



**Bettina B.F. Wittneben, Dagmar Kiyar**

# **Climate Change Basics for Managers**

**Originally published as:**

Bettina B.F. Wittneben, Dagmar Kiyar (2009):

**Climate Change Basics for Managers**

In: Management Decision, 47, 7, 1122-1132

DOI: 10.1108/00251740910978331

This is the author's version of a work that was accepted for publication. Changes resulting from the publishing process, such as editing, corrections and structural formatting, may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in the Journal cited above.

**Bettina B.F. Wittneben <sup>a,\*</sup>, Dagmar Kiyar <sup>b</sup>**

# **Climate Change Basics for Managers**

<sup>a</sup> Smith School of Enterprise and the Environment, Oxford University, Oxford, UK

<sup>b</sup> Wuppertal Institute for Climate, Environment and Energy, Wuppertal, Germany

\* Corresponding author: Bettina B.F. Wittneben, Smith School of Enterprise and the Environment, Oxford University, 75 George Street, Oxford OX1 2BQ (United Kingdom)

**E-mail:** [bettina.wittneben@smithschool.ox.ac.uk](mailto:bettina.wittneben@smithschool.ox.ac.uk)

## Climate Change Basics for Managers

### Abstract:

This paper sets out to tackle the issue of climate change from a business perspective. Managers today are expected to not only reduce emissions from operations, but also gain an awareness of the physical, political and social risks stemming from the impacts of climate change. We discuss how businesses can reduce their carbon footprint and anticipate changes in the physical and political environment related to climate change. As an illustration, the proposed climate strategy of a large European utility company, RWE, is described.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 “Why are the world’s biggest, toughest, most profit-seeking  
4 companies talking about the environment now? Simply put, because  
5 they have to.” (Esty and Winston 2006, p. 8)  
6  
7

8 Climate change implies a variety of consequences for businesses in regards to operational,  
9 public relations and financial aspects. More than ever, in times of global financial and  
10 economic constraint, the business response is critical to addressing this great concern. What  
11 are the reasons for taking climate change aspects into business consideration? In this article,  
12 we would like to discuss why climate change is pertinent in business decision making and  
13 what kinds of considerations apply to the private sector when addressing climate change.  
14  
15

### 16 **Why incorporate climate change considerations in business decisions?** 17

18 First and foremost, political reasons call for business concern for climate change: European  
19 energy-intensive companies, for instance, have to meet the EU-ETS targets. And at least since  
20 the entering into force of the Kyoto Protocol in February 2005, the legally binding  
21 international agreement to reduce greenhouse gas emissions worldwide, climate policy plays a  
22 prominent role in global politics. By now, many national political requirements have to be  
23 met<sup>1</sup> and companies have to consider climate aspects as an economic factor in their business  
24 strategy.  
25  
26

27  
28 Secondly, considering climate change is economically advantageous: Climate change already  
29 interferes with the regulatory business environment. Increasingly, financial institutions have  
30 to consider climate risks; as worldwide economic losses due to natural disasters accumulate,  
31 climate change related risks and opportunities have to be integrated into core financial  
32 operations. This occurs with direct implications for financing business investments. Rating  
33 agencies, working for large investment funds, are looking for answers from businesses  
34 regarding their solutions to tackle the challenge climate change. They screen companies for  
35 environmental and sustainability factors and exclude poor performers (Esty 2007). And  
36 “when the financial services industry... starts worrying about the environment, you know  
37 something big is happening” (Esty and Winston 2006, p.9).  
38  
39  
40

41 Thirdly, there are causes that can be summarised as public relations: The general public  
42 expects an answer to the climate change question from business leaders. There is not only a  
43 governmental assessment of companies but also the verdict by the public. People are  
44 concerned about the environment and want problems to be tackled. Companies are responding  
45 by reporting on greenhouse gas emissions in sustainability reports. Not only current figures  
46 are estimated, but solutions and answers to decrease the environmental impact of business  
47 operations are also expected to be discussed in these reports. Acting responsibly is not just an  
48 exercise in accounting: finding the right answers regarding this challenge can positively shape  
49 brand image and may attract new customers (Esty 2007).  
50  
51  
52

53 “Whatever sector or business you’re in, disclosure is increasingly  
54 expected, and failure to disclose can put you at a strategic  
55  
56  
57

---

58 <sup>1</sup> Beside international and European policies, national governments have also moved to implement carbon  
59 reducing measures. The German government, for instance, has agreed upon the so-called “Meseberg Decision”  
60 in 2007, that includes inter alia clean power generation, combined heat and power improvement, energy  
efficiency and improvement of existing building codes. The UK government has passed the Climate Change Act  
2008 that includes legally binding targets for the UK, a carbon budgeting system and the creation of a  
Committee on Climate Change to advise Government.

