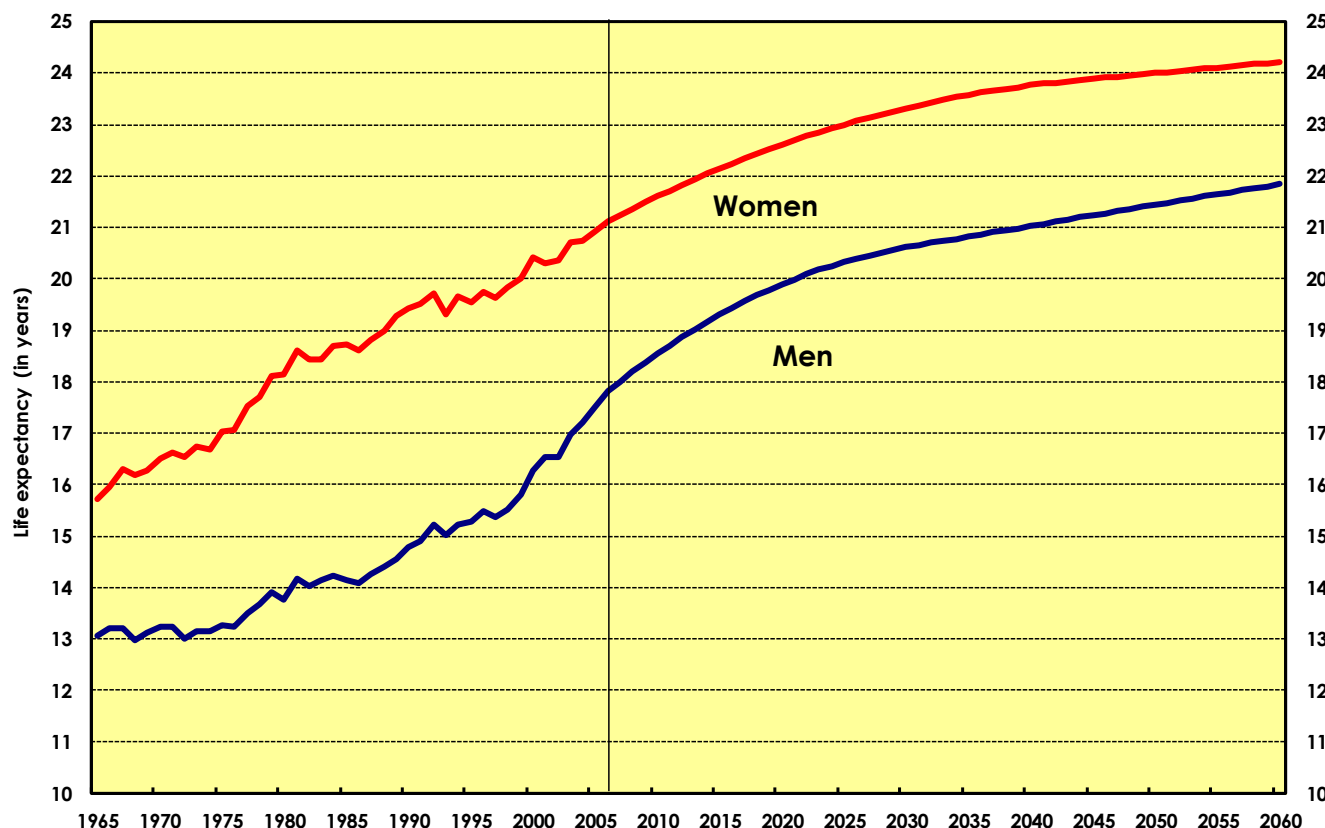
A projection of the Québec population is the basis for determining the number of Plan contributors and beneficiaries. The projection begins with the population estimated by Statistics Canada as at 1 July 2009, to which are applied the mortality, birthrate and migration assumptions.

The current population structure strongly influences the results of projections for the years to come. The age distribution of the initial population shows a significant aging of the Québec population. The first cause of this aging is the large drop in birthrates in the 1960s and a continuing low level thereafter.

The effect of low birthrates on the population distribution is amplified because it follows the high birthrates observed during the baby boom in Québec between 1945 and 1965.

3. One of the principal sources of projections is a seminar organized by the Régie des rentes in September 2009, entitled "Perspectives démographiques, économiques et financières, 2009-2030".

Chart 1
Changes in life expectancy at age 65



In the 1950s, the average fertility rate was 4,0 children per woman. It dropped rapidly thereafter to a level below 2,0 in 1971. Subsequently, the rate oscillated between 1,4 and 1,8 children, giving a 35-year average of 1,6. The introduction of the Québec Parental Insurance Plan in 2006 was followed by a slight increase in births; the fertility rate increased from 1,5 in 2005 to 1,7 in 2009.

Another cause of the aging of the population is the large reduction in mortality rates for adults. Since the Plan began, this phenomenon has been manifested as a rapid increase in life expectancy for retirees. Benefit payouts therefore increase significantly because the benefit payment period increases with a longer life expectancy.

As Chart 1 indicates, life expectancy at age 65 increased by 35% for men between 1966 and 2006,⁴ rising from 13,2 to 17,8 years. For women, life expectancy at age 65 increased from 15,9 to 21,1 years during the same period, which is an increase of 33%.

The demographic projections are based on several assumptions, which are detailed in Appendix III and can be summarized as follows:

- The **total fertility rate** is estimated to be 1,73 children per woman in 2010.

4. Life expectancy in 2006 is based on data for the period from 2005 to 2007.

It decreases slightly to 1,65 in 2018 and then remains constant throughout the entire projection period.

- **Net migration** is 31 500 people in 2010 and remains constant throughout the entire projection period. However, since the population will increase until the end of the projection period, the ratio between net migration and the population will decrease from 0,40% in 2010 to 0,35% in 2060. Net international migration is 44 600 people, and Québec will have a negative net interprovincial migration of 13 100 people.
- **Mortality rates** drop continually over the entire projection period. This reduction is established by age and sex based on historical data and on projections used by several organizations. The overall reduction obtained is twice as slow as that observed on average over the last 20 years. Chart 1 shows the changes in life expectancy at age 65 from the beginning of the Plan until the end of the projection period. In 2060, life expectancy at age 65 reaches 21,8 years for men and 24,2 for women. A closing of the gap between men and women is expected: the difference between them will drop from 3,3 years in 2006 to 2,4 years in 2060.

Any differences between these assumptions and the actual rates of birth and mortality as well as the actual net migration in the coming decades will have an effect on the exact distribution of the population by age. It is unlikely, however, that such changes could significantly reduce the aging of the population, which has already begun and is a result of the drop in birthrates and the increase in life expectancy.

By projecting the population over a long period, it is possible to grasp the magnitude of the upheavals caused to the age structure by the phenomena described above.

The result is a gradual transition of the Québec population to an older society whose demographic structure is significantly different from the structure observed when the Plan was created. This demographic transformation will be a determining factor in changes in the Plan's financial situation.

The distribution of the Québec population in 1970 resembles an age pyramid with a larger number of people in the younger age groups. Baby boomers are represented in Chart 2 by darkly shaded areas. In 1970, they were between ages 5 and 24 and represented more than 40% of the population.

Chart 2 also shows the distribution of the population in 2005, 2025 and 2045. It illustrates the effect the drop in birthrates and a longer life expectancy have on the distribution. In 2005, there are 633 000 more baby boomers, whose ages are between 40 and 59, than the portion of the population under age 20, which will significantly impact the labour market.

In 2025, the same group, then between the ages of 60 and 79, will still account for approximately one quarter of the total population, and it will for the most part be retired. In 2045, the people in this group, who will then be age 80 and over, will total approximately 983 000 – almost four times the population of this age group in 2005 – and therefore will represent approximately 10,9% of the total population.

Table 1 shows population changes for three age groups (0 to 19, 20 to 64 and 65 and over) for the projection period of 2010 to 2060, as well as the ratio of the population aged 20 to 64 to the population aged 65 and over.

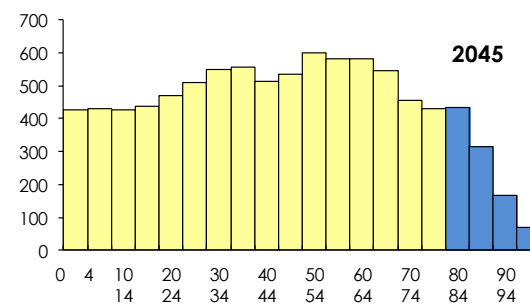
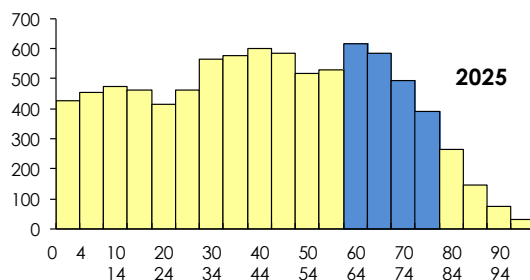
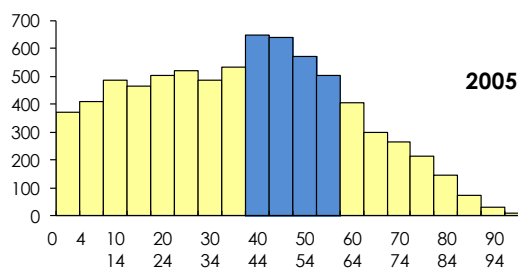
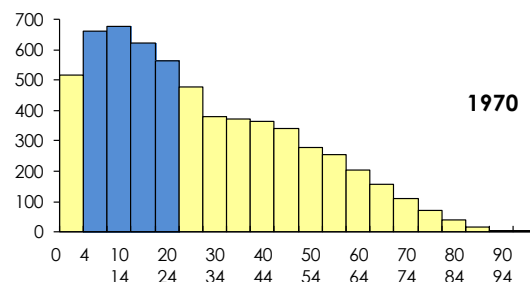
This ratio provides a measure of population aging. It changes quickly, from 4,1 in 2010 to 2,5 in 2025. In 2045, there are two people aged 20 to 64 for each person aged 65 or over.

Table 1 also illustrates that the number of people aged 20 to 64 begins to decrease as of 2017.

Additional population data are presented in section 2.5 of Appendix III, including the percentage of the population aged 65 and over, as well as the ratio of people aged 20 to 59 to those aged 60 and over.

Chart 2
Distribution of the Québec population, by age

(in thousands, by 5-year age groups, according to the last birthday)



 Baby boomers

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Table 1
Projected population of Québec
(in thousands, on 1 July, age at the last birthday)

Year	All ages ^a	0 to 19	20 to 64	65 and over	Ratio: <u>20 to 64</u>
					<u>65 and over</u>
2010	7 890	1 731	4 948	1 210	4,1
2011	7 951	1 723	4 975	1 252	4,0
2012	8 011	1 717	4 994	1 299	3,8
2013	8 070	1 714	5 011	1 345	3,7
2014	8 128	1 714	5 023	1 392	3,6
2015	8 185	1 715	5 031	1 439	3,5
2016	8 240	1 718	5 035	1 487	3,4
2017	8 294	1 725	5 034	1 536	3,3
2018	8 346	1 736	5 025	1 586	3,2
2019	8 397	1 748	5 009	1 640	3,1
2020	8 446	1 760	4 989	1 696	2,9
2021	8 493	1 773	4 969	1 751	2,8
2025	8 661	1 814	4 869	1 978	2,5
2030	8 820	1 793	4 799	2 228	2,2
2035	8 925	1 746	4 849	2 329	2,1
2040	8 994	1 722	4 909	2 363	2,1
2045	9 032	1 723	4 894	2 415	2,0
2050	9 043	1 742	4 842	2 459	2,0
2055	9 038	1 757	4 799	2 482	1,9
2060	9 033	1 752	4 756	2 526	1,9

a) In this table and others, the total is not necessarily equal to the sum of the parts, since figures have been rounded off.

4.2 Economic assumptions

The economic assumptions are related to changes in activity rates, employment rates, unemployment rates, the inflation rate, average employment earnings and the rate of return on investments.

Economic assumptions are described in detail in Appendix III and can be summarized as follows:

- The **global activity rate**, which is the ratio between the number of people who are active and the population aged 15 and over, is determined in large part by the distribution of the population by age. Consequently, an aging population will result in considerable downward pressure on the global activity rate by the year 2030 because of the passage of the baby-boom generation from age groups with higher activity rates to age groups with lower activity rates. Based on the activity rates by age that were selected, the global activity rate will thus fall by 5,7 percentage points between 2010 and 2030, dropping from 65,3% to 59,6%. Thereafter, the rate will fall more slowly, reaching 58,1% in 2060.

The impact of an aging population, however, will be offset in part by social and economic factors. These factors include improved labour market conditions, due to the low growth of the workforce and a higher level of education among older workers. These factors, combined with an increased life expectancy and, in turn, a need to finance one's retirement, should sway workers to remain at work longer, involving, for example, phased retirement from the labour market.

In terms of activity rates by age and taking these factors into account, a gradual increase in the activity rates for men and women between the ages of 25 and 64 is expected. Because activity rates are already very high for men aged 25 to 54, future increases will be moderate and over periods of not more than 5 years. The increases will be more marked among men aged 55 to 64 and will be over longer periods.

For women, the increase in activity rates is more significant than for men for groups aged 50 and over. The higher participation of women in the labour market, which began several decades ago, will continue at a slower pace than in the past for women aged 25 to 49 and at a faster pace for women aged 50 and over.

As a result, the activity rate for the population aged 20 to 64 will increase more moderately than in the past, rising from 79,6% in 2010, to 82,9% in 2030, and then to 83,9% in 2060.

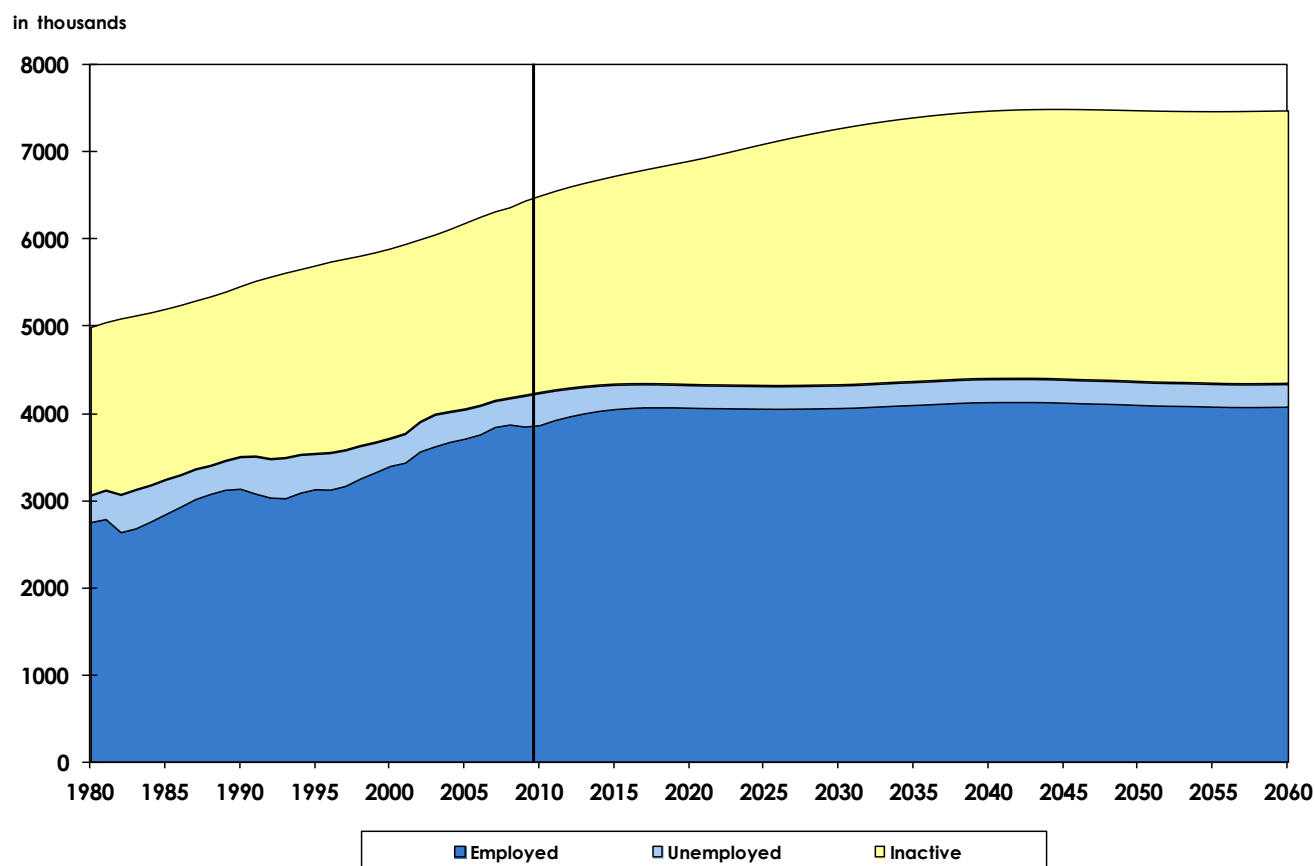
Once the activity rates are determined on the basis of age group and sex, they are applied to the projected population aged 15 and over to obtain the active population. This projection reveals slower growth of the active population up to 2017 and remains relatively stable for the remainder of the projection period. Thus, the active population in 2060 will roughly correspond to the expected level for 2017.

- The **employment** projection takes into account a period of slow growth of the workforce, during which unemployment will gradually fall. In the very short-term, the expected increase in employment also takes into account the forecasted economic recovery. It is therefore 0,4% in 2010 and 1,5% in 2011, decreasing gradually until it becomes nil in 2018.

The unemployment rate will reach its lower limit of 6,0% in 2019. Thereafter, employment will vary at the same rate as the active population.

Chart 3 shows the changes in the population aged 15 and over according to labour force status (employed, unemployed, inactive).

Chart 3
Distribution of the population aged 15 and over, by labour force status



- The desire of the Bank of Canada and the federal government to keep the **inflation rate** inside a target zone of 1% to 3% until the end of 2011 leads us to expect a low inflation rate during the coming years.

The assumed annual inflation rate is 1,6% in 2010. It will increase to 2,0% in 2011. Thereafter, the inflation rate will increase 0,1% annually and reach its projected long-term rate of 2,5% in 2016.

- The **real rate of increase in average employment earnings** in the long term is tied to increases in productivity. This assumption also takes into account an anticipated tightening of the labour market.

Between 2009 and 2019, the nominal rate of increase in average earnings will rise from 0,5% to 3,7%. After excluding inflation, the real rate of increase was 0,2% in 2009. Then it will rise steadily, reaching 1,2% in 2019 and remain constant thereafter.

- The **real rate of return** for the reserve is represented by the difference between the nominal rate of return and the inflation rate. This assumption is based on an analysis of historical trends and rate of return projections for each investment category. The valuation of the global rate of return for the Plan's fund takes into account the distribution of investments by category and the fees related to fund management.

The projected real rate of return until 2019 is 4,3%. It gradually increases until 2022 when it will level off at 4,5% (the nominal rate of return will be 7,0%).

4.3 Other assumptions

The Plan's actuarial report includes several other assumptions; the main ones are the retirement rate and the disability incidence rate. Appendix III contains a detailed description of the assumptions that pertain to benefits.

4.3.1 Retirement rate

For the purposes of this report, the retirement rate is the ratio of the number of persons who become beneficiaries of a retirement pension at a given age to the total number of eligible persons of the same age.

It makes it possible to determine when retirement benefits become payable.

The normal retirement age under the Plan is 65. However, since 1984, a person can choose to receive a reduced retirement pension as of age 60 if he or she meets certain conditions. The average age at which retirement pensions began was 63,4 for the cohort of men who reached age 60 in 1984. It reached 62,0 in 1997 as the result of a significant drop in the activity rate for men aged 60 to 64, which dropped from 54,1% in 1984 to 37,5% in 1996.

For women, the average starting age for a retirement pension decreased from 63,1 to 61,5 during the same period, but was not accompanied by a corresponding decrease in the activity rates of women aged 60 to 64. The average starting age for a retirement pension for men and women has remained about the same since 1997.

The expected increase in activity among people aged 60 to 64 during the projection period could be reflected by a slight decrease in the number of workers who will in fact retire at age 60 and by an increase in the retirement rates for the ages between 61 and 65. However, this increased activity is not directly reflected in retirement rates, since it is more and more common for people between ages 60 and 65 to be considered active even if a retirement pension is being received. This could be the result of the Plan's provisions for phased retirement and due to the fact that a beneficiary of a retirement pension can return to the labour market.

The retirement rate at age 60, which is 51% for men in 2009, remains stable throughout the entire projection period. For women, the retirement rate at age 60 is 59% in 2009, drops to 56% in 2019 and, as for men, subsequently remains stable. After age 65, retirement rates are practically nil.

Thus, for women, the average age when a pension begins will increase from 61,5 in 1997 to 61,8 in 2019 and remain constant thereafter. For men, it remains stable at age 62 throughout the entire projection period.

4.3.2 Disability incidence rate

The disability incidence rate for a given year is equal to the ratio of the number of new disability pension beneficiaries during that year to the number of people who have contributed sufficiently to qualify for a disability pension. It is developed from the Plan's experience from 2004 to 2008.

The disability incidence rate has a direct impact on the number of new disability pensions. It is given for certain ages in Table 38, in Appendix III. The rate increases as a function of age and there is a marked increase as of age 60, mainly because of the broadened definition of disability that begins to apply at that age.

Disability incidence rates for women have increased substantially in recent years and are now slightly higher than rates for men aged 35 to 56. However, before age 35 and after age 56, the rates for women remain lower than those for men.

5. Results

5.1 Contributions

Plan contributions are determined by the number of contributors, the contributory earnings and the contribution rate. Thus, the demographic and economic assumptions described in the preceding sections allow us to determine the level of future contributions. Appendix III describes in more detail the method used to calculate contributions.

Generally, people whose annual employment earnings exceed the basic exemption (3 500 \$) contribute to the Plan. Because of the freeze of the basic exemption and the increase in the number of employed persons, the number of contributors will increase continually throughout the projection period, until 2019. It will increase on average 0,8% per year, from 3 893 000 in 2010, to 4 168 000 in 2019. Thereafter, because of an increase in the labour force, it will rise to 4 340 000 in 2060.

Contributory earnings are equal to average pensionable earnings (subject to the prescribed maximum) less the basic exemption. The average annual contributory earnings in 2010 are 28 676 \$ for men and 24 474 \$ for women.

Table 2 shows future changes in contributions. Since the contribution rate is stable at 9,9% over the entire projection period, total contributions will increase only as a function of increases in the total contributory payroll. As of 2040, since the number of contributors is relatively stable, contributions progress only because of wage increases.

Total contributions will increase from 10,4 billion \$ in 2010 to 70,0 billion \$ in 2060, the year in which the number of contributors will reach its maximum.

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Table 2
Changes in contributions

YEAR	NUMBER OF CONTRIBUTORS	TOTAL CONTRIBUTORY PAYROLL	CONTRIBUTIONS ^a
	(in thousands)	(in millions of \$)	(in millions of \$)
2010	3 893	103 947	10 446
2011	3 959	108 182	10 870
2012	4 012	112 357	11 288
2013	4 057	116 843	11 738
2014	4 095	121 629	12 217
2015	4 125	126 584	12 714
2020	4 166	153 587	15 418
2025	4 159	184 995	18 565
2030	4 188	223 805	22 454
2035	4 271	273 863	27 468
2040	4 342	334 190	33 512
2045	4 363	403 906	40 495
2050	4 352	484 565	48 577
2055	4 336	580 397	58 178
2060	4 340	698 675	70 027

a) Contributions calculated on the basis of the total contributory payroll and the contribution rate are increased by the non-refund to employers of certain contribution overpayments and reduced by the expenses related to accounts receivable for contributions.

5.2 Benefits

The Québec Pension Plan provides financial protection in the event of retirement, disability (disability pension, pension for a disabled person's child) and death (surviving spouse's pension, orphan's pension and death benefit). Appendix II describes those benefits. The projection of benefit amounts is based on the assumptions previously described. Section 5 of Appendix III details the method used to determine the number of beneficiaries and average pension amounts.

The projected number of beneficiaries for the period from 2010 to 2060 is shown in Table 3 by type of benefit and is broken down by sex in Table 4.

The number of people receiving a **retirement pension** will increase by 89% between now and 2030 because of babyboomers reaching retirement and the rapid growth in the number of women entitled to a retirement pension. Thereafter, the number of beneficiaries will increase more slowly. Thus, in 2010, there will be one retirement pension beneficiary for every 2.8 contributors to the Plan. The ratio is less than 2 as of 2021.

The increase in the number of **surviving spouse's pensions** will be 63% between now and 2050 because of a large increase in the number of deaths. It will decline slightly thereafter because the number of deaths among beneficiaries will become higher than the number of new beneficiaries. The proportion of men among the beneficiaries of a surviving spouse's pension will increase from 14% to 21% during the projection period, which ends in 2060; that increase reflects the increased participation of women in the Plan.

The number of people receiving a **disability pension** will increase between now and 2021 and then hover around 84 000 to 92 000. That is partly the result of population aging: by 2020, the more populous cohorts will reach the upper age limit, that is, age 65, for receiving a disability pension (see Table 1).

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Table 3
Projection of the number of beneficiaries as at 31 December
(in thousands)

YEAR	RETIREMENT PENSION ^{a,b}	DISABILITY PENSION	SURVIVING SPOUSE'S PENSION ^a	DEATH BENEFIT ^c	ORPHAN'S PENSION AND PENSION FOR A DISABLED PERSON'S CHILD	REFUND TO SOCIAL ASSISTANCE ^d
2010	1405,5	81,0	355,8	41,6	27,5	0,7
2011	1464,1	82,0	361,3	42,5	27,4	0,6
2012	1523,7	83,1	366,6	43,6	27,2	0,5
2013	1584,5	84,5	371,9	44,7	27,1	0,4
2014	1648,0	86,6	377,1	45,8	26,9	0,2
2015	1711,3	87,9	382,2	47,0	26,8	0,2
2016	1774,6	89,2	387,4	48,2	26,6	0,1
2017	1840,1	90,4	392,6	49,4	26,6	0,0
2018	1905,8	91,4	397,9	50,7	26,4	0,0
2019	1972,6	91,8	403,3	52,1	26,2	0,0
2020	2038,6	92,0	408,8	53,5	26,1	0,0
2021	2103,1	92,2	414,4	55,0	26,0	0,0
2025	2347,1	89,7	438,7	61,6	25,4	0,0
2030	2542,2	84,3	473,3	71,5	24,7	0,0
2035	2639,3	85,9	510,1	82,5	24,1	0,0
2040	2719,0	90,5	542,2	92,7	23,4	0,0
2045	2784,9	90,6	563,7	100,1	22,7	0,0
2050	2821,7	89,5	571,3	103,4	22,3	0,0
2055	2856,1	88,4	566,5	102,6	22,2	0,0
2060	2855,4	84,3	555,4	99,5	22,0	0,0

- a) A beneficiary who receives concurrently a retirement pension and a surviving spouse's pension is listed in the two corresponding columns of the table.
- b) The number given in this table for beneficiaries of a retirement pension does not take into account that as of 1 January 1994, the retirement pension can be shared between spouses.
- c) Number of contributors whose death gives entitlement to a death benefit in the year indicated.
- d) The Régie makes reimbursements to the Ministère de l'Emploi et de la Solidarité sociale for certain beneficiaries of income security benefits (welfare). This is a closed group of people under age 65 who were receiving income security benefits on 31 December 1971.

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Table 4
Projection of the number of beneficiaries as at 31 December, by sex
(in thousands)

YEAR	MEN				WOMEN			
	RETIREMENT PENSION ^{a,b}	DISABILITY PENSION	SURVIVING SPOUSE'S PENSION ^a	DEATH BENEFIT ^c	RETIREMENT PENSION ^{a,b}	DISABILITY PENSION	SURVIVING SPOUSE'S PENSION ^a	DEATH BENEFIT ^c
2010	689,2	41,9	53,2	26,5	716,3	39,1	302,6	15,1
2011	714,8	42,0	55,9	26,9	749,3	40,0	305,3	15,6
2012	741,1	42,2	58,7	27,4	782,6	40,9	307,9	16,2
2013	768,0	42,6	61,4	27,9	816,5	41,8	310,5	16,8
2014	796,3	43,5	64,1	28,4	851,7	43,1	312,9	17,4
2015	824,6	44,0	66,9	28,9	886,8	43,9	315,4	18,0
2016	853,1	44,5	69,6	29,5	921,5	44,7	317,9	18,7
2017	882,8	44,9	72,3	30,1	957,3	45,4	320,3	19,4
2018	913,0	45,4	75,0	30,7	992,8	46,0	322,9	20,1
2019	943,9	45,4	77,7	31,3	1 028,7	46,3	325,6	20,8
2020	974,5	45,5	80,4	32,0	1 064,1	46,5	328,4	21,5
2021	1 004,9	45,5	83,1	32,7	1 098,2	46,7	331,3	22,3
2025	1 120,0	44,2	93,5	35,9	1 227,1	45,5	345,2	25,7
2030	1 211,7	41,3	105,2	40,7	1 330,6	43,0	368,2	30,8
2035	1 254,9	42,2	113,9	45,8	1 384,4	43,8	396,2	36,7
2040	1 291,0	44,5	118,8	50,0	1 427,9	46,0	423,4	42,7
2045	1 324,1	45,0	120,1	52,5	1 460,8	45,7	443,6	47,5
2050	1 343,9	44,5	118,9	53,3	1 477,8	45,0	452,4	50,1
2055	1 363,0	44,1	117,0	52,4	1 493,1	44,3	449,4	50,1
2060	1 364,8	42,1	116,2	51,0	1 490,6	42,2	439,2	48,5

a) A beneficiary who receives concurrently a retirement pension and a surviving spouse's pension is listed in the two corresponding columns of the table.

b) The number given in this table for beneficiaries of a retirement pension does not take into account that as of 1 January 1994, the retirement pension can be shared between spouses.

c) Number of contributors whose death gives entitlement to a death benefit in the year indicated.

