

# WORKSHEETS ON CLIMATE CHANGE

## Climate change in the city

The twin cities of Bonn (Germany)  
and Chengdu (China)



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## The twin cities of Bonn (Germany) and Chengdu (China)

The scientists have summed it up very clearly, most recently with the publication of the IPCC's fifth assessment report: humans are the main cause of climate change, and the effects of climate change are already tangible, especially in the countries of the Global South. While the global community agrees, at least on paper, that it needs to stop this dangerous climate change and to mitigate its consequences, there is still vigorous debate on an international level about how exactly this should happen, and what state should contribute how much.

Germany and China are important actors in this climate policy debate. In economic terms, Germany is the strongest country in the EU, and as an industrialized country, it has correspondingly high CO<sub>2</sub> emissions. China is the largest of the emerging nations, and, as a result of its rapidly growing economy, has been the greatest emitter of greenhouse gases worldwide for several years.

Both states are in a position to make a critical contribution to climate protection. In recent years the Chinese government has decided on important climate targets and programmes to reduce greenhouse gas emissions, and China is an international leader in the development of renewable energies. Germany has embarked on the *Energiewende* (transition to clean energy), and has begun to implement the necessary, climate-friendly restructuring of the economic system.

Within national and international efforts at climate protection, cities are a particular focus of attention. Cities are responsible for 70 % of worldwide energy consumption. Over half of the total global population already lives in cities, and this proportion is growing. In Germany and China too,

the trend towards urbanization continues. Cities are places where human life is concentrated, and where the risks and consequences of global climate change are intensified for both people and infrastructure. Heat stress, heavy rainfall events, storms, floods, rising sea levels, landslides and drinking water shortages have a greater impact in urban areas, and will occur even more often in the future. Almost half of the world's biggest cities are on the coast, and are thus directly threatened by rising sea levels. The effects of climate change are most strongly felt by marginalized population groups, who often live in informal settlements in the parts of cities that are particularly exposed to risks.

Cities are also places in which the demand for energy, housing, food, water, consumer goods and services is especially high. Thus urban areas are at the origin of much climate-damaging activity, but are at the same time crucial and innovative centres for successful climate protection worldwide. This applies to cities in developing, emerging and industrialized countries. It is expected that the urban population will see its greatest growth not just in the world's gigantic megacities, but in small and medium-sized cities in the emerging and developing countries.

Local and municipal authorities therefore play a vital role in the successful implementation of climate protection measures worldwide. If we consider the local level of the city, a very precise picture of the challenges and opportunities in climate protection emerges. This worksheet focuses on twin cities which are quite disparate in many respects: Bonn and Chengdu, capital of the Chinese province of Sichuan.

## Use in the classroom

Many people already know what climate change means on a global level, or for whole continents. But what do the current and future challenges mean for a local living area such as a city?

This worksheet begins with a general discussion of the effects of climate change for Germany and China, providing background material on the national contexts. Students are made aware that climate change not only affects the Global South, but that it is already affecting areas of life in all the geographical zones of the world. After this general introduction the focus shifts to the local level, the twin cities of Bonn and Chengdu, allowing students to understand the topic of climate change with reference to a specific, narrowly defined

urban context. This gives them an insight into development policy issues with regard to climate change. The two cities, Chengdu and Bonn, have been linked by a project partnership for several years, and they serve as an example that includes the perspectives of both an industrialized and an emerging country. The idea is that students will develop an awareness of the diversity of climate protection and climate adaptation measures, and will be inspired to question individual and social modes of action, finding creative ways to reorganize these.

The comparison between China and Germany leads into the topic, and gives students the chance to use various media to develop their own picture of the two countries. Here general

information (**M 1**) is combined with issues relating to climate protection and adaptation to the consequences of climate change. Resources **M 2** to **M 4** concentrate on the situation in Germany, presenting Germany in its role as a global actor and discussing the Energiewende. China's ambivalent role as a strongly developing emerging country, and as the greatest emitter of greenhouse gases, is clearly illustrated by the presentation of the CO<sub>2</sub> emissions of the world's four biggest emitters (**M 5** and **M 6**). Material from the UN climate summit in New York in 2014 gives a preview of the developments the two countries are hoping to achieve (**M 4** and **M 7**). **M 8** refers to the global effects of human activity on our environment, in the context of climate change.

Once the students have familiarized themselves with the topic on a national level, the focus shifts to the urban sphere,

to the cities of Bonn and Chengdu (**M 10** and **M 11**). **M 12** to **M 17** vividly present specific examples from the real lives of Chinese and German school pupils, showing where and how climate change is already visible. This enables them to assess how much the regions under consideration in this worksheet are affected. **M 18** and **M 19** follow on from this, connecting climate change to environmental pollution on a national level.

In order to emphasize the vital importance of reducing CO<sub>2</sub> emissions, the official climate-related goals of the two cities are listed (**M 20**), and an overview of the efforts they are making is presented in tabular form (**M 21**). In addition, **M 22** and **M 23** briefly introduce select examples of civil society actors in Bonn and Chengdu, to encourage students to study the subject in more depth on their own.

## The partnership between Chengdu and Bonn

Since 2000 Bonn and Chengdu have been twin cities, as part of the partnership between the German federal state of North Rhine-Westphalia and the province of Sichuan. While this was initially conceived mainly as a cultural exchange, the focus is now on the areas of environmental and climate protection. The partnership offers space both for professional exchanges of information about technological innovations and economic developments, and for personal contacts, as in the case of the school partnership between the Integrierte Gesamtschule Bonn-Beuel (Bonn-Beuel Integrated Comprehensive School) and Shude High School in Chengdu. Tertiary students from Bonn also have the opportunity to get to know Chengdu personally in the framework of a funded study visit.

The project "Sino-European partnership for low-carbon sustainable urban development" encourages collaboration between the cities of Bonn and Chengdu in the area of climate change and low-carbon urban development. The organizations Germanwatch and Third Generation Environmentalism (E3G) bring together political decision-makers and civil society actors from Chengdu and Bonn, to jointly develop potential solutions, and to support each other on the way to a low-carbon, sustainable city. The Bonn-Chengdu climate partnership was established in this framework in 2012, building on the twin city arrangement.

### Further reading:

IPCC (2014): Climate Change 2014: Synthesis Report:  
<http://www.ipcc.ch/report/ar5/syr/> (Accessed 02.02.2015)

Resilient Cities: Annual Global Forum on Urban Resilience and Adaptation:  
<http://resilient-cities.iclei.org/> (Accessed 02.02.2015)

Cambridge Institute for Sustainability Leadership (2014): Climate Change – Implications for Cities:  
[http://www.cisl.cam.ac.uk/business-action/low-carbon-transformation/ipcc-briefings/pdfs/briefings/IPCC\\_AR5\\_\\_\\_Implications\\_for\\_Cities\\_\\_\\_Briefing\\_\\_\\_WEB\\_EN.pdf](http://www.cisl.cam.ac.uk/business-action/low-carbon-transformation/ipcc-briefings/pdfs/briefings/IPCC_AR5___Implications_for_Cities___Briefing___WEB_EN.pdf) (Accessed 03.03.2015)

# Germanwatch

Following the motto “Observing, Analysing, Acting”, Germanwatch has been actively promoting global equity and the preservation of livelihoods since 1991. In doing so, we focus on the politics and economics of the North and their worldwide consequences. The situation of marginalised people in the South is the starting point of our work. Together with our members and supporters as well as with other actors in civil society, we intend to represent a strong lobby for sustainable development.