1  
2  
3           disadvantage.” Global Reporting Initiative, Alyson Slater (Bortz  
4           2007)  
5  
6

7       Last but not least, early or first movers, following the idea of Schumpeter’s pioneer profit, can  
8       achieve financial gains by introducing new goods or methods of production as innovative  
9       action results in monetary benefits. Some companies have already capitalized on this  
10      opportunity. They have addressed questions such as: What do regulatory frameworks such as  
11      emission trading involve? How are greenhouse gases measured? How is a carbon inventory  
12      set up? How can a business’s carbon footprint be measured? What technologies are  
13      considered clean, sustainable, alternative or zero emissions? What is a cap-and-trade system  
14      and how does it differ from a carbon tax?  
15

16  
17      All these questions and more have to be considered by managers today. When Rex Tillerson,  
18      Chairman and CEO of the Exxon Mobil Corporation called for a political shift from carbon  
19      trading to a carbon tax in early January 2009 (ExxonMobil 2009), a clear signal was sent to  
20      the business community: greenhouse gas emissions are dangerous and need to be reduced.  
21      The question that remains is how to achieve the cuts most efficiently, not whether to reduce  
22      emissions (Hoffman 2007, Porter & Reinhardt 2007, Wittneben Forthcoming). Since the  
23      Intergovernmental Panel on Climate Change, the association of hundreds of scholars  
24      reviewing the latest scientific findings, reported in 2007 that the evidence for human-induced  
25      climate change was overwhelming and unequivocal (IPCC 2007), it has become clear that  
26      tackling global warming is one of the greatest challenges to humankind in the 21st Century.  
27  
28

29  
30      Businesses, as part of society, are now faced with not only the challenge of how to reduce  
31      emissions to mitigate climate change (Okereke 2007) but also how climate change will impact  
32      their operations. In this paper, we discuss how businesses can assess their contribution to  
33      climate change and increase their ability to mitigate. Furthermore, we elaborate ways for  
34      businesses to assess how climate change affects their operations and how to increase the  
35      ability to adapt, both in terms of disruption of natural weather patterns as well as the impact of  
36      policy implications.  
37  
38

### 39           **Contributing to Climate Change** 40

41  
42      The disruption to our climate system that has been brought about by rising emissions from the  
43      burning of fossil fuels since the industrial revolution alongside the emission of other  
44      greenhouse gases into the atmosphere (IPCC 2007) and can only be tackled by profound  
45      changes in the patterns of production and consumption that our economies have come to rely  
46      on (Jones & Levy 2007). Any business therefore needs to not only look at its own operations  
47      but also at the introduction of greenhouse gases at all levels of the system the company is part  
48      of. Having said that, a company must, of course, start by measuring the greenhouse gases of  
49      its operations in order to then move to the system thinking required to tackle climate change.  
50      Measuring carbon emissions is not straight forward for many types of operations and requires  
51      some learning in the organization (Molisa & Wittneben 2008). It is critical, however, that the  
52      measurements are undertaken in such a way that they are reliable, verifiable and comparable.  
53      A system of carbon performance measurement is likely to be established under any type of  
54      regulatory regime that will eventually make this data comparable and publicly available.  
55  
56

57  
58      In order to adequately assess the contributions of any one business on climate change, there  
59      are various aspects that need to be considered:  
60

1. Quantify direct greenhouse gas (GHG) emissions from **operations**

2. Report GHG emissions and **compare** across the sector
3. Assess GHG emissions from the **value chain**, including suppliers and usage of products
4. Locate position of organization within **system of production and consumption**
5. Evaluate the effect of the organization on **other systems**

### Mitigating Climate Change

“The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve the stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.” (IPCC 2007a)