Tables 5 and 6 show the amount of projected benefits, by type of benefit, for the period from 2010 to 2060. The data in Table 5 are in current dollars; the data in Table 6 are in 2010 constant dollars.⁵

Plan benefits will increase rapidly. In current dollars, they are 10,1 billion in 2010, will increase to 13,2 billion in 2015 and will continue to increase, reaching 88,6 billion in 2060. Expressed in constant dollars, benefits will have doubled by 2040.

5. For a given year, the value in 2010 constant dollars is equal to the corresponding value in current dollars divided by the cumulative index of the indexation rates used as of 2010 in the projections.

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Table 5
Projection of benefits
(in millions of current dollars)

YEAR	RETIREMENT PENSION	DISABILITY PENSION	SURVIVING SPOUSE'S PENSION	DEATH BENEFIT	ORPHAN'S PENSIONS AND PENSIONS FOR A DISABLED PERSON'S CHILD	REFUNDS TO SOCIAL ASSISTANCE	TOTAL BENEFITS
2010	7 560,8	789,6	1 580,6	104,1	25,5	1,8	10 062,4
2011	8 002,2	811,5	1 618,5	106,6	25,7	1,5	10 566,0
2012	8 514,4	837,8	1 663,6	109,2	26,1	1,2	11 152,3
2013	9 057,2	867,4	1 709,0	111,9	26,5	0,9	11 772,9
2014	9 653,3	905,1	1 758,8	114,7	26,9	0,6	12 459,5
2015	10 291,9	943,6	1 811,6	117,6	27,3	0,5	13 192,6
2016	10 966,5	979,6	1 867,3	120,7	27,8	0,2	13 962,1
2017	11 689,0	1 016,1	1 925,1	123,8	28,4	0,0	14 782,5
2018	12 447,0	1 052,4	1 984,1	127,1	29,0	0,0	15 639,7
2019	13 245,2	1 085,0	2 044,1	130,5	29,5	0,0	16 534,5
2020	14 084,5	1 113,9	2 105,9	134,1	30,1	0,0	17 468,6
2021	14 947,3	1 143,4	2 171,0	137,8	30,7	0,0	18 430,3
2025	18 727,4	1 235,6	2 462,6	154,3	33,3	0,0	22 613,3
2030	23 561,3	1 334,1	2 938,1	179,2	36,6	0,0	28 049,3
2035	28 406,1	1 580,1	3 576,4	206,7	40,3	0,0	33 809,6
2040	34 301,1	1 972,2	4 395,9	232,2	44,3	0,0	40 945,8
2045	41 937,3	2 337,6	5 338,8	250,8	48,6	0,0	49 913,1
2050	51 219,2	2 704,0	6 335,1	258,9	54,1	0,0	60 571,3
2055	62 866,9	3 140,3	7 349,0	256,9	60,8	0,0	73 673,9
2060	76 342,9	3 484,7	8 435,3	249,4	68,2	0,0	88 580,5

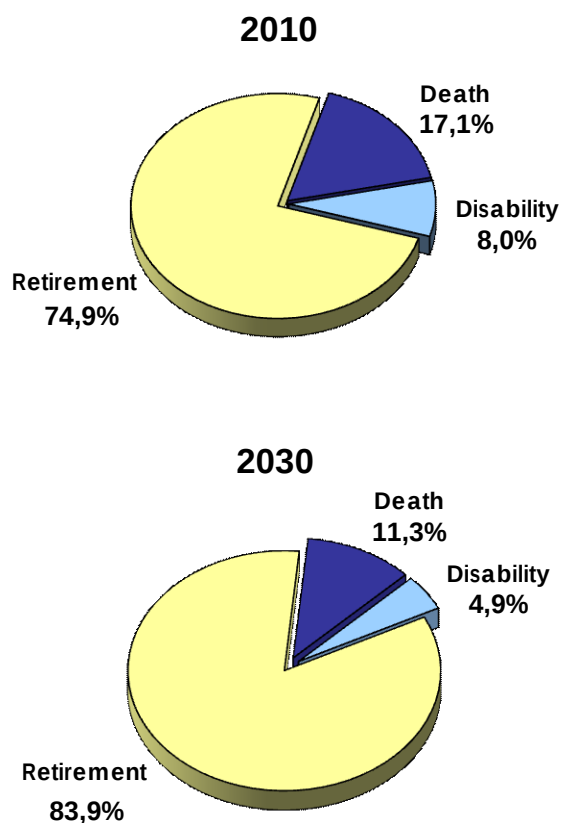
Table 6
Projection of benefits
(in millions of constant dollars)

YEAR	RETIREMENT PENSION	DISABILITY PENSION	SURVIVING SPOUSE'S PENSION	DEATH BENEFIT	ORPHAN'S PENSIONS AND PENSIONS FOR A DISABLED PERSON'S CHILD	REFUNDS TO SOCIAL ASSISTANCE	TOTAL BENEFITS
2010	7 560,8	789,6	1 580,6	104,1	25,5	1,8	10 062,4
2011	7 883,9	799,5	1 594,5	105,0	25,4	1,5	10 409,9
2012	8 224,1	809,2	1 606,9	105,5	25,3	1,1	10 772,0
2013	8 576,9	821,4	1 618,4	106,0	25,1	0,9	11 148,5
2014	8 944,6	838,7	1 629,7	106,3	24,9	0,6	11 544,7
2015	9 321,8	854,7	1 640,9	106,5	24,8	0,5	11 949,1
2016	9 700,1	866,4	1 651,7	106,7	24,6	0,2	12 349,8
2017	10 087,0	876,8	1 661,3	106,9	24,5	0,0	12 756,5
2018	10 479,1	886,1	1 670,4	107,0	24,4	0,0	13 167,0
2019	10 879,2	891,2	1 679,0	107,2	24,3	0,0	13 580,8
2020	11 286,3	892,6	1 687,6	107,5	24,1	0,0	13 998,1
2021	11 685,6	893,9	1 697,3	107,7	24,0	0,0	14 408,5
2025	13 263,9	875,2	1 744,2	109,3	23,6	0,0	16 016,1
2030	14 749,3	835,1	1 839,2	112,2	22,9	0,0	17 558,8
2035	15 716,8	874,3	1 978,8	114,4	22,3	0,0	18 706,5
2040	16 774,2	964,4	2 149,7	113,6	21,7	0,0	20 023,6
2045	18 126,6	1 010,4	2 307,6	108,4	21,0	0,0	21 573,9
2050	19 567,2	1 033,0	2 420,2	98,9	20,7	0,0	23 140,0
2055	21 227,5	1 060,4	2 481,4	86,8	20,5	0,0	24 876,5
2060	22 783,8	1 040,0	2 517,4	74,4	20,4	0,0	26 436,0

Chart 4 illustrates the distribution of benefits in 2010 and in 2030 according to each of the Plan's areas of protection: retirement pension, disability benefits (disability pension and pension for a disabled person's child) and survivors' benefits (surviving spouse's pension, orphan's pension and death benefit).

The increasing proportion of the retirement pension, which rises from 74,9% to 83,9% of total benefits in 2030, well reflects the Plan's greater maturity. The distribution of the population by age that results from the aging of the population underlines the importance of the retirement pension. Thereafter, the proportion of each type of benefit remains relatively stable.

Chart 4
Benefit amounts expressed as a
percentage of total benefits
(according to the event giving entitlement to
a benefit)



5.3 The reserve

The reserve constitutes the Plan's net assets, that is, the accumulated difference between cash inflows and outflows since the Plan's inception. Its main purpose is to ensure the stability of the contribution rate.

Tables 7 and 8 show, respectively, in current dollars and in 2010 constant dollars, the cash inflows and outflows and the reserve for the period from 2010 to 2060.

The initial reserve was 29,6 billion \$ as at 31 December 2009, that is, 2,9 times the cash outflows for 2010. From 2010 to 2013, the reserve will increase, as expressed both in dollars and in multiples of annual cash outflows.

As of 2013, cash outflows will be greater than contributions. At that time, investment income will be required to cover part of the Plan's benefits. The ratio of the reserve to annual cash outflows will decrease thereafter.

In current dollars, the reserve will reach a maximum of 51,7 billion \$ in 2023 and diminish thereafter, falling below twice the annual cash outflows as of 2026. Total depletion will occur in 2039. In 2010 constant dollars, the reserve will reach its maximum in 2019 (40,3 billion \$).

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Table 7
Projection of the reserve
(in millions of current dollars)

YEAR	CASH INFLOWS			CASH OUTFLOWS			RESERVE		
	CONTRI- BUTIONS	INVEST- MENT INCOME	TOTAL	BENEFITS	ADMINIS- TRATION COSTS	TOTAL	AT 31 DECEMBER	AS A PROPORTION OF CASH OUTFLOWS FOR THE FOLLOWING YEAR	PAY-AS- YOU-GO CONTRIBU- TION RATE
	\$	\$	\$	\$	\$	\$	\$		%
2010	10 446	1 751	12 197	10 062	113	10 176	31 602	3,0	9,6
2011	10 870	1 995	12 864	10 566	116	10 682	33 785	3,0	9,7
2012	11 288	2 161	13 449	11 152	119	11 271	35 963	3,0	9,9
2013	11 738	2 331	14 069	11 773	122	11 894	38 137	3,0	10,0
2014	12 217	2 504	14 721	12 459	125	12 584	40 274	3,0	10,2
2015	12 714	2 678	15 392	13 193	128	13 321	42 345	3,0	10,4
2016	13 214	2 850	16 065	13 962	132	14 094	44 316	3,0	10,5
2017	13 752	2 975	16 728	14 783	136	14 919	46 125	2,9	10,7
2018	14 279	3 088	17 367	15 640	140	15 780	47 712	2,9	10,9
2019	14 850	3 186	18 035	16 534	145	16 679	49 068	2,8	11,1
2020	15 418	3 310	18 728	17 469	149	17 618	50 178	2,7	11,3
2021	16 005	3 418	19 424	18 430	154	18 584	51 018	2,6	11,5
2025	18 565	3 484	22 049	22 613	174	22 787	50 692	2,1	12,1
2030	22 454	2 865	25 319	28 049	203	28 252	40 420	1,4	12,4
2035	27 468	1 524	28 991	33 810	237	34 047	19 583	0,6	12,2
2040	33 512	*	*	40 946	277	41 223	*	*	12,2
2045	40 495	*	*	49 913	323	50 236	*	*	12,3
2050	48 577	*	*	60 571	377	60 949	*	*	12,4
2055	58 178	*	*	73 674	441	74 115	*	*	12,6
2060	70 027	*	*	88 580	515	89 095	*	*	12,6

* As of 2039, the reserve and investment income are nil. At that time, the contribution rate would have to be increased to a level at least equal to the pay-as-you-go rate to ensure full payment of the Plan's benefits.

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Table 8
Projection of the reserve
(in millions of constant dollars)

YEAR	CASH INFLOWS			CASH OUTFLOWS			RESERVE ^a	PAY-AS-YOU-GO CONTRIBUTION RATE
	CONTRIBUTIONS	INVESTMENT INCOME	TOTAL	BENEFITS	ADMINISTRATION COSTS	TOTAL		
	\$	\$	\$	\$	\$	\$	\$	%
2010	10 446	1 751	12 197	10 062	113	10 176	31 602	9,6
2011	10 709	1 965	12 674	10 410	114	10 524	33 286	9,7
2012	10 903	2 087	12 990	10 772	115	10 887	34 737	9,9
2013	11 115	2 208	13 323	11 148	115	11 264	36 115	10,0
2014	11 320	2 320	13 640	11 545	116	11 660	37 317	10,2
2015	11 515	2 426	13 941	11 949	116	12 065	38 354	10,4
2016	11 688	2 521	14 210	12 350	117	12 467	39 198	10,5
2017	11 867	2 568	14 435	12 757	117	12 874	39 803	10,7
2018	12 022	2 600	14 622	13 167	118	13 285	40 169	10,9
2019	12 197	2 617	14 814	13 581	119	13 700	40 303	11,1
2020	12 355	2 652	15 007	13 998	120	14 118	40 209	11,3
2021	12 513	2 673	15 185	14 409	120	14 529	39 885	11,5
2025	13 149	2 467	15 616	16 016	123	16 139	35 903	12,1
2030	14 056	1 794	15 850	17 559	127	17 686	25 303	12,4
2035	15 198	843	16 041	18 707	131	18 838	10 835	12,2
2040	16 388	*	*	20 024	135	20 159	*	12,2
2045	17 503	*	*	21 574	140	21 714	*	12,3
2050	18 558	*	*	23 140	144	23 284	*	12,4
2055	19 644	*	*	24 877	149	25 025	*	12,6
2060	20 899	*	*	26 436	154	26 590	*	12,6

(a) After conversion into constant dollars, the reserve for a given year is no longer exactly equal to the reserve of the previous year plus the net total of the current year's cash inflows and outflows.

* As of 2039, the reserve and investment income are nil. At that time, the contribution rate would have to be increased to a level at least equal to the pay-as-you-go rate to ensure full payment of the Plan's benefits.

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Table 9 provides more details about changes to the operating balance, that is, the amount by which contributions are greater than benefits and administration costs.

It also shows net cash inflows, that is, the operating balance plus investment income as well as the use of investment income and the reserve to fund cash outflows.

Table 9
Funding sources for cash outflows
(in millions of current dollars)

YEAR	CASH OUTFLOWS (1)	CONTRI- BUTIONS (2)	OPERATING BALANCE (2) - (1)	INVESTMENT INCOME (3)	NET CASH INFLOWS (2) - (1) + (3)	INCOME USED	RESERVE USED	RESERVE
	\$	\$	\$	\$	\$	%	%	\$
Reserve as at 31 December 2009								29 581
2010	10 176	10 446	270	1 751	2 021	0	0	31 602
2011	10 682	10 870	188	1 995	2 183	0	0	33 785
2012	11 271	11 288	17	2 161	2 178	0	0	35 963
2013	11 894	11 738	-156	2 331	2 175	7	0	38 137
2014	12 584	12 217	-367	2 504	2 137	15	0	40 274
2015	13 321	12 714	-607	2 678	2 071	23	0	42 345
2016	14 094	13 214	-880	2 850	1 970	31	0	44 316
2017	14 919	13 752	-1 167	2 975	1 808	39	0	46 125
2018	15 780	14 279	-1 501	3 088	1 587	49	0	47 712
2019	16 679	14 850	-1 829	3 186	1 357	57	0	49 068
2020	17 618	15 418	-2 200	3 310	1 110	67	0	50 178
2021	18 584	16 005	-2 579	3 418	839	75	0	51 018
2025	22 787	18 565	-4 222	3 484	-738	100	1	50 692
2030	28 252	22 454	-5 798	2 865	-2 933	100	7	40 420
2035	34 047	27 468	-6 579	1 524	-5 055	100	21	19 583
2040	41 223	33 512	-7 711	*	*	*	*	*
2045	50 236	40 495	-9 741	*	*	*	*	*
2050	60 949	48 577	-12 372	*	*	*	*	*
2060	89 095	70 027	-19 068	*	*	*	*	*

* As of 2039, the reserve and investment income are nil. At that time, the contribution rate would have to be increased to a level at least equal to the pay-as-you-go rate to ensure full payment of the Plan's benefits.

The following conclusions can be drawn from Table 9:

- During the period 2010 to 2012, contributions are higher than cash outflows, which will result in a rapid accumulation of reserve funds.
- Between 2013 and 2023, investment income is increasingly used to offset the shortfall between contributions and cash outflows. For example, in 2017, investment income represents a maximum of 18% of cash inflows, which clearly illustrates the role of the reserve as a source of income for the Plan during this period.

- As of 2024, contributions and investment income are no longer sufficient to fund cash outflows, causing the reserve to decrease.
- During 2039, the Plan reserve will be totally depleted. As of that time, contributions would have to be set at a level equivalent to current financial needs.

Chart 5 shows, for each year until 2040, the amount of contributions and investment income as well as the extent of cash outflows (benefits and administration costs).

Chart 5
The Plan's cash inflows and outflows
(in millions of current dollars)

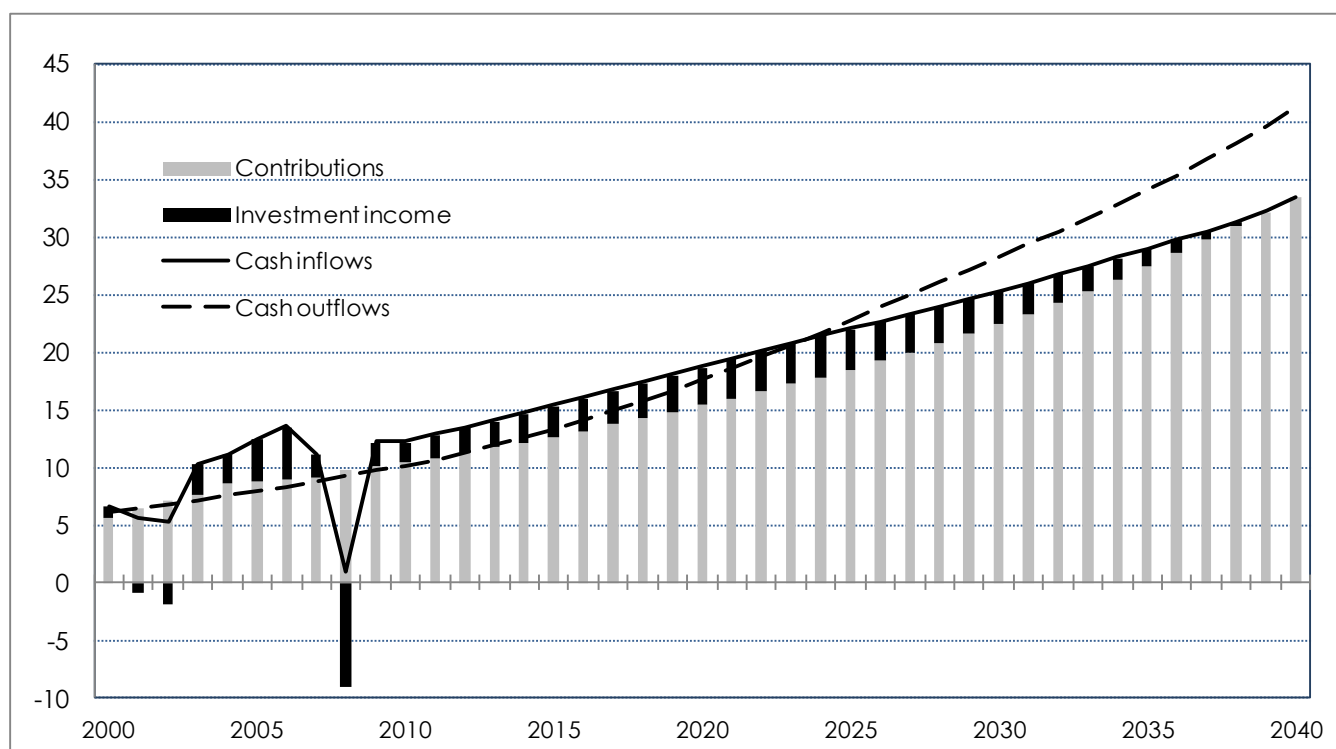
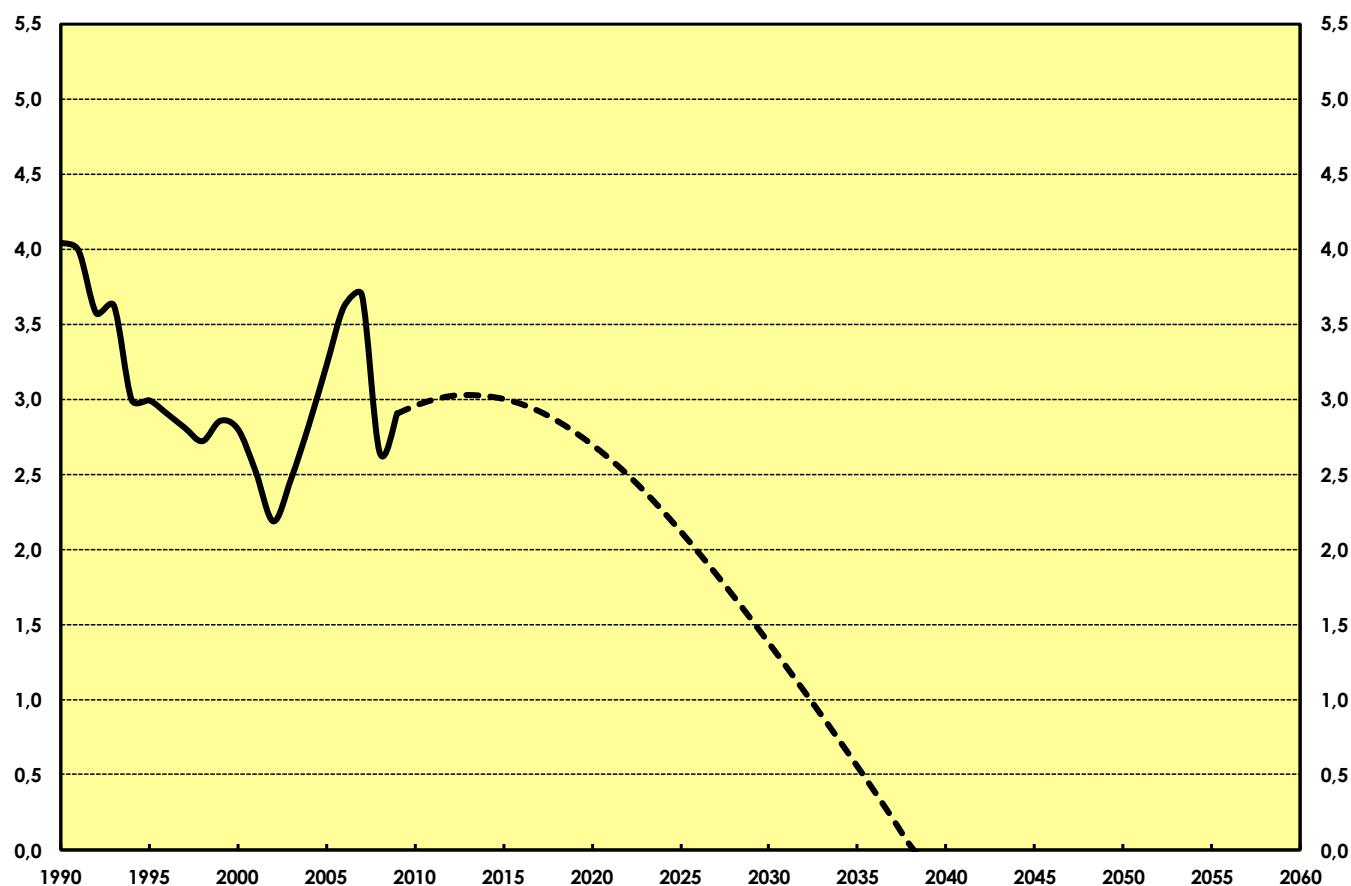


Chart 6

Changes in the ratio of the reserve at the end of each year to cash outflows for the following year



The ratio of the reserve at the end of one year to the cash outflows for the following year, serves to monitor the relative size of the reserve. The ratio of 4,0 in 1990 dropped to 2,9 at the end of 2009 and will be 3,0 in 2013. It then declines steadily until it becomes nil in 2039. Chart 6 illustrates these changes.

The decrease as of 2014 follows the rapid increase in cash outflows that result from the arrival of a large number of retirees during the period from 2010 to 2030.

5.4 Other results

5.4.1 Steady-state contribution rate

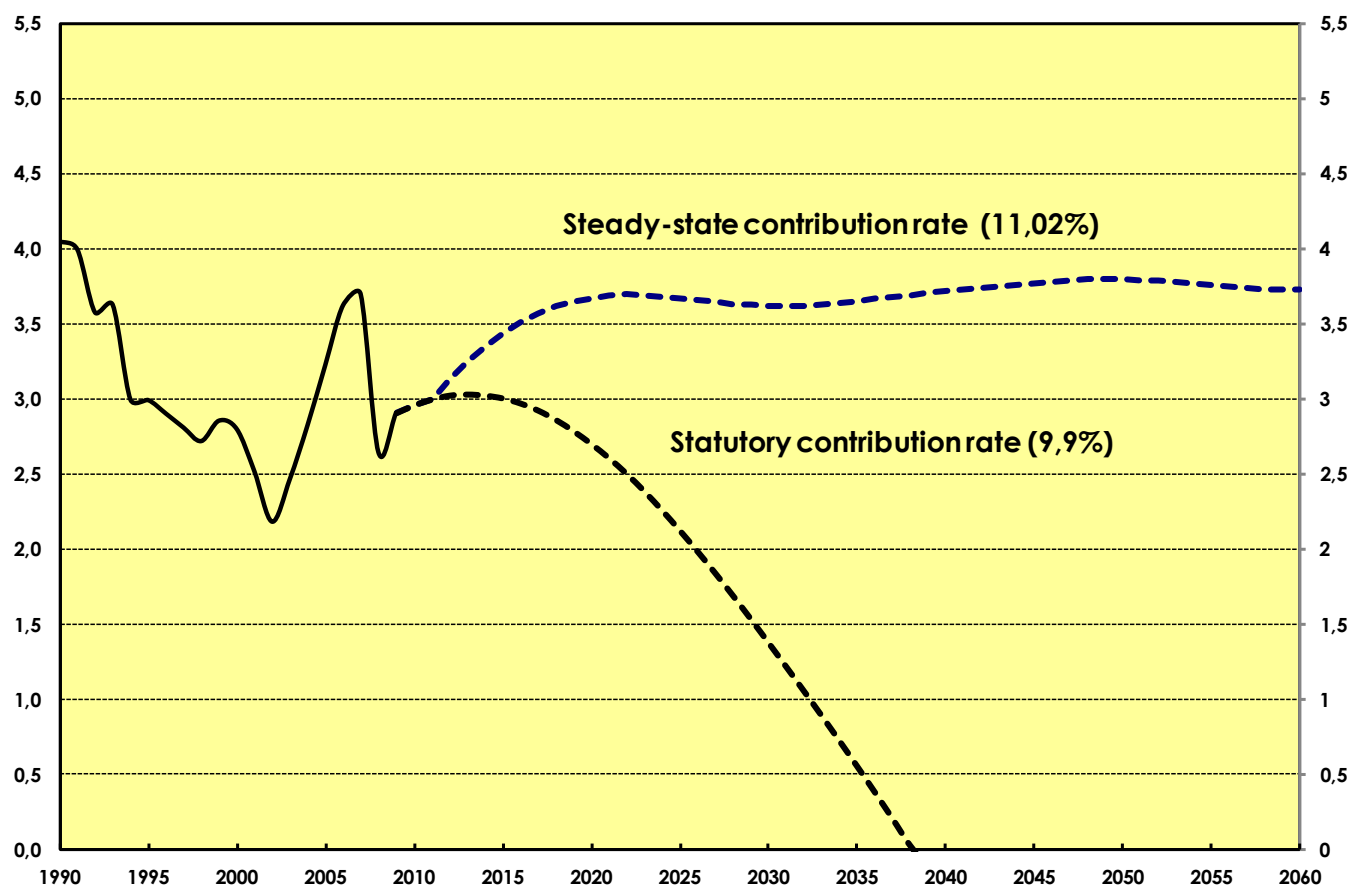
As indicated in section 2, the steady-state contribution rate is an indicator of the Plan's funding stability. It is the contribution rate that would enable the ratio of the reserve to cash outflows to remain stable between 2040 and 2060.

The rate is 11,02%, that is, a difference of 1,12 percentage points compared with the contribution rate established by the *Act respecting the Québec Pension Plan*.

Chart 7

Changes in the ratio of the reserve at the end of one year to cash outflows for the following year

(based on the statutory contribution rate and the steady-state contribution rate)



If this rate were applied as of 2012, the reserve would increase rapidly to amount to 3,7 times the annual cash outflows in 2020, and that level would be maintained thereafter (see Chart 7). Maintaining such a reserve level, even after 2060, seems to be necessary so that investment income could continue to fill the gap between contributions and the Plan's cash outflows.

The detailed results of the projection of the reserve based on a contribution rate of 11,02% are presented in Appendix IV.

For purposes of comparison, the steady-state contribution rate, based on data and assumptions from the previous actuarial report, was 10,54%. The increase of this rate from 10,54% to 11,02% is explained briefly in section 5.4.5 and in detail in Appendix VI.

The difference between the statutory and the steady-state contribution rates has therefore increased considerably since the last actuarial report.