We attempt to approach our goals by advocating for the prevention of dangerous climate change, food security, and compliance of companies with human rights.

Germanwatch is funded by membership fees, donations, grants from “Stiftung Zukunftsfähigkeit” (Foundation for Sustainability) as well as grants from various other public and private donors.

You can also help achieve the goals of Germanwatch by becoming a member or by donating to:

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## Within the series of *Worksheets on Climate Change* the following publications are available in English:

- Global climate change – General issues
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- Sea level rise – Consequences for coastal and lowland areas: Bangladesh and the Netherlands
- Going under! The threat of rising sea levels for the small island nation of Tuvalu
- The threat to tropical rainforests and international climate protection
- Climate change and food security – Trends and key challenges
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All worksheets are also available in German.



**Observing. Analysing. Acting.**  
For Global Equity and the Preservation of Livelihoods.

## M 1

China and Germany – A comparison in numbers<sup>1</sup>

	 China	 Germany
Population	1,369,811,000 (2014)	81,254,000 (2014)
Area	9,562,911 km <sup>2</sup> (2014)	357,170 km <sup>2</sup> (2014)
Population of the capital city	Peking, about 19.7 millions	Berlin, about 3.5 millions
Population growth per year	0.5 % (2013)	0.25 % (2013)
proportion of population living in rural areas	45.59 % (2014)	24.91 % (2014)
proportion of population living in extreme poverty	6.26 % (2011)	0.34 % (2010)
Gross national income per capita per year	6,560 US\$ (2013)	47,270 US\$ (2013)
economic growth per year	7.68 % (2013)	0.11 % (2013)
cars per 1000 inhabitants	53.6 (2011)	530.96 (2011)
proportion of population connected to drinking water supply	91.9 % (2012)	100 % (2012)
electricity consumption per person	3,297.98 kWh (2011)	7,080.96 kWh (2011)
CO <sub>2</sub> emissions per capita (in tonnes) <sup>2</sup>	7.4 (2013)	10.2 (2013)
changes in CO <sub>2</sub> emissions per capita from 1990 to 2012 (in %) <sup>2</sup>	+246 %	-20 %
total CO <sub>2</sub> emissions* (in Mio, tonnes) <sup>2</sup>	10,330 (2013)	840 (2013)

\* CO<sub>2</sub> emissions in 2013 (in millions of tonnes), excluding emissions from land use, land use changes and forestry.

<sup>1</sup> (Source: BMZ: Information of the country China. [http://www.bmz.de/de/was\\_wir\\_machen/laender\\_regionen/asien/china/index.html](http://www.bmz.de/de/was_wir_machen/laender_regionen/asien/china/index.html), accessed 27.10.14)

<sup>2</sup> (Source: PBL Netherlands Environmental Assessment Agency (2014): Trends in global CO<sub>2</sub> emissions: 2014 Report. [http://www.pbl.nl/sites/default/files/cms/publicaties/PBL\\_2014\\_Trends\\_in\\_global\\_CO2\\_emissions\\_2014\\_1490\\_0.pdf](http://www.pbl.nl/sites/default/files/cms/publicaties/PBL_2014_Trends_in_global_CO2_emissions_2014_1490_0.pdf), accessed 05.01.2015)

## M 2

The German Energiewende  
(transition to clean energy)

“Germany has decided to radically restructure its energy supply. The aim of the German federal government is to make Germany one of the most energy-efficient and environmentally friendly economies in the world, and to boost prosperity and competitiveness at the same time. The target is to cover 80 per cent of our electricity consumption with renewable energy by 2050, while cutting our energy consumption to half of what it was in 2008. The plan is to remove the last nuclear power station from the national grid in 2022. [...] The Energiewende is a joint undertaking, which concerns every part of our society. The majority of

citizens are in favour of a safe, affordable and environmentally acceptable energy supply. And this goal can only be achieved together. Everyone has to make a contribution to the Energiewende: politicians, businesses and society. [...] Today, a quarter of our electricity already comes from wind, sun, biomass or water. In 2013, the proportion of renewable energies rose to 25.4 per cent of what is referred to as gross electricity consumption. Renewable energies cover just under a tenth of heat consumption.”

German federal government, on its website on the Energiewende

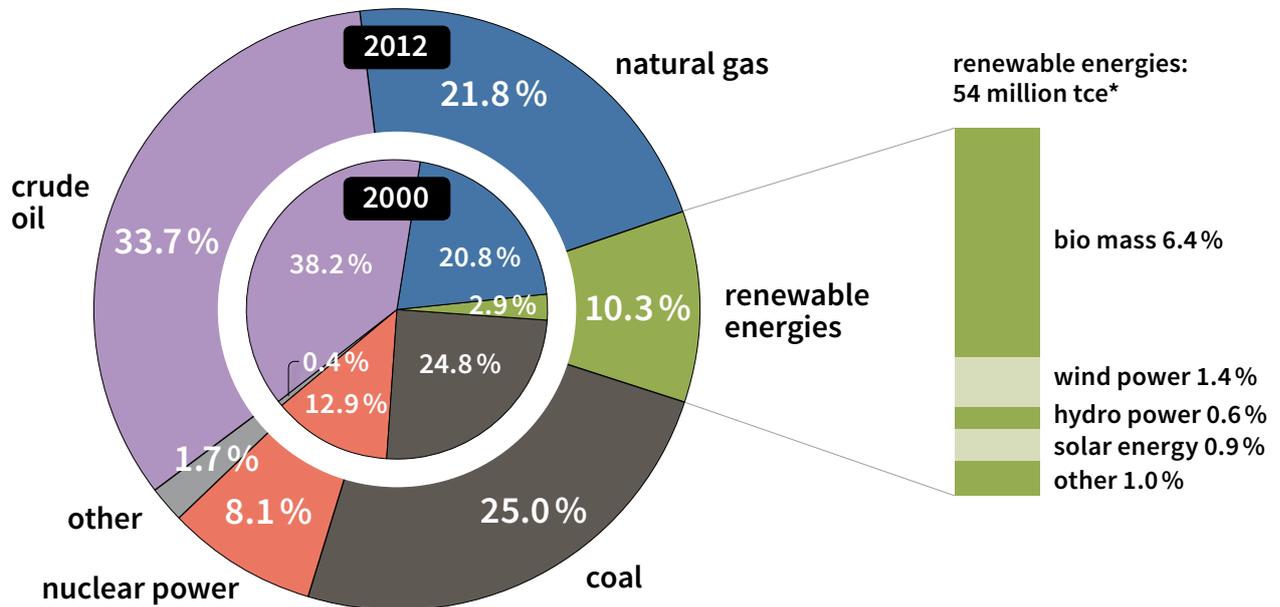
(Source: The German Government (2014): results of the Energiewende 2014. [http://www.bundesregierung.de/Content/DE/\\_Anlagen/2014/06/2014-06-18-energie-wende-weiter-voranbringen.pdf?\\_\\_blob=publicationFile&v=3](http://www.bundesregierung.de/Content/DE/_Anlagen/2014/06/2014-06-18-energie-wende-weiter-voranbringen.pdf?__blob=publicationFile&v=3), p. 2, accessed 09.12.14)

## M 3

## Germany's energy mix in 2012



Germany's primary energy consumption in 2012: 469 million tce\*



(Source: Arbeitsgemeinschaft Energiebilanzen (AGEB), Auswertungstabellen zur Energiebilanz Deutschland 1990 bis 2013. Tabelle 2.1 Primärenergieverbrauch nach Energieträger. September 2014. <http://www.ag-energiebilanzen.de/10-0-Auswertungstabellen.html>, accessed 19.08.2015)

Germany's primary energy consumption in 2012 came to a total of 469 million tonnes of coal equivalent (tce)\*. Renewable energies made up 54 million tce.