Once management is aware of the role of its business operations on the climate system, it can take steps to mitigate climate change (Kolk and Pinkse 2005, Hoffman 2006). The climate system, fossil fuel consumption and their interaction are highly complex and have to be thought of in complex terms. Businesses are not only under increasing pressure from regulation, consumers and other companies to lower their carbon footprint, but also need to consider the cost to the system that society is part of in broader terms. Fossil fuel consumption leads not only to the disruption of weather patterns directly in contact with the company’s operations, but also affects social and ecological systems in other parts of the world and in future times. Our suggestions for ways to lower the impact of business on climate change are listed below but not exhaustive:

1. Capitalize on **energy efficiency** gains
2. Switch to **renewable** energy sources
3. Collect and apply **best practice** examples
4. Increase **expectations** of suppliers and consumers
5. Encourage **individual** behavioural change within the company’s reach
6. Integrate **mitigation thinking** into all decisions across operations
7. Develop **novel approaches** to reducing GHG across the system of production and consumption
8. Communicate **achievements** in lowering emissions
9. Assist in furthering effective climate **policy**

### Being affected by climate change

Every organization will be affected by climate change in different ways (Lash & Wellington 2007). It is hence critical to the running of a business to assess the particular situation a business finds itself in (Porter and Reinhardt 2007). This analysis takes several forms:

1. Risk analysis of climate impacts on **operations**
2. Risk analysis of climate impacts of **locations**
3. Assessment of **insurance** needs
4. Analysis of climate **policy** developments

### Climate-proof operations

As climate change will continue to increase the frequency and intensity of extreme weather events, climate-proofing operations will become increasingly important to the survival of the

1  
2  
3 business (Sussman & Freed 2008). As every organization is part of a larger community, it is  
4 critical for business to also help others adapt to prevent social unrest. The following adaptation  
5 options need to be considered by managers:  
6  
7

- 8 1. Reduce reliance on **scarce resources**
- 9 2. Consider climate change impact on different **locations**
- 10 3. Set up adequate **insurance** for you and for others
- 11 4. Consider a potential contribution to **community** adaptation needs such as flood  
12 defences to prevent increased social unrest and climate refugees
- 13 5. Communicate **effective ways** to adapt to climate change
- 14 6. Act early on **legislation** on climate change
- 15 7. Anticipate **emerging policy** developments
- 16 8. Recognize **new business opportunities** to support adaptation needs
- 17 9. Recognize **new markets** as weather patterns change  
18  
19

20  
21 Table 1 summarises the various considerations that managers need to contemplate, including  
22 what mitigation and adaptation mean to business, why managers need to care about this and  
23 how they can address climate change.  
24

25  
26 INSERT TABLE 1 ABOUT HERE  
27

## 28 **On Offsetting**

29

30 When reducing emissions in the short term is too costly for a business or the emissions are  
31 integral to its operations, the option of carbon offsetting arises. Offsetting is intended to  
32 neutralize emissions by setting up mitigation projects outside of the range of business  
33 operations. If the company is bound to an emission trading scheme, it can trade certificates  
34 with other market participants depending on the shortfall of emission reductions. For  
35 companies that do not participate in an emission trading regime, though, carbon offsetting is  
36 voluntary.  
37  
38

39  
40 In the past few years carbon offsetting schemes have come under criticism due to fraudulent  
41 behaviour and failures to adhere to sustainability targets (Davies 2007, Smith 2007).  
42 Offsetting is inherently problematic as comparing reductions of emissions across greenhouse  
43 gases is scientifically contested. The sequestration of carbon emissions by forests, for  
44 instance, is especially difficult to calculate and needs further scientific inquiry. Beside this,  
45 the long-term uptake of carbon emissions by forests requires the assurance of property rights  
46 to the forest and complete isolation of the forest from local communities and other  
47 ecosystems. Furthermore, offsetting usually comes at a high transaction cost to pay  
48 intermediaries.  
49  
50

51  
52 Reducing emissions directly is always preferable to offsetting, because the integrity of the  
53 activities can be ensured. Business managers can also use creative thinking to expand their  
54 activities in ways that would encourage emission reductions. For example, an organization  
55 that engages in micro-financing could set up a fund that deliberately supports renewable  
56 energy projects as a way to offset the company's business flights. Offsetting then takes place  
57 along the firm's strengths, strategies and context. That way, in-house expertise can be drawn  
58 upon to ensure the integrity and continuity of reductions.  
59  
60