5.4.2 Pay-as-you-go contribution rate

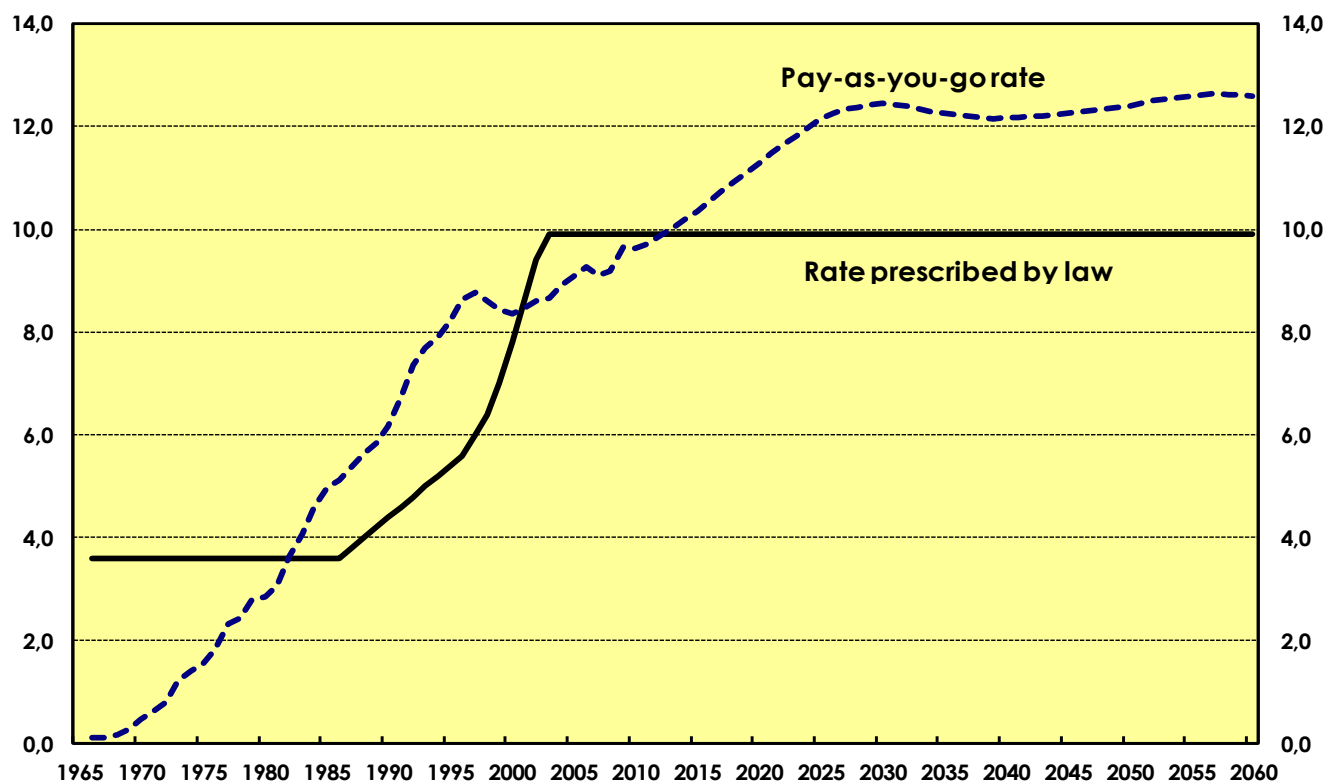
Changes in funding for the Plan can also be measured using the pay-as-you-go contribution rate. This rate is calculated by dividing cash outflows for one year by the contributory payroll during the same year. It helps to illustrate what would be required of contributors to fund cash outflows if there were no reserve.

Chart 8 shows relative changes to the pay-as-you-go contribution rate and the contribution rate prescribed by law between 1966 and 2060. It helps to illustrate the effect the adopted method of funding would have on the contribution rate, compared with a pure pay-as-you-go funding scheme. It also shows the role of the reserve and the investment income it generates. The positive difference between these two curves, from 2010 to 2013, combined with the investment income generated by the accumulated reserve enables the funding of cash outflows as of 2013, the year the pay-as-you-go rate exceeds the rate of 9,9% prescribed by law.

Table 11 of Appendix I shows detailed data for the period from 1966 to 2009 and Tables 7 and 8, in section 5.3, show the projection of the pay-as-you-go rate from 2010 to 2060.

That rate increases steadily from 9,6% in 2010 to 12,4% in 2030. It varies slightly thereafter, reaching 12,6% in 2060.

Chart 8
Pay-as-you-go contribution rate and the rate prescribed by law
(as a percentage)



5.4.3 Sensitivity tests on the results

Tests were made to measure the sensitivity of the results to changes in the demographic assumptions described in section 4.1 and economic assumptions described in section 4.2. For each change in assumption, the ratio of the reserve for a given year to cash outflows for the following year were calculated for each of the years in the projection period, based on statutory provisions for benefits and the contribution rate of 9.9%. The steady-state contribution rate was determined for each change in assumptions. The results are shown in Appendix V.

Since the projections must cover a long period, any recurrent variation in the difference between cash inflows and outflows may have a non-negligible effect on the accumulated reserve. The sensitivity tests show, however, that it usually only takes a slight adjustment in the contribution rate over a long period to completely reverse the long-term impact of such variations on the reserve.

The tests show that the Plan's future funding situation is particularly sensitive to the assumptions regarding the increase in employment earnings, the workforce, the reduction in mortality rates and investment yields.

For example, the assumption regarding the increase in employment earnings was the subject of two sensitivity tests. Results show the impact of an upward or downward 0,4 percentage point change in earnings as of 2019.

An annual increase in earnings of 0,8% instead of 1,2% (long-term) would result in total depletion of the reserve in 2035. The steady-state contribution rate would therefore be 11,41% rather than 11,02%.

Inversely, an equivalent increase in employment earnings would reduce the steady-state contribution rate to 10,64%. The latter scenario would result in total depletion of the reserve in 2046.

5.4.4 Comparison and reconciliation with the previous actuarial report

Appendix VI shows the differences observed between the actual operating results and projections in the previous report for the years 2007, 2008 and 2009. Lower than projected returns on investment, a higher increase than anticipated in the amount of contributions and an overestimation of administrative costs are the main points covered in this section.

Furthermore, from a more prospective point of view, the projections in this report are compared and reconciled with those of the actuarial report as at 31 December 2006. The steady-state contribution rate is 0,48 percentage points higher compared with the rate of 10,54% calculated on the basis of the results of the previous actuarial analysis. This difference is attributable to different factors. First, the Plan reserve experienced a heavy loss due to the 2008 financial crisis. The assumption concerning future returns on investments was revised downward. Second, the assumptions concerning the life expectancy of beneficiaries, fertility, migration and activity rates were revised.

Average starting salaries were higher than expected. However, the projection for future changes in salaries was revised downward. Lastly, the amendment to the *Act* in 2008 regarding the retirement pension supplement will result in an increase in Plan benefits.

6. Conclusion

This actuarial report shows that the contribution rate of 9,9% that is prescribed in the *Act respecting the Québec Pension Plan* is sufficient to pay future benefits **until only 2039**. However, the 9,9% contribution rate will not be enough to ensure the Plan's long-term financial stability.

As at 31 December 2009, the reserve represents 3 times the cash outflows of the following year. Based on the assumptions used for this report, contributions are greater than cash outflows until 2013, which will make it possible to increase the reserve. As of 2014, a portion of the investment income from the reserve will have to be used to cover the shortfall between contributions and cash outflows.

Between 2010 and 2016, the reserve will remain at a level of 3 times the Plan's cash outflows. Thereafter, due primarily to the growing number of retirees, this ratio will decrease. Investment income will have to be used to bridge the gap between income from contributions and cash outflows until 2023.

As of 2024, the investment income plus contributions will be insufficient to fund cash outflows, and therefore the reserve will begin to gradually decline. In 2026, the reserve will reach a level less than twice the cash outflows. In 2039, the reserve will be nil. If no change is made to contributions or to benefits by that time, the total depletion of the reserve will make it necessary for future generations to assume a contribution rate of more than 12,2% beyond 2039, that is, the pay-as-you-go rate.

The steady-state contribution rate, that is, the rate that would ensure the long-term stability of the ratio between the reserve and cash outflows, is 11,02%. The rate is higher than the 10,54% calculated in the previous actuarial report. The difference is attributable in large part to the major decrease in Plan assets in 2008.

The difference between the steady-state contribution rate and the prescribed 9,9% contribution rate is 1,12 percentage points. Therefore, the results of this analysis once again confirm the necessity of making changes to the Plan in order to stabilize long-term funding and to avoid the creation of an imbalance between the financial burden imposed on current generations of contributors and the burden that will be imposed on future generations.

Since the results of long-term projections are uncertain, they must be revised at least once every three years. The next actuarial report is scheduled to be made as at 31 December 2012.

7. Actuarial opinion

In our opinion, this actuarial report:

- was prepared in accordance with section 216 of the *Act respecting the Québec Pension Plan*;
- is based on data that are sufficient and reliable;
- uses reasonable and appropriate assumptions;
- is based on methods that are relevant.

The report and the opinions given in it are in accordance with accepted actuarial practice, the general standards of practice of the Canadian Institute of Actuaries and the *Guidelines of Actuarial Practice for Social Security Programs* of the International Actuarial Association.

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22 October 2010

Appendix

I

Review of Plan funding

1. Changes in Plan funding

This appendix explains the Plan's funding method, focusing on the background and principal reasons that have brought about funding changes since the Plan's inception.

At the Plan's inception in 1966, the government adopted a partially funded approach, which is between a pure pay-as-you-go funding scheme¹ and full capital funding.² This method of funding was recommended in 1964 by the Interministerial Committee of the Québec Pension Plan because of the public nature of the Plan. The assurance that contributions would always be paid by Québec workers through the government's taxation power guaranteed the public plan's continuity and made it unnecessary to have full funding.

Moreover, the Committee alerted the government against a pure pay-as-you-go scheme because of the foreseeable long-term risk of increases in the contribution rate that are inherent in that type of plan and the detrimental consequences for the government that could occur in a difficult economic juncture. The mixed funding scheme proposed by the Committee was aimed at constituting a contingency reserve equal to only a few years of benefits so as to protect the Plan against economic fluctuations.

The Committee recommended a contribution rate of 4%, that is, a rate higher than would have been needed for a pure pay-as-you-go plan and higher than the 2% rate proposed for the implementation of the Canada Pension Plan.

The Québec and federal governments wanted the two plans to be similar with respect to contributions and the main benefits since the totality of Canadian workers would be covered and thus, a significant number of workers would participate in both plans during their working lives. The establishment of an initial contribution rate of 3,6% was a compromise reached by the two governments.

It was clear from the Plan's inception that the initial rate of 3,6% would have to be raised later. However, changes in the Plan's demographic and economic environment as well as amendments to the Plan's provisions created additional upward pressure on the contribution rate. In those circumstances, two sequences of increase in the contribution rate had to be scheduled.

From 1966 to 1970, net cash inflows during the Plan's inception period and an economic juncture that was more favourable than initially anticipated resulted in the constitution of a relatively large reserve. The 1970 actuarial report pointed out the Plan's favourable course in the preceding years but still forecast a fully depleted reserve in 2007, a sign of inadequate long-term funding.

The following decade was marked by several increases in benefits, including the following:

- the maximum pensionable earnings adjustment of 12,5% per year, from 1976 to 1987 although initially MPE growth was expected to be only 2% a year;
- full indexation of benefits as of 1974 with an adjustment to offset the effects of the levelling off between 1966 and 1973;

1. In a pure pay-as-you-go funding scheme, the contributions of a given year are used to pay the benefits of the same year.

2. In a fully funded plan, the aggregate contributions made throughout the active life of a group of workers are used to pay all of that group's benefits.

- exclusion from the contributory period of the months for which a person received family benefits for a child under the age of 7, if those months fall within a year in which the person's employment earnings were less than his or her average pensionable earnings. This measure was implemented in 1977 and was retroactive;
- an increase in the fixed-benefit portion of the surviving spouse's pension and the disability pension, as of January 1973. That portion increased from 27,60 \$ to 80,00 \$ a month;
- the retirement pension is no longer reduced on the basis of earnings for people aged 65 to 69, as of 1 January 1977.

The changes made after 1970 were the subject of reports indicating to what extent they would modify the most recent Plan estimates. Those reports mentioned that the value of benefits was increasing substantially, total depletion of the reserve was approaching and the Plan's long-term funding was insufficient.

Between 1966 and 1986, demographic factors also put pressure on contribution rates. A significant drop in the number of births at the end of the 1960s as well as an increase in life expectancy that was greater than projected were reflected in changes in population structure. The funding method and, consequently, the level of the contribution rate were brought into question. The mixed funding method adopted at the Plan's inception was closer to pay-as-you-go funding than to full capital funding. The contribution rate that resulted from this choice is stable so long as the demographic structure remains stable, that is, so long as the ratio of workers to retirees remains constant. Population aging, which is the result of demographic changes, increased that ratio and made it necessary to change the contribution rate.

Table 10 shows the change in population structure from the Plan's inception to 2060. It gives the percentage of the population aged 65 and over and the ratio of the population aged 20 to 64 to the population aged 65 and over.

Changes in the Plan's economic environment, which have been observed since the 1980s, have put additional pressure on contribution rates. The funding method adopted at the Plan's inception was compatible with the economic situation observed during the 1960s and 1970s, that is, rapid growth in total payroll and a not-very-high real rate of return on investments.

This situation has reversed itself since the beginning of the 1980s. Consequently, contributions have changed more slowly than expected. Moreover, the low level of capital funding has made it impossible to take full advantage of the higher rate of return on investments.

Table 10
Changes in the population structure
from 1966 to 2060

YEAR	PROPORTION OF THE POPULATION AGED 65 AND OVER	RATIO : 20 TO 64
	(%)	65 AND OVER
1966	6,0	8,4
1970	6,6	8,1
1975	7,4	7,6
1980	8,5	7,0
1985	9,6	6,5
1990	10,8	5,8
1995	11,8	5,3
2000	12,9	4,9
2005	13,8	4,6
2010	15,3	4,1
2015	17,6	3,5
2020	20,1	2,9
2025	22,8	2,5
2030	25,3	2,2
2035	26,1	2,1
2040	26,3	2,1
2045	26,7	2,0
2050	27,2	2,0
2055	27,5	1,9
2060	28,0	1,9

Confronted by insufficient long-term funding for the Plan, it was decided to adjust the contribution rate. The first series of increases in the contribution rate occurred in 1986. The federal government, under an agreement with the Canadian provinces, adopted a funding method to ensure that the Canada Pension Plan reserve would not be exhausted. This method was intended to maintain a reserve equal to at least twice the cash outflows for the following year throughout the projection period. Thus, the contribution rate rose from 3,6% in 1986 to 5,6% in 1996. The Gouvernement du Québec adopted a similar approach with regard to the Québec Pension

Plan by maintaining parity with the Canada Pension Plan contribution rates.

In 1996, the government's working paper on a reform of the Québec Pension Plan showed that the pace of increase in the contribution rate that began in 1986 was not sufficient. According to the actuarial report as at 31 December 1994, the contribution rate would have to reach 13% in the long term to maintain a reserve equal to twice the cash outflows of the following year throughout the projection period. On the one hand, the question of fairness was raised because of the required sharp increase in the contribution rate. On the other hand, the confidence of contributors and beneficiaries in the Plan's future had been shaken by the spectre of a lack of funds in the near future if the contribution rate was not increased more rapidly.

Those were the circumstances in which the second series of increases in the contribution rate was undertaken. The government, in harmony with the federal government and the governments of the other provinces, decided to bring in the projected increases sooner than scheduled so that it would be possible to avoid having a rate considered to be too high. The reform put into place in 1998 was designed to rapidly increase the contribution rate from 6,0% in 1997 to 9,9% in 2003.

That reform, with its subsequent increase in contribution rates, was aimed at ensuring the Plan's sustainability and to improve fairness between generations of contributors. More concretely, the objective sought was to stabilize the contribution rate so that future generations of workers would make contributions on the basis of the same rate for an equivalent level of benefits.

The reform made it possible to increase the Plan's degree of capital funding. The resulting reserve makes it possible to maintain the same contribution rate for a very long period. The contribution rate of 9,9% will spare future generations from having to pay contributions at an estimated rate of 13% or more, which was the level projected in the actuarial reports made prior to the reform. The levels of certain benefits were also reduced. These adjustments have also contributed to limiting long-term increases in the contribution rate.

2. Changes in the reserve

For purposes of illustration, Table 11 shows the history of cash inflows and outflows and the Plan's reserve. The data in the table are presented and calculated on the basis of the Plan's financial statements, on a calendar-year basis and on the cash basis of accounting.

The investment income history has been adjusted to ensure uniformity of the calculation over time. This includes income paid to the Régie as well as changes in market value. The administration costs shown in the table include the collection fees paid to Revenu Québec.

Since the values shown are established on the cash basis of accounting, the reserve as at 31 December 2009 and the estimated cash outflows for 2010 differ from the values of the actuarial analysis, which is determined on the accrual basis of accounting. Despite this basic difference, the ratio between the reserve and cash outflows of the following year calculated for 2009 is identical to the ratio for the actuarial analysis, that is, 3,6.

Actuarial Report
of the Québec Pension Plan
as at 31 December 2009

Table 11
Changes in the reserve from 1966 to 2009^a
(in millions of current dollars)

YEAR	CASH INFLOWS				CASH OUTFLOWS			RESERVE		
	CONTRI- BUTION RATE	CONTRI- BUTIONS	INVESTMENT INCOME	TOTAL	BENEFITS	ADMINIS- TRATION COSTS ^b	TOTAL	AT 31 DEC.	AS A PROPORTION OF CASH OUTFLOWS FOR THE FOLLOWING YEAR	PAY-AS-YOU- GO CONTRI- BUTION RATE
	%	\$	\$	\$	\$	\$	\$	\$		%
1966	3,6	188	0	188	—	6	6	182	26,0	0,1
1967	3,6	224	- 13	212	0	7	7	386	33,6	0,1
1968	3,6	236	42	278	4	8	12	653	31,2	0,2
1969	3,6	271	- 29	241	13	8	21	874	24,1	0,3
1970	3,6	284	145	429	26	10	36	1 266	24,8	0,5
1971	3,6	287	207	494	43	8	51	1 709	24,0	0,6
1972	3,6	321	216	537	61	11	71	2 175	17,6	0,8
1973	3,6	361	71	433	112	12	124	2 484	15,6	1,2
1974	3,6	404	- 104	300	145	15	159	2 625	12,8	1,4
1975	3,6	478	284	762	193	12	205	3 181	11,0	1,5
1976	3,6	574	549	1 123	272	19	290	4 014	10,2	1,8
1977	3,6	611	460	1 070	365	29	394	4 691	9,8	2,3
1978	3,6	704	473	1 177	454	24	478	5 390	9,3	2,4
1979	3,6	747	318	1 065	554	25	579	5 876	8,3	2,8
1980	3,6	925	478	1 403	675	30	705	6 575	7,7	2,9
1981	3,6	984	- 111	873	818	34	852	6 596	6,3	3,1
1982	3,6	1 053	2 249	3 302	1 007	41	1 048	8 850	7,0	3,6
1983	3,6	1 109	1 371	2 480	1 223	46	1 268	10 062	6,2	4,1
1984	3,6	1 241	1 186	2 427	1 561	50	1 611	10 877	5,7	4,6
1985	3,6	1 357	2 114	3 471	1 847	57	1 904	12 445	5,8	5,0
1986	3,6	1 524	1 679	3 203	2 077	58	2 135	13 513	5,6	5,1
1987	3,8	1 737	618	2 355	2 338	65	2 404	13 465	5,0	5,4
1988	4,0	1 913	1 354	3 267	2 623	60	2 683	14 049	4,8	5,6
1989	4,2	2 107	2 204	4 311	2 887	68	2 955	15 405	4,7	5,8
1990	4,4	2 336	58	2 394	3 177	73	3 250	14 549	4,0	6,2
1991	4,6	2 451	2 477	4 928	3 518	78	3 596	15 882	4,0	6,8
1992	4,8	2 601	665	3 266	3 899	78	3 977	15 170	3,6	7,3
1993	5,0	2 694	2 762	5 456	4 165	80	4 244	16 381	3,6	7,7
1994	5,2	2 963	- 425	2 538	4 438	82	4 519	14 400	3,0	7,9
1995	5,4	3 187	2 551	5 738	4 721	87	4 807	15 330	3,0	8,2
1996	5,6	3 341	2 071	5 412	5 038	86	5 124	15 619	2,9	8,6
1997	6,0	3 666	1 842	5 508	5 292	88	5 381	15 746	2,8	8,8
1998	6,4	4 099	1 551	5 649	5 531	74	5 605	15 790	2,7	8,6
1999	7,0	4 810	2 572	7 381	5 737	69	5 806	17 365	2,9	8,4
2000	7,8	5 653	1 008	6 661	6 008	74	6 082	17 944	2,8	8,3
2001	8,6	6 500	- 928	5 572	6 331	77	6 409	17 108	2,5	8,5
2002	9,4	7 119	- 1 891	5 228	6 715	78	6 793	15 543	2,2	8,6
2003	9,9	7 667	2 610	10 277	7 031	86	7 117	18 704	2,5	8,7
2004	9,9	8 665	2 523	11 188	7 504	79	7 583	22 309	2,8	8,9
2005	9,9	8 820	3 656	12 477	7 799	100	7 899	26 887	3,2	9,1
2006	9,9	9 013	4 520	13 533	8 247	93	8 340	32 079	3,6	9,3
2007	9,9	9 093	2 066	11 159	8 659	99	8 758	34 481	3,7	9,1
2008	9,9	9 854	-8 962	892	9 186	97	9 284	26 089	2,7	9,2
2009	9,9	10 136	2 072	12 209	9 672	100	9 772	28 526	2,8	9,7

- a) The data are calculated on the basis of the Québec Pension Plan's financial statements and on the cash basis of accounting. The method used differs from the values of the actuarial analysis, which is determined on the accrual basis of accounting.
- b) Prior to 1998, expenses related to accounts receivable on contributions are included in the collection fees. Since 1998, a portion has been deducted from contributions and another portion from investment income.

Appendix

II

**Summary of the main
provisions of the
*Act respecting the
Québec Pension Plan***

1. Date of Plan's inception

The Québec Pension Plan (QPP) began operating on 1 January 1966.

2. Significant amendments to the Act since the last actuarial report

The *Act to amend the Supplemental Pensions Plans Act, the Act respecting the Québec Pension Plan and other legislative provisions* (S.Q. 2008, c. 21) brought in an **annual retirement pension supplement** for beneficiaries of a pension under the QPP or Canada Pension Plan (CPP) who work and make contributions to the QPP. The supplement applies to earnings in 2008 and subsequent years. It affects pensions paid as of January 2009.

3. Definitions

a) Maximum pensionable earnings (MPE)

Upper limit beyond which a worker's pensionable employment earnings for a given year are not subject to Plan contributions. Earnings that exceed the MPE are not used to calculate pensions. The MPE of a given year is equal to the MPE of the preceding year multiplied by the ratio between the average weekly wage in Canada established by Statistics Canada for two consecutive 12 month periods ending on 30 June. The amount is rounded down to the nearest hundred dollars. In 2010, it is 47 200 \$.

b) Basic exemption

Lower limit below which a person's employment earnings for a given year are not subject to Plan contributions. From 1975 to 1998, the limit was 10% of the MPE.

Since 1998, the basic exemption is set at 3 500 \$.

c) Contributory period

Reference period beginning on a person's 18th birthday or on 1 January 1966 if the person was already 18 years old on that date. The contributory period ends on the earliest of the following dates: death, 70th birthday or on the date as of which payment of a retirement pension under the Plan begins.

Certain periods are excluded from the contributory period. They include: the three months preceding the beginning of a disability pension and all the months in which a person is entitled to a disability pension under the Plan; all the months for which family benefits were paid for a child under the age of 7, provided those months fall within a year in which the person's employment earnings were less than the basic exemption; and certain months for which an unreduced income replacement indemnity was paid pursuant to the *Act respecting industrial accidents and occupational diseases*.

d) Pension index

Cumulative index representing the average Consumer Price Index for Canada for the period of 12 months ending on 31 October of the year that precedes the year in which the index is established.

4. Contribution to the Plan

Subject to certain exceptions, every person 18 years of age or older who receives employment earnings for work done in Québec must contribute to the Plan if his or her earnings are greater than the basic exemption, unless he or she is receiving a

disability pension under the Québec Pension Plan or a similar plan.

The beneficiaries of a retirement pension who work must contribute to the Plan just like all other workers.

Contribution to the Plan is determined by applying the contributory rate to the portion of employment earnings included between the basic exemption and the MPE. From 1966 to 1986, the rate was 3,6%. From 1987 to 1996 it rose 0,2% a year, reaching 5,6% in 1996. In 1997, it was raised to 6,0%. In accordance with the Plan's reform, the contribution rate increased to 6,4% in 1998, to 7,0% in 1999, to 7,8% in 2000, to 8,6% in 2001 and to 9,4% in 2002. In 2003 and for subsequent years, the contribution rate has been set at 9,9%.

The rate is divided equally between the worker and his or her employer. A self-employed worker must pay the entire contribution.

5. Retirement pension

a) Eligibility

The retirement pension is paid for life to a person aged 60 years or over who contributed to the Plan and who makes an application. Every application for a retirement pension from a person whose age is between 60 and 64 must be accompanied with a declaration of cessation of work or participation in a phased retirement program. Between the ages of 60 to 64, a person is deemed to have stopped working if his or her employment income calculated on an annual basis is less than 25% of the MPE. If a person has not stopped working, he or she can still receive a retirement pension if he or she participates in a phased retirement program, that is, if his or her pay has been reduced by at least 20% as the result of an agreement with his or her

employer to reduce the number of hours worked.

b) Amount of the pension

The initial monthly amount of the retirement pension paid to a person is equal to 25% of the average MPE for the last 5 years, that is, for the year of retirement and the preceding four years. The average MPE is adjusted so as to take the following into account:

- a person's pensionable earnings in relation to the MPE during his or her contributory period;
- his or her period of participation in the Plan in relation to his or her contributory period (up to 15% of the months in which earnings were low or nil can be excluded from the contributory period; moreover, the months for which family benefits were paid to the contributor for a child under age 7 can be excluded if it is to the contributor's advantage);
- the number of months included between the date of retirement and his or her 65th birthday. The amount of the pension is decreased or increased by 0,5% a month, respectively, depending on whether the person's age at retirement is under or over 65. Beneficiaries of a disability pension who are declared to be disabled after 1998 and who reach age 65 receive a retirement pension that is reduced by an adjustment of 0,5% a month for each month for which a disability pension was paid between the ages of 60 and 65.

c) Retirement pension supplement for retirees who work

A working retiree whose annual employment earnings are greater than the basic exemption must contribute to the Plan.

In return, he or she receives an annual retirement pension supplement that is 0,5% of his or her contributory earnings.

d) Pension retroactivity after age 65

An applicant over age 65 is entitled to a retroactive retirement pension. The period of retroactivity can reach a maximum of 60 months but may not include any months in the period prior to his or her 65th birthday.

6. Disability benefits

a) Eligibility

Under the *Act respecting the Québec Pension Plan*, a person is disabled if he or she has a severe and prolonged physical or mental disability. A disability is **severe** if it makes the person unable to regularly do any type of substantially gainful work. It is **prolonged** if it will result in death or be permanent. If a person is between the ages of 60 and 65 and not totally disabled, he or she is entitled to a disability pension if the impairment makes him or her unable to do his or her usual work.

A person may be entitled to a disability pension if he or she contributed to the Plan for one of the following periods:

- 2 of the last 3 years in his or her contributory period;
- 5 of the last 10 years in the contributory period;
- at least half of the years in the contributory period, but not less than 2 years.

A disability pension is not paid to anyone who, after 31 December 1985, becomes the beneficiary of an unreduced income replacement indemnity paid pursuant to the *Act respecting industrial accidents and occupational diseases*.

b) Calculation of the disability pension

The initial monthly disability pension is comprised of a fixed portion (426,10 \$ in 2010) and a variable portion equal to 75% of the accumulated retirement pension.

c) Cessation of payment

Payment of a disability pension stops on the date on which a person ceases to be disabled or no later than his or her 65th birthday.

d) Pension for a disabled person's child

A fixed monthly benefit is paid for each child of a disabled person, up to the age of 18. This benefit is 68,22 \$ in 2010.

7. Survivors' benefits

a) Eligibility

To give entitlement to a surviving spouse's pension, a death benefit or an orphan's pension, a deceased contributor must have paid contributions during one third of his or her contributory period but for not less than 3 years. The number of years of contribution required is never more than 10, no matter how many years the person worked.

A surviving spouse's pension is paid for life to the spouse of the deceased contributor. A spouse is the person to whom the contributor was married, in a civil union or in a de facto (common law) union, regardless of sex.

b) Calculation of the surviving spouse's pension

- i) The initial monthly amount of the surviving spouse's pension, paid to a spouse under 65 years of age, is made up of two portions: a fixed portion and a variable portion equal to 37,5% of the retirement pension accumulated by the deceased contributor.

The fixed portion depends on the surviving spouse's age:

- for a surviving spouse under age 45, the amount is 109,12 \$ in 2010; or, if there is a dependent child, 395,62 \$;
 - for a surviving spouse between the ages of 45 and 54, the amount is 426,10 \$ in 2010;
 - for a surviving spouse between the ages of 55 and 64, the amount is 426,10 \$ in 2010. That amount has been indexed since 2007 since the fixed portion of the pension for beneficiaries between the ages of 45 and 54 exceeded 399,59 \$ in that year. Until 2006, the latter amount corresponded to the amount of the fixed portion for new beneficiaries aged 55 to 64.
- ii) The initial monthly amount of the surviving spouse's pension paid to a spouse who is 65 years of age or over is equal to 60% of the retirement pension accumulated by the deceased contributor.
- iii) If a surviving spouse receives a retirement pension or a disability pension, the initial monthly amount of the surviving spouse's pension may be reduced.
- iv) The monthly amount of a surviving spouse's pension is recalculated when the beneficiary reaches 45, 55 and 65 years of age or when he or she becomes entitled to a retirement pension or disability pension.

c) Death benefit

The death benefit is a fixed amount of 2 500 \$ for all eligible contributors.

d) Orphan's pension

The orphan's pension is a fixed monthly benefit, which is 68,22 \$ in 2010 and which can be paid for each child of the deceased contributor until age 18.

8. Pension indexation

All pensions in payment are increased on 1 January of each year. The increase, as a percentage, is equal to the percentage increase in the Pension Index for that year, compared with the Pension Index for the preceding year.

9. Partition of benefits between former spouses

The pensionable earnings of two former spouses are divided equally for each of the months in which they lived together during their marriage or civil union. Partition is automatic for a person who obtains a judgment of divorce, legal separation, civil annulment of marriage or dissolution or annulment of civil union, unless the judgment explicitly mentions that there is renunciation.

The partition right is also granted to de facto (common law) spouses, but both former spouses must make a joint application. The earnings recorded under the Plan for the two spouses are divided equally for the period of cohabitation.

10. Retirement pension sharing

It is possible for spouses who have reached 60 years of age to transfer between themselves a portion of their retirement pensions, based on the number of years of conjugal relationship, for example, for the purpose of tax reduction. Sharing is possible even if only one of the spouses has participated in the Plan.

Sharing is carried out on application and ends with the death of either of the spouses or the breakdown of their conjugal relationship. In the case of married spouses, the application can be made by either spouse. In the case of de facto (common law) spouses, a joint application must be made by both spouses.