*Annotation: In total there is a primary energy consumption of 100.6%. This is because 0.6% constitute the surplus electricity that is exported from Germany abroad.*

\* The unit of measure "tonnes of coal equivalent" (tce) describes a certain energy content: one tce corresponds to the energy contained in one tonne of coal. This makes it possible to compare the energy content of different fuels.

## M 4

## Germany's plans regarding climate and development policy

“ We're all in the same boat. Climate action is a vital issue for the survival of the whole of humankind. Germany is leading the way with ambitious targets.

- By 2020, we want to reduce our carbon emissions by at least 40 per cent compared to 1990 levels.
- By 2022, we will have phased out nuclear power.
- And by 2025, we will have increased the share of renewable energy to at least 40 per cent.

*But we can only limit global warming to below two degrees if developing and emerging economies do their part, too. We will give them massive support. [...] We need to decouple economic growth from increases in emissions. Let me give you two examples.*

- We will no longer provide any funds for new coal-fired power stations under our climate and development cooperation. And we will only provide limited funding for modernising existing coal-fired power plants. We will establish clear criteria for this funding.

- Worldwide, just like at home, we are aiming for a new energy era. We are investing 300 million euros a year to make German technology and expertise available to developing countries. This way we can help promote the use of renewable energies – such as wind and solar power – and energy efficiency.

*That is why Germany is providing half a billion euros each year for the protection of forests and other ecosystems worldwide. [...] We are willing to provide up to 750 million euros (that is about one billion US dollars) to the Green Climate Fund. We are doing this in the expectation that other industrialised countries, too, will shoulder their fair share. [...] Each country needs to contribute to global climate action according to its means. Then we will manage to conclude a new climate agreement in Paris in late 2015.”*

Extracts from the speech by the German Minister of Development, Gerd Müller, on the UN climate summit in September 2014 in New York

(Source: [http://www.bmz.de/en/press/speeches/Mueller/2014/September/20140923\\_statement\\_climate-summit.html](http://www.bmz.de/en/press/speeches/Mueller/2014/September/20140923_statement_climate-summit.html), accessed 27.10.2014)


  
 EXERCISES

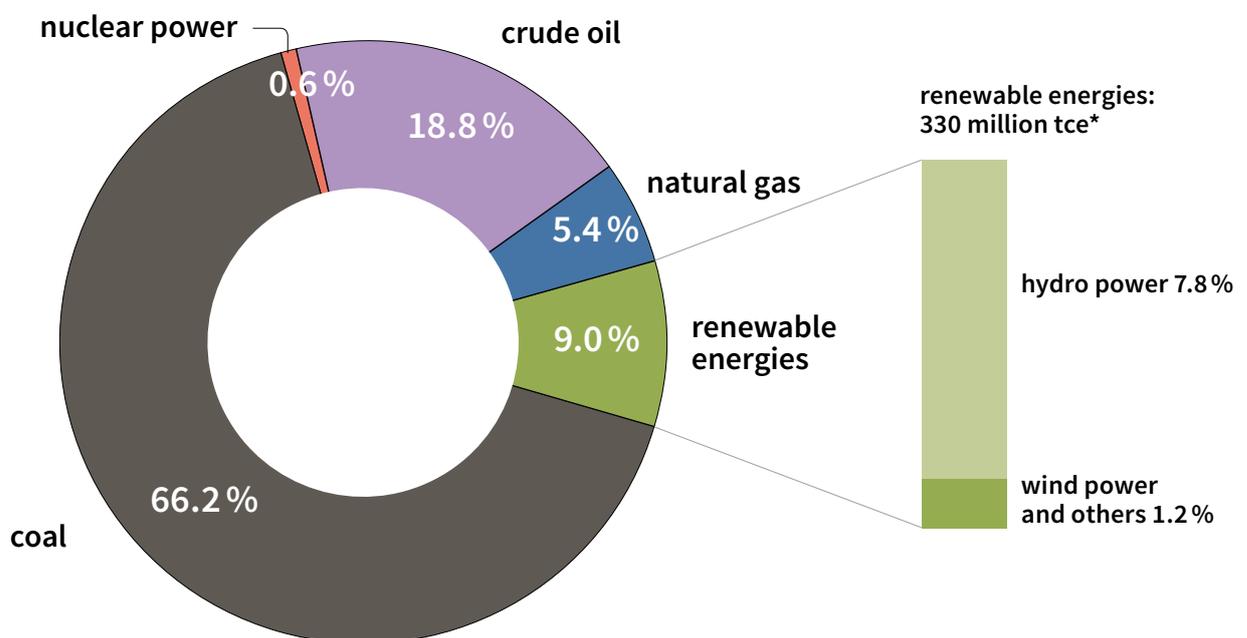
1. Look at the table (M 1) and compare the two states. What sort of picture of China and Germany emerges? Can any preliminary conclusions be drawn about the issue of climate?
2. Describe the key points of German climate policy. What plans is Germany pursuing with the Energiewende (M 2)? How has German power generation changed in recent years (M 3)? Do the plans of the federal government, outlined in M 2, match the actual developments in power generation in Germany?
3. In September 2014, Ban Ki-moon, the General Secretary of the United Nations, invited political decision-makers from all over the world to a special UN climate summit in New York. This was the biggest-ever gathering of heads of government about climate policy, and its aim was to raise awareness of climate change. The representatives of the individual states were expected to give specific commitments to climate protection, laying the foundations for a global agreement on climate in Paris, in 2015. The German Chancellor, Angela Merkel, did not take part in the summit; instead the Federal Minister for the Environment, Barbara Hendricks, and the Federal Minister for Economic Cooperation and Development, Gerd Müller, spoke in her place. Taking into consideration your work on the previous materials, assess Gerd Müller's statements (M 4). How does Germany present itself at the UN summit?

