Chapter 13
Risk Management and Climate Change: A Question of Insurability

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13.1 Introduction

In the recent past, the world has experienced an increasing trend of devastating environmental disasters. The scientific community has agreed that the frequent occurrence of these disasters is closely related to anthropogenic climate change. The victims of environmental disasters—whether from the private or public sector—often face enormous damages. The Western world often tries to cover potential damages by means of insurance. But this only works in very few cases. Existing insurance policies may cover only an insignificant part of the enormous damage. As a result, concern has arisen with respect to the insurability of climate change environmental disasters. This paper aims at clarifying the question of whether and under what circumstances it is possible to secure the risks caused by climate change environmental disasters through risk management. It also highlights the role of different actors within risk management.

13.2 The Concept of Risk Management

Risk management is the systematic treatment of risks or, in other words, risk management are all human activities which integrate recognition of risk, risk assessment and developing strategies to manage it (Krause and Borens, 2009a, p. 181; Kirchner 2002, p. 18). According to Renn et al., risk management helps to reduce an intolerable high risk of an event to an acceptable amount

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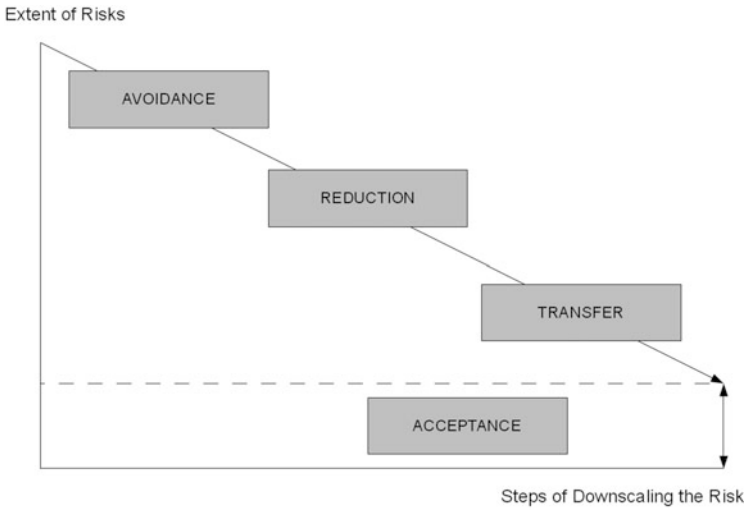

Fig. 13.1 Treatment of risk in a risk management system according to ISO 31000

(Renn et al. 2007, p. 97). Risk management can also help to reduce the probability or gravity of a negative outcome of that event.

Risk management includes all kinds of risks, e.g. physical, legal and financial risks. If you try to find an interdisciplinary definition of risk, it will be the product of likelihood and impact of an event relating to a variation of drawn objectives and it will be counted by the unit of the objectives (Krause and Borens 2009a, pp. 180–181). In short, a risk describes the probability and impact of an event. An event with a low probability of occurrence and a high loss is the same as a high probability and low loss risk. At zero risk there are no differences from the objectives.

Risk management is a discipline which was practiced during the ancient period. In modern times, risk management is used mostly by the financial sector, i.e. to find risks and chances of investments. Since the first risk management codex US-MIL-STD 882 was established by the United States Army in the 1970s, many other institutions tried to fix a standard for risk management. Governments tried to establish risk management acts. One of the most important acts is the BASEL II Codex which came into force in 2009 (Krause and Borens 2009a, pp. 181–182). Towards the end of 2009, the International Organization for Standardization (ISO) published the ISO 31000. The ISO 31000 standardizes the risk management process (Krause and Borens 2009a, p. 184). According to the ISO 31000, risk management is all 'coordinated activities to direct and control an organization with regard to risk'. In ideal risk management, a prioritization process is followed, whereby the risks with the greatest loss and the greatest probability of occurrence are handled first, and risks with lower probability of occurrence and lower loss are handled in descending order (Kirchner 2002, p. 18).

The strategies to solve risk include four kinds of different treatments: transferring the risk to another party, avoiding the risk, reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk (Fig. 13.1) (Kirchner 2002, pp. 43–46).