## **Reducing emissions – a case study**

1  
2  
3 By assessing publicly available company reports and interviewing senior staff, we have put  
4 together the case study of RWE, the German utility giant. It becomes apparent that carbon  
5 reductions are not straightforward and a mixture of measures has to be created to take into  
6 account the requirements by emission reduction targets and business operations. Text Box 1  
7 illustrates the implementation and planning for carbon emission reductions by RWE.  
8  
9

10 INSERT TEXT BOX ON RWE CASE ABOUT HERE  
11

### 12 **So, what does it mean to become carbon neutral?**

13  
14  
15 As the illustration of the RWE business case displayed in the text box shows, it is not always  
16 easy to work towards emission reductions. As long as our economy continues to rely so  
17 heavily on fossil fuels, any individual business effort will not be able to shoulder the burden  
18 of mitigating climate change.  
19

20  
21 Little by little awareness for climate change issues in the managerial world is increasing.  
22 What is still needed is further “climate change education”. Business schools are starting to  
23 engage with the topic, like Australia’s largest business school at Monash University (Gumley  
24 2006) or Said Business School in the UK. To find out early what climate change means for  
25 your business, where the risks are, but also where opportunities can be seen, is essential these  
26 days. Strategies to cope with climate change risks need to be developed – both for climate  
27 change mitigation and adaptation (Hansjürgens and Antes 2008; Hoffman and Woody 2008).  
28  
29

30  
31 Structural change is necessary to bring about the reductions needed. Nevertheless, with  
32 broader based thinking that takes managers beyond business operations to the larger impacts  
33 of their decisions on the whole system, climate strategies can have a much greater effect.  
34 More research from organisation and management scholars is needed to find ways in which  
35 we can bring about structural change to lower carbon emissions. Addressing green  
36 management in the 2009 Academy of Management Conference is a good start but a more  
37 systemic approach to theorising about lowering greenhouse gas emissions is required to  
38 adequately address the immense challenges posed by climate change.  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



## Bibliography

1  
2  
3  
4  
5  
6  
7  
8  
9  
Bortz, Christina (2007): Conversation. Alyson Slater, Global Reporting Initiative's director of strategy, on how disclosing emissions benefits companies. In: Harvard Business Review, October 2007, p. 32

10  
11  
12  
13  
14  
15  
Carbon Market Data (2008): RWE, Enel and E.ON top the list of European CO2 emitters. 13. May 2008. Available online:  
<http://www.carbonmarketdata.com/pages/EU%20ETS%202007%20Company%20Rankings%20-%20May%202008.pdf> (Accessed 4 April 2009)

16  
17  
18  
19  
20  
21  
22  
Davies, Nick (2007): Truth about Kyoto: huge profits, little carbon saved. On the eve of a G8 summit focused on climate change, Nick Davies reveals major flaws in the global system designed to reduce emissions. In: *The Guardian*, 2 June. Available online:  
<http://www.guardian.co.uk/environment/2007/jun/02/india.greenpolitics> (Accessed 4 April 2009)

23  
24  
25  
26  
27  
Esty, Daniel C. and Winston, Andrew S. (2006): Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage. Yale: Yale University Press. 1. Edition (October 9, 2006)

28  
29  
30  
31  
Esty, Daniel C. (2007): What Stakeholders Demand. In: Harvard Business Review, October 2007, pp. 30+34

32  
33  
34  
35  
36  
EEA (2008) European Environment Agency: Greenhouse gas emissions in Europe 1990-2006 (EC GHG Inventory Report 2008). Available online:  
<http://www.eea.europa.eu/themes/climate/multimedia/greenhouse-gas-emissions-in-europe-1990-2006-ec-ghg-inventory-report-2008> (Accessed 4 April 2009)

37  
38  
39  
40  
41  
42  
ExxonMobil (2009): Strengthening global energy security. Remarks by Rex W. Tillerson. Chairman and CEO, Exxon Mobil Corporation. January 8, 2009. Available online:  
[http://www.exxonmobil.com/Corporate/news\\_speeches\\_20090108\\_rwt.aspx](http://www.exxonmobil.com/Corporate/news_speeches_20090108_rwt.aspx) (Accessed 4 April 2009)