## M 5

## China's energy mix in 2012



China's primary energy consumption in 2012: 3620 million tce\*

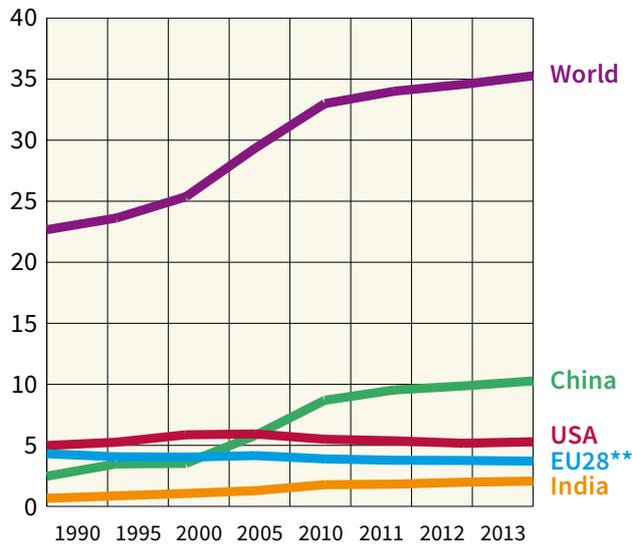


(Source: China National Renewable Energy Centre (CNREC): China Renewable Energy Outline 2012, December 2014. <http://www.cnrec.org.cn/english/publication/2014-01-20-408.html>, accessed 26.01.2015)

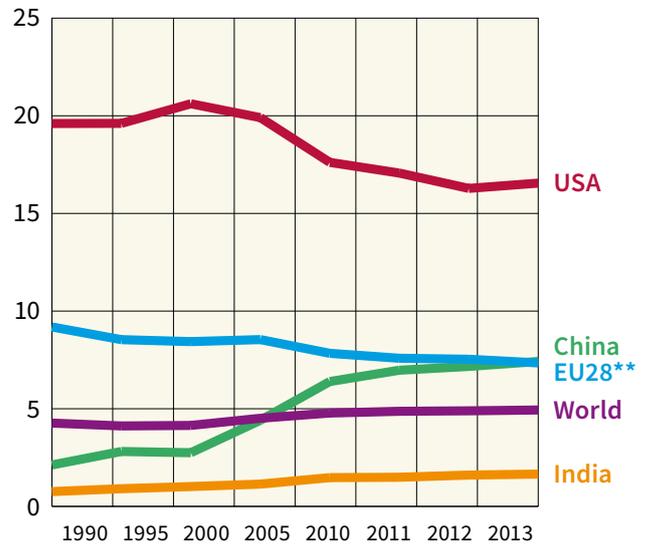
China's primary energy consumption in 2012 came to a total of 3620 million tonnes of coal equivalent (tce)\*. Renewable energies made up 330 million tce, of which 7.8% was generated by hydro power and 1.2% by wind power and other renewable energy sources.

\*The unit of measure "tonnes of coal equivalent" (tce) describes a certain energy content: one tce corresponds to the energy contained in one tonne of coal. This makes it possible to compare the energy content of different fuels.

## M 6

Development of the CO<sub>2</sub> emissions of the four main emittersa) Development of emissions in Gt CO<sub>2</sub>\* from 1990 to 2013

(Source: EGAR – Emission Database for Global Atmospheric Research: CO<sub>2</sub> time series 1990–2013 per region/country. <http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts1990-2013>, accessed 15.01.2015)

b) Development of emissions in tonnes of CO<sub>2</sub> per capita from 1990 to 2013

(Source: EGAR - Emission Database for Global Atmospheric Research: CO<sub>2</sub> time series 1990–2013 per capita for world countries. [http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts\\_pc1990-2013](http://edgar.jrc.ec.europa.eu/overview.php?v=CO2ts_pc1990-2013), accessed 15.01.2015)

\* Gt CO<sub>2</sub> are gigatonnes of CO<sub>2</sub>. One gigatonne converts to 1,000,000,000 tonnes.

\*\* EU 28 stands for the European Union with its 28 member states.

**In 2013, China produced 29 % of worldwide CO<sub>2</sub> emissions, followed by the US with 16 % and the EU 28\*\* with 11 %.**

(Source: adapted from PBL Netherlands Environmental Assessment Agency (2014), Trends in global CO<sub>2</sub> emissions: 2014 Report, S. 13. [http://www.pbl.nl/sites/default/files/cms/publicaties/PBL\\_2014\\_Trends\\_in\\_global\\_CO2\\_emissions\\_2014\\_1490\\_0.pdf](http://www.pbl.nl/sites/default/files/cms/publicaties/PBL_2014_Trends_in_global_CO2_emissions_2014_1490_0.pdf), accessed 05.01.2015)

## EXERCISES

- Describe China's energy mix (M 5) and compare it with that of Germany (M 3).
- Using the visual material under M 6, describe the development of the greenhouse gas emissions of the four biggest emitters worldwide. Assess how the relationship between the countries changes when the emissions per capita (b) are included.

## M 7

## Chinas promises at the UN climate summit



“China is ready to work with the international community to actively tackle the grave challenge of climate change. China attaches high importance to addressing climate change. As Chinese President Xi Jinping pointed out, responding to climate change is what China needs to do to achieve sustainable development at home as well as to fulfill its due international obligation as a responsible major country. [...] Recently, we adopted the national plan on climate change to make sure we will meet the target of cutting carbon intensity by 40 to 45 percent by 2020 from the 2005 level. [...] China, a developing country with 1.3 billion people, faces a daunting task of growing the economy, improving people’s lives and protecting the environment. As a responsible major country, China will make greater effort to more

effectively address climate change and take on international responsibilities that are commensurate with its national conditions, stage of development and actual capabilities. We will announce post-2020 actions on climate change as soon as we can, which will bring about marked progress in reducing carbon intensity, increasing the share of non-fossil fuels and raising the forest stock, as well as the peaking of total CO<sub>2</sub> emissions as early as possible. [...] By so doing, China will blaze a path of sustainable development that leads to both economic growth and effective tackling of climate change. [...] Both developed and developing countries need to follow the path of green and low-carbon development that suits their national conditions.”

Extracts from the speech by the Chinese Vice Premier, Zhang Gaoli, on the UN climate summit in September 2014 in New York

(Source: [http://statements.unmeetings.org/media2/4628014/china\\_english.pdf](http://statements.unmeetings.org/media2/4628014/china_english.pdf), accessed 19.02.2015)

## M 8

## Millions of premature deaths annually linked to air pollution



“In new estimates released today, WHO reports that in 2012 around 7 million people died - one in eight of total global deaths - as a result of air pollution exposure. This finding more than doubles previous estimates and confirms that air pollution is now the world’s largest single environmental health risk. Reducing air pollution could save millions of lives. [...]”

Regionally, low- and middle-income countries in the WHO South-East Asia and Western Pacific Regions had the largest air pollution-related burden in 2012, with a total of 3.3 million deaths linked to indoor air pollution and 2.6 million deaths related to outdoor air pollution. “Cleaning up the air we breathe prevents noncommunicable diseases as well as reduces disease risks among women and vulnerable

groups, including children and the elderly,” says Dr Flavia Bustreo, WHO Assistant Director-General Family, Women and Children’s Health. [...] WHO estimates indoor air pollution was linked to 4.3 million deaths in 2012 in households cooking over coal, wood and biomass stoves. [...] In the case of outdoor air pollution, WHO estimates there were 3.7 million deaths in 2012 from urban and rural sources worldwide. [...] “Excessive air pollution is often a by-product of unsustainable policies in sectors such as transport, energy, waste management and industry. In most cases, healthier strategies will also be more economical in the long term due to health-care cost savings as well as climate gains,” says Dr Carlos Dora, WHO Coordinator for Public Health, Environmental and Social Determinants of Health.”