Risk transfer is the type of risk treatment that gives answers to the leading question. Risk transfer means causing another party to accept the risk, typically by contract or by hedging (Ehrmann 2005, pp. 89–90). Insurance is one type of risk transfer that uses contracts. The leading question is as follows: Can we trade climate risk by insurance?

13.3 Risk Potential of Climate Change

Before answering the leading question, we should take a look at the risk potential of climate change-related events. The annual reports of the World Economic Forum (WEF) contain several kinds of environmental and other risks. According to their 2008 report, which is in line with the above definition of risk, climate change risk is taken as shown in Fig. 13.2. The reports from 2009 to 2011 show the likelihood and impacts of events caused by climate change in a different way and provide less specific numbers.

The figures show the risk of the listed events to be taken in the years 2007 and 2008 and the outlook for 2009. The numbers between 1 and 5 for likelihood and severity are taken in order to ensure easy understanding, clarity and comparability. The numbers shown are not fixed; the risks are open to mitigation measures which will alter likelihood and severity within 10 years. According to the above definition of risk, risk is more significant if it is calculated by the actual numbers and not clustered; e. g. in 2007, the risk of an extreme weather event in regard to the economic losses was valued at 2.5 billion US$. In 2008, the risk increased up to 3.75 billion US$. The WEF shows the highest risk related to tropical storms: In 2008, it resulted in 10,000 deaths (WEF 2008, pp. 45–51; WEF 2009, pp. 27–31).

According to the World Economic Forum (WEF), until 2050 German private and public households have to expect up to 33 billion US$ costs for climate change (Kemfert 2005, p. 209). In 2006, the Worldwide Fund for Nature (WWF) and the SAM Group published a study about climate-related risks for the industry. According to this study, RWE AG, Europe's biggest emitter of carbon dioxide, has to deal with risks amounting to 17 % of its net equity value if we go ahead without changing our behavior (WWF and SAM 2006, p. 1). In the 2011 Global Risk Report of the WEF, climate change-related risks are presented as the highest risks. Also the risk of climate change is interconnecting with the risk of water security, food security and extreme energy price volatility. North America and Asia are expected to experience most of the impacts (WEF 2011, pp. 1, 44, 46). Since 2006, the NGO Germanwatch embarked on annually releasing the 'Global Climate Risk Index' (CRI). The Index for 2011 affirms that less developed countries are generally more affected by climate change than industrialized countries. The CRI shell serves as a warning signal indicating past vulnerability which may further increase in regions where extreme events will become more frequent or more severe through climate change (Harmeling 2010, p. 5). Table 13.1 shows the top ten countries of the 2011 Long-Term Climate Risk Index beside the CRI score, death

2007						2008						Outlook (O no chang,↑ ↓ in-, decrease)		
Economic Loss			Lives Lost			Economic Loss			Lives Lost					
L	S	R	L	S	R	L	S	R	L	S	R	L	S[$]	S[D]
Extreme weather events														
3	3	9	-	-	-	3,5	3	10,5	3,5	2,5	8,75	0	0	↑
Heat waves														
-	-	-	-	-	-	3,5	3	10,5	3,5	2	7	↓	0	0
Loss of freshwater														
3,5	2,5	8,75	3,5	3	10,5	3	2	6	3	2,5	7,5	0	0	↓
Tropical Storms														
2	3	6	-	-	-	2	3	6	4	3	12	↓	0	↓
Inland Flooding														
2	2,5	5	2	2	4	2	2,5	5	2	2,5	5	0	0	0

Likelihood: 1: < 1%, 2:1–5%, 3: 5–10%, 4: 10–20%, 5: >20%
Severity - economic loss [billion US$]: 1: 2–10, 2: 10–50, 3: 50–250, 4: 250–1,000, 5: >1,000
Severity - lives lost: 1: 1,600–8,000, 2: 8,000–40,000, 3: 40,000–200,000, 4: 200,000–1m, 5: >1m.
Source: Own calculation based on WEF, Risk Report 2008 and 2009