Appendix

III

**Assumptions and
method**

1. Introduction

This appendix describes the assumptions made and the methods used to carry out the actuarial analysis. Briefly put, the analysis of the Plan is based on two parameters: Québec's population and the economic situation. The latter includes employment, inflation, average employment earnings and rates of return on investments. Those parameters, together with the Plan's experience, serve to determine future cash inflows and outflows. The Plan's reserve changes as a function of the difference between, on the one hand, contributions and investment income for a given year and, on the other hand, benefits and administration costs for the same year.

Because of significant changes in the demographic structure during the projection period, special attention was given to the description of population changes and the economic assumptions particularly sensitive to those changes.

The report's projections cover a very long period, from 2010 to 2060. For such a period, one should not accord too great a significance to the absolute value of a particular result. It is more important to take into account the generally observed trend, particularly by using the relationships between the various results, for example, the level of the reserve in relation to cash outflows.

The demographic and economic assumptions are described in sections 2 and 3. The succeeding sections focus mainly on the method for projecting contributions (section 4), benefits (section 5), administrative costs (section 6), and the reserve (section 7). Table 12 summarizes the main demographic and economic assumptions made for this report.

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Table 12
Summary of the main assumptions

DEMOGRAPHICS				
Total fertility rate	2010	1,73		
	2018 and after	1,65		
Net migration	2010 and after	Interprovincial:	-13 100	
		International:	44 600	
		Total:	31 500	
Mortality reduction (life expectancy)			AT BIRTH	AT AGE 65
	2010	Men:	79,2	18,5
		Women:	83,5	21,6
	2030	Men:	82,3	20,6
		Women:	85,9	23,3
	2060	Men:	84,1	21,8
		Women:	87,0	24,2
ECONOMY				
Activity rate		AGE 15 AND OVER	AGE 20 TO 64	
	2010	65%	80%	
	2030	60%	83%	
	2060	58%	84%	
Employment (average annual change)	2010-2014		0,9%	
	2015-2024		0,1%	
	2025-2034		0,1%	
	2035-2044		0,1%	
	2045-2060		- 0,1%	
Unemployment rate	2010		8,7%	
	2015		6,4%	
	2019 and after		6,0%	
Inflation rate	2010		1,6%	
	2011		2,0%	
	2016 and after		2,5%	
Real rate of increase in average employment earnings (annual change)	2010		0,3%	
	2015		0,8%	
	2019 and after		1,2%	
Real rate of return on investments	2010 to 2019		4,3%	
	2022 and after		4,5%	

2. Demographic assumptions and population projection

The projection of Québec's population serves as the basis for determining the number of Plan contributors and the number of new beneficiaries for each type of benefit. It also allows us to estimate the payment period for benefits.

The population projection was made using an initial estimated population as at 1 July 2009 and assumptions related to mortality, fertility rates, in-migration and out-migration. Thus, the number of individuals of a given age in a given year depends on the number of individuals one year younger in the preceding year plus the number of in-migrants less the number of out-migrants and deaths.

A projection was made for each year of age from 0 to 119. The number of individuals aged 0 represents the number of births in the year. The population is determined as at 1 July of each year on the basis of the age on the last birthday and on the basis of the age on the nearest birthday. The first serves as the basis for population projection and the second is used primarily for determining benefits that are payable.

In developing the demographic assumptions, several elements were taken into consideration, including historical trends, the opinions and projections of experts, comparisons with the assumptions made by other public agencies in Québec, in Canada and abroad and public policies on immigration.

2.1 Initial population on 1 July 2009

The initial population was based on an estimate of the population as at 1 July 2009, published by Statistics Canada. That estimate is based on the population established in the 2006 census, which was adjusted to take into account census underenumeration, and on known data about population movements.

2.2 Mortality

The mortality tables used for the analysis were based on data provided by the Institut de la statistique du Québec covering the Québec population for the years 2005 to 2007. The mortality rates, that is, the probability of death during a given year, vary according to age, sex and year. In 2006, life expectancy at birth was 78,0 years for men and 82,9 years for women.

Mortality tables were established for each year in the projection period, taking into account decreasing mortality rates. If that reduction had not been taken into account for analyzing the Plan, there could have been an underestimation of the amount of future benefits. However, prudence is necessary over the long term because of uncertainties over reductions in the main causes of death.

The average reduction factor by age for the period from 2007 to 2060 is 50% of the average level observed for the period from 1986 to 2006. The anticipated level of reduction is, however, greater for the first years of the projection period. The annual increase in life expectancy at the beginning of the projection period reflects more, therefore, the increase observed in the later years. Thereafter, the pace of increase slows gradually because it is probable that it will not be possible to reduce some causes of mortality beyond a certain point and that the

decrease in the frequency of some diseases may have the effect of increasing the frequency of other diseases. Furthermore, the impact of new technologies on life expectancy, genetic research and new medications is difficult to determine. Lifestyle and environment today appear to be the most influential factors on the mortality of individuals. The rate of reduction in mortality rates at certain ages, by sex and period, are shown in Table 13. A sample of mortality rates by age and sex for the years 2010, 2030 and 2060 are shown in Table 14.

From 2010 to 2060, life expectancy at birth will increase from 79,2 years to 84,1 years for men and from 83,5 years to 87,0 years for women (see Table 15). Life expectancy at age 60 will increase by 3,6 years for men and 2,8 years for women during the same period.

The values given in Table 15 are indicators of the global level of mortality for the population in a given year and can thus be compared with mortality data generally circulated for life expectancy (static mortality table). However, they do not take into account the projected reductions in mortality for succeeding years.

If we want to measure the life expectancy of a particular person, we must take into account the mortality reductions that will affect his or her generation in future years (dynamic mortality table). For example, taking future mortality reductions into account shows a life expectancy that is 1,8 years longer for men aged 60 in 2010, that is, 24,4 years, and 1,6 years longer for women in the same generation, that is, 27,5 years. These data, shown in Table 16, give a truer picture of an individual's remaining life expectancy.

Table 13
Annual rate of reduction in mortality rates
(as a percentage)

AGE	MEN			WOMEN		
	Observed 1986-2006	2007-2015	2016-2060	Observed 1986-2006	2007-2015	2016-2060
0 to 9 years	3,13	3,13	1,16	4,32	2,84	1,22
10 to 19 years	3,48	3,13	1,16	2,16	2,12	0,91
20 to 29 years	2,72	2,82	1,04	1,75	1,84	0,79
30 to 39 years	2,33	2,44	0,90	2,21	2,02	0,87
40 to 49 years	2,26	2,38	0,88	1,49	1,40	0,60
50 to 59 years	2,97	2,67	0,99	1,67	1,55	0,66
60 to 69 years	3,07	2,75	1,01	1,78	1,68	0,72
70 to 79 years	2,64	2,40	0,89	1,76	1,63	0,70
80 to 89 years	1,84	1,69	0,62	1,57	1,46	0,63

Table 14
Mortality rates for the population of Québec
(per thousand)

AGE	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
0	4,5	3,0	2,3	3,8	2,4	1,9
10	0,1	0,1	0,1	0,1	0,0	0,0
20	0,7	0,5	0,4	0,3	0,2	0,2
30	0,7	0,5	0,4	0,3	0,2	0,2
40	1,3	1,0	0,8	0,7	0,6	0,5
50	3,1	2,2	1,8	2,2	1,8	1,6
60	7,7	5,3	4,2	5,0	3,9	3,4
65	12,6	8,8	7,0	7,9	6,1	5,2
70	20,5	14,4	11,6	12,8	9,9	8,6
75	33,4	24,3	20,0	21,2	16,4	14,3
80	55,9	43,1	36,6	36,7	28,7	25,1
90	154,7	130,1	116,8	116,8	96,6	87,2

Table 15
Life expectancy for the population of Québec,
not including reductions in mortality after the year indicated

AGE	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
0	79,2	82,3	84,1	83,5	85,9	87,0
10	69,6	72,6	74,3	73,9	76,1	77,2
20	59,8	62,8	64,5	64,0	66,2	67,3
30	50,2	53,1	54,7	54,2	56,3	57,4
40	40,6	43,4	45,0	44,4	46,5	47,6
50	31,3	33,9	35,4	34,9	36,9	38,0
60	22,6	24,9	26,2	25,9	27,7	28,7
65	18,5	20,6	21,8	21,6	23,3	24,2
70	14,8	16,6	17,7	17,5	19,1	19,9
75	11,5	12,9	13,8	13,8	15,1	15,9
80	8,6	9,7	10,4	10,4	11,5	12,1
90	4,4	4,9	5,2	5,2	5,8	6,1
100	2,2	2,4	2,5	2,5	2,7	2,7

Table 16
Life expectancy for the population of Québec,
including reductions in mortality after the year indicated

AGE	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
60	24,4	25,6	27,0	27,5	28,4	29,1
65	19,9	21,2	22,4	22,9	23,9	24,6
70	15,8	17,0	18,1	18,5	19,5	20,2
75	12,2	13,2	14,1	14,5	15,5	16,0
80	9,0	9,8	10,5	10,8	11,7	12,2
90	4,5	4,9	5,3	5,3	5,8	6,1
100	2,2	2,4	2,5	2,5	2,7	2,7

2.3 Births

The basic assumption made to determine the annual number of births is the total fertility rate. For a given year, that rate is obtained by adding the fertility rates by age for all ages. The rate therefore represents the number of children that a given generation of women will have during their period of fertility (ages 15 to 49), if the observed fertility rates by age for a given year were applied to them.

After a pronounced drop in the 1960s, the total fertility rate reached a level of 2,1 children per woman in 1970, which is the threshold for population replacement in the absence of migration. The reduction continued at a much slower rate, reaching its low point at 1,36 children per woman in 1987. Thereafter, the rate increased, reaching 1,67 in 1992 and then dropped again, reaching 1,45 in 2000. In recent years, it has increased, reaching 1,74 in 2008.

For this report, it was assumed that the total birth rate is 1,74 in 2009, gradually drops to 1,65 in 2018, then remains stable until the end of the projection period. The rate is greater than the rate projected in the preceding actuarial report, which was set at 1,60 as of 2007.

The distribution of fertility by mother's age is also constant as of 2018. Table 17 shows, by age group, the average annual fertility rates per thousand women.

The aggregate fertility rates for a generation of women over time make it possible to determine a fertility measure at age 45, also called the completed fertility rate. The measurement (observed and projected) is generally higher than the chosen final fertility rate for all generations of women. The number of children per woman in a particular generation (measured at age 45), which is around 1,65 in 2009, reaches its maximum of 1,75 in 2019 and declines thereafter, reaching 1,65 around 2031 (Chart 9).

The masculinity rate for births was set throughout the projection period at the average level observed between 2005 and 2009, that is, 51,4% throughout the projection period. That means that there are about 51 boys and 49 girls per 100 births, which partially offsets the higher mortality of men in various periods of their lives.

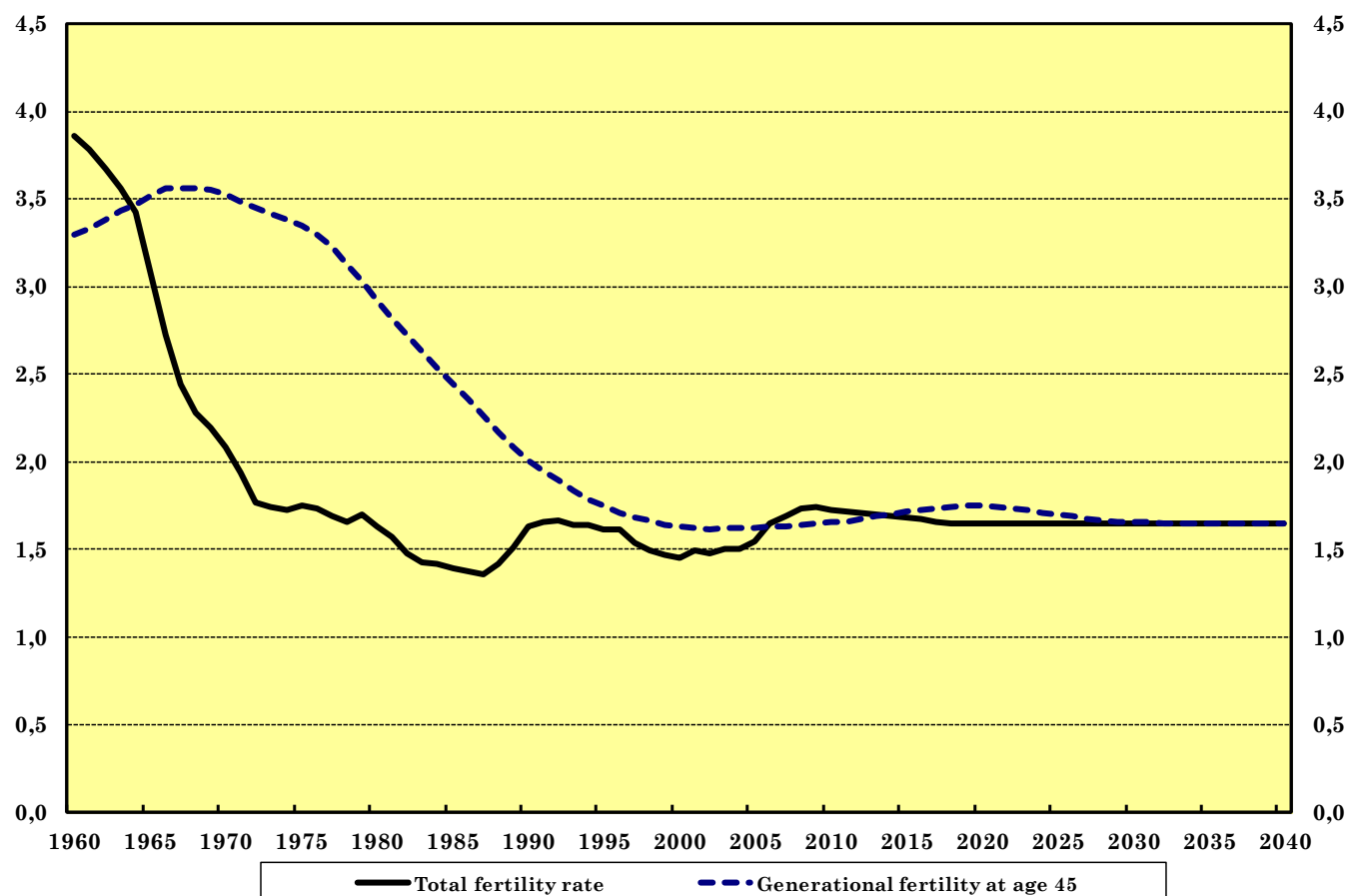
It should be noted that birth assumptions do not have a great effect on short and medium term results since it is the population aged 18 and over that has an impact on the Plan's cash inflows and outflows.

Therefore, the births in a given year will not have an effect on the number of new contributors until approximately twenty years later.

Table 17
Fertility rates and total fertility rates

YEAR	AVERAGE ANNUAL FERTILITY RATE BY AGE GROUP (FOR 1 000 WOMEN)							TOTAL FERTILITY RATE (per woman)
	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	
2010	10,1	53,8	117,4	110,8	45,8	7,3	0,3	1,73
2011	10,1	54,0	117,2	110,1	44,8	7,1	0,3	1,72
2012	10,1	54,1	117,1	109,4	43,9	6,8	0,3	1,71
2013	10,2	54,3	116,9	108,6	42,9	6,6	0,3	1,70
2014	10,2	54,4	116,7	107,9	42,0	6,4	0,2	1,69
2015	10,2	54,6	116,5	107,2	41,0	6,2	0,2	1,68
2016	10,2	54,7	116,4	106,5	40,0	5,9	0,2	1,67
2017	10,2	54,9	116,2	105,7	39,1	5,7	0,2	1,66
2018	10,2	55,0	116,0	105,0	38,1	5,5	0,2	1,65
2020	10,2	55,0	116,0	105,0	38,1	5,5	0,2	1,65
2030	10,2	55,0	116,0	105,0	38,1	5,5	0,2	1,65
2040	10,2	55,0	116,0	105,0	38,1	5,5	0,2	1,65
2050	10,2	55,0	116,0	105,0	38,1	5,5	0,2	1,65
2060	10,2	55,0	116,0	105,0	38,1	5,5	0,2	1,65

Chart 9
Total fertility rate and generational fertility at age 45



2.4 Migration

Net migration is the difference between in-migration and out-migration during a given year, both internationally and inter-provincially. Between 1986 and 2008, Québec's net migration has oscillated between a slightly negative level and a positive level of about 37 000 people, with the average being about 21 000 people, that is, 0,29% of the population. Net migration since 2001 is, however, higher than in the past, ranging from 27 000 to 37 000 people, that is, about 0,43% of the population.

It is difficult to predict net migration because of the set of factors that can affect each of its components.

International migration

The assumption for international migration was determined by taking into account the immigration policies of the Québec and Canadian governments, in particular the immigration targets of the Ministère de l'Immigration et des Communautés culturelles published in December 2009. The number of international immigrants is set at 52 400 a year and the number of international emigrants is anticipated to be 7 800. International net migration is therefore 44 600, that is, 0,49% of the population in 2060.

Interprovincial migration

With regard to the net interprovincial migration, a reversal of historical trends has been noted in recent years. This number changed from - 18 000 in 1997 to approximately - 200 in 2003. Thereafter, however, the reversal has not been maintained as net interprovincial migration has declined. In 2007, it was - 13 000.

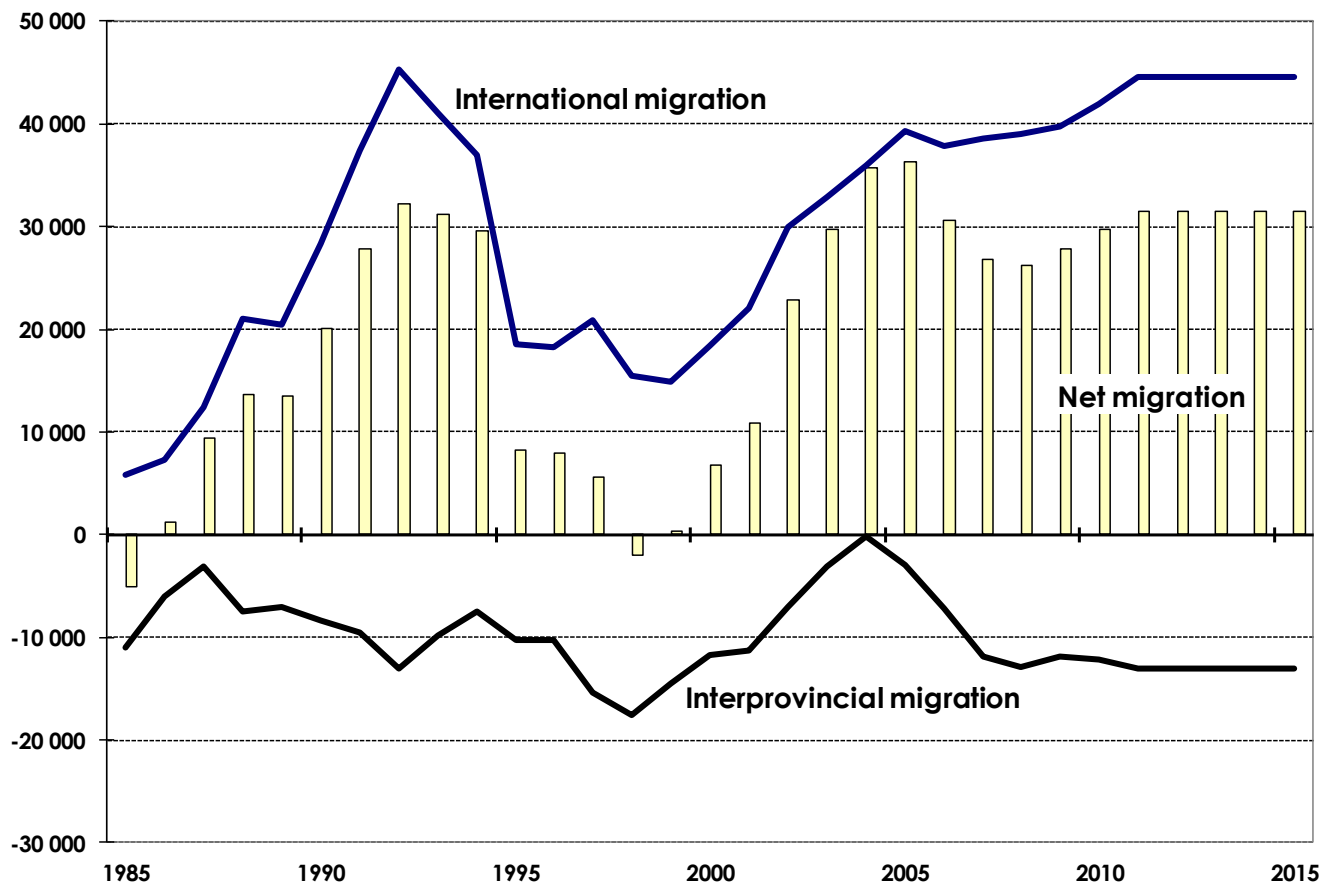
In future, the favourable labour market outlook in Québec should have a positive effect on the retention of Quebec workers, but the strong labour demand in the Canadian West could have a limiting effect. Thus, taking into account the significant increase in the number of international immigrants and the rate at which they will be retained, the number for interprovincial out-migration is expected to rise. Net interprovincial migration is therefore set at - 13 100 throughout the projection period.

Net migration

Net migration is therefore set at 31 500 (0,40% of the population) in 2010 and remains stable throughout the entire projection period, as shown in Chart 10.

The breakdown of in-migrants and out-migrants by age group and sex used for this report is based on estimates by Statistics Canada for the period from 1 July 2005 to 1 July 2009. According to that breakdown, the average age of in-migrants is 29 years and that of out-migrants is 33 years.

Chart 10
Net migration for Québec (1985-2015)



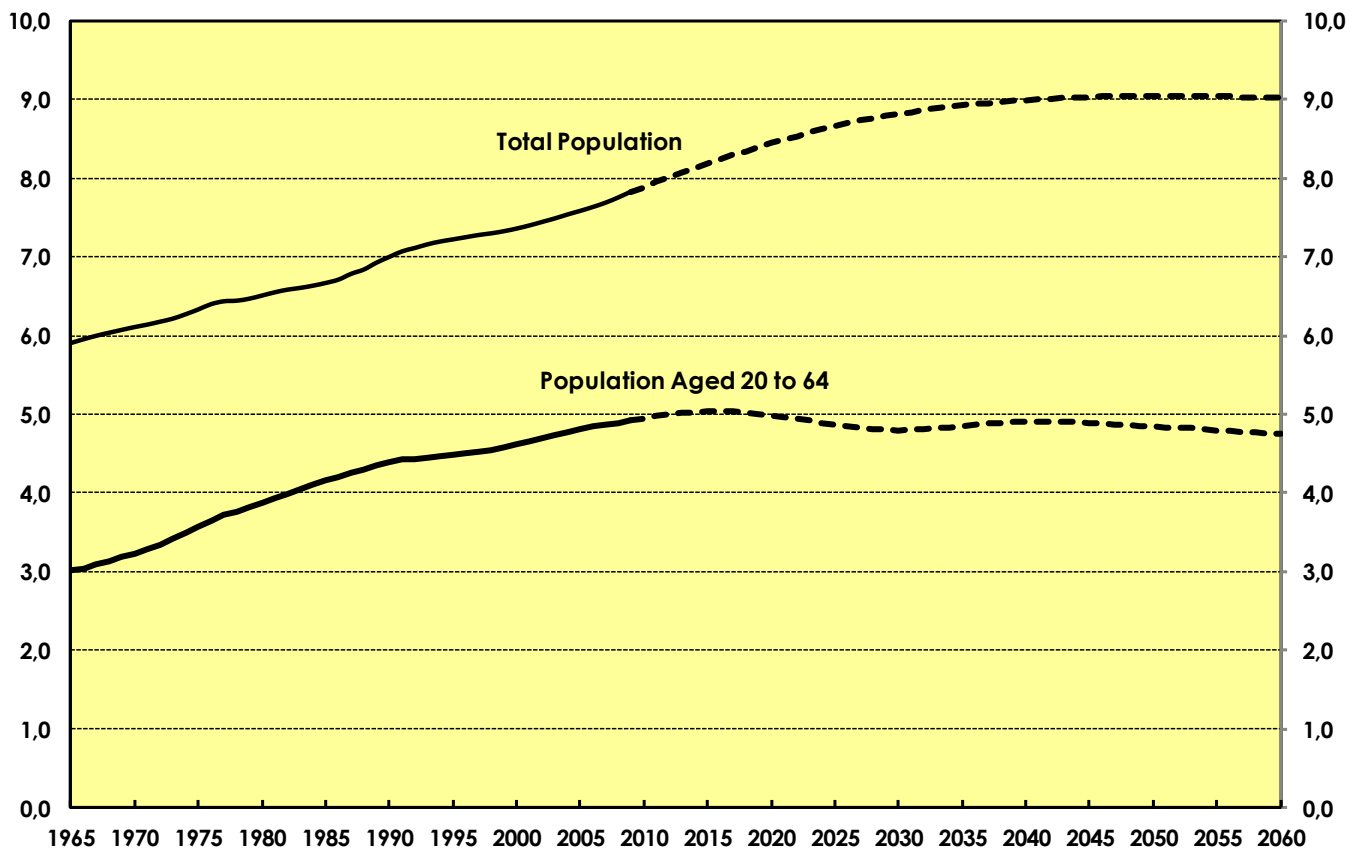
2.5 The projected population and its characteristics

The estimated population of Québec on 1 July 2009 is 7 829 000 people. Chart 11 shows changes in the total population and in the population of people aged 20 to 64 years since the Plan began and until the end of the projection period.

Table 18 shows the projected population on 1 July of each year, with some of its characteristics. For the next 10 years, the population increase is relatively constant, with an average annual increase of 0,70%.

Thereafter, growth will slow. In 2050, the population will reach a peak of 9 043 000, and will then decline slightly, reaching 9 033 000 in 2060. The number of people between the ages of 20 and 64 years, which is estimated to be 4 948 000 in 2010, will increase to just over 5 035 000 in 2016, then decrease to 4 799 000 by 2030. Thereafter, the population aged 20 to 64 varies slightly until the end of the projection period.

Chart 11
Population of Québec (1965-2060)
(in millions)



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Table 18
Projected population of Québec

A) NUMBER OF PEOPLE BY AGE GROUP (in thousands)					
YEAR	FROM 0 TO 17	FROM 18 TO 19	FROM 20 TO 64	65 AND OVER	TOTAL
2010	1524	207	4948	1210	7890
2011	1521	202	4975	1252	7951
2012	1521	196	4994	1299	8011
2013	1522	192	5011	1345	8070
2014	1526	188	5023	1392	8128
2015	1534	181	5031	1439	8185
2020	1599	162	4989	1696	8446
2025	1637	177	4869	1978	8661
2030	1599	193	4799	2228	8820
2035	1555	191	4849	2329	8925
2040	1536	186	4909	2363	8994
2045	1545	178	4894	2415	9032
2050	1568	174	4842	2459	9043
2055	1579	178	4799	2482	9038
2060	1568	184	4756	2526	9033

B) PERCENTAGE BREAKDOWN BY AGE					
YEAR	FROM 0 TO 17 AS A PERCENTAGE OF THE TOTAL	FROM 20 TO 64 AS A PERCENTAGE OF THE TOTAL	65 AND OVER AS A PERCENTAGE OF THE TOTAL	65 AND OVER AS A PERCENTAGE OF THE 20 TO 64 AGE GROUP	60 AND OVER AS A PERCENTAGE OF THE 20 TO 59 AGE GROUP
2010	19,3	62,7	15,3	24,5	38,1
2011	19,1	62,6	15,8	25,2	39,2
2012	19,0	62,3	16,2	26,0	40,3
2013	18,9	62,1	16,7	26,8	41,5
2014	18,8	61,8	17,1	27,7	42,8
2015	18,7	61,5	17,6	28,6	44,3
2020	18,9	59,1	20,1	34,0	52,5
2025	18,9	56,2	22,8	40,6	61,1
2030	18,1	54,4	25,3	46,4	64,2
2035	17,4	54,3	26,1	48,0	65,0
2040	17,1	54,6	26,3	48,1	67,3
2045	17,1	54,2	26,7	49,4	69,5
2050	17,3	53,5	27,2	50,8	70,9
2055	17,5	53,1	27,5	51,7	72,8
2060	17,4	52,6	28,0	53,1	71,9

Table 18 also shows the relative size of some age groups. By 2036, the number of people aged 65 and over will double. As of 2047, there will be less than two people aged 20 to 64 for each person aged 65 or over. At the end of the table, the change in the ratio of the population aged 60 and over to the population aged 20 to 59 is more pertinent with respect to the Québec Pension Plan because it gives a measure of the change in the ratio of the number of beneficiaries of the retirement pension (available as early as age 60) and the number of contributors. As of 2020, there will be less than two people aged 20 to 59 for each person aged 60 and over.

Chart 12, which shows a breakdown of the Québec population for some age groups, clearly illustrates that aging of the population will accelerate between 2010 and 2030.

Table 19 gives the annual population variation, that is, total births and net migration less deaths. Chart 13 illustrates changes in births, migration and deaths in Québec for the period from 2010 to 2060. As of 2051, the number of deaths will be greater than the sum of births and net migration, which will result in a drop in the Québec population.