43  
44  
45  
46  
47  
Greenpeace (2008): Greenpeace Magazin/ wir-klimaretter.de: RWE: Vorweg gehen im Schildkrötentempo. Available online: <http://www.klima-luegendetektor.de/2008/09/12/rwe-vorweg-gehen-im-schildkrotentempo/> (Accessed 4 April 2009)

48  
49  
50  
51  
52  
Gumley, Wayne (2006): Climate change is a hot topic in education. In: The Age. October 2006. Available online: <http://www.theage.com.au/news/business/climate-change-is-a-hot-topic-in-education/2006/10/18/1160850997894.html> (Accessed 4 April 2009)

53  
54  
55  
56  
Hansjürgens, Bernd and Antes, Ralf (2008): 'Introduction' in Bernd Hansjuergens and Ralf Antes (eds.): Economics and Management of Climate Change. Risks, Mitigation and Adaptation. Springer Verlag.

57  
58  
59  
60  
Hoffman, Andrew J. (2006): Getting Ahead of the Curve: Corporate Strategies That Address Climate Change. Prepared for the Pew Center on Global Climate Change, October 2006. Available online: [http://www.pewclimate.org/docUploads/PEW\\_CorpStrategies.pdf](http://www.pewclimate.org/docUploads/PEW_CorpStrategies.pdf) (Accessed 4 April 2009)

1  
2  
3 Hoffman, Andrew J. (2007): Regulation: If You're Not At The Table You're On The Menu.  
4 In: Harvard Business Review, October 2007, pp. 8-9  
5

6  
7 Hoffman, Andrew J. and Woody, John G. (2008): Climate Change: What's your Business  
8 Strategy? (Memo to the CEO). Harvard Business School Press (April 15, 2008)  
9

10 IPCC (2007): Summary for Policymakers – A report of Working Group I of the  
11 Intergovernmental Panel on Climate Change. Available online:  
12 <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf> (Accessed 4 April 2009)  
13  
14

15 IPCC (2007a): Working Group III Report. Mitigation of Climate Change. Available online:  
16 <http://www.ipcc.ch/ipccreports/ar4-wg3.htm> (Accessed 4 April 2009)  
17

18 Jones, Charles A. and David L. Levy (2007): North American Business Strategies Towards  
19 Climate Change. In: European Management Journal. Vol. 25, No. 6, pp. 428-440  
20  
21

22 Kolk, Ans and Pinske, Jonatan (2005): Business Responses to Climate Change: Identifying  
23 Emergent Strategies . In: California Management Review. California Management Review,  
24 Vol. 47, No. 3, pp. 6-20  
25

26 Lash J, and Wellington F. (2007): Competitive Advantage on a Warming Planet. In: Harvard  
27 Business Review, March 2007. Available online:  
28 <http://www.solutionsforglobalwarming.org/docs/HarvardBusReviewonclimatechange-3-07.pdf>  
29 (Accessed 4 April 2009)  
30  
31

32 Molisa Pala and Wittneben Bettina B.F. (2008): Sustainable development, the Clean  
33 Development Mechanism, and business accounting. In: Hansjuergens B. and Antes R.:  
34 Economics and Management of Climate Change. Leipzig. Springer, pp.175-192  
35  
36

37 Okereke, Chukwumerije (2007): An Exploration of Motivations, Drivers and Barriers to  
38 Carbon Management: The UK FTSE 100. In: European Management Journal. Volume 25,  
39 No. 6, pp. 475-486  
40  
41

42 Porter, Michael E. and Reinhardt, Forest L. (2007): A Strategic Approach to Climate. In:  
43 Harvard Business Review, October 2007, pp. 1-4  
44

45 RWE Homepage: <http://www.rwe.com/> (Accessed 4 April 2009)  
46  
47

48 RWE (2007): Factbook. CO<sub>2</sub> Emissions Trading in Europe. September 2007. Available  
49 online: <http://www.rwe.com/web/cms/contentblob/108838/data/3244/blob.pdf>  
50 (Accessed 4 April 2009)  
51

52 RWE (2008): Our responsibility. Report 2007. Available online:  
53 <http://www.rwe.com/web/cms/mediablob/en/207620/data/1838/Our-Responsibility.pdf>  
54 (Accessed 4 April 2009)  
55  
56