(Source: WHO – World Health Organization (2014): 7 million premature deaths annually linked to air pollution, press release. <http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/#>, accessed 19.02.105)

“ Roughly three quarters of all smog-related deaths were registered in China and India. But even in the industrialized states of Europe, WHO ascribes 279,000 deaths to environmental air pollution. ”

(Source: "Süddeutsche Zeitung" from 25.03.2014: Millionen Tote wegen Luftverschmutzung, own translation. <http://www.sueddeutsche.de/gesundheit/who-analyse-millionen-menschen-sterben-jaehrlich-wegen-luftverschmutzung-1.1921179>, accessed 11.12.14)

In China, respiratory illnesses have now become the most common cause of death. Studies show that up to 1.2 million people in China die prematurely from polluted air every year. The main causes of smog are coal-fired power sta-

tions, industrial air pollution and car exhaust fumes. In Beijing alone, the number of registered cars has risen by four million in the last 15 years.

## EXERCISES

- How does China present itself at the UN climate summit in New York (M 7)? Take into account China's ambivalent role as an emerging country and as the current biggest emitter of greenhouse gases worldwide (M 6).
- M 8 discusses air pollution as an increasingly serious environmental problem. There are often media reports about smog in China, an emerging country. What connection do you see between the pollution of the environment and man-made climate change?
- Finally, compare the two countries, China and Germany. Use the information from M 1, and connect this with resources M 2 to M 8. Also discuss the announcements made by Germany (M 4) and China (M 7) at the UN summit in September 2014 in New York.

## The twin cities Bonn and Chengdu



### M 9

## Climate change in urban areas

Cities occupy a special position in the context of climate change: on the one hand they are particularly endangered by the effects of climate change, such as heavy rainfall events, landslides, heat stress and storms, but on the other hand they are at the origin of much climate-damaging activity.

Cities are places where human life is concentrated. Over half of the world's population already lives in urban areas. This leads to an enormous demand for energy, housing and infrastructure, to give city-dwellers the basic necessities of life. The structure of these supply systems, however, is one of the main causes of greenhouse gas emissions. Once they are built, supply systems have a relatively long life, and a long-term impact on a city's energy and emission pathways. They

help to establish forms of land use, life cycles of raw materials, transport-related decisions, and lifestyles, all of which are difficult to change retrospectively. This can be observed particularly clearly in the transport sector: an insufficiently developed local transport system and a lack of cycle and footpath networks support non-sustainable mobility practices, and have extremely long-lasting effects. The form and structure of a city also influence its greenhouse gas output. What is crucial is a compact form with a high population density, short distances or no distances between residential areas and workplaces, optimal accessibility based on climate-friendly forms of transport, and the best possible use of vegetation in even the smallest spaces.

**Urban areas devour by far the greatest proportion of the energy consumed worldwide. In 2006 they were responsible for 71–76 % of energy-related CO<sub>2</sub> emissions. It is likely that the greatest increase in urban population will**

**take place not only in the world's gigantic megacities, but also in small and medium-sized cities in developing and emerging countries.**

(Source: Germanwatch (2014): Klima? Wandel. Wissen! Neues aus der Klimawissenschaft, exhibition, own translation. <http://germanwatch.org/de/9434>)

M 10

Location and basic data of Bonn and Chengdu

a) Chengdu



**Province:** Sichuan  
**Size:** 12,121 km<sup>2</sup>  
**Population:** 14.7 million (2011)  
**Mild subtropical climate**  
**Average temperature:** 17 °C



Photo: DWang

b) Bonn



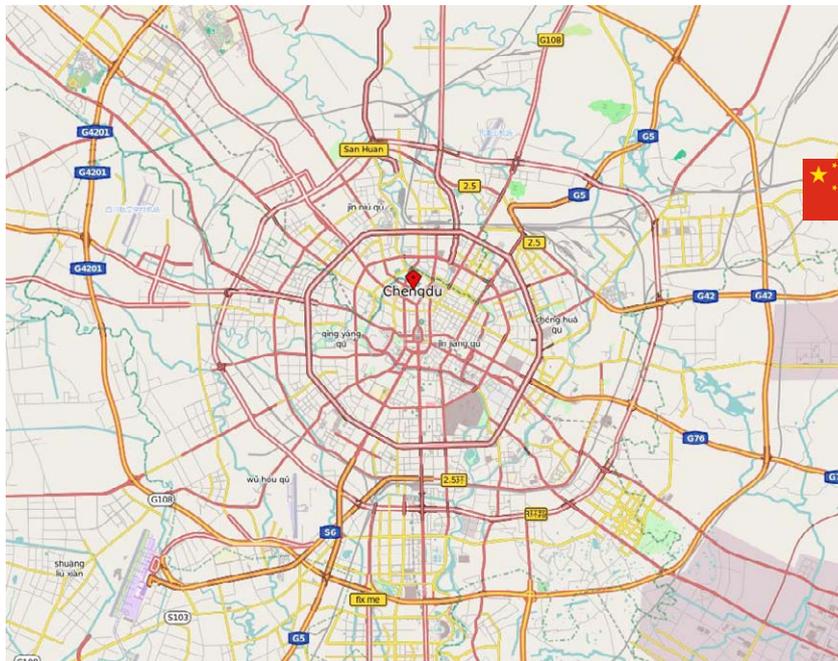
**Federal state:** North Rhine-Westphalia  
**Size:** 141 km<sup>2</sup>  
**Population:** 327,913 (2012)  
**Maritime climate**  
**Average temperature:** 10 °C



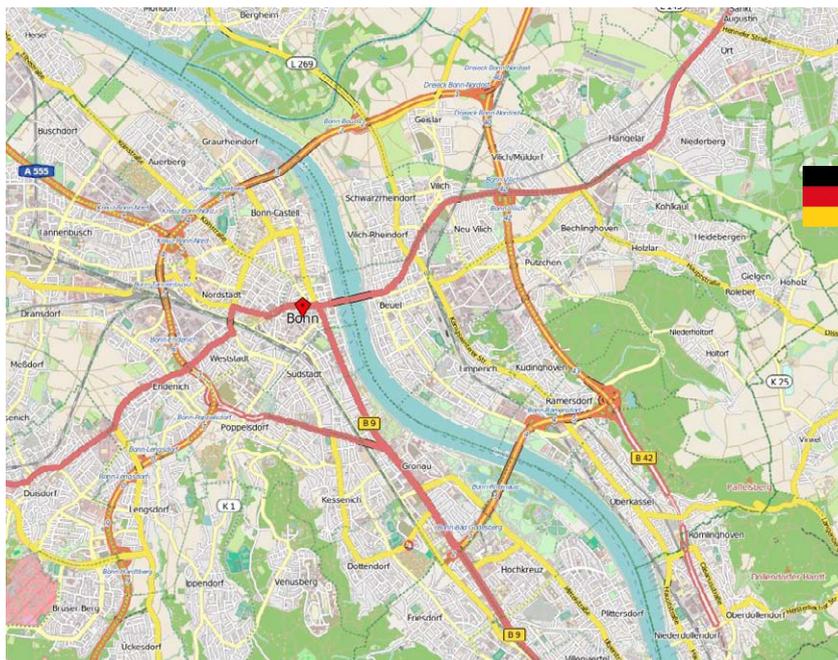
Photo: Michael Sondermann/fotografisch.de Bonn

## M 11

## City maps of Bonn and Chengdu



Chengdu and the surrounding area



Bonn and the surrounding area

(Source: <http://www.openstreetmap.de/karte.html>, accessed 15.01.2015)


  
 EXERCISES III

9. To what extent are cities especially affected by the impact of climate change (M 9)? What does this have to do with population growth?