Fig. 13.2 Risk of climate change-related events

Table 13.1 Long-term Climate Risk Index 2011

CRI, 1990–2009	Country	CRI score	Death per 100,000 inhabitants	Total losses in million US$ PPP	Number of events
1	Bangladesh	7.33	5.63	2,068.14	259
2	Myanmar	8.67	14.33	676.35	30
3	Honduras	10.83	5.21	663.57	53
4	Nicaragua	16.17	2.80	263.33	39
5	Vietnam	19.00	0.59	1,861.50	203
6	Haiti	19.67	3.98	164.62	46
7	Philippines	26.83	1.08	684.45	270
8	Dominican Republic	27.67	2.55	185.08	41
9	Mongolia	31.00	0.54	308.65	30
10	Tajikistan	33.50	0.47	311.27	51

Source: Harmeling (2010) Global Climate Risk Index 2011. Germanwatch

per 100,000 inhabitants, total losses in million US$ per purchasing power parties (PPP) and the number of events most affected between 1990–2009. Bangladesh is this year's most affected country as it was in 2009 and 2008.

The annual Global Risk Report is supported by Munich Re with respect to the core data which are among the most reliable and complete data bases on this matter

and provide the basis for the report. The CRI score analyses the quantified impact of extreme weather events. It looks at impacts and results in an average ranking of countries in four indicators. The CRI score should be seen as a piece in the puzzle of an analysis of countries' exposure and vulnerability to climate-related risk (Harmeling 2010, pp. 6–7).

Another problem is that more and more peak catastrophes have happened. Compared to the Global Climate Risk Index 2010, not even the year 1991 with the Bangladesh-Cyclone has there been a peak year as remarked by Harmeling in the 2010 report. The 2010 Pakistan flooding event only nine years after the Bangladesh-Cyclone leads to a different evaluation of the occurrence of extreme weather events.

13.4 Can We Trade Climate Risk by Insurance?

The amount of losses from natural hazards has grown and the WEF still expects an increase (WEF 2011). This has been caused by climate change, increased population density and the well-being in the catastrophe-prone areas and additionally other events which have not been realized yet, i.e. the acute flooding risk for all coastal areas sum up the problem. The flooding risk poses potentially a very acute problem for the Netherlands. Scientists expect a flood in the next years that will consume about half of the Netherlands. On the 'Flood Maps' internet page http://flood.firetree.net, the impact on the coastal areas around the world is shown. Countries like Bangladesh are flooded every year in a catastrophic proportion. Flooding which are repeated every 50 or 100 years are as catastrophic as flooding that occurred decades before i.e. the River Elbe flooding in the Dresden area in 2002 or the River Oder flooding in 1997. The last one seems to be an annual event. The first remarkable flooding took place in 1838 and after that, there was another in 1947 which was followed by the one in winter 1981. The interval between two floods is increasing. Since 1997, flooding occurs in the River Odra area almost every year and in 2010 Germany and Poland had to deal with three floodings.

As far as flooding is concerned, insurance companies offer quite limited coverage, forcing governments to assume major flooding risk even though they are not professional risk-bearers. When we examine the case of the 2010 flooding in Pakistan, it will be deduced that the country would have been helpless in taking care of the losses without donations from around the world. A look at the development of costs to the U.S. insurance industry caused by weather-related catastrophes shows that the costs remained constant until 1987 after which an increase of costs can be detected. In 2005, the costs amounted to 50 billion dollars. Insured U.S. weather-related losses are growing ten times faster than premiums and the overall economy, and even faster when compared with the population (Mills et al. 2006, pp. 114–119).

The risk of catastrophes due to climate change has several special features, which must be considered when catastrophe insurance arrangements are being developed. A natural catastrophe is a low-probability event, but when it happens, it generates very large losses. The climate catastrophe has a high potential of resulting losses for an individual in magnitude or it is a high loss for an individual insured. As a result, the insurer should have access to a large pool of liquid capital. Furthermore, a high loss potential develops a danger of insolvency for the insurer. The insurer has to identify these risks and try to develop methods to avoid them. Another special feature of climate-related catastrophes is that nobody knows when and how the loss will happen. Even if the catastrophe is forecasted, only few people believe in it because of the huge losses to be expected: When flooding was to occur at River Odra officials failed to heed to the flooding warning that was given by the Swiss Meteorologist J. Kachelmann. An early warning can save lives and damages.