57 RWE (2008a): Facts and Figures 2008. Updated October 2008. Available online:  
58 [http://rwe.com.geber.de/factbook/en/servicepages/downloads/files/entire\\_rwecom\\_fact08.pdf](http://rwe.com.geber.de/factbook/en/servicepages/downloads/files/entire_rwecom_fact08.pdf)  
59 (Accessed 4 April 2009)  
60

1  
2  
3 Smith, Kevin (2007): The Carbon Neutral Myth. Offset Indulgences for your Climate Sins.  
4 Available online: [http://www.tni.org/reports/ctw/carbon\\_neutral\\_myth.pdf?](http://www.tni.org/reports/ctw/carbon_neutral_myth.pdf?)  
5 (Accessed 4 April 2009)  
6  
7

8 Sussman, Frances G. and Freed, J. Randall (2008): Adapting to Climate Change: A Business  
9 Approach. Prepared for the Pew Center on Global Climate Change  
10 April 2008. Available online: [http://www.pewclimate.org/docUploads/Business-](http://www.pewclimate.org/docUploads/Business-Adaptation.pdf)  
11 [Adaptation.pdf](http://www.pewclimate.org/docUploads/Business-Adaptation.pdf) (Accessed 4 April 2009)  
12  
13

14 Wittneben, Bettina B.F. (forthcoming) Exxon is Right: Let's re-examine our choice for a cap-  
15 and-trade system over a carbon tax. In: Energy Policy  
16

17 WWF (2007): Dirty Thirty. Ranking of most polluting power stations in Europe. May 2007.  
18 Available online:  
19 [http://assets.panda.org/downloads/european\\_dirty\\_thirty\\_may\\_2007.pdf](http://assets.panda.org/downloads/european_dirty_thirty_may_2007.pdf)  
20 (Accessed 4 April 2009)  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

	What can a company do?	Why is it necessary?	How can this be operationalised?
Mitigation of Climate Change	<ul style="list-style-type: none"> <li>• Quantify direct greenhouse gas (GHG) emissions from <b>operations</b></li> <li>• Report GHG emissions and <b>compare</b> across the sector</li> <li>• Assess GHG emissions from the <b>value chain</b>, including suppliers and usage of products</li> <li>• Locate position of organization within <b>system of production and consumption</b></li> <li>• Evaluate the effect of the organization on <b>other systems</b></li> </ul>	<ul style="list-style-type: none"> <li>• Political guidelines and <b>law</b>, that result in economic costs of GHG emissions</li> <li>• <b>Saving</b> costs by using more efficient operation solutions</li> <li>• <b>Public</b> relations (customers as well as financial markets and institutions and employees)</li> <li>• <b>Risk</b> protection</li> <li>• <b>First-mover</b> advantage</li> </ul>	<ul style="list-style-type: none"> <li>• Capitalize on <b>energy efficiency</b> gains</li> <li>• Switch to <b>renewable</b> energy sources</li> <li>• Collect and apply <b>best practice</b> examples</li> <li>• Increase <b>expectations</b> of suppliers and consumers</li> <li>• Encourage <b>individual</b> behavioral change within the company's reach</li> <li>• Integrate <b>mitigation thinking</b> into all decisions across operations</li> <li>• Develop <b>novel approaches</b> to reducing GHG across the system of production and consumption</li> <li>• Communicate <b>achievements</b> in lowering emissions</li> <li>• Assist in furthering effective climate <b>policy</b></li> </ul>
Adaptation to Climate Change	<ul style="list-style-type: none"> <li>• Risk analysis of climate impacts on <b>operations</b></li> <li>• Risk analysis of climate impacts of <b>locations</b></li> <li>• Assessment of <b>insurance</b> needs</li> <li>• Analysis of climate <b>policy</b> developments</li> </ul>	<ul style="list-style-type: none"> <li>• Protect operations</li> <li>• Make informed decisions on location of business</li> <li>• Consider the community and business context</li> <li>• Abide to laws and guidelines</li> <li>• Access new markets</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce reliance on <b>scarce resources</b></li> <li>• Consider climate change impact on different <b>locations</b></li> <li>• Set up adequate <b>insurance</b> for you and for others</li> <li>• Consider a potential contribution to <b>community</b> adaptation needs such as flood defences to prevent increased social unrest and climate refugees</li> <li>• Communicate <b>effective ways</b> to adapt to climate change</li> <li>• Act early on <b>legislation</b> on climate change</li> <li>• Anticipate <b>emerging policy</b> developments</li> <li>• Recognizing <b>new business opportunities</b> to support adaptation needs</li> <li>• Recognize <b>new markets</b> as weather patterns change</li> </ul>

### **An illustrative example: RWE emerging emission reduction strategy**

In 1898, German Electricity Company RWE AG was founded as Rheinisch-Westfälisches Elektrizitätswerk Aktiengesellschaft (RWE), in Essen, North Rhine-Westphalia. In 1900 the first RWE power plant, a 1.2 MW hard coal plant in Essen, went online.