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10. What impression do you have of the cities of Bonn and Chengdu (M 10 and M 11)?

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11. Use the internet to research the topics of energy and climate in the cities of Bonn and Chengdu. Present your findings, and show the approach you used in your research. What were you able to find out? Discuss any difficulties that arose during your research.

# Effects of climate change in Chengdu and Bonn

## M 12 Flooding

According to the Intergovernmental Panel on Climate Change (IPCC), climate change will mean, on global average, that heavy rainfall and floods, as well as droughts, will become more severe and more frequent. The effects will differ by re-

gion. For Europe, floods are seen as one of the main dangers, capable of causing increasing economic losses and harm to humans. The Rhine will also be affected by climate changes:

“ Phases of high and low water flow are likely to be more frequent and more extreme. Floodwaters may be higher and last longer, thus causing more frequent and severe damage. Low water levels may restrict shipping and limit the water supply. Low water levels also reduce groundwater

recharge, and have a negative impact on groundwater quality. Higher air temperatures lead to higher water temperatures, which can in turn – in combination with lower outflows – cause countless ecological and chemical changes to watercourses. ”

(Source: IKSIR – International Commission of the Protection of the Rhine, own translation. <http://www.iksr.org/index.php?id=342>, accessed 16.01.2015)

## M 13 Extreme water levels of the Rhine



a) The Rhine in flood



b) Low water level on the Rhine in November 2011

## M 14

## The European windstorm “Kyrill” in 2007: Over 300 severe-weather call-outs in Bonn



“After Thursday’s severe windstorm “Kyrill”, which also left traces in Bonn, the city has made a preliminary assessment of the damage. Given the severity of the storm which passed over the city, Bonn has emerged relatively unscathed. There were no serious injuries or fatalities. The damage to property, however, is likely to cost millions. Two workers suffered slight injuries on a call-out to the Museum König in the Adenauerallee. In the city’s

woodlands, numerous trees fell, and some animal enclosures were damaged. [...] The underpass at Poppelsdorfer Allee/ Quantiusstraße/ the bus station was knee-deep in water on Friday morning, and had to be temporarily closed to traffic. A scaffolding tower collapsed at the Clara Schumann Secondary School, and roof tiles and windows were damaged at the Röttgenstraße youth centre.”

(Source: <http://www.internetcologne.de/cms//artikel.php/7/33157/uebersicht.html/1501/30/uebersicht.html>, own translation, accessed 18.12.14)

## M 15

## The consequences of the windstorm for the forest



“The state government of North Rhine-Westphalia placed 100 million euros in a “Kyrill” emergency programme, so that the damage to the woodlands could be dealt with as quickly as possible. [...] The greatest losses were due to lower revenues from wood sales. This was because the amount of wood blown over in a single night was the same as the amount felled in North Rhine-Westphalia in three years. There was suddenly so much wood on the market that prices fell drastically. “In terms of losses sustained, Kyrill was the most severe windstorm ever seen in North Rhine-Westphalia, and showed us the consequences

that climate change can have, even in our part of the world. Windstorms, heavy rainfall events, and longer dry spells are consequences of climate change, for which we have to prepare our forests”, explained [...] the North Rhine-Westphalian Minister for the Environment, Johannes Remmel. One of the consequences of this realization is that monocultures of spruce in the local woodlands will be cut down, and replaced with deciduous trees suitable for local conditions. The aim is to retain a healthy, stable, mixed-aged forest, combining deciduous trees and conifers.”

(Source: Holger Willcke in “General-Anzeiger” from 20.01.2012: Vor fünf Jahren wütete Orkan Kyrill im Kottenforst, own translation. <http://www.general-anzeiger-bonn.de/lokales/bonn/vor-fuenf-jahren-wuetete-orkan-kyrill-im-kottenforst-article605674.html>, accessed 18.12.14)



12. Explain the impact of climate changes on water availability (M 12). What are the effects of extreme precipitation and long-lasting heatwaves?
13. Describe the consequences of Kyrill mentioned in M 14 and M 15. How do you explain the high financial losses in the forestry sector?

## M 16

## Heatwave in China



“ Over the last few days, an unusual heatwave in China has claimed numerous lives. According to media reports, two dozen people from several regions have died of heatstroke, ten in Shanghai alone [...] For the first time since the warning system was introduced in 2009, China’s weather agency (CMA) announced the highest emergency level for seven provinces, and for the two cities of Chongqing and Shanghai. In particular, residents of the east and south have been warned about the risk of heatstroke and fire. [...] Shanghai experienced its hottest July since records began 140 years ago. Temperatures were above 35 degrees

for 24 days, the longest period ever. The harbour city also saw its highest ever temperature, 40.6 degrees. [...] “Climate change and human activities are contributing jointly to the heatwave”, said researcher Zheng Yan, from the Institute for Urban and Environmental Studies at the Academy of Social Sciences [...] in Beijing. He went on to say that not everything can be explained by global warming, but that the heat is intensified in cities by traffic, concrete structures, waste heat from air-conditioning units, and industrial operations. ”

(Source: “HNA Hessische Allgemeine/ Online” from 31.07.2013: Zwei Dutzend Hitzetote in China, own translation.  
<http://www.hna.de/welt/zwei-dutzend-hitzetote-china-zr-3034332.html>, accessed 03.03.2015)

## M 17

## Drought hits lakes and rivers along the Yangtze



“ Hundreds of lakes and rivers along the Yangtze River have dried up due to a severe and prolonged drought, according to the local drought relief headquarters.

[...] 900 reservoirs and 132 rivers have been affected by the drought, causing one-third of the province’s farmland to dry up. [...] The provincial meteorological station said the drought will last

for another week, adding that this will likely increase the area of farmland affected by the heat. [...] Local authorities have prioritized water use for local residents and livestock. The Yangtze River valley is a major rice-producing area and the drought will likely hit output, according to analysis by flood control officials. ”

(Source: “ShanghaiDaily” from 03.08.2013: Drought hits lakes and rivers along the Yangtze.  
<http://www.shanghaidaily.com/national/Drought-hits-lakes-and-rivers-along-the-Yangtze/shdaily.shtml>, accessed 9.12.14)

## M 18

## Environmental pollution and climate change – a dangerous combination



Consequences of climate change such as floods and heavy rainfall events, heatwaves and periods of drought are becoming more and more obvious in China. Increasingly serious environmental problems further exacerbate the situation.

In China, incorrect rubbish disposal and industrial waste lead to severe pollution of rivers, lakes and soils. According to information from the Chinese Environment Ministry, 60 per cent of groundwater is polluted and not suitable for drinking. 16 per cent of soils are also severely contaminated; nearly one fifth of China's arable land is poisoned with contaminants. Extreme precipitation, droughts and heatwaves – intensified by climate change – exacerbate a situation which is already critical because of massive environmental problems.



Cleaning of the rubbish-polluted Yangtze River in China (2012).

## M 19

## Chengdu's major water supply cut



“ Chengdu, the capital of southwestern China's Sichuan Province, was forced to cut its major tap water supply yesterday because one of the city's major drinking water sources was polluted.

The supply was cut at 6pm and affected most of Chengdu's 12 million people, with many forced to carry water from public taps at street level or buy bottled water at dinner time.