Concerning the question about the probability of a catastrophic event and the resulting loss compared to traditional insured risk, the result is that the usual policy pricing methods are inapplicable. Another special point is the market incompleteness. Usually, there is no private insurance offer for certain types of catastrophic risks. One reason for this is the lack of capacity of the insurance industry money to cope with some catastrophes due to extremely large loss potential (Mills et al. 2006, pp. 123–138). This is due to the fact that the government, like in the past, has to assume the burden of solving the financial problems caused by climate catastrophe.

13.5 Aspects of Solving the Problems

In relation to stakeholders and their options and possibilities to take care of the problem, four aspects should lead to a solution of the problem. The most important stakeholders of the problem are concerned governments and the insurance industry. They are in every kind of issue related to catastrophes and have the possibilities of taking action with politics and money. That is why the role of the governments should first of all be clear. After this is determined, the impact of climate-related parameter uncertainty on insurance contracts should be determined. Then, a national or international catastrophic insurance fund should be implemented. Last but not least, the insurance consumers should be encouraged to adopt a responsible behavior in order to minimize the loss associated with climate change-related catastrophes.

13.5.1 The Role of the Governments

Especially in cases where there is no private insurance to cope with climate catastrophic events, governments could play three main roles. Firstly, as a co-insurer,

hand in hand with the private insurance industry. Secondly, the governments could play the role of a re-insurer directly, or they could lend money for primary insurers to fill up capital. The third possibility is to be a holder of resource pools. For example, a national fund for damages caused by climate change. In Germany, the government takes action in case of a catastrophe but the money has to be taken out of the annual public budget i.e. when river Elbe flooded, the German federation and the hardest-hit states put in place a federal flood fund of over 6 billion €. The amount of money is orientated on the losses but also on the financial capacity of the federal state and the provinces at the time of the disaster. It is unimaginable that in bad times less money would be given.

The heaviest impact, as shown in the Global Risk Report and the Global Climate Risk Index, is faced by developing countries. Most often, they do not share the same luxury and cannot avoid long term economic impacts as easy as Germany e.g. catastrophe caused by climate change often leads to a reduction in aggregate supply and demand with lower level of income for the community which leads to deflation and a higher level of unemployment. That is why economists claim that the necessary instruments of macroeconomic stabilization need to respond to shocks, and contingency plans need to be implemented in order to keep the costs of natural disasters at a minimum (Banuri 2005, p. 11).

13.5.2 Impact of Climate Related Parameter Uncertainty on Insurance Contracts

Climate change brings several kinds of catastrophes and damages with it; the insurance industry may have to cope with a variety of special damages. Flood, windstorm, wildfires, mold and moisture damage, earth movement and coastal erosion and health impact are interacting. Because of the character of a climate catastrophe, it is not easy to set prices for an insurance premium. The insurance industry does not want to extend the insurance coverage without increasing the premium. That is why the insurance industry has to strive to improve loss data collection and enhance the actual analysis. Furthermore, they have to analyze the positive and negative implications of climate change on their business, investments and customers (Mills et al. 2006, pp. 135–136).

Besides, we have to take a look at the impact of climate-related parameter on insurance contracts. This leads to the assumption that the insurer doesn't want to extend its insurance coverage but rather the premium will increase. This can be stopped by a national fund for damages which covers special damages the insurance industry is not willing to insure without a premium increase. The governments should force engineers to construct safer buildings just like earthquake-proof buildings and protect constructions to prevent loss of government money.

Beside the sustainable insurance contracts, an insurance company like the Munich Re is investing more and more into sustainable funds. By October 2009,

the Munich Re already invested 100 million € out of their 65 billion € asset. This is for now a very negligible investment, but it is growing every year. The criteria of environmental sustainability have become more and more important (Munich Re 2009).

13.5.3 National or International Insurance Funds

The question is how to organize 'catastrophe insurance' in a sustainable way. Starting in the 1990s, the private insurance industry could not provide coverage against natural hazards in the traditional way without significant insolvency risk because of the very high loss and low probability event (Nell and Richter 2004, p. 3). That is why national or international insurance funds are necessary, useful and practicable. Funds can safeguard private insurers and their customers and they can be an effective tool in case of market incompleteness. It is necessary that the fund has as much money as needed in case of a catastrophe to provide fast direct aid to the catastrophe area (Pollner 1999, p. 3). The federal flooding fund mentioned above was not a sustainable fund from 2002. The fund was only set up for the river Elbe flooding and was closed by the end of 2006. In case of future flooding, Germany has to set up a new fund with money out of the annual public budget.