Chart 12
Breakdown of the Québec population

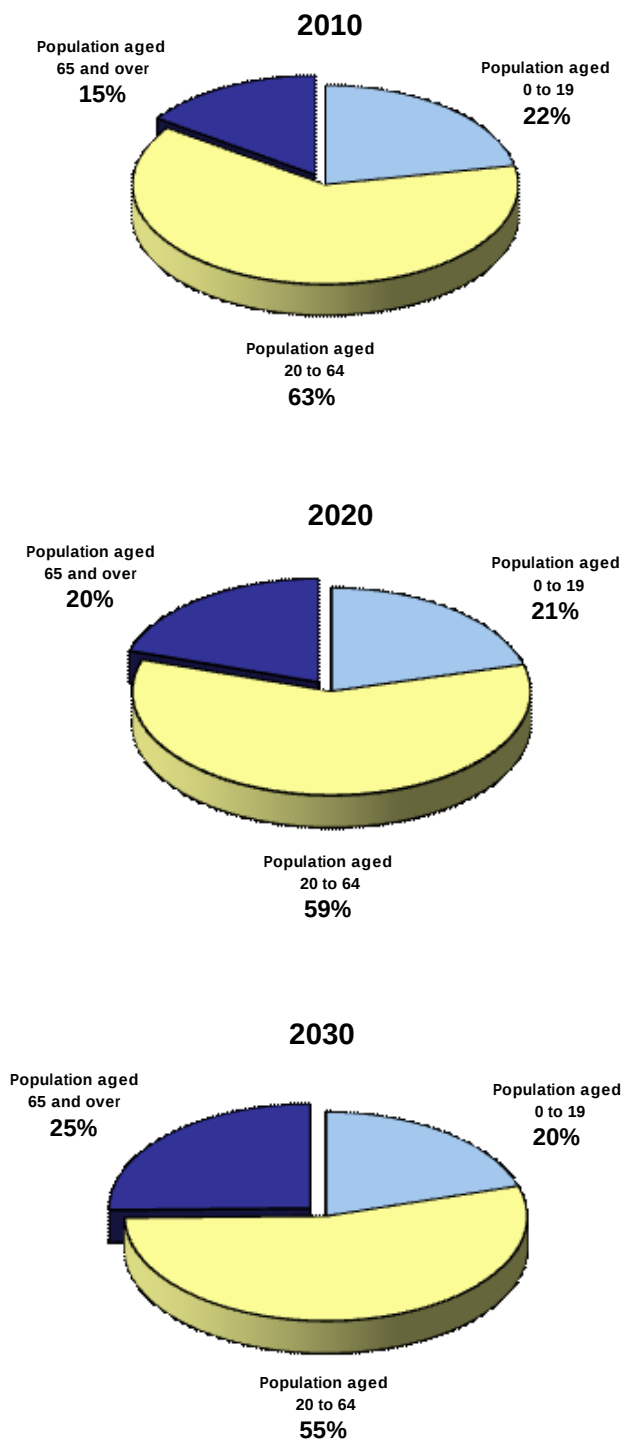
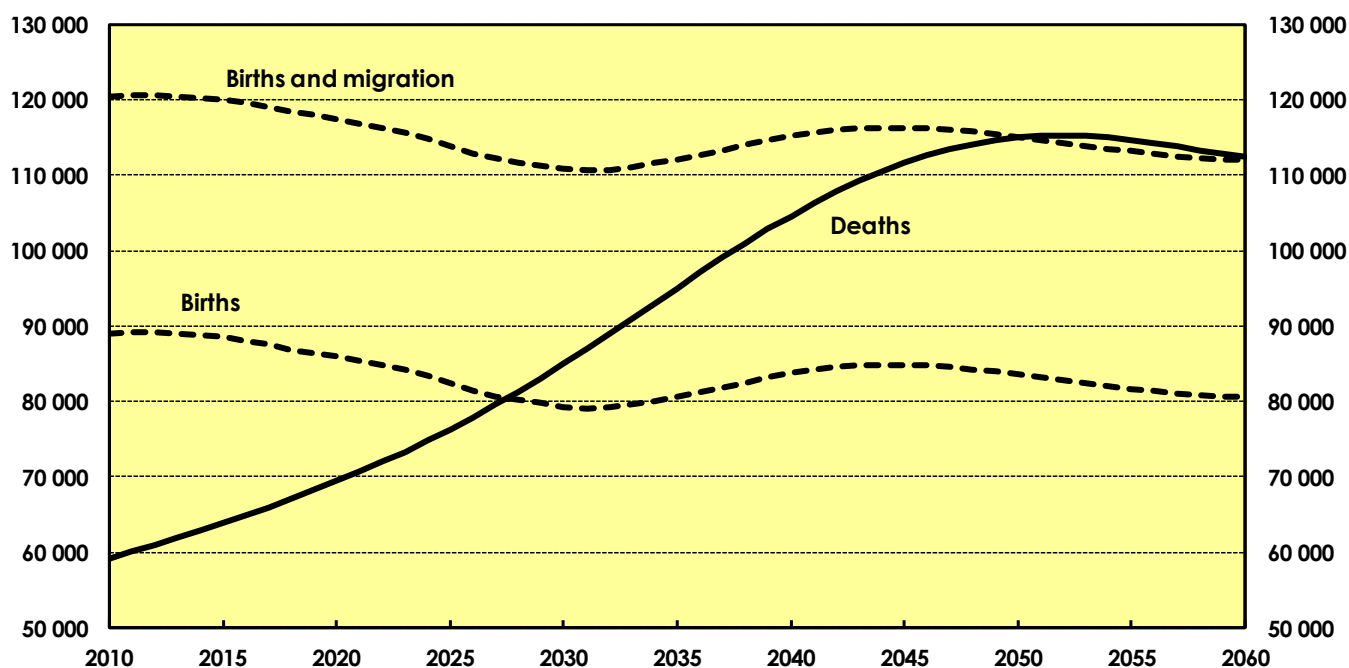


Table 19
Components of Québec's demographic variation
(in thousands)

YEAR	POPULATION ON 1 JANUARY	BIRTHS	NET MIGRATION	DEATHS	ANNUAL POPULATION VARIATION
2010	7 859,2	89,0	31,5	59,2	61,3
2011	7 920,5	89,2	31,5	60,1	60,6
2012	7 981,1	89,2	31,5	61,0	59,7
2013	8 040,8	89,0	31,5	61,9	58,6
2014	8 099,4	88,8	31,5	62,9	57,4
2015	8 156,8	88,5	31,5	63,9	56,1
2020	8 421,5	86,0	31,5	69,5	48,0
2025	8 642,4	82,4	31,5	76,3	37,6
2030	8 806,1	79,3	31,5	85,0	25,8
2035	8 915,9	80,6	31,5	95,1	17,1
2040	8 987,8	83,8	31,5	104,6	10,7
2045	9 029,0	84,9	31,5	111,7	4,7
2050	9 042,2	83,6	31,5	115,0	0,1
2055	9 038,0	81,7	31,5	114,7	-1,5
2060	9 032,0	80,6	31,5	112,4	-0,3

Chart 13
Births, migration and deaths in Québec



3. Economic assumptions

The economic assumptions concern changes in activity and employment rates, the unemployment rate, the inflation rate, employment earnings and the rate of return on investments.

Since the purpose of the actuarial analysis is the projection of the Plan's cash inflows and outflows on a very long term basis, the assumptions are based on structural factors, in a context of continued economic growth.

To make the best estimate of changes in the economic variables relevant to the analysis, several elements were taken into account, including historical trends, labour policy, monetary policy, studies carried out by experts, forecasts made by public and private agencies as well as the results of comparisons made on the national and international levels.

3.1 Labour market

The historical data on labour market indicators were taken from the *Labour Force Survey* carried out by Statistics Canada. The diagram on the next page shows the makeup of the population in terms of the various components of the labour market, based on the survey.

Projections of labour market indicators, mainly the projection of employed persons, were used to determine the number of Plan contributors.

3.1.1 Activity rate by age

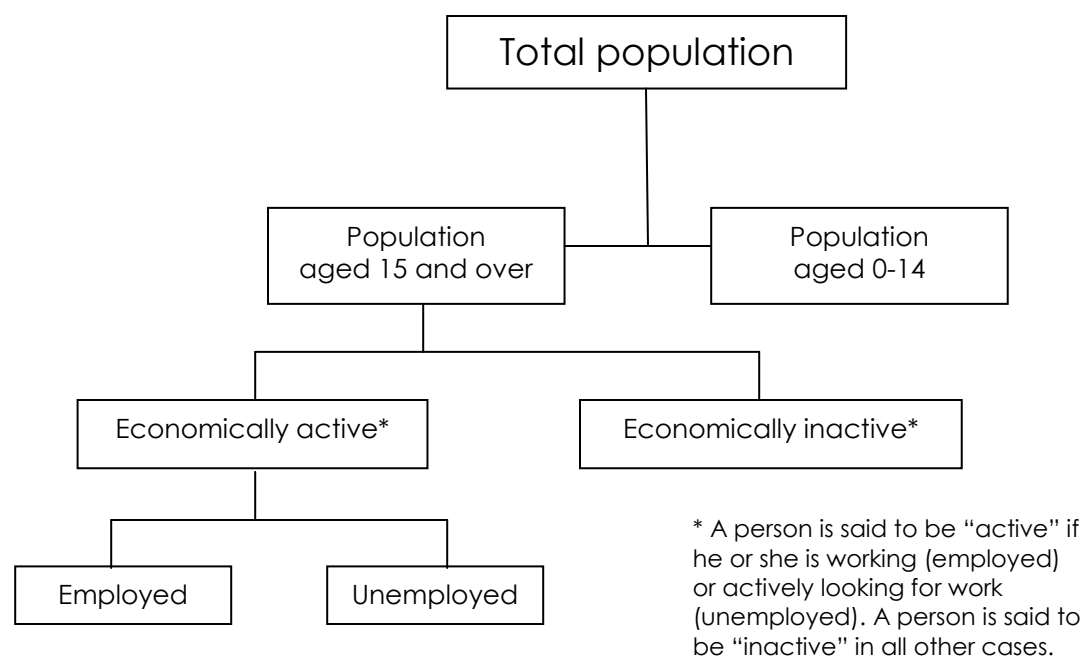
The probability of entering the labour market or remaining in it varies considerably during a person's lifetime. It is relatively low among young people, primarily because of school attendance. It is at its highest among adults and then begins to drop at around age 50, becoming marginal among the elderly. It is therefore necessary to make an assumption on the change in activity for each age group and each sex.

Applying the activity rates to the population by age group for each sex makes it possible to project the economically active population. The change in the overall activity rate, that is, the ratio of the active population to the population aged 15 and over, is thus greatly influenced by distribution by age of the population.

Effect of population aging on the overall activity rate

In 2010, baby boomers will be between the ages of 45 and 65 and represent about 40% of the active population. The aging of this group of workers will lead to a major decline in the overall activity rate over the next two decades.

To get an idea of the effect that population changes by age and sex can have on the overall activity rate over the next fifty years, the activity rates for 2009 were applied by five-year age group and by sex, to the population in future years.



Such a simulation assumes that the current level of activity in the labour market, by age, will continue throughout the entire projection period.

The exercise shows that population aging will exert considerable downward pressure on the overall activity rate between now and 2030. Thus, the overall activity rate (age 15 and over) would decline continually, dropping from 65,4% in 2010 to 57,2% in 2030, and then to 55,0% in 2060.

However, socio-economic factors will also have an effect on labour force participation. By carrying out a simulation like the preceding one but maintaining activity rates by age group and by sex at their 1976 levels, the activity rate for the population aged 15 and over would have been approximately 54,2% in 2009, whereas in fact, it was 65,2%.

The increase in the activity rate for the population aged 15 and over, from 58,8% in 1976 to 65,2% in 2009, can be primarily attributed to the marked increase in the

participation of women in the labour market, which has grown from 41,4% to 60,9%.

Throughout the projection period, socio-economic factors will in part offset the negative demographic effects on the overall activity rate. The following factors were taken into account for each of the population's age groups.

The 15 to 24 age group

The two main factors that affect the economic activity of young people are labour market conditions and school attendance. Activity rates and school attendance in the 15 to 24 age group have been relatively stable for the past few years, at a historically high level. The school attendance rate for the 15 to 19 age group has been stable since 1991 while that for the 20 to 24 age group has been stable since 1996.

An improvement in labour market conditions due to anticipated weak growth in the labour force will favour an increase in the activity rates of young people. However, the qualifications required for labour market

entry are now higher. Because of expected changes in the Québec economy, the demand for more highly educated workers is likely to continue. School attendance should, therefore, remain stable, leaving little room for an increase in activity rates.

For the 15 to 19 age group, activity rates are expected to be the same as those observed, on average, from 2001 to 2008, that is, 52,25% for men and 52,5% for women. For the 20 to 24 age group, activity rates should correspond to the average rates for those years, that is, 81,5% for men and 77,6% for women. Activity rates for the 15 to 24 age group will be stable as of 2015.

Age groups between 25 and 54

Men aged 25 to 54 have the highest level of participation in the labour market. Between 1976 and 1995, the activity rates for all age brackets in that age group showed slight declines. That trend, however, has been reversed since 1995.

The activity rates for men aged 25 to 34 years are expected to increase gradually until 2015. They will be stable for men aged 35 to 39 and 40 to 44 as of 2010. Activity rates for men aged 45 to 49 years and 50 to 54 years will be stable as of 2015. Since activity rates for adult men are already relatively high, increases will be limited to a recovery of the activity declines over the last two decades. Two factors, similar to factors affecting the 15 to 24 age group, favour an increase in activity rates for men: the arrival of more highly educated cohorts and an improvement in employment opportunities because of the expected slow growth of labour.

The activity rates for women aged 25 to 54 increased considerably for all five-year age groups between 1976 and 2009. However, the increased participation of women in the labour market, which began several decades ago, has reached a certain maturity.

During the last decade, women aged 25 to 54 have maintained, as have men, a high level of activity. Moreover, women continue to spend more and more time on their education, which should increase their presence in the labour market. In fact, women now represent the majority of the full-time student population in universities.

Activity rates are expected to increase gradually until 2015 for women aged 25 to 49, except for women aged 35 to 39, for whom the increase ends in 2010. As of those years, activity rates level off throughout the entire projection period. For women aged 50 to 54, activity rates are expected to increase until 2020, and will level off later since their higher levels of education have had less effect until now.

The difference between activity rates for adult men and women, which has narrowed greatly in the last few decades, will continue therefore to decline, but at a less rapid pace. The predominant role of women as child-care givers will probably prevent the complete elimination of that difference, although the majority of women are now returning to the labour market within one year of the birth of a child.

The 55 to 64 age group

Between 1984 and 1996, activity rates for men aged 55 to 64 declined continuously, dropping 8,5 and 16,6 percentage points respectively for age groups 55 to 59 and 60 to 64.

The trend among these age groups was retirement, either voluntarily or otherwise, at an increasingly earlier age. In the case of voluntary separation, employers used early departures as a means of renewing labour. This method became extremely popular with workers. In the case of involuntary separation, many employers laid off workers to reduce their payroll and lower the average

age of employees. Because of their lack of qualifications and the abundance of labour, the probability of finding work was low for older workers who lost their jobs. However, since 1996, this trend towards earlier retirement has reversed.

Labour scarcity, higher education levels of older workers, increased popularity of phased retirement programs, and government initiatives now focused on maintaining employment seem to favour a recovery in the activity rates for men and women aged 55 to 59 and 60 to 64. For both sexes, the activity rates of these two age groups increase gradually over the entire projection period.

Thus, it is probable that current generations of younger women will maintain a high level of activity when they reach these ages. However, the expected increases for women aged 55 to 59 are higher than for men until 2025. For women aged 60 to 64, the greater increase continues until 2030, when it becomes about the same for both sexes in both age groups.

The 65 and over age groups

It is important to analyze separately the behaviour of workers aged 65 to 69 and those aged 70 and over. The historical data show that the activity rates for these two groups, for both sexes, are significantly different.

From 2001 to 2009, activity rates for men aged 65 to 69 more than doubled. However, it is anticipated that their level of activity will remain stable until 2060. The stability takes into account the fact that the number of jobs available for people aged 65 to 69 should increase at the same pace as the group's population. The continuing increase in life expectancy in the coming decades should also be a factor favouring employment for this age group.

The participation of women aged 65 to 69 in the labour market was rather marginal between 1976 and 2005. However, the increase in life expectancy and the scarcity of labour should contribute to an increase in the activity rate for this age group throughout the entire projection period.

Activity rates for people aged 70 and over should remain stable for men and increase very gradually for women because of the strong growth of the oldest—and consequently, less active—portion of that group. As is the case for people aged 65 to 69, even though activity rates for the 70 and over age group are expected to be stable or increase gradually by sex, these assumptions will significantly increase the number of active people in the category. This is due to the increase in that population during the projection period and the continual increase in their life expectancy.

Table 20 shows the activity rate assumptions made for men and women, by 5-year age group in 2010, 2015, 2030 and 2060.

Overall activity rates

As previously mentioned, the increases expected in activity rates between now and 2030 in most 5-year age groups of men and women will partially offset the negative demographic impact on overall activity.

Between 2009 and 2030, the activity rate of the population aged 20 to 64 will increase 3,6 percentage points, rising from 79,3% to 82,9%. Between 1976 and 2009, that rate increased by 11,4 percentage points. The more moderate increase foreseen for this aggregate activity rate (ages 20 to 64) can be attributed, in large part, to the presence of the numerous baby-boom generations in age groups where economic activity drops off, that is, as of age 55.

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As Table 21 shows, the impact of population aging is obviously much more apparent where the activity rate is expressed for the population aged 15 and over. This overall rate

falls by 5,7 percentage points, from 65,2% to 59,6% between 2009 and 2030. It increased by 6,4 points between 1976 and 2009.

Table 20
Activity rate by age group and by sex

AGE GROUP	MEN				WOMEN			
	2010	2015	2030	2060	2010	2015	2030	2060
	%	%	%	%	%	%	%	%
15 to 19	54,5	52,3	52,3	52,3	56,1	52,5	52,5	52,5
20 to 24	79,3	81,5	81,5	81,5	75,6	77,6	77,6	77,6
25 to 29	89,4	91,7	91,7	91,7	82,8	86,9	86,9	86,9
30 to 34	90,0	93,5	93,5	93,5	85,0	86,5	86,5	86,5
35 to 39	92,8	92,8	92,8	92,8	85,6	85,6	85,6	85,6
40 to 44	92,4	92,4	92,4	92,4	85,5	86,7	86,7	86,7
45 to 49	90,1	91,5	91,5	91,5	85,3	86,1	86,1	86,1
50 to 54	87,3	87,6	88,0	88,0	79,2	81,4	83,5	83,5
55 to 59	72,7	74,8	79,7	83,9	63,1	67,2	75,9	79,7
60 to 64	49,4	50,9	55,5	60,8	36,9	40,8	52,5	57,3
65 to 69	21,9	21,9	21,9	21,9	10,5	10,9	12,1	14,0
70 and over	5,4	5,4	5,4	5,4	2,1	2,2	2,5	3,0
20 to 64	83,3	84,2	85,4	86,5	75,8	77,3	80,4	81,3
15 and over	69,8	68,8	62,8	60,9	60,9	60,3	56,4	55,4

Changes in the active population

The projection of the active population is based on the projection of the population aged 15 and over, for which the methodology is described in section 2. An adjustment was made to that population to make it comparable to the concept used in the *Labour Force Survey* carried out by Statistics Canada. Thus, the population aged 15 and over, after adjustment, corresponds to the civilian population aged 15 and over, excluding institutionalized people and people living on Indian reserves.

By applying these activity rates by age group and by sex to the projected population in the same manner, we obtained the active population for each group.

The active population aged 15 and over will increase slightly until 2017, and hover around that level for the remainder of the projection period. In 2060, the active population will be almost exactly the same as in 2017.

Table 21
Labour force changes and aggregate activity rates

YEAR	LABOUR FORCE		ACTIVITY RATE FOR PERSONS AGED 20 TO 64			ACTIVITY RATE FOR PERSONS AGED 15 AND OVER		
	TOTAL	CHANGE	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
(in thousands)		%	%	%	%	%	%	%
2010	4 242	-	83,3	75,8	79,6	69,8	60,9	65,3
2015	4 338	0,4	84,2	77,3	80,8	68,8	60,3	64,5
2020	4 334	0,0	84,3	78,2	81,3	66,7	59,0	62,8
2025	4 322	-0,1	84,7	79,3	82,0	64,5	57,5	60,9
2030	4 330	0,0	85,4	80,4	82,9	62,8	56,4	59,6
2035	4 368	0,2	85,5	80,6	83,1	62,1	56,0	59,1
2040	4 402	0,2	85,4	80,4	82,9	61,9	56,0	58,9
2045	4 396	0,0	85,5	80,4	83,0	61,6	55,8	58,7
2050	4 368	-0,1	85,8	80,6	83,2	61,3	55,6	58,4
2055	4 347	-0,1	86,0	80,8	83,4	61,1	55,5	58,2
2060	4 346	0,0	86,5	81,3	83,9	60,9	55,4	58,1

3.1.2 Employment and the unemployment rate

From a situation of relatively abundant labour observed in recent decades, Québec is now gradually headed toward a situation in which there will be fewer workers available. Between 1976 and 2009, the average rate of employment growth was 1,3% a year. More than 70% of that growth was among women. Table 22 shows changes in employment and the unemployment rate for some years between 2010 and 2060.

Future changes in the labour force will make it impossible to sustain employment growth at past levels. It is anticipated that employment will increase at an average rate of 0,7% between 2010 and 2017. Combined with the weak growth in the labour force, job creation will bring about a gradual reduction in the unemployment rate. From a level of 8,5% in 2009, the unemployment rate will reach its lower limit of 6,0% in 2019.

After full employment is reached, the number of workers will change at the same pace as the labour force changes. Employment will decrease slightly between 2018 and 2026. Thereafter, it follows the changes in the population aged 25 to 59, which makes up the available labour force. Employment will therefore increase between 2027 and 2043, then decline between 2044 and 2057. The projected number of workers for 2060 is nearly identical to the number projected for 2018 (4,08 million workers).

Table 22
Changes in employment and the unemployment rate

YEAR	EMPLOYMENT (in thousands)				UNEMPLOYMENT RATE
	MEN	WOMEN	TOTAL	VARIATION	
				%	%
2010	2 030	1 843	3 873	-	8,7
2015	2 133	1 925	4 058	0,9	6,4
2020	2 141	1 933	4 074	0,1	6,0
2025	2 133	1 930	4 063	-0,1	6,0
2030	2 132	1 939	4 071	0,0	6,0
2035	2 145	1 961	4 106	0,2	6,0
2040	2 157	1 981	4 138	0,2	6,0
2045	2 152	1 980	4 132	0,0	6,0
2050	2 137	1 969	4 106	-0,1	6,0
2055	2 126	1 960	4 086	-0,1	6,0
2060	2 125	1 960	4 085	0,0	6,0

3.2 Inflation rate

Inflation, measured by the rate of increase in the Consumer Price Index for Canada, determines the rate of indexation for pensions. It is also an important element in assumptions related to average employment earnings and yields on investments.

Since the Bank of Canada introduced inflation targeting as part of its monetary policy in 1991, inflation has stayed at a low, stable level after fluctuating strongly in previous decades. From 2,7% between 1961 and 1970, the average annual inflation rate climbed to 8,0% from 1971 to 1980 and then dropped to 5,9% between 1981 and 1990, then to 2,0% from 1991 to 2009.

The desire of the federal government and the Bank of Canada to maintain the current strategy for inflation control leads us to expect a weak inflation rate for the coming years. In November 2006, the Canadian government and the Bank of Canada announced that they would maintain their inflation control target until the end of 2011.

In the next few years, the Canadian monetary policy will be to keep the inflation rate in the 1% to 3% bracket.

The inflation assumption made for this report is 1,6% in 2010 and 2,0% in 2011. Thereafter, price pressures may occur to the extent that wage pressures increase (see the following section). Consequently, the inflation rate will gradually increase, reaching 2,5% in 2016 and remain at that level until the end of the projection period.

The indexation rate for pensions will be equal to the inflation rate from the preceding year, as of 2014.

3.3 Real rate of increase in average employment earnings

The relative abundance of labour in the last several decades has been a limiting factor in the real increase in employment earnings. Since 1991, the growth in average weekly earnings (AWE) in Québec has on average only been 1,9%, which is a level lower than inflation. During the same period, the Canadian AWE increased by 2,2% a year.

In future, however, employment earnings are expected to change in other ways. Future changes in employment earnings will result for the most part from changes in worker productivity and a shrinking labour market, because of an increasingly limited labour availability. Future changes in productivity are expected to be especially influenced by the following factors:

- **Aging of the labour force:** generally, we consider that the productivity of a worker increases up to the midpoint of his or her career. It then stabilizes for some or falls for others. However, the portion of the population represented by people age 55 and over will increase from 16,1% in 2010 to 20,7 % in 2021. This factor taken separately would limit the anticipated increase in worker productivity.
- **Worker training:** the improved training of young people will contribute to increasing the level of worker productivity in coming years. Furthermore, better educated individuals tend to work to a later age because they enter the labour market later due to their increased schooling.

- **Hours worked:** the number of hours worked will have a limited effect on productivity per worker. The scarcity of labour should make full-time employment more available to people who currently work part-time involuntarily.
- **Capital investment:** in the coming years, a shrinking labour force should bring businesses to substitute capital for labour where possible. Therefore, although investment growth is expected to slow as the technological sector reaches its full development, it will remain strong in the coming years and result in increases in worker productivity.

From 2009 to 2019, the average nominal rate of increase in earnings should rise from 0,5% to 3,7%. Once inflation is excluded, the real rate of increase will be 0,2% in 2009, then it will increase each year, reaching its long-term level of 1,2% in 2019.

Table 23 summarizes the assumptions made for inflation and the increase in average employment earnings. For the purposes of this report, we assume that future changes in salaries and wages will occur at the same pace in Québec and in Canada. Consequently, changes in the Canadian AWE, which is used to determine growth in the maximum pensionable earnings (MPE) under the Plan, are identical to changes in average annual earnings in Québec.

Table 23
Inflation rates and increase in average employment earnings

YEAR	INFLATION	INCREASE IN AVERAGE EMPLOYMENT EARNINGS
	%	%
2010	1,6	1,9
2011	2,0	2,4
2012	2,1	2,6
2013	2,2	2,8
2014	2,3	3,0
2015	2,4	3,2
2016	2,5	3,4
2017	2,5	3,5
2018	2,5	3,6
2019 and later	2,5	3,7

The real increase in employment earnings is not equally distributed between men and women. In fact, the projected increase in average annual earnings is higher for women because of their higher levels of education and an increase in the number of hours worked in a year. From 2010 to 2030, the average real rate of increase in earnings is expected to be 3,7% for women, compared with 3,3% for men. Thereafter, the gap will gradually narrow so that as of 2045, the increase will be the same for both sexes.

3.4 Rates of return

Rates of return are determined for each year in the projection period and for each category of assets. Those rates reflect the projected return in the various financial markets.

Investment categories

In accordance with the *Act respecting the Québec Pension Plan*, the assets of the Plan are deposited in the Caisse de dépôt et placement du Québec (CDP). The investment

portfolio has three major divisions: fixed income securities, stock market securities and other variable income securities.

Fixed income securities include bonds, real estate debt and short-term investments.

Stock market securities include Canadian, U.S. and foreign stock shares. In this report, the foreign shares category includes emerging market shares.

Lastly, **other variable income securities** include private equity and real estate investments. Private equity offers expectations of a higher yield as compensation for a higher risk. For this actuarial analysis, the category of private equity includes investments in infrastructures.

Asset allocation

The *Politique de placement du fonds du Régime de rentes du Québec* is determined by the Board of Directors at the Régie. This policy sets the objectives to strive for and the portfolio's asset allocation for the reference period. The Board of Director's investment policy committee meets at least four times a year to ensure a follow-up. Moreover, by law, the policy must be revised every 3 years.

Under the policy, fixed income investments account for 30% of the portfolio, the proportion of stock market securities is 45% and the variable income securities make up 25%.

The investment policy grants managers of the CDP some degree of leeway with regard to departure from the actual asset allocation compared with these targets. However, for projection purposes, the anticipated allocation is based on these targets.

For this actuarial analysis, it is assumed that the asset allocation, which corresponds to the investment portfolio for the reference period

set out in the policy, will remain stable throughout the projection period. A breakdown of the allocation is shown in Table 24.

Table 24
Allocation of the Plan's fund assets

Asset Categories	2010 and later
	%
Short term	0,5
Bonds	22,0
Real estate debt	7,5
Canadian stock shares	13,0
U.S. stock shares	9,0
Foreign stock shares	23,0
Private equity	12,0
Real estate	13,0

Since the Plan is partially funded and most of its funding will come from future contributions, it is less vulnerable to investment yield fluctuations than a more fully funded pension plan. Thus, the portfolio's asset allocation is oriented toward long-term growth.

Rate of return by asset category

Yields on fixed income securities are mainly composed of coupon income and the appreciation of asset fair values based on interest rate variations.

Yields on stock market securities and other variable income securities include dividend income (for stock shares) or rental income (from buildings) and appreciation of the asset fair values. No distinction is made between earned and unearned income resulting from appreciation of the fair value.

One of the approaches used to determine the rates of return for the various investment types is the history of past yields over long periods. This is done by considering economic juncture changes and by identifying the differences in rates of return between the various asset categories. Yield projections made by various institutions (including the CDP), financial research documents, surveys and the Plan's fund investment policy are also taken into account.

The real rate of return for each asset category is kept constant throughout the projection period, with the exception of the rate for fixed income securities. For the latter, the current context of very low interest rates is reflected in the assumptions. The use of stable yield rates for the other asset categories takes into account the difficulty of making year-by-year predictions of financial market yields.

The impact that an aging population may have on the financial markets was considered when determining rates of return by asset category. In fact, in the coming decades, the baby-boom generation will leave the savings phase and enter the retirement phase, thereby affecting capital supply and demand. Furthermore, the baby-boomers' passage to retirement in the industrialized countries will inevitably constrain the labour market. We anticipate a decrease in the working-age population, which could result in a decrease in the labour force in several countries and thus be detrimental to economic growth in those countries. These phenomena could result in downward pressure on financial market yields.

The approaches used to project rates of return for the different asset categories are summarized as follows:

- The actual yield for fixed income securities is greatly affected by changes in interest rates. At this time, rates are below their historical average.

The projected return for **fixed income securities** over the the first 10 years is based on the bond portfolio's anticipated yield when it is valuated. The yield gradually increases, until it reaches its ultimate level.