An unnamed source from the Chengdu Water Corporation said garbage was dumped in the

Baimu River, a major drinking water source, upstream from downtown in the city's Chongyi Township. [...] It was still unknown as to what kind of pollution it was and who dumped the garbage. Last July, Chengdu's tap water supply was cut because heavy rains flooded the Minjiang River, another drinking water source, and silted up many water plants. ”

(Source: Wang Xiang in "ShanghaiDaily" from 03.04.2010: Chengdu's major water supply cut. <http://www.shanghaidaily.com/national/Chengdus-major-water-supply-cut/shdaily.shtml>, accessed 9.12.14)

### EXERCISES

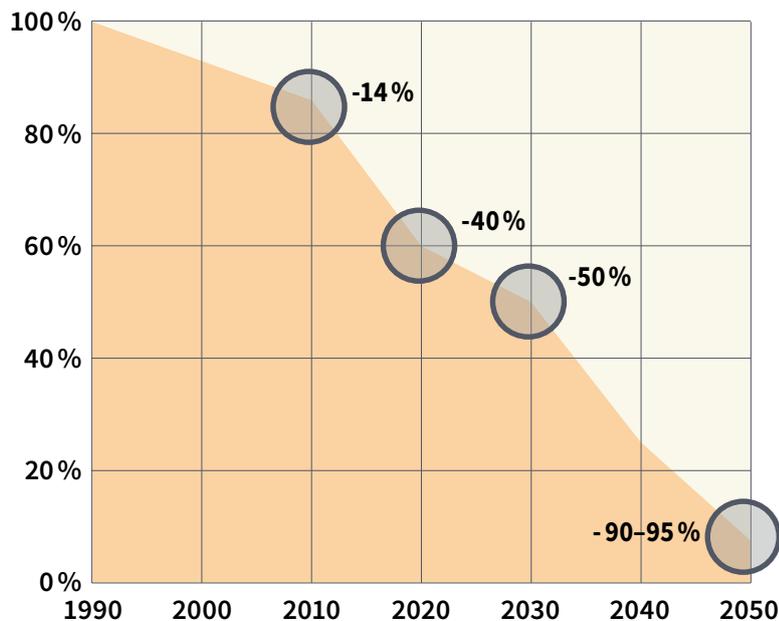
14. M 9 described in what form cities, as concentrations of human life, are affected by climate change. What is the specific phenomenon presented in M 16? To what extent is this a situation which is particularly acute for cities?
15. What were the long-term consequences of the 2013 drought described in M 17?
16. Explain the connection between environmental pollution and the effects of climate change (M 8, M 18 and M 19). Why is this combination especially threatening for China?
17. Finally, assess the degree to which the two cities are affected. Take into account the comparison between China and Germany.

# Climate protection and adaption on climate change

M 20

## What reduction targets have Bonn and Chengdu set themselves?

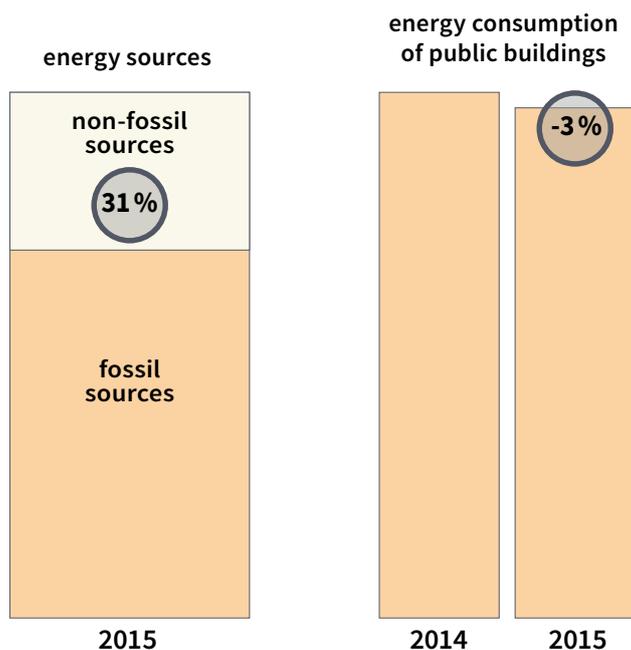
### a) Climate protection targets: Bonn



- **2010:** 14 % less CO<sub>2</sub> output in comparison to reference year, 1990
  - **2020:** 40 % less CO<sub>2</sub> output in comparison to reference year, 1990
  - **2030:** 50 % less CO<sub>2</sub> output per capita in comparison to reference year, 1990
  - **2050:** 90 to 95 % less CO<sub>2</sub> output in comparison to reference year, 1990
- **Long-term goal: sustained reduction of CO<sub>2</sub> emissions to 2.5 tonnes per inhabitant**

(Source: adapted from [http://www.bonn.de/umwelt\\_gesundheit\\_planen\\_bauen\\_wohnen/klimaschutz/ziele/index.html](http://www.bonn.de/umwelt_gesundheit_planen_bauen_wohnen/klimaschutz/ziele/index.html), accessed 16.01.2015)

### b) Climate protection targets: Chengdu



- **2015:** increase energy production from non-fossil sources to at least 31 %
  - **2015:** reduce energy consumption of public buildings by 3 %
- **Long-term goal: Chengdu as a "World Modern Garden City"**

(Source: adapted from Lindner, S., Li, L. & Müller, A. (2014): Fact Sheets Chinese and German city policies, Sino-European Partnership on Low Carbon and Sustainable Urban Development: Fact Sheet Chengdu. <http://low-carbon-partnerships.org/en/4998>, accessed 10.12.2014)

## M 21

## Examples of reduction and adaptation measures taken by Chengdu and Bonn: an overview

Bonn 	Sector	Chengdu 
<p><b>Cycle capital:</b> By intensifying efforts to promote cycling, Bonn hopes to increase the share of total traffic made up by cyclists from 12 % to 25 %. The aim is to turn Bonn into the cycling capital of North Rhine-Westphalia by 2020!</p>	Transport	<p><b>Electric vehicles:</b> Starting with a pilot project to demonstrate the use of electric vehicles for public transport (buses, taxis), Chengdu joined the national initiative “10 Cities and 1000 Vehicles” in 2010. The city already has a network of 14 charging stations.</p>
<p><b>Energy-efficient standards for new buildings</b> on land belonging to the city of Bonn have been established as binding.</p>	Buildings	<p><b>Green Buildings</b> Chengdu promotes the construction of resource- and energy-saving buildings, by offering advice and support in the planning and realization stages.</p>
<p>The <b>solar roof register</b> (Solardachkataster) is an internet-based information system, which shows the owners of private houses or commercial buildings whether it would be possible and profitable to install a solar energy facility on their roofs.</p>		<p><b>Green roofs and walls:</b> To develop additional green spaces in the urban area, Chengdu is successfully using the roofs and walls of buildings.</p>
<p><b>Ecoprofit (Ökoprofit)</b> is a consulting and training programme provided by the city of Bonn, to help companies achieve a lasting improvement in their environmental management.</p>	Industry	<p><b>Project to increase energy efficiency:</b> Chengdu helps companies to improve their energy efficiency by offering energy consumption analyses and advice on financing, implementing and maintaining energy-saving measures.</p>
<p><b>“Sustainable Bonn”:</b> Hotels, restaurants and congress organizers are given advice and incentives to help them organize conferences in a more sustainable way.</p>		
<p><b>The Energy Agency Bonn</b> functions as a consulting service for all matters relating to renewable energies and energy-efficient building and modernization.</p>	Energy	<p>Chengdu supports the exploration and use of non-fossil energy sources and technologies in Chengdu, especially that of <b>renewable energies</b> or of power storage technologies for electric vehicles.</p>
<p><b>Public procurement:</b> In the tendering and contracting process for municipal projects and in the procurement of work equipment, special attention is paid to social standards and environmental protection criteria.</p>	Environment	<p><b>“Green Belt”:</b> The “Green Belt” surrounds the city of Chengdu, and connects monuments, green spaces, parks and leisure facilities. By developing and preserving this “Green Belt”, Chengdu protects the environment and promotes environmentally friendly leisure activities.</p>