13.5.4 Encourage Sustainable Behaviour of the Consumer and the Populace

Can the insurance customer be driven to take action to reduce the negative effect of climate change or the climate change by itself to reduce losses? This idea is to compensate responsible behavior of customers when they reduce their loss potential or when they exhaust CO_2 emission, they get a discount on premium. The insurance industry in Germany, for instance, already tried this several years. In 2007, the DEVK insurance company gave owners of the BahnCard a bonus to their car insurance premium of up to 30 %. With a BahnCard, its owner gets a discount of the costs of a train and public traffic charge of 25 %, 50 % or 100 %. On the one hand, a certain aspect of the customer's behavior out of the insurance area drives the insurance premium. But on the other hand, an owner of the BahnCard uses more public traffic to compensate the costs of the BahnCard and drives less and the risk of a car accident decreases. This is an example of how less risky behavior can lead to a reduction of the negative climate effects. More examples like this are found in other insurance contracts. Other insurance companies decouple the insurance contract and the risk behavior of the customer. In 2009, the DA direct insurance company gave savings of up to 30 % to costumers of new environmentally-friendly cars. The company asks for several ecological criteria of the car. Here, the risk behavior of

the customer has nothing to do with the calculation of the insurance premium, i.e. the normal price-driving factor.

A big problem is the high density of population in some flooding-prone areas. With a sustainable urban land use planning and relocation, the government can take action to prevent the people not to construct any buildings in dangerous areas. In 2004, several years after the Elbe flooding, the German Federal State of Saxony revised its water protection law (SächsWG). Since then, it is forbidden to build or change any buildings in admitted flood-prone areas (§100a SächsWG). However, the residents were not relocated, and the construction of new buildings is forbidden. For residents of flood-prone areas, this means that they have to expect new damages from flooding and have to bear the burden of resolving the risk themselves.

13.5.5 Using Risk Management for Assistance

It may also be a combination of the solutions discussed above which, when put together in a risk management system according to ISO 31000, could lead to a sustainable solution and help to reduce the loss of climate-related catastrophe. In case of climate-related risks, using a risk management system can help to bring some kind of structure in the chaotic climate catastrophic events, their negative impact, an assessment of likelihoods and the dealing with it. Implementing a risk management system helps to find an understanding of climate-related catastrophes by analyzing it in all aspects. It should be taken in all involved organizations and helps to create a communication and reporting mechanism to learn more about annual or periodic events on a national or international level. It should be noted that the most important aspect of a risk management system is that it has to be established as a cycle with steps reviewing of earlier steps. Also, earlier events and their impact will be reviewed in a cycle. A review should also lead to a continuous improvement of the whole risk management system (Krause and Borens 2009b, p. 231).

As discussed above, using a risk management system according to ISO 31000 in general is helping also to develop strategies to treat the impact of risks by avoiding, reducing, transferring and accepting, as shown in Fig. 13.1. The solutions mentioned above to solve problems caused by climate-related catastrophes can be put in the system of transferring, avoiding, reducing as shown in Fig. 13.3.

The stakeholders of catastrophes are each apart from the overall system of risk treatment. First of all, sustainable behavior should avoid the risk of climate change in the long run. Citizens should not build houses in flood-prone areas. Furthermore, insurance pricing system could drive this necessary sustainable behavior to avoid the risk. Protection law by national governments, such as land planning law, will reduce the risk of a catastrophe by minimizing the impact. Unavoidable and not easily reduced risks must be transferred to insurance companies and or to national and international funds as shown above. After all, the remaining risk accepted intentionally must be borne by the affected persons.