- The real rate of return for the **bond** portfolio is based mainly on the historical yields on long-term federal bonds and on an analysis of differences in historical yields between federal, provincial and corporate bonds, according to different maturities. The anticipated real rate of return on long-term federal bonds is 2,5%, that is, the same rate as that anticipated for the entire **bond** portfolio based on the issuers and maturity dates. This rate is the point of reference that enables us to determine the risk premium of the other asset categories.
- The projected actual yield for **short-term securities** is estimated to be 1,0% less than the assumption made for long-term federal bonds. Therefore the projected real rate of return is 1,5%.
- **Real estate debt** is mainly comprised of prime mortgage loans. Their anticipated yield is higher than the yield on other fixed-income securities. The risk premium assigned for the entire projection period is 0,6% and the projected real rate of return, 3,1%.
- For **Canadian stock shares**, the projected real rate of return is 5,4%. The risk premium of 2,9% corresponds to the additional yield expected by investors to offset the higher risk associated with the Canadian stock market.
- Assumptions for the real rate of return on **U.S. stock shares** are similar to those for the Canadian stock market. The projected real rate of return is 5,4%.

- **Foreign stock shares** are from markets other than those in Canada or the United States. To reflect the higher level of risk, the projected risk premium of 3,2% results in real rate of return of 5,7%.
- The yield assumption for **private equity** involves a risk premium of 3,9%. The real rate of return of 6,4% projected for private market investments is the highest rate for any asset category.
- The real rate of return for **real estate** is set at 0,2% higher than the assumption made for Canadian stock shares, that is, a risk premium of 3,1%. The projected real rate of return is 5,6%.

Table 25 shows the real rate of return (excluding inflation) for each asset category.

Table 25
Real rate of return by asset category

ASSET CATEGORY	2010 TO 2019	2022 AND LATER
	%	%
Short term	0,7	1,5
Bonds	1,7	2,5
Real estate debt	2,3	3,1
Canadian stock shares	5,4	5,4
U.S. stock shares	5,4	5,4
Foreign stock shares	5,7	5,7
Private equity	6,4	6,4
Real estate	5,6	5,6

Management fees

Management fees are expressed in percentage points of managed assets and are deducted directly from the realized rate of return. A reduction of 0,25 percentage points on the absolute value of gross yield was assumed for the entire projection period.

This value takes into account the level of management fees related to each asset category and to the distribution of the assets in the portfolio.

Overall rate of return

The overall rate of return assumption is the result of weighting the different rates of return according to asset category and the projected distribution of assets.

Table 26 illustrates the assumption of the overall rate of return on Plan assets during the projection period, after deduction of management fees. Nominal rates (including inflation) and real rates (excluding inflation) are shown.

Table 26
Rate of return on Plan assets, after
deduction of management fees

YEAR	REAL RATE	NOMINAL RATE
	%	%
2010	4,3	5,9
2011	4,3	6,3
2012	4,3	6,4
2013	4,3	6,5
2014	4,3	6,6
2015	4,3	6,7
2016	4,3	6,8
2017	4,3	6,8
2018	4,3	6,8
2019	4,3	6,8
2020	4,4	6,9
2021	4,5	7,0
2022 and later	4,5	7,0

4. Plan contributions

The amount of Plan contributions depends on the number of contributors, their contributory earnings and the contribution rate. Thus, the demographic and economic assumptions described in the preceding sections make it possible to determine the level of future contributions.

For the purpose of projecting cash inflows, the amount of contributions is determined on the accrual basis of accounting, that is, they are charged to the year in which they are due, whether or not they are received during that year. Therefore, the amounts determined in the actuarial analysis differ from accounting data included in the Plan's financial statements, which are compiled according to the actual date on which they are received.

4.1 Determining Plan participation

Generally speaking, all persons age 18 and over whose annual employment income exceeds the basic exemption (3 500 \$) contribute to the Plan. The number of persons who contribute to the Québec Pension Plan is therefore strongly correlated with the level of employment identified in section 3.1 as "employed persons". A person who is unemployed or economically inactive for several months during a year may, nevertheless, have sufficient employment income to contribute to the Plan.

More specifically, the number of contributors to the Plan is determined, by sex and by age, as a function of the relationship between the number of employed persons and the number of persons with employment earnings greater than the basic exemption. That calculation requires a distribution of workers according to their employment earnings, which is based on information in the Plan's Record of Contributors for 2006 and 2008.

Since the basic exemption is set at 3 500 \$, the annual increase in workers' earnings results in an increase in Plan participation. Adjustments were made to the data in order to be able to more precisely establish the number of participants in the Plan as at 31 December 2009 and, as a result, the level of benefits accrued. The objective of the adjustments, which were based on an analysis of the historical record of Plan participation, was to exclude from the data base contributors who contributed little to the Plan and are not likely to apply for benefits.

Table 27 shows the results of projecting Plan participation, that is, participation rates (the ratio of the number of contributors to the population aged 18 to 64¹) and the number of contributors by sex. It shows that the gap between the participation rates for men and women is narrowing. Table 28 shows participation rates by sex and by age group.

1. Since 1998, workers contribute to the Plan even if they are receiving a retirement pension. Some contributors may therefore be aged 65 or over.

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Table 27
Plan participation by sex

YEAR	PARTICIPATION RATE (ages 18 to 64)		NUMBER OF CONTRIBUTORS (in thousands)		
	MEN	WOMEN	MEN	WOMEN	TOTAL
	%	%			
2010	79	72	2 066	1 826	3 893
2011	81	73	2 102	1 857	3 959
2012	81	73	2 129	1 883	4 012
2013	82	74	2 152	1 905	4 057
2014	83	75	2 172	1 923	4 095
2015	83	75	2 188	1 938	4 125
2020	85	77	2 202	1 965	4 166
2025	86	79	2 189	1 971	4 159
2030	87	81	2 190	1 998	4 188
2035	88	82	2 226	2 045	4 271
2040	88	83	2 257	2 086	4 342
2045	89	83	2 267	2 096	4 363
2050	90	84	2 263	2 089	4 352
2055	90	84	2 256	2 080	4 336
2060	91	85	2 259	2 081	4 340

Table 28
Plan participation rates for the purpose of calculating contributions, by age and by sex

AGE GROUP	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
	%	%	%	%	%	%
20 to 24	73	82	85	72	78	81
25 to 29	83	90	91	78	85	87
30 to 34	82	94	94	78	86	87
35 to 39	84	90	91	78	85	86
40 to 44	85	89	90	79	82	84
45 to 49	85	89	89	81	85	85
50 to 54	83	86	87	75	81	82
55 to 59	71	77	84	61	75	81
60 to 64	48	50	58	32	50	58
65 to 69	24	23	27	9	14	19
18 to 64	79	87	91	72	81	85

4.2 Calculation of contributory earnings

Contributory earnings are employment earnings that fall between the basic exemption of 3 500 \$ and the maximum pensionable earnings (MPE). The MPE is the upper limit of the earnings taken into account under the Plan for calculating contributions and benefits. The MPE, which is 47 200 \$ in 2010, increases according to changes in the average weekly earnings (AWE) in Canada, that is, at the same rhythm as the expected rate of increase in the average employment earnings of all workers.

In addition to anticipated changes in wages, the projection of average earnings takes into account the effect of the change in the demographic structure and the more rapid increase of women's earnings compared with men's. The average employment earnings projected by sex and by age group were adjusted in two ways to obtain the average pensionable earnings. First, they were reduced to take into account the fact that pensionable earnings under the Plan cannot exceed the MPE. Second, they were slightly increased because the earnings of workers who earned less than the basic exemption were excluded from the average that is used. Contributory earnings are equal to the average pensionable earnings from which the basic exemption has been subtracted.

These adjustments were made by taking into account the distribution of workers according to their earnings, that is, the proportion of workers in each earnings bracket and the total payroll attributed to each bracket.

Table 29 shows changes in average employment earnings and average pensionable earnings by sex, as well as the MPE.

The ratio of average pensionable earnings of women to those of men increased from 71,1% in 1966 to 86,9% in 2010 and will reach 92,4% in 2060. Table 30 shows average employment earnings by age and by sex in 2010, 2030 and 2060.

Table 31 shows changes in average pensionable earnings by age and by sex.

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Table 29

Average employment earnings by sex, average pensionable earnings by sex and MPE

YEAR	AVERAGE EMPLOYMENT EARNINGS		AVERAGE PENSIONABLE EARNINGS		MAXIMUM PENSIONABLE EARNINGS (MPE)
	MEN	WOMEN	MEN	WOMEN	
	\$	\$	\$	\$	\$
2010	43 895	31 864	32 176	27 974	47 200
2011	44 860	32 725	32 800	28 591	48 100
2012	45 927	33 686	33 482	29 274	49 100
2013	47 115	34 741	34 282	30 056	50 300
2014	48 428	35 899	35 205	30 944	51 700
2015	49 856	37 181	36 193	31 918	53 200
2020	58 830	45 056	42 492	37 982	63 000
2025	69 952	54 763	50 294	45 405	75 600
2030	83 373	66 357	50 524	54 102	90 600
2035	99 417	80 262	70 549	64 451	108 700
2040	118 860	96 707	83 835	76 819	130 300
2045	142 435	116 115	99 940	91 890	156 300
2050	170 833	139 247	119 304	110 017	187 500
2055	204 942	166 924	142 595	131 677	224 800
2060	245 794	200 148	170 703	157 705	269 600

Table 30

Average employment earnings by age and by sex

AGE GROUP	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
	\$	\$	\$	\$	\$	\$
20 to 24	19 294	36 794	109 034	15 978	31 275	92 679
25 to 29	32 655	62 272	184 534	26 898	52 931	156 854
30 to 34	42 442	80 935	239 841	31 982	64 748	191 873
35 to 39	49 230	93 881	278 205	36 859	75 105	222 564
40 to 44	53 797	102 590	304 011	39 608	82 072	243 209
45 to 49	57 233	109 141	323 426	40 037	85 883	258 741
50 to 54	58 184	110 956	328 803	39 661	85 013	263 042
55 to 59	52 124	99 400	294 560	34 522	75 609	235 648
60 to 64	39 889	76 068	225 416	25 649	56 150	180 333
65 to 69	31 062	59 234	175 532	17 963	40 387	136 038
All ages	43 895	83 373	245 794	31 864	66 357	200 148

Table 31
Average pensionable earnings for the purpose of calculating contributions,
by age and by sex

AGE GROUP	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
	\$	\$	\$	\$	\$	\$
20 to 24	19 453	35 649	102 688	16 523	30 868	88 883
25 to 29	29 522	55 121	161 326	26 283	49 682	144 503
30 to 34	33 856	63 374	186 380	28 858	55 263	161 895
35 to 39	35 211	66 315	195 286	31 062	59 884	175 777
40 to 44	36 023	68 338	201 419	31 914	62 553	184 100
45 to 49	36 699	69 590	205 229	32 245	64 550	191 393
50 to 54	37 188	70 666	208 220	32 278	64 362	193 223
55 to 59	35 164	65 195	189 337	29 881	59 122	177 058
60 to 64	30 249	52 702	147 491	25 003	48 202	141 150
65 to 69	25 023	41 693	105 491	20 821	37 568	104 657
All ages	32 176	59 524	170 703	27 974	54 102	157 705

4.3 Calculating contributions

Contributions to the Plan, for each age group of contributors and by sex, are the product of the following factors:

- population;
- Plan participation rate;
- average contributory earnings (average pensionable earnings less the basic exemption);
- the contribution rate of 9,9%, prescribed in the *Act respecting the Québec Pension Plan*.

The total amount of contributions is increased to take into account that some contributions are not refunded to employers. Such a situation occurs when a worker changes jobs, holds more than one job at the same time or where his or her total annual earnings are less than the basic exemption.

The assumption for the increase is based on data provided by Revenu Québec. The amount of the adjustment was 169 million \$ in 2010, that is 1,65% of collected contributions. This percentage is reduced thereafter to take into account the effect of the freeze of the basic exemption.

The projection of contributions was completed by a downward adjustment to take into account costs related to contribution accounts receivable. The amount subtracted from contributions is estimated to be 14 and 15 million \$ in 2010 and 2011, respectively. The amount changes thereafter according to the total contribution amount.

5. Plan benefits

This section describes the method and assumptions used to project benefits. Determining the sums needed to pay benefits in coming years required two steps. First, we had to determine the sums needed to pay pensions already being paid on the date of this report. Then, we had to determine the sums needed for pensions that will begin being paid after that date. Sums needed for new pensions were determined according to benefit eligibility rates as well as the incidence and amount of each benefit.

For the projection of cash outflows, the sums are determined on the accrual basis of accounting, that is, they are charged to the year in which they are due, whether or not they are paid during that year. Therefore, the sums determined in the actuarial analysis differ from accounting data included in financial statements, which are compiled according to the actual date the sums are paid.

The short-term results are in line with Plan results for recent years.

Table 32
Estimates of pensions payable as at 31 December 2009

BENEFIT TYPE	NUMBER OF BENEFICIARIES		AVERAGE MONTHLY BENEFIT	
	MEN	WOMEN	MEN	WOMEN
Retirement pension	663 662	683 916	\$ 569,81	\$ 329,44
Surviving spouse's pension ^a				
• Under age 65	18 964	61 565	578,36	650,47
• Age 65 and over	31 491	238 176	76,46	323,89
Disability pension	41 615	38 107	849,28	783,38
BENEFIT TYPE	NUMBER OF BENEFICIARIES		AVERAGE MONTHLY BENEFIT	
	MEN AND WOMEN		MEN AND WOMEN	
Orphan's pension	17 054		\$ 67,94	
Pension for disabled person's child	10 635		67,94	
Income security (welfare)	799		198,81	

a) The average monthly benefit takes into account combination with a retirement pension or a disability pension.

5.1 Projection of sums to pay pensions already being paid on the date of the report

For each benefit type payable as a pension, the number of beneficiaries and the average pension amount were determined at the valuation date, that is, 31 December 2009, by sex and by age group. To that data, obtained from Plan statistics, was added an estimate of the number of pensions payable at that date but whose payment had not yet begun (late applications or applications being processed and that will be granted retroactively).

Table 32 shows estimates of pensions payable as at 31 December 2009 by pension type and by sex.

The projection of pensions being paid at the valuation date was made by taking into account the survival probabilities of beneficiaries, pension indexation and adjustments to reflect certain provisions of the *Act*. For example, where the beneficiary of a surviving spouse's pension retires, his or her pension must be recalculated by taking into account the combination rules prescribed by law. The factors used to determine the payable portion of surviving spouse's pension were determined on the basis of Plan data.

5.2 Calculating sums for new pensions: eligibility rates and levels of payable pensions

To project new pensions, it is first necessary to determine the eligibility rate² for the various benefits and the level of pensions payable to each generation of eligible contributors. Pensions are calculated on the basis of the ratio, during the contributory period, of average pensionable earnings to the MPE. The projection model uses the concept of "potential pension as a percentage of the maximum" to designate the ratio of the average retirement pension of eligible persons to the maximum pension (or, for surviving spouse's pensions and disability pensions, the ratio of the average variable portion of the pension to the maximum variable portion).

The projection of eligibility rates and potential pensions as a percentage of the maximum involves two models. The first model makes it possible to determine with precision the eligibility rates and pension levels for the early years of the projection period. Eligibility and the potential pension are determined individually for each person in the Record of Contributors³ using the earnings recorded for each year and by applying the eligibility conditions for the various benefits and the pension formula. The results are aggregated to determine initial values for the eligibility rate and the potential pension, by age and by sex.

2. The eligibility rate is the ratio of the number of persons eligible for a benefit (in terms of required contributions) to the population.

3. The Record of Contributors contains information related to Plan participation since the beginning of the Plan.

Eligibility rates by age and sex are projected by taking into account the historical relationship that exists between the eligibility difference between a cohort of a given age and another cohort as well as the Plan participation rates. The difference in the potential pension between a cohort of a given age and another cohort is determined by taking into account both Plan participation rates and pensionable earnings levels.

This model is gradually being combined with a second model, which projects benefits over a longer term on the basis of the aggregate pensionable earnings of a given cohort. Career profiles (participation and average pensionable earnings) are also determined for the various cohorts of contributors. For the period from 1966 to 2008, participation rates and average pensionable earnings come from the Record of Contributors. For 2009 and the following years, they come from the projection of contributions (see section 4.1), to which some adjustments had to be made.

5.2.1 Adjustment to take into account the effects of partition

When a partition of earnings occurs, following the breakdown of a marriage, civil union or de facto (common law) union, the earnings entered in the Record of Contributors are changed. Adjustments made to earnings prior to this actuarial report are therefore integrated into the earnings history for the purpose of calculating benefits. However, the pensionable earnings projected to determine contributions do not take partition into account.

Thus, before being used for the long-term projection model, the participation rates must be adjusted. This involves changing the participation rates and the average pensionable earnings provided by the contribution calculation model so as to take into account the legislative provisions for

partition of pension credits between former spouses. Those provisions affect both the average pensionable earnings and the number of years of participation of each former spouse. The method used to value the effect of the partition of earnings was to adjust the participation rates and the average employment earnings of each generation on the basis of the data concerning partitions carried out between 2004 and 2007.

In the case of the short-term projection model described in the introduction to section 5.2 of this appendix, the effect of partition on eligibility and pension levels is measured in a precise way for partitions carried out from 2005 to 2008.

For both the short-term projection model and the long-term model, adjustments made to participation rates and earnings are weighted on the basis of the number of projected partitions. Table 33 shows changes in the number of partitions for some years in the projection period. This number changes as a function of the number of divorces and the partition renunciation rate. The number of divorces is influenced by the aging of the population.

A consequence of the partition of earnings is an increase in the eligibility rates and potential pensions of women but a decrease for men because women are more likely to obtain additional years of contribution as a result of partition.

Table 33
Changes in the number of partitions

YEAR	NUMBER OF PARTITIONS
2010	6 974
2011	6 993
2012	6 999
2013	7 003
2014	7 007
2015	7 017
2020	7 018
2025	6 982
2030	6 917
2035	6 889
2040	6 855
2045	6 788
2050	6 747
2055	6 755
2060	6 745

5.2.3 Adjustment to take into account earnings outside Québec

A final adjustment is required to take into account earnings recorded under the Canada Pension Plan for persons who have contributed to both the Québec Pension Plan and the Canada Pension Plan and who are likely to apply for a pension under the Québec Plan. That adjustment is determined by age group, for each sex.

Plan participation rates adjusted for the purpose of calculating benefits (in the long-term projection model) are shown in Table 34. Average pensionable earnings adjusted for the same purpose are shown in Table 35.

5.2.2 Adjustment to take into account periods of disability

Although beneficiaries of a disability pension do not contribute to the Plan, the absence of pensionable earnings does not have a negative effect on their eligibility for other benefits or on the amount of their pension. Thus, for the purposes of the long-term projection model, participation rates are adjusted to take into account the prevalence of disability in the population. Such an adjustment is not required in the short-term model because the projection factors already take into account the effect of that situation on eligibility and on the amount of the pension paid to disabled persons.

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Table 34
Plan participation rates after adjustment for the purpose of calculating benefits,
by age and by sex

AGE	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
	%	%	%	%	%	%
20 to 24	74	83	86	73	79	82
25 to 29	83	90	92	78	85	87
30 to 34	83	94	94	79	88	88
35 to 39	85	91	92	79	87	87
40 to 44	86	90	91	81	84	86
45 to 49	86	90	90	82	86	86
50 to 54	84	88	89	77	84	85
55 to 59	74	80	86	65	78	83
60 to 64	58	61	69	42	61	69
All ages	82	87	90	75	84	86

Table 35
Average pensionable earnings after adjustment for the purpose of calculating benefits,
by age and by sex

AGE	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
	\$	\$	\$	\$	\$	\$
20 to 24	19 991	36 793	106 716	16 910	31 707	91 857
25 to 29	29 847	55 671	162 922	26 633	50 322	146 382
30 to 34	33 967	63 698	187 209	29 651	56 814	166 283
35 to 39	35 387	66 695	196 381	31 679	61 127	179 377
40 to 44	36 111	68 456	201 825	32 458	63 615	187 313
45 to 49	36 892	69 988	206 402	32 674	65 323	193 735
50 to 54	37 223	70 645	208 037	32 484	64 794	194 299
55 to 59	35 304	65 431	189 700	30 169	59 524	177 948
60 to 64	31 249	55 045	154 974	25 990	50 154	147 424
All ages	33 786	63 098	184 144	29 494	57 663	169 969

5.2.4 Calculating eligibility rates

Eligibility rates were calculated for each of the years in the projection period, by sex and by age group and according to the conditions for granting each type of benefit.

Eligibility was calculated as a function of earnings during the contributory period. The period was adjusted to take into account certain provisions of the *Act*:

- Exclusion of the period during which a contributor received a disability pension;
- Exclusion of the period during which a beneficiary of family benefits had a dependent child under the age of 7 and during which earnings did not exceed the basic exemption;
- Subject to certain conditions, exclusion of the months during which an unreduced indemnity is paid by the Commission de la santé et de la sécurité du travail (CSST), if the period exceeds 24 months.

In the **short-term** projection model, eligibility rates are calculated using the Régie's administrative data for the period from 2000 to 2008. In particular, that data takes into account periods in which family benefits were received for children under the age of 7. This exercise was carried out to determine eligibility rates as at 31 December 2008 and projection factors for those rates by the age and sex of contributors. A projection of eligibility rates was made for each generation, by age and by sex.

In the **long-term** projection model, the proportion of eligible persons is determined as a function of average Plan participation rates for each cohort.

Career profiles are also drawn for each generation of contributors by assuming that a portion of each generation worked during its entire contributory period, that a second group had only one year of zero earnings, that a third group had two years of zero earnings, etc. Years of participation are thus determined for each career profile in a given generation. The eligibility rate for a given generation, for a given year, is obtained as a function of the proportion of career profiles that respect the Plan's eligibility conditions. This method requires us to adjust the career profiles of a given generation so as to accurately reflect the fact that a contributor may enter and leave the labour market several times.

Table 36 gives the eligibility rates for some benefit categories at age 60, by projection year and by sex. Age 60 was chosen because it represents, for the retirement pension, the starting age for the majority of beneficiaries. For the disability pension, it represents the age at which the eligibility conditions become less restrictive.

Eligibility rates for the retirement pension take into account applications filed outside Québec, which means that the levels for men can exceed 100%.

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Table 36
Eligibility rates for some benefit categories at age 60, by sex

YEAR	PROPORTION OF THE POPULATION ELIGIBLE FOR A RETIREMENT PENSION		PROPORTION OF THE POPULATION GIVING ELIGIBILITY FOR A DEATH BENEFIT	
	MEN	WOMEN	MEN	WOMEN
	%	%	%	%
2010	101,3	98,2	95,0	84,9
2011	100,0	98,0	95,0	85,6
2012	100,3	97,9	95,0	86,1
2013	98,2	97,5	95,0	86,3
2014	100,5	98,0	95,0	87,2
2015	98,8	98,1	95,0	88,0
2020	101,4	98,4	95,0	89,3
2025	100,0	98,9	92,4	89,0
2030	100,0	98,9	89,6	86,5
2035	99,9	99,0	88,8	85,5
2040	99,7	98,9	89,3	85,1
2045	100,5	99,1	90,3	84,7
2050	100,5	99,0	90,2	85,0
2055	100,5	99,3	91,8	87,1
2060	100,5	99,3	91,1	86,7

YEAR	PROPORTION OF THE POPULATION ELIGIBLE FOR A DISABILITY PENSION	
	MEN	WOMEN
	%	%
2010	90,0	75,4
2011	89,4	76,7
2012	89,6	77,3
2013	88,2	78,0
2014	90,3	79,6
2015	88,9	80,9
2020	88,9	84,7
2025	88,1	87,4
2030	88,5	88,1
2035	87,3	87,1
2040	87,6	85,0
2045	89,6	84,3
2050	89,6	84,8
2055	91,2	86,3
2060	90,7	85,9

5.2.5 Calculating potential pensions as a percentage of the maximum

Potential pensions are a function of the ratio of average pensionable earnings adjusted for benefit purposes to the MPE. Potential pensions are calculated according to sex and age, for each benefit category.

The method used is similar to that employed for calculating eligibility rates, except that it involves additional exclusions:

- Exclusion of the period during which a beneficiary of family benefits had a dependent child under the age of 7 and during which earnings were less than the average of the aggregate adjusted pensionable earnings;
- Exclusion of 15% of the number of months in which earnings were lowest. This exclusion cannot, however, result in reducing the participation period to less than 120 months.

Calculated on an individual basis, the potential pension is 100% for a worker whose earnings reach or exceed the MPE for every year in his or her contributory period.

In the **short-term** projection model, the potential pension as a percentage of the maximum is determined by using the Régie's administrative data for the period from 2000 to 2008 and its benefit calculation module. Similarly to the eligibility rate, the potential pension is projected for each generation by referring to the values observed at 31 December 2008 and to projection factors based on Plan experience.

In the theoretical **long-term** model, the average of the ratios of average pensionable earnings adjusted for the purposes of benefits to the MPE is calculated for different career profiles of a given generation.

That average is used to determine the benefit level of that generation.

For illustrative purposes, Table 37 shows the average retirement pension as a percentage of the maximum pension payable to new beneficiaries. It decreases for men until 2030 and then stabilizes at around 65%. Three factors explain the decrease:

- The average pensionable earnings are calculated for an increasingly longer period until 2013, which is the first year in which the population reaching age 65 will have had the possibility of always contributing to the plan since age 18.
- The maximum pensionable earnings (MPE) increased by 310% between 1976 and 1986. That resulted in a significant decrease in the ratio of average earnings to the MPE.
- The freeze on the basic exemption since 1998 results in a gradual increase in the number of contributors with very low earnings among future beneficiaries.

Table 37
Average retirement pension as a percentage of the maximum pension

YEAR	IN THE POPULATION REACHING AGE 60	
	MEN	WOMEN
	%	%
2010	72	52
2011	72	53
2012	72	53
2013	71	54
2014	71	55
2015	70	56
2020	66	56
2025	62	54
2030	60	54
2035	62	53
2040	63	55
2045	65	57
2050	65	57
2055	66	58
2060	65	58

Although these effects also apply to women, the ratio of their average retirement pension to the maximum pension increases during the projection period, reaching an upper limit of 58% in 2060. In fact, the large increase in their participation in the Plan and in their employment earnings has a greater influence than the phenomena previously mentioned.

In the case of the other benefits, potential pensions as a percentage of the maximum are generally higher because of more restrictive eligibility conditions.

5.3 Projection of new disability pensions

The sums initially allocated to new disability pensions for a given year are equal to the product of the following factors:

- the population of a given age group;
- that population's eligibility rate for a disability pension;
- the disability incidence rate⁴ in the eligible population;
- the average pension, made up of a fixed portion and a variable portion based on average pensionable earnings.

5.3.1 Number of new disability pension beneficiaries

The eligibility rate takes into account specific legislative provisions that apply as of age 60 and the fact that retirement pension beneficiaries are not entitled to a disability pension.

A study⁵ was carried out in 2006 by the Régie des rentes du Québec on historical changes in the disability pension. From 1994 to 2005, the disability incidence rates for persons under age 40 were relatively stable. For men aged 40 to 64, the data show a decline during that period varying from 18% to 30% according to age group. For women aged 40 to 59, the experience from 1994 to 2005 shows an increase in incidence rates varying from 5% to 25% according to age group.

4. By "disability incidence rate", we mean the proportion of eligible persons who become disabled in a given year. For the purposes of this report, the beginning of disability corresponds to the beginning of the period for which a monthly disability pension can be paid.

5. Régie des rentes du Québec, *Évolution de la clientèle de la rente d'invalidité de 1970 à 2003*.

For women aged 60 to 64, the incidence of disability has fluctuated greatly since 1994.

For projection purposes, incidence rates were determined on the basis of Plan statistics for the years 2004 to 2008, and include the application of a slight reduction of the rates for persons aged 60 in order to conform to the trend observed in recent years.

Since 1 January 1986, a disability pension under the Québec Pension Plan is no longer paid to persons who become beneficiaries of an unreduced salary replacement indemnity paid under the *Act respecting industrial accidents and occupational diseases*. The reduction in disability incidence rates that is attributable to that provision is taken into account in the method used to determine the rates described above.

Table 38 shows, for selected ages, the disability incidence rates used in this report. Table 39 shows the number of new beneficiaries of a disability pension.

Table 38
Disability incidence rates
(per thousand individuals)

AGE	MEN	WOMEN
22	0,37	0,13
27	0,39	0,21
32	0,49	0,41
37	0,68	0,80
42	0,96	1,19
47	1,75	2,12
52	3,42	3,54
57	5,52	5,30
60	29,80	27,30
61	16,96	12,89
62	13,04	10,64
63	10,77	9,84
64	11,55	8,03

5.3.2 Number of new disability pension beneficiaries

The disability pension includes a variable portion that is based on the contributor's average pensionable earnings and a fixed portion. The percentage used for the variable portion is calculated in the manner described in section 5.2 of this appendix and varies according to the contributor's age. The average monthly amount of new disability pensions is shown in Table 39.

The sums allocated to new pensions are projected for each year following the beginning of payment, taking into account the survival probabilities for disabled persons and pension indexation.

The cessation rate for disability pensions depends on the disabled person's probability of recovery and probability of death. It is based on Plan statistics for 2001 to 2007 and varies according to the beneficiary's age and the duration of the disability. However, as of the sixth year of disability, the rate varies only according to the beneficiary's age. Table 40 shows the cessation rate of disability pensions for selected ages.

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Table 39
Projection of new disability pensions

YEAR	NUMBER OF BENEFICIARIES			AVERAGE MONTHLY AMOUNT	
	MEN	WOMEN	TOTAL	MEN	WOMEN
				\$	\$
2010	5 971	5 185	11 156	875,49	800,76
2011	6 049	5 294	11 343	891,02	817,62
2012	6 114	5 388	11 502	907,42	835,53
2013	6 209	5 506	11 715	924,25	853,71
2014	6 318	5 624	11 942	942,21	872,87
2015	6 367	5 703	12 070	961,30	893,26
2020	6 480	5 893	12 373	1 083,55	1 017,27
2025	6 194	5 664	11 858	1 242,26	1 180,42
2030	5 860	5 433	11 293	1 442,21	1 385,29
2035	6 071	5 576	11 647	1 716,80	1 643,85
2040	6 388	5 761	12 149	2 036,35	1 942,88
2045	6 364	5 627	11 991	2 395,22	2 281,53
2050	6 378	5 681	12 059	2 804,79	2 668,04
2055	6 134	5 483	11 617	3 277,76	3 115,41
2060	5 868	5 275	11 143	3 832,37	3 645,12

Table 40
Cessation rates for disability pensions
(per thousand individuals)

MEN						
AGE WHEN PENSION BEGINS	1st YEAR	2nd YEAR	3rd YEAR	4th YEAR	5th YEAR	6th YEAR AND LATER
30	65	66	59	50	29	21
40	86	78	58	31	24	24
50	125	104	54	38	34	29
60	33	26	23	22	22	-
WOMEN						
AGE WHEN PENSION BEGINS	1st YEAR	2nd YEAR	3rd YEAR	4th YEAR	5th YEAR	6th YEAR AND LATER
30	55	64	44	35	55	21
40	78	77	47	32	22	17
50	108	83	49	32	27	18
60	18	18	13	13	11	-

5.4 Projection of new retirement pensions

The sums allocated for new retirement pensions are calculated on the basis of the number of new retirement pension beneficiaries in a given year and the average amount of their pensions.