Today the company is one of Europe's largest electric power companies with a total power plant capacity of 44,533 MW or 44.5 GW (as of December 2007). Electricity generation is mainly based on fossil fuels (31.6% lignite, 24.2% hard coal and 15.9% gas). This composition is reflected in the annual CO<sub>2</sub> emissions of the company (includes emissions from RWE power plants and contractually secured capacity): 158 mtCO<sub>2</sub> in 2007, 147 mtCO<sub>2</sub> in 2006 (RWE 2007 and RWE 2008a). The RWE CO<sub>2</sub> emissions in Germany from own RWE power plants were 123.2 mtCO<sub>2</sub> in 2007 (RWE 2008) and 118 in 2006 (RWE 2007); in comparison: German total emissions were 1,004.8 mtCO<sub>2</sub> in 2006 (EEA 2008).

With respect to these figures, RWE is by far the largest CO<sub>2</sub> emitter in Europe (Carbon Market Data 2008). Not least because of this inglorious position, Greenpeace, WWF and other environmental organisations criticise the company. In 2006, the WWF in cooperation with the Institute for Applied Ecology (Öko-Institut) compared and ranked Europe's most polluting power stations. Together these thirty power stations, the "Dirty Thirty", accounted for 393 million t CO<sub>2</sub>, which is equal to 10% of all EU CO<sub>2</sub> emissions. Although the EU-25 was analysed, most of these plants are located in Germany and the UK (10 plants each) and running on the particularly CO<sub>2</sub>-intense lignite. Six of the thirty plants are operated by RWE, four of these plants are among the top 10 (WWF 2007).

An expensive RWE publicity campaign released in October 2008 was the trigger for criticism by Greenpeace: With the engagement in the e8, a coalition of ten leading electricity companies from the G8 countries, RWE is involved in a CDM project on the Galapagos Islands on San Cristobal. In this project the diesel-powered generation was displaced by wind turbines, that generate 2,543 MWh on the island, which is equivalent to 31% of the total island electricity consumption (8,246 MWh). Chiefly, Greenpeace criticised two points: First, following UNFCCC the saving potential of this CDM project is 2,849 tons of CO<sub>2</sub> – the same amount is emitted in the RWE lignite plant "Niederaußem" in one hour. Secondly, the RWE share of the project costs is 625,640 US\$ or 6.3% of the total costs (9,952,790 US\$). This is only a fraction of the annual 30 millions advertising budget of the RWE group (Greenpeace 2008).

These two examples already illustrate the significance of green management and reveal the reasons for reducing: Public opinion is relevant for the company's decisions and actions, which can be supposed as the publicity campaigns of the company aim for a "green" exposition of the company (see for instance the current ProClimate Power 2011 campaign) and the commitment of the company in the mentioned e8 organisation and in the UN Global Compact (which RWE joined in January 2004). Furthermore, the company emphasises the inclusion of RWE in the "Climate Leadership Index" of the Carbon Disclosure Project (CDP) and in the Dow Jones Sustainability Index (DJSI) since 1999 (RWE Homepage).

But green answers are not only expected by the public relations department: You have to practise what you preach. Increasingly, clients expect answers to the urgent question of how the company will deal with climate change. Further political restrictions – national and international legal frameworks determine the company's climate policy. On the national level this is for instance the German Combined Heat and Power (CHP) Generation Act that targets a larger share of CHP generation in Germany and the German Renewable Energy Act that aims at a larger share of renewables in electricity production.

How does RWE respond to political restrictions? How do they deal with a changing business climate? One answer that addresses the current fuel mix and the corresponding high CO<sub>2</sub> emissions is the company's "Vision fuel mix" for 2020: By that year, 35% is targeted to come from lignite and hard coal (including CCS technology), 30% from gas, 11% from nuclear, 17% from renewable energies and 6% from pumped storage (RWE 2008a).