(Source: adapted from Lindner, S., Li, L. & Müller, A. (2014): Fact Sheets Chinese and German city policies, Sino-European Partnership on Low Carbon and Sustainable Urban Development. <http://low-carbon-partnerships.org/en/4998>, accessed 10.12.2014)


**EXERCISES**

**18. M 21** gives examples of measures undertaken by Bonn and Chengdu. In what way do these contribute to the cities' plans for emission reduction and adaptation? Look for more information about the different measures on the internet. You may find the following websites helpful:

<http://low-carbon-partnerships.org/en/home>

<http://www.bonnsustainabilityportal.de> (German and English articles)

## M 22

## Variety of activities in Bonn



The community garden on the grounds of the Ermekeil barracks

The Ermekeil barracks are located in the middle of the Südstadt district in Bonn. Previously used mainly to accommodate soldiers, the buildings, some of them historical, are now empty. The **Ermekeil Initiative** aims to develop the premises for long-term civilian use. Along with regular **'Repair Cafés'**, the grounds are already being used as a space for urban gardening.

Website: [www.ernekeilgarten.de](http://www.ernekeilgarten.de)



Repair Café by the initiative "Bonn im Wandel" ("Bonn in transition") in Haus Müllestoppe in Bonn

**"Repair Cafés"** offer a space where people can help each other – for free – to repair electronic devices such as laptops, telephones or vacuum cleaners, or other products, thus extending their useful life. A longer product life reduces the consumption of resources that would be used for the production of new devices.

Website: [www.repaircafe.org/de](http://www.repaircafe.org/de) und [www.facebook.com/Repaircafebonn.de](https://www.facebook.com/Repaircafebonn.de)



Consumers and farmers harvest potatoes together

Agricultural projects and community gardens show people how they can escape from prevailing consumer behaviour, and grow food in an environmentally friendly way. Such gardens are often found in the middle of urban areas, and have positive long-term effects on the city's climate.

**SoLaWi (Solidarische Landwirtschaft, roughly equivalent to community-supported agriculture)** in Bonn is a collective in which well over a hundred consumers, two farmers and one vegetable gardener take joint responsibility for managing an agricultural area. The producers are supported financially and in their practical work, and the consumers, in return for their contribution, get fresh, unpackaged, organically grown food.

Website: [www.solawi-bonn.de](http://www.solawi-bonn.de)



Solar energy facility on the Kennedy Bridge in Bonn

**Solar installations** derive electricity from the sun’s energy, and have become an important source of renewable energy in recent years. The installation shown here is on the south side of the Kennedy Bridge across the Rhine in Bonn. The electricity produced here corresponds to the needs of 20 households in Bonn.



**“Critical Mass”** is a movement that aims to generate effective publicity, act collectively, and draw attention to problems in the transport sector. All over the world, cyclists meet once a month in big cities, like here in Bonn, to jointly promote the bicycle as an environmentally friendly means of transport.

Website: [www.critical-mass.de](http://www.critical-mass.de)

A campaign carried out by the health insurance fund AOK and the Allgemeiner Deutscher Fahrrad-Club (ADFC, General German Cycle Club) in North Rhine-Westphalia, “Mit dem Rad zur Arbeit” (**“Ride your bike to work”**), aims to encourage workers to cycle to work more often. This is not only good for their health, but also for the environment. In 2014 Bonn had 1573 participants.

Website: [www.mit-dem-rad-zur-arbeit.de](http://www.mit-dem-rad-zur-arbeit.de)

**Atmosfair** is a non-governmental organization, working for climate protection in the areas of travel and mobility. The aim is to offer a climate-friendly alternative for journeys where a flight is unavoidable. In order to compensate for the emissions caused by the flight, airline passengers can pay a climate protection contribution to atmosfair, based on the distance travelled. This is used to promote the development of renewable energies in countries in the Global South, allowing CO<sub>2</sub> emissions to be saved elsewhere.

Website: [www.atmosfair.de](http://www.atmosfair.de)

## M 23

## Variety of activities in Chengdu



In China, unlike Germany, it has not previously been possible to give away used clothing for further use. Instead old clothes are often disposed of in environmentally harmful ways. The non-governmental organization **Green Zhejiang** provides clothing bins to encourage the recycling of clothing.

Website: [www.weibo.com/345900500](http://www.weibo.com/345900500)

(Source: adapted from Zhang Chu, Ren Hui, Dirk Rommeney & R. ShinWei Ng (2014): Addressing Low Carbon Urban Development – NGO Case Studies from China, p. 50–52. <http://low-carbon-partnerships.org/en/5026>, accessed 11.12.2014)



The civil society organization **Roots & Shoots** in Chengdu promotes environmentally sound lifestyles, and helps communities to organize themselves in ecologically sustainable ways and reduce CO<sub>2</sub> emissions. For example, technologies are used which improve the irrigation of gardens without harming the environment.

Website: [www.cdgyy.org](http://www.cdgyy.org)

(Source: adapted from Zhang Chu, Ren Hui, Dirk Rommeney & R. ShinWei Ng (2014): Addressing Low Carbon Urban Development – NGO Case Studies from China, p. 71–74. <http://low-carbon-partnerships.org/en/5026>, accessed 11.12.2014)



One of the core goals of the organisation **CURA (Chengdu Urban River Association)** is to protect rivers around Chengdu and improve their water quality. The aim is to involve the local population, for example by running environmental education workshops. The organization hopes to inform people who live near the rivers about the advantages of ecologically sustainable and environmentally friendly lifestyles and production methods.

Website: [www.rivers.org.cn/en](http://www.rivers.org.cn/en)

(Source: adapted from Zhang Chu, Ren Hui, Dirk Rommeney & R. ShinWei Ng (2014): Addressing Low Carbon Urban Development – NGO Case Studies from China, p. 18–22. <http://low-carbon-partnerships.org/en/5026>, accessed 11.12.2014)

## EXERCISES

19. Describe the measures presented under **M 22** and **M 23**. Are you already familiar with the projects presented here? What positive effects do these have for the environment and the climate? Do you think there would be potential to implement projects from Chengdu/China in Bonn/Germany and vice versa?

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20. Think about what you can change in your home, your leisure activities, or your mobility, to cut down on emissions yourself. Consider the projects and activities presented in the materials. Could you imagine taking part in such activities?

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21. Finally, go one step further. What do you expect? What do you want your school, your local community, your town, or your country to do in order to cut emissions? Let your imagination run wild!