5.4.1 Number of new retirement pension beneficiaries

The basic assumption for determining the number of new retirees during a given year is the retirement rate. That rate is determined by cohort for the ages from 60 to 70. For the purposes of this report, the retirement rate is not the probability that a person will retire at a given age. Instead, it represents the ratio between the number of persons who will become beneficiaries at a given age and the total number of eligible persons in the cohort.

The retirement rate was based on Plan experience from 1990 to 2009. A significant increase in the retirement rate for contributors aged 60 was observed up to 1997. In 1990, 37% of women and 28% of men began receiving a retirement pension at that age. Since 1997, the proportion for men has been relatively stable at 51%. For women, it rose to 63% dropping thereafter to 59% for 2007 to 2009.

The data for 1997 to 2009 also indicate a relative stability in the average age at which contributors begin receiving a retirement pension. For men, the age is 62 and for women, it is 61,6.

For men, the retirement rate for subsequent years is constant; for women ages 60 to 64, it depends on the level of economic activity over a 10-year period. Thereafter, the rate is kept at a constant level for the remainder of the projection period. Table 41 shows the retirement rates for cohorts reaching age 60 in 2010 and in 2060. This change in retirement rates for women means that the average age at which payment of a retirement pension begins increases to one month later by 2019 and remains stable thereafter.

The number of new retirement pension beneficiaries for each cohort was determined using the retirement rate obtained as indicated above and on the basis of the following factors:

- total population;
- eligibility rate of that population for a retirement pension;
- number of disability pension beneficiaries who will reach age 65.

Table 41
Retirement rates

AGE	RETIREMENT RATE AT THE INDICATED AGE FOR A COHORT REACHING AGE 60 IN 2010		RETIREMENT RATE AT THE INDICATED AGE FOR A COHORT REACHING AGE 60 IN 2060	
	MEN	WOMEN	MEN	WOMEN
	%	%	%	%
60	50,6	58,7	50,6	56,0
61	7,1	6,2	7,1	6,3
62	5,0	4,2	5,0	4,4
63	3,8	3,2	3,8	3,5
64	3,4	3,0	3,4	3,6
65	27,8	22,4	27,8	24,0
66	1,0	0,6	1,0	0,6
67	0,4	0,3	0,4	0,3
68	0,2	0,2	0,2	0,2
69	0,2	0,1	0,2	0,1
70	0,6	1,0	0,6	1,0
Total	100,0	100,0	100,0	100,0

5.4.2 Average pension of new retirement pension beneficiaries

The average retirement pension of new beneficiaries at a given age is the result of the following factors:

- 25% of the average MPE for the year of retirement and the four preceding years;
- the ratio of the average pension to the maximum pension, which depends on the ratio of the average pensionable earnings to the MPE during the contributory period;
- the actuarial adjustment factor applicable at the age in question, that is, a decrease or increase of 0,5% a month where a person applies for a pension before or after age 65.

Disability pension beneficiaries who were declared to be disabled after 1998 and who reach age 65 receive a retirement pension that is reduced by an adjustment factor of 0,5% a month where a disability pension was paid between ages 60 and 65. The retirement pension of those beneficiaries was adjusted accordingly.

Table 42 projects the number of new retirement pension beneficiaries for selected years as well as the average monthly pension received by the new retirees.

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Table 42
Projection of new retirement pensions

YEAR	NUMBER OF NEW BENEFICIARIES			AVERAGE MONTHLY AMOUNT	
	MEN	WOMEN	TOTAL	MEN	WOMEN
				\$	\$
2010	48 480	48 897	97 377	537,76	358,82
2011	49 196	50 135	99 331	556,57	385,53
2012	50 378	51 335	101 713	565,05	406,39
2013	51 671	52 774	104 445	578,31	420,55
2014	53 754	54 821	108 575	585,41	436,22
2015	54 333	55 636	109 969	599,09	450,94
2020	60 443	60 331	120 774	657,29	537,55
2025	60 693	58 979	119 672	751,72	639,22
2030	53 778	51 492	105 270	864,08	756,66
2035	52 717	50 510	103 227	1 022,94	888,76
2040	57 755	55 969	113 724	1 268,60	1 092,47
2045	58 820	56 959	115 779	1 562,01	1 364,58
2050	59 359	58 595	117 954	1 893,28	1 654,83
2055	57 671	57 158	114 829	2 312,95	2 020,60
2060	52 166	51 525	103 691	2 775,97	2 425,09

The sums allocated to new pensions are projected for each year that follows the beginning of payment, taking into account the survival probabilities for the beneficiaries, the indexation of pensions, the probability that a pension will be increased following new contributions by the beneficiary and the rate of such increases.

The data on the survival of Plan beneficiaries show that retirement pension beneficiaries have a lower mortality rate than the rate for the overall population, except for men aged 72 and over, whose rate is about the same.

The survival probabilities for retirement pension beneficiaries were determined by starting from the probabilities for the overall population. However, they were adjusted upwards in accordance with Plan data.

The effect of these adjustments decreases over time, as the number of persons entitled to a retirement pension increases with respect to the population.

Table 43 shows mortality rates for retirement pension beneficiaries, by age and by sex, for 2010, 2030 and 2060. The life expectancy for the same beneficiaries at selected ages, by sex, is shown in Table 44 for the same years. Life expectancy is determined without taking into account the reductions in mortality that are projected for years following the indicated year.

Table 43
Mortality rates for retirement pension beneficiaries
(by thousand individuals)

AGE	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
60	6,3	4,3	3,4	3,7	2,8	2,4
65	12,0	8,4	6,7	7,2	5,7	4,9
70	20,3	14,3	11,5	11,9	9,6	8,3
75	33,4	24,3	20,0	20,1	16,0	14,0
80	55,9	43,1	36,6	35,4	28,2	24,7
90	154,7	130,1	116,8	114,5	95,8	86,4
100	337,5	305,3	286,7	292,5	273,9	264,2

Table 44
Life expectancy for retirement pension beneficiaries

AGE	MEN			WOMEN		
	2010	2030	2060	2010	2030	2060
60	22,7	25,0	26,3	26,3	28,0	28,9
65	18,6	20,6	21,9	21,9	23,5	24,3
70	14,8	16,6	17,7	17,8	19,2	20,0
75	11,5	12,9	13,8	14,0	15,2	15,9
80	8,6	9,7	10,4	10,5	11,6	12,2
90	4,4	4,9	5,2	5,3	5,8	6,1
100	2,2	2,4	2,5	2,5	2,7	2,7

5.5 Projection of death benefits

The calculation of sums allocated to death benefits was made by taking the following factors into consideration:

- the number of deaths in the population;
- the eligibility rate of that population for a death benefit;
- the amount of the death benefit, which is set at 2 500 \$.

The number of beneficiaries of the death benefit is equal to the product of the first two factors. Table 45 shows the results for the projection of that number, by sex of the deceased contributor.

Table 45
Projection of death benefits, by sex of the deceased contributor

YEAR	NUMBER OF BENEFICIARIES		
	MEN	WOMEN	TOTAL
2010	26 493	15 070	41 563
2011	26 919	15 626	42 545
2012	27 380	16 204	43 584
2013	27 869	16 796	44 665
2014	28 377	17 401	45 778
2015	28 916	18 034	46 950
2020	31 994	21 534	53 528
2025	35 873	25 728	61 601
2030	40 706	30 818	71 524
2035	45 774	36 727	82 501
2040	49 952	42 747	92 699
2045	52 543	47 547	100 090
2050	53 281	50 071	103 352
2055	52 406	50 145	102 551
2060	50 995	48 546	99 541

5.6 Projection of new surviving spouse's pensions

Sums allocated to new surviving spouse's pensions for a given year were calculated on the basis of the number of new beneficiaries of the surviving spouse's pension and the average amount of their pension.

5.6.1 Number of new surviving spouses

The number of new surviving spouse's pensions in a given year is equal to the product of the following factors:

- the number of beneficiaries of the death benefit in the same year, given that the eligibility conditions for the death benefit (in terms of required contributions) are the same as the conditions for the surviving spouse's pension;
- the proportion of contributors having an eligible spouse at the time of death (see Table 46).

Data on that proportion were taken from the Plan's statistics for 2007 to 2009. That proportion takes into account both married people and people living in a de facto (common law) relationship (including same-sex couples).

We anticipate that an eventual decrease in the proportion of legally married people will be compensated by an increase in the number of de facto unions, which should result in a certain stability of the proportion of persons living as couples.

However, because of the increase in life expectancy, this proportion increases slightly for men, as of age 70, and for women, as of age 55.

Table 46 gives a sample of these proportions for the first and fiftieth years of projection.

The proportions for the intervening years are determined by interpolation.

Table 46
Proportion of contributors having an eligible spouse at the time of death

AGE	MEN		WOMEN	
	2010	2059	2010	2059
	%	%	%	%
22	4,6	4,6	3,0	3,0
32	32,0	32,0	43,3	43,3
42	41,9	41,9	57,0	57,0
52	50,7	50,7	59,9	59,9
62	61,4	61,4	52,8	55,0
67	64,1	64,1	47,4	50,8
72	67,0	67,3	41,6	45,7
77	66,1	67,6	32,0	36,1
82	62,0	64,5	21,6	25,9
87	54,7	57,9	10,4	12,5
92	42,9	45,9	3,7	4,5

5.6.2 Average pension of new surviving spouses

A surviving spouse's pension includes a variable portion, determined according to the deceased contributor's average pensionable earnings, and a fixed portion, if the new beneficiary is under age 65. The percentage applicable to the variable portion was determined as described in section 5.2 of this appendix and varies according to the deceased contributor's age. A percentage is assigned to new surviving spouses according to the distribution by age.

For new beneficiaries aged 60 and over, the amount of a surviving spouse's pension is calculated differently, depending on whether the survivor is or is not receiving a retirement pension. The sums allocated to new surviving spouse's pensions depend on the following factors:

- the proportion of surviving spouses who are beneficiaries of a retirement pension;
- the amount of the retirement pensions of surviving spouses, the amount of the retirement pensions of deceased contributors and the maximum amount of the retirement pension for a given year.

Some adjustments were made to reflect the fact that contributors who die have, at certain ages, a profile different than the profile of the average eligible contributor. Another adjustment was made to the amount of new pensions in order to take into account situations where the contributor and beneficiary are the same sex.

Table 47 shows the results of projections related to new surviving spouse's pensions. As is the case of the death benefit, the significant increase in the number of new beneficiaries between 2010 and 2060 is mainly because there will be an increase in the population aged 65 and over.

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Sums allocated to new pensions are projected for each year following the beginning of payment, taking into account the survival probabilities of beneficiaries, pension indexation, adjustment of the amount of the fixed portion and the fact that pension amounts are recalculated when a beneficiary reaches age 65 or retires.

The survival probabilities for beneficiaries of a surviving spouse's pension are based on the survival probabilities of the population. Plan data on the survival of beneficiaries show that beneficiaries of this type of pension have a mortality rate that is higher than the rate of the general population. Thus, the mortality rates for the population are adjusted upwards to arrive at the mortality rates of beneficiaries.

Table 47
Projection of new surviving spouse's pensions

YEAR	NUMBER OF BENEFICIARIES			AVERAGE MONTHLY AMOUNT	
	AGED 65 AND UNDER	AGED 65 AND OVER	TOTAL	BENEFICIARIES AGED 65 AND UNDER	BENEFICIARIES AGED 65 AND OVER
				\$	\$
2010	6 566	13 382	19 948	620,96	301,72
2011	6 557	13 744	20 301	631,77	305,65
2012	6 541	14 131	20 672	644,09	308,46
2013	6 524	14 539	21 063	656,65	311,61
2014	6 499	14 959	21 458	670,29	315,33
2015	6 472	15 399	21 871	685,15	319,95
2020	6 279	17 938	24 217	777,03	355,48
2025	6 015	21 048	27 063	892,57	408,32
2030	5 730	24 583	30 313	1 030,70	476,81
2035	5 514	27 765	33 279	1 196,74	567,97
2040	5 405	29 853	35 258	1 389,98	679,05
2045	5 291	30 732	36 023	1 613,17	809,92
2050	5 137	30 513	35 650	1 870,82	964,14
2055	4 965	29 703	34 668	2 167,93	1 141,88
2060	4 783	29 181	33 964	2 516,06	1 366,94

5.7 Projections of new orphan's pensions and pensions for children of disabled persons

The sums allocated for orphan's pensions and pensions for children of disabled persons were determined on the basis of the number of new beneficiaries and the amount of the benefit. In 2010, the benefit is 68,22 \$; it is indexed annually.

The number of new beneficiaries of the orphan's pension and the pension for children of a disabled person (see Table 48) was determined on the basis of the following factors:

- the number of new beneficiaries of a surviving spouse's pension under age 65 and the number of new disability pension beneficiaries;
- the average number of children per surviving spouse and disabled person.

For the first year in the projection period, the average number of children was determined on the basis of Plan statistics. For subsequent years, the average is projected in accordance with the changes expected in the total fertility rate.

The number of new beneficiaries was distributed by age, according to Plan statistics, and then projected on the basis of a unisex mortality table based on survival of the population. Pensions for children of disabled persons are terminated when the beneficiary reaches age 18.

Furthermore, in the case of pensions for children of disabled persons, the probabilities of cessation of the disability pension determined for each age group are taken into account.

Table 48
Projection of the number of new beneficiaries of orphan's pensions and pensions for children of disabled contributors

YEAR	ORPHAN'S	DISABLED PERSON'S CHILD
2010	2 677	2 071
2011	2 659	2 110
2012	2 576	2 094
2013	2 528	2 106
2014	2 481	2 133
2015	2 439	2 160
2020	2 251	2 261
2025	2 121	2 333
2030	2 035	2 355
2035	1 970	2 341
2040	1 902	2 304
2045	1 836	2 248
2050	1 777	2 254
2055	1 738	2 271
2060	1 700	2 280

5.8 Projection of reimbursements to social assistance

The Régie des rentes du Québec makes reimbursements to the Ministère de l'Emploi et de la Solidarité Sociale (MESS) for beneficiaries of income security benefits (welfare). This is a closed group of people under age 65 who were receiving income security benefits on 31 December 1971 and who were either disabled or surviving spouses within the meaning of the Plan and did not necessarily meet all of the eligibility requirements.

The amount of the benefit reimbursed was equal to half of the benefit determined in accordance with Plan provisions that were in force at the time, up to a maximum equal to half of the income security benefit.

The number of beneficiaries and their distribution by benefit level were determined on the basis of statistics provided by the MESS. Their projection by cohort takes into account the survival probability and the indexation of pensions used to value the Québec Pension Plan.

Reimbursements total 1.8 million \$ in 2010, and covered 700 beneficiaries. It is expected that 2017 will be the last year in which social assistance beneficiaries will fall under this provision of the *Act*.

6. Administration costs

Administration costs fall into 2 categories: the Régie's expenses for administering the Plan and fees for the collection of contributions by Revenu Québec.

The Régie's administration costs are estimated to be 95 million \$ for 2010. Thereafter, changes are based on wage increases and the inflation rate.

The fees for the collection of contributions are set under an agreement with Revenu Québec. They were estimated to be 19 million \$ in 2010 and change thereafter according to inflation, as provided for in the agreement.

Administration and collection costs represent 1.1% of the Plan's cash outflows in 2010 and 0.6% in 2060.

7. Plan reserve

The reserve is the Plan's net assets, to which some adjustments have been made. At the end of each year in the projection period, the amount of the reserve was determined at its fair value and calculated in the following way: investment income and contributions are added to the amount of the reserve at the end of the preceding year, and then benefits and administration costs are subtracted. The amount of benefits is determined by taking into account the administrative agreement between the Québec Pension Plan and the Canada Pension Plan for beneficiaries who contributed to both plans. The two plans compensate one another based on the participation of a beneficiary in each plan so that only one plan will pay a benefit. The plan that pays is determined by the beneficiary's place of residence when an application for benefits is filed.

7.1 Initial reserve

The initial Plan reserve as at 31 December 2009 was determined on the basis of the fair value of the Québec Pension Plan fund managed by the Caisse de dépôt et placement du Québec. That value mainly comprises participation deposit units. Table 49 shows the reconciliation used to determine the initial amount of the reserve.

The accounting method used for the Plan is similar to the cash basis of accounting, that is, cash inflows and outflows are not taken into account until they occur. However, the Plan's actuarial reports are made on the accrual basis of accounting and benefits are disbursed when they are encumbered and contributions and investment income are entered in the year in which they become due.

7.2 Investment income

The projection of investment income is carried out by using the rate of return after deduction of investment management fees, as described in section 3.4 of this appendix. That rate is applied to the Plan reserve and to the cash inflows and outflows for each of the years in the projection period by taking into account their monthly distribution. The investment income thus calculated includes both the income paid to the Régie by the Caisse de dépôt et placement du Québec and the change in the fair value of the reserve's investments.

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Table 49
Plan reserve as at 31 December 2009
(in millions of \$)

Plan assets in the Caisse de dépôt et placement du Québec as at 31 December 2009 (including receivable investment income)	28 633,8
PLUS:	
Contributions due before 2010 but collected after 2009	1 143,6
LESS:	
Benefits owing before 2010, but paid after 2009	120,7
Sums owing to the Canada Pension Plan	75,8
Plan reserve as at 31 December 2009	29 580,9

Appendix

IV

**Projection of the
reserve based on the
steady-state
contribution rate**

1. Introduction

This appendix shows changes in the Plan's reserve based on the contribution rate that corresponds to the steady-state contribution rate, as defined in section 2 of the actuarial report. This projection is presented for information purposes only, since the contribution rate is fixed at 9,9% under the *Act respecting the Québec Pension Plan*, and is a complement to information given in section 5.4.1 of the report.

2. Projection of the reserve based on the steady-state contribution rate

In this appendix, the projections of the actuarial analysis have been adjusted to simulate a change in which the contribution rate is set at 11,02% as of 2012. Tables 50 and 51 show respectively, in current dollars and 2010 constant dollars, the Plan's cash inflows and outflows and the reserve for the period 2010 to 2060, based on this simulation.

Compared with projections of the analysis based on the statutory contribution rate of 9,9%, the projected steady-state rate contributions are much higher, as is investment income, and the reserve is consequently larger. The results, however, show no change to cash outflows.

Applying the steady-state contribution rate would make it possible to stabilize, between 2040 and 2060, the ratio of the reserve to annual cash outflows at 3,7.

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Table 50
Projection of the reserve (contribution rate of 11,02% as of 2012)
(in millions of current dollars)

YEAR	CASH INFLOWS			CASH OUTFLOWS			RESERVE		
	CONTRI- BUTIONS	INVEST- MENT INCOME	TOTAL	BENEFITS	ADMINIS- TRATION COSTS	TOTAL	AS AT 31 DECEM- BER	IN PROPORTION TO CASH OUTFLOWS FOR THE FOLLOWING YEAR	PAY-AS- YOU-GO CONTRIBU- TION RATE
	\$	\$	\$	\$	\$	\$	\$		%
2010	10 446	1 751	12 197	10 062	113	10 176	31 602	3,0	9,6
2011	10 870	1 995	12 864	10 566	116	10 682	33 785	3,0	9,7
2012	12 567	2 198	14 765	11 152	119	11 271	37 279	3,1	9,9
2013	13 067	2 456	15 523	11 773	122	11 894	40 908	3,3	10,0
2014	13 601	2 728	16 329	12 459	125	12 584	44 653	3,4	10,2
2015	14 154	3 015	17 169	13 193	128	13 321	48 500	3,4	10,4
2016	14 712	3 315	18 026	13 962	132	14 094	52 432	3,5	10,5
2017	15 310	3 575	18 885	14 783	136	14 919	56 399	3,6	10,7
2018	15 897	3 836	19 733	15 640	140	15 780	60 352	3,6	10,9
2019	16 532	4 096	20 628	16 534	145	16 679	64 301	3,6	11,1
2020	17 165	4 413	21 578	17 469	149	17 618	68 261	3,7	11,3
2021	17 818	4 737	22 555	18 430	154	18 584	72 232	3,7	11,5
2025	20 669	5 836	26 505	22 613	174	22 787	87 639	3,7	12,1
2030	24 997	7 101	32 099	28 049	203	28 252	106 265	3,6	12,4
2035	30 579	8 608	39 187	33 810	237	34 047	129 065	3,7	12,2
2040	37 308	10 630	47 938	40 946	277	41 223	159 589	3,7	12,2
2045	45 082	13 139	58 221	49 913	323	50 236	197 089	3,8	12,3
2050	54 080	16 080	70 160	60 571	377	60 949	240 893	3,8	12,4
2055	64 769	19 351	84 120	73 674	441	74 115	289 306	3,8	12,6
2060	77 960	23 010	100 970	88 580	515	89 095	343 991	3,7	12,6

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Table 51
Projection of the reserve (contribution rate of 11,02% as of 2012)
(in millions of constant dollars)

YEAR	CASH INFLOWS			CASH OUTFLOWS			RESERVE ^a	PAY-AS-YOU-GO CONTRIBUTION RATE
	CONTRIBUTIONS	INVESTMENT INCOME	TOTAL	BENEFITS	ADMINISTRATION COSTS	TOTAL		
	\$	\$	\$	\$	\$	\$	\$	%
2010	10 446	1 751	12 197	10 062	113	10 176	31 602	9,6
2011	10 709	1 965	12 674	10 410	114	10 524	33 286	9,7
2012	12 138	2 123	14 261	10 772	115	10 887	36 008	9,9
2013	12 374	2 326	14 700	11 148	115	11 264	38 738	10,0
2014	12 603	2 528	15 131	11 545	116	11 660	41 374	10,2
2015	12 820	2 731	15 550	11 949	116	12 065	43 929	10,4
2016	13 013	2 932	15 944	12 350	117	12 467	46 377	10,5
2017	13 212	3 085	16 297	12 757	117	12 874	48 669	10,7
2018	13 384	3 229	16 613	13 167	118	13 285	50 810	10,9
2019	13 579	3 365	16 943	13 581	119	13 700	52 814	11,1
2020	13 755	3 536	17 291	13 998	120	14 118	54 699	11,3
2021	13 930	3 703	17 633	14 409	120	14 529	56 470	11,5
2025	14 639	4 134	18 772	16 016	123	16 139	62 071	12,1
2030	15 648	4 445	20 094	17 559	127	17 686	66 521	12,4
2035	16 919	4 763	21 682	18 707	131	18 838	71 411	12,2
2040	18 245	5 198	23 443	20 024	135	20 159	78 044	12,2
2045	19 486	5 679	25 165	21 574	140	21 714	85 188	12,3
2050	20 660	6 143	26 803	23 140	144	23 284	92 028	12,4
2055	21 870	6 534	28 404	24 877	149	25 025	97 686	12,6
2060	23 266	6 867	30 133	26 436	154	26 590	102 661	12,6

a) After conversion into constant dollars, the reserve for a given year is no longer exactly equal to the reserve from the previous year, to which is added the net total of cash inflows and outflows for the current year.

Appendix



Sensitivity tests on the results

1. Introduction

Since all projections have a degree of uncertainty, sensitivity tests were conducted on the results. Those tests were used to measure the changes in the results that would occur if changes in an assumption were different than that made in the report. The tests were limited to the main demographic and economic variables.

Eight assumptions were the object of sensitivity tests. Three tests pertain to demographic assumptions, that is, fertility, net migration and mortality reduction over time. Five tests pertain to economic assumptions, namely, activity rate, employment, inflation rate, real rate of increase in average employment earnings and real rate of return on investments.

Two tests were conducted for each assumption. The first evaluated the effect on the results of changes less favourable for the Plan than those used in the actuarial report and the second evaluated the effect of more favourable changes. The variations in assumptions tested represent a difference considered to be significant with respect to the assumptions made in the actuarial report without, however, being the upper and lower limits of a probable interval of change for each variable.

For each test, two indicators are given. A comparison between the value of these two indicators during tests and in the actuarial report indicates to what degree the results are sensitive to each change of assumption. These indicators are as follows:

- the **ratio of the Plan reserve to the cash outflows for the following year**. As with the actuarial report, changes in the ratio during the projection period were determined on the basis of the provisions for benefits and the contribution rate of 9,9% provided for in the *Act*;
- the **steady-state contribution rate**, that is, the rate¹ that would enable the ratio of the reserve to cash outflows from 2040 to 2060 to remain constant.

A less favourable change in an assumption (test I) gives a weaker ratio of the Plan reserve to cash outflows for the following year than the one in the report and consequently, an increase of the steady-state contribution rate. A more favourable change (test II) has the opposite effect.

The difference between the steady-state contribution rate of a particular test and the rate of 11,02% for the actuarial report represents an estimate of the adjustment to the contribution rate that would be required to compensate for the effect caused by the change of assumption.

The sensitivity tests are carried out on the largest of the assumptions in the actuarial valuation. While the scenarios used for the tests are reasonable, they are hypothetical and used for illustrative purposes. They are not based on the probability of the occurrence of any particular event and do not take into account interrelations between the different variables. For example, the result of increased growth of the available workforce could be decreased pay raises. Consequently, the effect observed in one test cannot be combined with the effect of one or several other tests. Moreover, the results of the

1. For the purposes of this analysis, the steady-state contribution rate was applied as of January 2012.

sensitivity tests cannot be extrapolated, since the effect on the results of the actuarial report is not necessarily linear.

Two synoptic tables are found at the end of this appendix. Table 60 shows, for each assumption, the changes of assumptions used to test the sensitivity of the results. Table 61 shows the steady-state contribution rate that would result in maintaining a constant reserve to cash outflows ratio between 2040 and 2060 for each of the different sensitivity tests.

2. Sensitivity tests on the results of changes in the demographic assumptions

2.1 Fertility

In this report, the total fertility rate is 1,65 children per woman in 2018 and remains constant throughout the entire projection period.

A variation in the fertility rate and, consequently, in the number of births, results in a change in the number of new Plan contributors around 20 years later. Thus, the effect of a variation in fertility on the reserve can be observed only in the long term.

In the first test, the rate is lower than in the report. It decreases progressively, reaching 1,5 in 2018 and remains constant thereafter. In the second test, it increases gradually, reaching 1,85 in 2018 and remains constant thereafter. Compared with the report, the number of births declines (test I) or increases (test II) and in both cases the trend grows until 2018. From that date until 2035, the variation decreases by 8 000 births per year in the first test and increases by 10 000 births per year in the second test. The effect of the change in births on the number of new contributors is felt around 20 years later.

In 2060, the cumulative effect of the fertility rate results in a reduction of 4,5% in the number of contributors in the first test and an increase of 6,1% in the second.

Changes in the reserve for each test, shown as the ratio of the Plan reserve to cash outflows for the following year, are shown in Table 52. In the first test, the ratio is 1,4 in 2030 and the reserve is completely depleted in 2038. In the second test, the ratio is also 1,4 in 2030 and the reserve is completely depleted in 2039.

In the test in which fertility is lowest, the steady-state contribution rate is 11,15%, representing a 0,13 increase over the rate of 11,02% in the report. In the test in which fertility is the highest, the contribution rate would be 10,85%.

Table 52
Sensitivity tests: fertility

RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR			
YEAR	TEST I (lower fertility)	REPORT	TEST II (higher fertility)
2020	2,7	2,7	2,7
2030	1,4	1,4	1,4
2040	-	-	-
2050	-	-	-

2.2 Net migration

In the report, there is an assumption for in-migration and out-migration for each calendar year. Net migration is stable throughout the projection period, at 31 500 people. The first consequence for the Plan of a change in net migration is a change in the number of new contributors. Over a longer term, the number of beneficiaries also changes.

In the first test, net migration declines progressively, reaching 20 000 people as of 2014 and remains at this level thereafter. In the second test, net migration is gradually increased to 43 000 people in 2014 and remains constant thereafter. According to the first sensitivity test, the population declines by 8,7% in 2060, compared with the report. In the second test, the population increases by 8,6%. The number of contributors decreases by 10,1% in 2060 in the first test, but increases by 10,0% in the second.

The effect of these tests on the reserve, expressed as the ratio of the reserve to cash outflows for the following year, is shown in Table 53. In the first test, the ratio is 1,0 in 2030 and the reserve is nil in 2035. On the other hand, for a growing population, as assumed in the second test, the ratio of the reserve to cash outflows for the following year increases by 1,7 in 2030 and the reserve is completely depleted in 2044 (compared with 2039 in the report).

In the test in which net migration is lowest, the steady-state contribution rate is 11,40%, which would be an increase of 0,38 compared with the rate of 11,02% in the report. For the test with the higher net migration, the rate would be 10,68%, a drop of 0,34.

Table 53
Sensitivity tests: net migration

YEAR	RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR		
	TEST I (lower net migration)	REPORT	TEST II (higher net migration)
2020	2,6	2,7	2,8
2030	1,0	1,4	1,7
2040	-	-	0,5
2050	-	-	-

2.3 Mortality reduction

The report was based on assumptions for mortality reductions for each age and calendar year. The mortality reduction results in an increase in life expectancy at age 65 for men, rising from 18,5 years in 2010 to 21,8 years in 2060 and for women, from 21,6 years to 24,2 years over the same period.