Figure 1a and b illustrate the changing fuel mix.

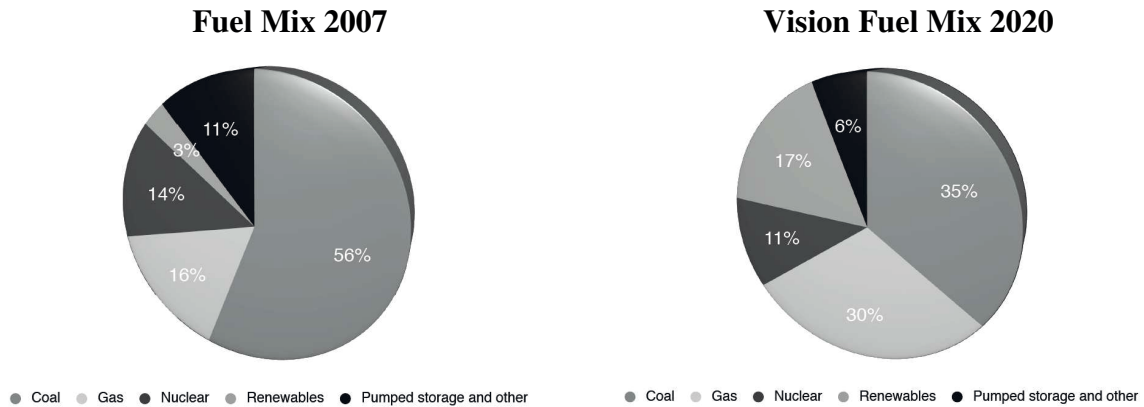


Figure 1.a Fuel Mix 2007

Figure 1.b Vision Fuel Mix 2020

Figures based on RWE 2008a

Related to the 2020 fuel mix statement is RWE's strategy for climate protection (RWE 2008a). It consists of four central measures:

- Increasing Energy Efficiency,
- Extension of renewable energies,
- Utilizing the Kyoto Protocol market mechanisms, Clean Development Mechanism and Joint Implementation,
- Power plant based on Carbon Capture and Storage

The extension of renewable energies and the importance of carbon capture and storage (CCS) technology are quantified in the following figures: From 2007 to 2020 the share of renewables is targeted to increase from 3% to 17%. A new affiliate, RWE Innogy, was established in February 2008 to achieve the renewables goal. The share of coal is intended to decrease, but with an R&D budget of €1 bn from 2007 to 2013 for CCS technology, the RWE Group underlines the importance of this technology and the company's affirmation to electricity generation from coal.

RWE has started an energy efficiency action package with a budget of 150 million Euros, which is available for all customer groups. It contains for instance free energy audits for municipalities, hospitals and welfare institutions, public campaigns like presentations at school and colleges and a sponsorship prize for the most energy-efficient industrial building.

As mentioned above, the company is subject to regulations on climate change. Concrete reduction targets are outlined by the European Union Greenhouse Gas Emission Trading Scheme (EU-ETS), in particular the German National Allocation Plan (NAP). For the second phase of the EU-ETS, RWE estimates annual CO<sub>2</sub> emissions of about 140 mtCO<sub>2</sub> and expected certificates granted per year of about 80 mtCO<sub>2</sub> (RWE 2008a). To meet the estimated shortfall under NAP II (2008-2012), RWE uses the flexible Kyoto Mechanisms. For the second trading period, companies are allowed to offset up to 22% of their allowances (for RWE about 90 mtCO<sub>2</sub>) with CDM and JI certificates. RWE is willing to make full use of this opportunity: with

1  
2  
3 a budget of 150 million Euro allocated for international projects, as well for Carbon Funds as for  
4 direct involvement in projects (funding and technology), RWE participates in the international  
5 carbon market.  
6  
7

8 For the existing RWE power plants, the company plans a renewal programme to improve the  
9 efficiency of the existing plants. This includes the replacement of most inefficient plants, as well  
10 as the use of new technologies like pre-drying of lignite to increase plant efficiency from 43% to  
11 47% (RWE 2008). The next years will show whether RWE can fulfil the objectives of the  
12 company's emission reduction targets.  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60