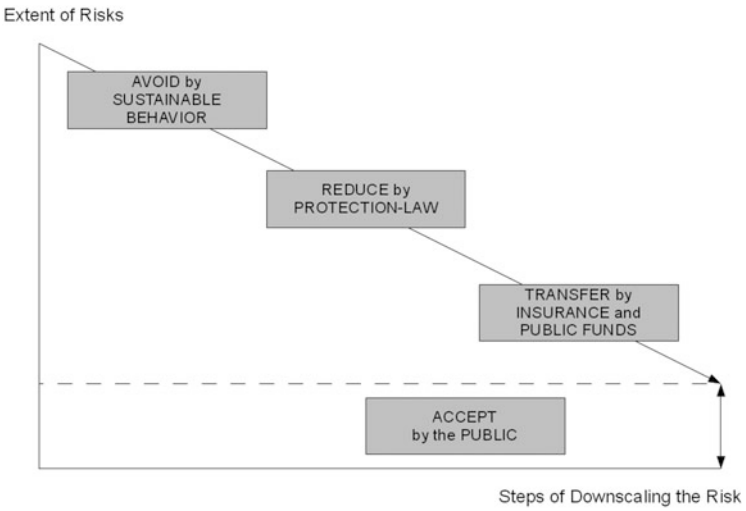

Fig. 13.3 Treatment of climate-related catastrophe risks according to ISO 31000

13.6 Conclusion

To sum up, the insurance industry has to learn more about climate change and its extent of losses to be able to set up more resilient premium. Furthermore, with this new information, they don't longer have to be surprised by catastrophes and face insolvency even if there are more and more peak catastrophes. Also, citizens are charged higher premiums because of frequent occurrence rates and enormous damage (WEF 2007, 2008, 2009). Therefore, they should be advised not to build in risk-prone areas. The way Germany addresses the problem through water protection law is right. It is also a fact that in developing countries, the settlement areas are near big rivers because of the fertile nature of land in these areas and not all citizens can be tracked to live in safer areas. That is why governments should set up funds so that in case of a disaster the current budget should not be over-stressed or overused and the macroeconomic harm remains low. Using a risk management system according to ISO 31000 may put all aspects together in a co-act solution.

Biography Lars Krause has been a research fellow at the Department of Civil and Public Law with References to the Law of Europe and the Environment of the Brandenburg University of Technology since 2010. After his studies with a focus on Environmental Law, he has been doing his doctorate.
Krause's research work focuses on risk in terms of law as well as risk management. In 2008 he translated the strategic chapter of ISO 31000 into German and commented on it. Lately he has been occupied with Chemical and Atomic Energy

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References

Banuri S (2005) The macroeconomic impact of natural disasters. Macroeconomic theory for applications, Department of Economics, Dr. Edward Day, Texas. http://utdallas.edu/~sxb030200/sb_cp3_nat_disasters_122005.pdf. Accessed 1 June 2011

Ehrmann H (2005) Risk management. Friedrich Kiehl, Ludwigshafen

Harmeling S (2010) Global climate risk index 2011. Who suffers most from extreme weather events? Weather-related loss events in 2009 and 1990 to 2009. Germanwatch, Bonn

Kemfert C (2005) Deutsches Institut für Wirtschaftsforschung (DIW) Berlin Wochenbericht Nr. 12–13/2005: pp. 209–215

Kirchner M (2002) Risikomanagement. Rainer Hampp, München

Krause L, Borens D (2009a) Strategisches Risikomanagement nach ISO 31000. ZRFC Part 1 04/09:180–186

Krause L, Borens D (2009b) Strategisches Risikomanagement nach ISO 31000. ZRFC Part 2 05/09:227–231

Mills E, Roth RJ Jr, Lecomte E (2006) Availability and affordability of insurance under climate change: a growing challenge for the US. J Insur Regul 25(2):109–149

Munich Re (2009) Klimafreundliche Projekte – Hoch im Kurs. Pressnote by October, 9th 2009, Munich

Nell M, Richter A (2004) Improving risk allocation through indexed cat bonds. The Geneva Papers on Risk and Insurance 29:183–201

Pollner JD (1999) Using capital markets to develop private catastrophe insurance. The World Bank Group, Note No. 197

Renn O, Schweizer P-J, Dreyer M, Klinke A (2007) Risk. How society deals with uncertainty. oekom, Munich

WEF (2007) Global risk report 2007. World Ecology Forum, Cologny, Geneva

WEF (2008) Global risk report 2008. World Ecology Forum, Cologny, Geneva

WEF (2009) Global risk report 2009. World Ecology Forum, Cologny, Geneva

WEF (2011) Global risk report 2011. World Ecology Forum, Cologny, Geneva

WWF Deutschland, SAM Group (2006) Carbonizing valuation – climate risks for the company's value. 11/2006