The sensitivity tests used variations in the level of mortality reduction during the projection period. A mortality reduction that is greater than the reduction used in the report results in increased life expectancy. Since that means that benefit payments would be made over a longer period, the aggregate benefit amount would increase. Similarly, a smaller reduction would reduce the aggregate benefit amount.

The first test assumes an increase in life expectancy compared with the report. Life expectancy at age 65 would thus be 23,3 years for men and 25,7 years for women in 2060. That represents an increase of 1,5 years for each sex compared with the report. The second test assumes a shorter life expectancy, that is, 20,4 years for men and 22,7 years for women in 2060. That represents a reduction of 1,5 years for each sex compared with the report.

In the first test, benefits increase by 4,8% in 2060. In the second, they decrease by 5,0%.

The effects of these tests on the reserve, expressed as the ratio of the reserve to cash outflows for the following year, is shown in Table 54. In the first test, the ratio is 1,2 in 2030 and the reserve becomes nil in 2037. In the second test, the ratio is 1,6 in 2030 and the reserve becomes nil in 2042.

The steady-state contribution rate is 11,29% for the greater mortality reduction test (test I), which represents a 0,27 increase over the rate of 11,02% in the report. For the smaller mortality reduction test (test II), the rate is 10,73%, a decrease of 0,29.

Table 54
Sensitivity tests: mortality reduction

YEAR	RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR		
	TEST I (longer life expectancy)	REPORT	TEST II (shorter life expectancy)
2020	2,7	2,7	2,7
2030	1,2	1,4	1,6
2040	-	-	0,2
2050	-	-	-

3. Sensitivity tests on the results due to changes in the economic assumptions

3.1 Activity rates

In terms of activity, the actuarial report projects:

- a slight decline in activity rates until 2015 for people in the 15 to 24 age group, which are expected to stabilize thereafter;
- in general, a gradual increase in the activity rates of people in the 25 to 64 age group. This increase ends at different times, depending on the age group:
 - for the population aged 25 to 34, women aged 40 to 44, and people aged 45 to 49, the increase ends in 2015;
 - for people aged 35 to 39 and men aged 40 to 44, the rates level off as of 2010;
 - for the population aged 50 to 54, the projected increase ends in 2020;
 - for people aged 55 to 64, the rate increases steadily until the end of the projection period, in 2060;
- stable activity rates for men 65 years of age and over throughout the projection period; for women in the same age group, a continual increase in rates is projected until 2060.

Despite an increase in activity rates based on age group and sex, the overall activity rate, namely the rate for the population aged 15 and over, declines between 2010 and 2060 due to an aging population. From 65,3% in 2010, the overall activity rate declines to 59,6% in 2030 and to 58,1% in 2060.

In the first test, activity is reduced. All activity rates by age group were lowered by 2% compared with the actual report, and this, for the entire projection horizon. The same is therefore true for the overall activity rate.

The second test assumes a higher rate of activity than in the report. The activity rates by age group were increased by 2% compared with the report, and this, for the entire projection horizon. The overall activity rate is therefore 61,6% in 2030 and 60,1% in 2060.

A downward change in labour market participation (test I) affects employment because the minimum rate of unemployment projected for the entire projection period (6%) remains unchanged from the report. This decrease results in a reduction of the number of Plan contributors and of the aggregate amount of benefits over the longer term. An upward change in activity on the labour market (test II) has the opposite effect.

The effects of these tests on the reserve, expressed as the ratio of the reserve to cash outflows for the following year, is shown in Table 55. In the first test, where activity on the labour market is lower, the ratio is 0,7 in 2030, that is, a decrease of 0,7 compared with the report, and the reserve becomes nil in 2034. In the test where activity is higher, the ratio is 2,0 in 2030 and the reserve becomes nil in 2046.

The steady-state contribution rate is 11,31% in the first test, representing a 0,29 increase compared with the rate in the report. In the second test, it drops by 0,27 reaching 10,75%.

Table 55
Sensitivity tests: activity rates

RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR			
YEAR	TEST I (lower activity)	REPORT	TEST II (higher activity)
2020	2,4	2,7	3,0
2030	0,7	1,4	2,0
2040	-	-	0,8
2050	-	-	-

3.2 Employment

According to the actuarial report, employment will grow at an average rate of 0,7% from 2010 to 2017. The unemployment rate will drop gradually from 8,5% in 2009, reaching its lower limit of 6,0% in 2019. As of 2019, employment will change at the same rate as the active population since the minimum unemployment rate will have been reached. The level of employment will be higher in 2060 than in 2009, increasing to 241 000 jobs.

In the sensitivity tests on employment changes, activity rates remain the same as in the report. However, the unemployment rate is changed so the tests will have the desired employment changes. A downward change in employment has the main effect of reducing the number of contributors to the Plan as well as the aggregate amount of benefits, once these people reach retirement. An upward change in employment has the opposite effect.

In the first test, the unemployment rate is higher than in the report and results in less favourable changes in employment levels. The minimum rate of unemployment of 8% is reached in 2020. From 2010 to 2017, employment increases by 0,4% on average. From 2018 to 2020, the level of employment will be relatively stable. Thereafter, employment varies at the same pace as in the report. This can be explained by the fact

that the changes in the economically active population are identical to the changes in the report, and that during the last four decades of the projection period, the unemployment rate is stable in the test and in the report. In the test, there are 154 000 more jobs in 2060 than in 2009. In the actuarial analysis, however, the projected increase between 2009 and 2060 is 241 000.

In the test with employment higher than in the report, the decline in unemployment is greater. The unemployment rate reaches a lower limit of 4,0% in 2020. Employment increases somewhat more rapidly than in the report during the first decade, at an average annual rate of 0,7% from 2010 to 2020. Thereafter, employment decreases at the same pace as in the report for the same reasons given for the less favourable test. In this test, there are 328 000 more jobs in 2060 than in 2009.

The effect of these tests is shown in Table 56. In the first test (lower employment), the ratio of the reserve to cash outflows for the following year reaches 1,0 in 2030 and the reserve is completely depleted in 2036. In the second test (higher employment), the ratio reaches 1,7 in 2030 and the reserve is completely depleted in 2042.

The steady-state contribution rate is 11,20% in the first test and 10,86% in the second, which represents, respectively, an increase of 0,18 and a decrease of 0,16 compared with the report's rate of 11,02%.

Table 56
Sensitivity tests: employment

YEAR	RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR		
	TEST I (lower employment)	REPORT	TEST II (higher employment)
2020	2,6	2,7	2,8
2030	1,0	1,4	1,7
2040	-	-	0,3
2050	-	-	-

3.3 Inflation rate

The report projects an inflation rate of 1,6% in 2010 and 2,0% in 2011. Thereafter, the inflation rate increases by 0,1% per year, reaching 2,5% in 2016. It remains at that level until the end of the projection period.

In the first test, the inflation rate is lower than in the report as of 2012. It is stable at 2,0% from 2011 to 2060. In the second test, the rise is more rapid and greater as of 2012. The inflation rate increases until 2016, reaching 3,0%. It remains at that level thereafter.

In the sensitivity tests for inflation, the assumptions for the real rate of increase in average employment earnings and the real rate of return on investments are the same as in the report. However, the nominal rates are adjusted.

An upward movement of inflation, compared with the assumption in the report, has a direct effect on contributions, benefits and investment income:

- contributions are higher than in the report for two reasons: a nominal increase in average employment earnings and faster growth of the proportion of workers with incomes higher than the basic exemption (which is not indexed);

- the benefits are higher because of the higher indexation rate for pensions;
- investment income is also higher because of a higher nominal rate of return.

The combined effect of those factors is an increase in cash inflows (contributions and investment income) that is greater than the increase in cash outflows (benefits). A downward movement of the inflation rate has the opposite effect.

The effect of these tests is shown in Table 57. In the first test (lower inflation), the ratio of the reserve to cash outflows for the following year is 1,2 in 2030 (compared with 1,4 in the report) and the reserve becomes nil in 2037. In the second test (higher inflation), the ratio is 1,5 in 2030 and the reserve becomes nil in 2040.

The steady-state contribution rate is 11,16% in the first test and 10,90% in the second, which represents, respectively, an increase of 0,14 and a decrease of 0,12 compared with the report's rate of 11,02%.

Table 57
Sensitivity tests: inflation rate

YEAR	RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR		
	TEST I (lower inflation)	REPORT	TEST II (higher inflation)
2020	2,7	2,7	2,7
2030	1,2	1,4	1,5
2040	-	-	-
2050	-	-	-

3.4 Real rate of increase in average employment earnings

The report projects that the real rate of increase in average employment earnings will climb from 0,3% in 2010 to 1,2 % in 2019. The rate of increase will remain stable thereafter.

The sensitivity tests consist of varying the real increase in average employment earnings. The projection of contributions is especially sensitive to variations in this assumption. In fact, a slight variation has a significant impact on a year's cash inflows, since the rate of increase is applied to a total payroll of several billion dollars and since the effect of a change for a given year affects the total payroll of subsequent years. Variations in this assumption also affect benefits, although less significantly since the variations will have only a gradual effect on new pensions.

The first test sets the real increase at 0,8%, as of 2019, and the second test sets the real increase at 1,6% as of that same year. Thus, the first test reduces contributions in 2060 by 13,5% and benefits by 7,6%. On the other hand, the second test increases contributions by 17,3% and benefits by 10,3%.

The effect of these tests is shown in Table 58. In the first test, the ratio of the reserve to cash outflows for the following year reaches 1,0 in 2030 (compared with 1,4 in the report) and the reserve becomes nil in 2035. In the second test, the ratio reaches 0,6 in 2040 and the reserve becomes nil in 2046.

The steady-state contribution rate is 11,41% for the test in which the increase in average employment earnings is weakest (test I), that is, an increase of 0,39 compared with the rate of 11,02% in the report.

For the test in which the increase is higher (test II), the steady-state contribution rate is 10,64%, which represents a decrease of 0,38 compared with the rate in the report.

Table 58
Sensitivity tests: real rate of increase in average employment earnings

YEAR	RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR		
	TEST I (lower earnings)	REPORT	TEST II (higher earnings)
2020	2,6	2,7	2,8
2030	1,0	1,4	1,8
2040	-	-	0,6
2050	-	-	-

3.5 Real rate of return on investments

The projected real rate of return on investments in the report is 4,3% until 2019. Thereafter, it increases gradually until 2022 reaching its final level of 4,5%. The average real rate of return for the period from 2010 to 2060 is 4,5%.

Variations of this assumption have an immediate impact on income generated by the reserve. Contributions and aggregate benefits are not affected in any way.

The first test shows the effect of a variation of a 0,5 percentage point drop in the real rate of return during the entire projection period and the second test shows the opposite effect, that is, a variation of a 0,5 percentage point increase in the rate of return. Because of the cumulative effect of such changes on the reserve, in the first test, investment income decreases by 25% compared with the report in 2030. In the second test, investment income for the same year increases by 31%.

Table 59 shows the ratio of the reserve to cash outflows for the following year. A decrease of 0,5% in the rate of return (test I) results in a decrease in the ratio to 1,1 in 2030, (compared with 1,4 in the report) and the reserve becomes nil in 2037.

On the other hand, a 0,5% increase in the rate of return (test II) increases the ratio to 1,7 in 2030 and the reserve becomes nil in 2041.

The steady-state contribution rate is 11,24% in the first test and 10,80% in the second, which represents, respectively, a change of 0,22 compared with the report's rate of 11,02%.

Table 59
Sensitivity tests: real rate of return

YEAR	RATIO OF THE RESERVE TO CASH OUTFLOWS FOR THE FOLLOWING YEAR		
	TEST I (lower return)	REPORT	TEST II (higher return)
2020	2,5	2,7	2,9
2030	1,1	1,4	1,7
2040	-	-	0,2
2050	-	-	-

4. Summary

Table 60 shows, for each assumption, the variations used to test the sensitivity of the results. Table 61 shows the effect the tests have on the steady-state contribution rate. The steady-state contribution rate is defined in section 5.4.1 of the report.

The results of the sensitivity tests shown in Tables 52 through 59 of the preceding sections indicate that the level of the reserve is sensitive to the actuarial assumptions used. Since the projections must be made for a long period, any recurring variation in the difference between cash inflows and cash outflows can have a non-negligible effect on the projected level of the reserve. However, the sensitivity tests also show that a small, long-term adjustment in the contribution rate would usually completely offset the impact of such variations on the long-term level of the reserve.

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Table 60
Variations used to test the sensitivity of the results

TEST I (unfavourable)				ASSUMPTIONS IN THE REPORT			TEST II (favourable)		
DEMOGRAPHY									
Fertility rate	1,50 (2018)			1,65 (2018)			1,85 (2018)		
Net migration	20 000 (2014)			31 500 (2010)			43 000 (2014)		
Life expectancy (at age 65)	2030	Men:	21,7	2030	Men:	20,6	2030	Men:	19,5
		Women:	24,2		Women:	23,3		Women:	22,3
	2060	Men:	23,3	2060	Men:	21,8	2060	Men:	20,4
		Women:	25,7		Women:	24,2		Women:	22,7
ECONOMY									
Activity rate (Age 15 and over)	2010	63,3%		2010	65,3%		2010	67,3%	
	2030	57,6%		2030	59,6%		2030	61,6%	
	2060	56,1%		2060	58,1%		2060	60,1%	
Minimum unemployment rate	8,0%			6,0%			4,0%		
	(2019)			(2019)			(2020)		
Inflation rate	2,0% (2011)			2,5% (2016)			3,0% (2016)		
Real rate of increase in average employment earnings	0,8%			1,2%			1,6%		
	(2019)			(2019)			(2019)		
Real rate of return (average 2010-2060)	4,0%			4,5%			5,0%		

A year in parenthesis indicates the time as of which the value shown remains constant thereafter.

Table 61
Effect of the various tests on the steady-state contribution rate

	TEST I (unfavourable)	REPORT	TEST II (favourable)
DEMOGRAPHY			
Fertility rate	11,15%	11,02%	10,85%
Net migration	11,40%	11,02%	10,68%
Life expectancy	11,29%	11,02%	10,73%
ECONOMY			
Activity rate	11,31%	11,02%	10,75%
Minimum unemployment rate	11,20%	11,02%	10,86%
Inflation rate	11,16%	11,02%	10,90%
Real rate of increase in average employment earnings	11,41%	11,02%	10,64%
Real rate of return	11,24%	11,02%	10,80%

Appendix

VI

**Comparison and
reconciliation with the
actuarial report as at
31 December 2006**

1. Introduction

In this appendix, the projections made in the actuarial report as at 31 December 2006 are first compared with the operating results for the period from 2007 to 2009. They are then compared and reconciled with the projections in the actuarial report as at 31 December 2009.

2. Comparison of the projections in the actuarial report as at 31 December 2006 and the results of the last three years

The projections made in the actuarial report as at 31 December 2006 were compared with the results published in the financial statements for the years 2007 to 2009. Those results were adjusted so that they could be presented on the same basis as those in the actuarial report, that is, by considering that sums are disbursed as soon as they are encumbered and received as soon as they are due. Table 62 shows the results of that comparison. Each element in the table is analysed in the following pages.

Table 62
Changes in the Plan reserve from 31 December 2006 to 31 December 2009
(in millions of dollars)

	OPERATING RESULTS (A)	PROJECTION IN THE 2006 ACTUARIAL REPORT (B)	DIFFERENCE (C) = (A) – (B)	DEVIATION (C) / (B)
	\$	\$	\$	%
Reserve as at 31 December 2006	32 712,8	32 508,8	204,0	0,6
CASH INFLOWS: 2007, 2008 AND 2009				
Contributions	29 497,7	28 875,4	622,3	2,2
Investment income (including capital gains)	- 4 582,7	7 188,6	- 11 771,3	- 163,7
Total	24 915,0	36 064,0	- 11 149,0	- 30,9
CASH OUTFLOWS: 2007, 2008 AND 2009				
Administration costs	295,9	315,0	- 19,1	- 6,1
Benefits	27 751,0	27 595,2	155,8	0,6
Total	28 046,9	27 910,2	136,7	0,5
Reserve as at 31 December 2009	29 580,9	40 662,6	- 11 081,7	- 27,3

2.1 Initial reserve

In the report as at 31 December 2006, the reserve at the beginning of the projection period was estimated to be 32,5 billion \$. That sum was made up of the net assets of the Régie des rentes du Québec as at 31 December 2006 plus the estimated value of amounts due or receivable but not entered on the books as at 31 December 2006. In the 2009 report, the reserve as at 31 December 2006 was corrected upward by 204 million \$, a difference of 0,6% compared with the the initial reserve in the 2006 report. The difference is mainly the result of an underestimation of the contributions due for 2006 and collected in 2007.

Contributions also depend on the increase in average contributory earnings. Table 63 shows the average increase in earnings for the period from 2007 to 2009. Overall, the rate of increase in contributory earnings changes at an annual pace that is 0,5% higher than the assumption in the 2006 report.

2.2 Contributions

The contributions collected from 2007 to 2009 were 2,2% (622,3 million \$) higher than the projection in the actuarial report as at 31 December 2006. This difference results mainly from the underestimation of the number of contributors. The number of contributors in 2009 is now estimated¹ at 3 868 000, that is, 19 000 more than the number projected in the 2006 report.

Table 63
Average rate of increase in employment earnings according to various measures
(as a percentage)

Period	2006 Actuarial report			Observed or estimated data		
	Maximum pensionable earnings (MPE)	Average annual employment earnings	Average annual contributory earnings	Maximum pensionable earnings (MPE)	Average weekly earnings - Québec	Average annual contributory earnings
2007-2009	2,6	2,6	3,0	2,6	2,4	3,5

1. Contributor data for a given year are not complete until several months after the year's end because of the time required for processing tax returns and validating of employer remittances by Revenu Québec.

Table 63 also compares the wage increase assumption in the 2006 report to the average weekly earnings observed in Québec, as estimated by Statistics Canada. We can conclude the following:

- for the period from 2007 to 2009, overall growth in average annual earnings as measured by the average weekly earnings in Québec was 0,2% less than had been projected;
- the increase in the MPE, which is based on the increase in the average weekly earnings in Canada, was 2,6% during the period from 2007 to 2009, as projected in the 2006 report. This increase brings the MPE for 2010 to 47 200 \$.
- the breakdown of workers by level of earnings was different than had been projected. Further to the application of the *Pay Equity Act*, the distribution of women's income changed. Moreover, the wage of a certain percentage of individuals has neared the average employment earnings.

2.3 Investment income

From 2007 to 2009, net losses on investments were 4,6 billion \$. This sum is comprised of income of 2,5 billion \$ and a decrease in the fair value of investments of 7,1 billion \$ during the period. The projected net investment income was 7,2 billion \$. The downward movement in the reserve resulting from differences in yields is therefore 11,8 billion \$ compared with the projection in the 2006 report. Table 64 compares the nominal rates of return projected in the 2006 report with rates observed from 2007 to 2009.

During this period, the average rate of return on the portfolio of variable income securities was -10,2%, whereas the projected average

rate was 7,9%. Furthermore, the average rate of return on fixed income securities was 1,7%, compared with a projected return of 5,5%.

Table 64
Rates of return (2007-2009)

YEAR	2006 ACTUARIAL REPORT	OBSERVED DATA
	%	%
2007	6,7	6,4
2008	6,8	- 26,4
2009	6,9	9,7
Average rate	6,8	-4,9

2.4 Administration costs

From 2007 to 2009, administration of the Québec Pension Plan cost 19,1 million \$ less than had been projected. The administration costs of the Plan comprise the costs incurred by the Régie des rentes du Québec for the Plan's administration and the fees charged by Revenu Québec for the collection of contributions. The observed difference of 6,1% for the period from 2007 through 2009 is mainly the result of an overestimation of costs incurred by the Régie in 2008 and 2009.

2.5 Benefits

Aggregate benefit payments were 0,6% higher than the projected amounts, that is, a difference of 155,8 million \$. The over-estimation of some benefits can be partially offset by the under-estimation of certain others. Overall, the difference is less than 1%. These differences can be attributed to a number of circumstances. For example, the under-estimation of the indexation rate for benefits for 2008 and 2009 has an effect on all pensions.

The indexation rate for benefits on 1 January of each year is based on the average inflation rate observed for the 12-month period ending in October of the preceding year. The rates for 2007, 2008 and 2009 were estimated, respectively, at 2,1%, 1,8% and 2,0% in the 2006 report. In fact, the rates were 2,1%, 2,0% and 2,5%, respectively.

Table 65 shows that amounts for the death benefit and income security (welfare) reimbursements were overestimated. On the other hand, the were underestimated for retirement pensions, disability pensions and surviving spouse's pensions. Deviations of more than 1,0% or 100 million \$ are examined in more detail in the following subsections.

2.5.1 Disability pension

Sums actually paid in disability pension benefits were 4,7% higher than the projected sums, that is, a difference of 108,3 million \$. The difference observed is essentially the result of underestimating the average pension for claims incurred but not reported.

2.5.2 Death benefit

Sums actually paid for the death benefit were 3,4% less than the projected sums, that is, 10,3 million \$. The difference is mainly the result of overestimating the number of deaths among women and consequently, overestimating the total amount of the death benefits to be paid.

Table 65
Benefit payments in 2007, 2008 and 2009
(in millions of \$)

	OPERATING RESULTS (A)	PROJECTION IN THE 2006 ACTUARIAL REPORT (B)	DIFFERENCE (C) = (A) - (B)	DEVIATION (C) / (B)
	\$	\$	\$	%
Retirement pension	20 347,5	20 296,3	51,2	0,3
Disability pension	2 411,9	2 303,6	108,3	4,7
Death benefit	291,1	301,4	- 10,3	- 3,4
Surviving spouse's pension	4 615,5	4 608,8	6,7	0,1
Orphan's pension and pension for a disabled person's child	77,8	77,8	0,0	0,0
Reimbursements to social assistance	7,2	7,2	0,0	- 0,6
Total	27 751,0	27 595,2	155,9	0,6

2.6 Reserve as at 31 December 2009

The 2006 report projected an increase of 8,2 billion \$ in the reserve between 2007 and 2009. The reserve actually decreased by 3,1 billion \$, reaching 29,6 billion \$ as at 31 December 2009. By adding together the differences explained above, we can see that cash inflows were 30,9% less than projected, mainly because of investment income. Cash outflows were 0,5% higher than projected.

3. Comparison of the projection in the actuarial report as at 31 December 2006 with the actuarial report as at 31 December 2009

Table 66 shows that, according to this report, the reserve expressed as a proportion of the cash outflows for the following year is lower than that projected in the previous report, throughout the projection period.

Table 66
Reserve as a proportion of cash outflows for the following year

YEAR	2006 ACTUARIAL REPORT	2009 ACTUARIAL REPORT
2010	4,0	3,0
2011	4,1	3,0
2012	4,1	3,0
2015	4,1	3,0
2020	3,9	2,7
2025	3,5	2,1
2030	3,0	1,4
2035	2,5	0,6
2040	1,9	*
2045	1,1	*
2050	0,1	*
2055	*	*
2060	*	*

* The reserve is nil.

The differences in the results from one report to the next are mainly the result of taking into account the Plan's observed experience until 2009 and of revisions to the assumptions and methodology. The following section takes a closer look at the variations and their effects on the steady-state contribution rate.

4. Reconciliation of the steady-state rates between the report as at 31 December 2006 and the report as at 31 December 2009

The results of this report were reconciled with those of the actuarial report as at 31 December 2006, so as to determine the effects of the numerous changes that affect the projections. The indicator used for the reconciliation is the steady-state contribution rate, as defined in section 5.4.1 of the report.

Only assumptions having a significant effect on the results in the report were selected for the reconciliation, which was made in three steps:

- The first step described the effects of the amendment to the *Act* in 2008 (retirement pension supplement), changes to the definition of the steady-state contribution rate and the improvements made to the projection model between 2007 and 2009.
- The second step measured the effect of the results for 2007, 2008 and 2009 on the starting data in the report as at 31 December 2009.
- The third step showed the effect of the main changes made to the assumptions with respect to future years.

Methodological changes

After the actuarial report as at 31 December 2006 was published, the *Act respecting the Québec pension plan* was amended in June 2008. One of the amendments has a significant effect on the Plan's funding, namely, the measure that allows all retirement pension beneficiaries who work and contribute to the Plan to receive a pension supplement based on his or

her contributions. The amendment also increased the steady-state rate.

In this report, as in the previous one, the steady-state contribution rate is defined as the rate that keeps constant the ratio of the reserve to annual cash outflows during the period from 2040 to 2060. Furthermore, the year in which the application of the steady-state contribution rate begins was changed from 2008 to 2012 compared with the previous actuarial report. Delaying the application of the steady-state contribution rate by four years has the effect of increasing that rate.

Moreover, improvements made to the projection model were changed so as to determine eligibility rates, the average pension for new beneficiaries and retirement rates. These changes have the effect of increasing the steady-state rate, with the average pension being most affected.

Results from 2007 to 2009

The average yields in the last three years were negative, resulting in an initial reserve, as at 31 December 2009, that was significantly lower than that projected in the previous report. The effect of the decrease was to significantly increase the steady-state rate. Two other factors related to starting data also had an impact on the steady-state rate: a population as at 31 December 2009 that was more numerous than anticipated and starting salaries and wages that were higher than those estimated in the previous report.

Changes in assumptions

The main changes to the assumptions that have an effect on the steady-state rate are as follows:

- The total fertility rate was adjusted upward compared with the previous report. In the 2006 report, the rate was 1,60 as of 2007 and remained stable thereafter. In this report, the rate drops from 1,73 in 2010 to 1,65 in 2018 and remains stable thereafter.
- The recent experience shows a significant reduction in mortality over the last few years. In this report, life expectancies at the beginning of the projection period are equivalent to those used in the 2006 report. Thereafter, life expectancies increase in the short and medium terms compared with the previous report, gradually decreasing in the long term. Therefore, the overall reduction in mortality projected in the actuarial report as at 31 December 2009 is greater than that projected for the period of 2010 to 2060 in the 2006 report. Lower mortality rates in the 2009 report result in an increase in the duration of payment for all types of pensions, as well as a decrease in the number of death benefits and new surviving spouse's pensions;
- Migration progresses differently in the two reports. In the 2006 report, net migration was 26 500 in 2007 and remained stable thereafter. In this report, net migration is 31 500 throughout the entire projection period.
- The overall activity rate is higher in this report than in the 2006 report. The anticipated activity rate for persons aged 20 to 64 for 2010 was 79,4% in the 2006 report, whereas it is 79,6% in this report. The slight increase observed since the last report affects the entire projection period.
- In the previous report, the inflation rate was 1,8% in 2007, 1,9% in 2008, 2,0% from 2009 to 2011, and then increased, reaching its maximum of 2,5% in 2016. In this report, the inflation rate is 1,6% in 2010, 2,0% in 2011, then will increase 0,1% annually, reaching its maximum of 2,5% in 2016;
- For the period from 2010 to 2019, the real rate of increase in average employment earnings was 1,2% in the 2006 report, compared with 0,8% in this report. This rate is set at 1,2% as of 2012 in the 2006 report, whereas it is set at that level as of 2019 in the 2009 report.
- The age at which women retire is higher, compared with the previous report, which increases the average retirement pension. Furthermore, the average combined retirement-surviving spouse's pension also increased for women compared with the 2006 report.
- The average real rate of return on investments calculated for the next 50 years, is 0,25 percentage points lower in this report.

Table 67 shows the results of the reconciliation. The table reveals that the negative yields in 2008 had a significant upward effect on the steady state contribution rate (+ 0,37%). The effect is partially countered by higher than anticipated average starting wages, which lowered the steady-state contribution rate (- 0,26%).

As for the projection assumptions, the steady-state contribution rate is mainly affected by the projected increase in life expectancy (+ 0,19%), a slower progression in wages (+ 0,20%) and a decline in the yield rate (+ 0,11%) compared with the 2006 report. The steady-state contribution rate is, however, lowered by the increased birth rate and migration (- 0,20%) and the increase in activity rates (- 0,16%) compared with the previous actuarial report.

The changes in methodology have made it possible to incorporate the calculation of the reirement pension supplment following the amendments to the *Act* in 2008, delay the application of the steady-state contribution rate by four years, as well as adjust projected retirement rates downward and future benefit payments upward. The result of their combined effect is to increase by 0,24% the steady-state contribution rate.

Table 67
Reconciliation of the results of the report as at 31 December 2009
with those of the previous report

	STEADY-STATE CONTRIBUTION RATE %
ACCORDING TO THE ACTUARIAL REPORT AS AT 31 DECEMBER 2006	10,54

CHANGES	VARIATIONS WITH RESPECT TO THE 2006 REPORT	EFFECT OF THE CHANGE	
1) <u>Methodological changes</u>			
Amendments to the Act in 2008	Introduction of the retirement pension supplement	+ 0,08	10,62
Initial year for applying the steady-state contribution rate	2012 (instead of 2008)	+ 0,11	10,73
Method for projecting eligibility rates and average pensions	Increase in the average pension of future beneficiaries and decrease in retirement rates	+ 0,05	10,78
2) <u>Results from 2007 to 2009</u>			
Initial population	Higher than anticipated	- 0,07	10,71
Average starting wages	Higher than anticipated	- 0,26	10,45
Initial reserve	Lower than anticipated (negative yield in 2008)	+ 0,37	10,82
3) <u>Changes in assumptions</u>			
Births	Increase in the total fertility rate	- 0,07	10,75
Mortality	Increase in life expectancy in the short-term and medium-term	+ 0,19	10,94
Migration	Increase in net migration	- 0,13	10,81
Labour market	Increase in overall activity rates	- 0,16	10,65
Inflation	Short-term decrease in the inflation rate	+ 0,01	10,66

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CHANGES	VARIATIONS WITH RESPECT TO THE 2006 REPORT	EFFECT OF THE CHANGE	STEADY-STATE CONTRIBUTION RATE %
3) <u>Changes in assumptions (continued)</u>			
Wages	Short-term changes slower in future	+ 0,20	10,86
Retirement	Increase in retirement age and increase in combined pensions (retirement and surviving spouse's pension) for women	+ 0,05	10,91
Investment yields	Decrease in anticipated rate of return	+ 0,11	11,02
ACCORDING TO THE ACTUARIAL REPORT AS AT 31 DECEMBER 2009			11,02