

WHO UNFCCC Climate and Health Country Profiles – Reference Document

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Background

During the WHO Global Climate and Health Conference, August 2014, UNFCCC Executive Secretary Cristiana Figueres and WHO Director-General Margaret Chan agreed to provide country-specific information on health risks from climate change, and potential health benefits of adaptation and mitigation policies.

The purpose of the WHO UNFCCC Climate and Health Country Profiles is to empower Ministers of Health and other decision-makers to engage, advocate and act for health, in national preparations for the UN Framework Convention on Climate Change negotiations in Paris in December 2015, by providing a brief snapshot of the impacts of climate change on health and the opportunities for health co-benefits in their own countries. The country profiles summarize the most relevant and reliable information on health and climate for each country. They build on existing data and, where available, make use of data generated through regional and country-level processes.

The Climate and Health Country Profile Project is a joint collaboration of The World Health Organization (WHO) and the Secretariat of the UN Framework Convention on Climate Change (UNFCCC), supported and in-part funded by the Wellcome Trust, working together with CDP, the World Meteorological Organization (WMO) and the World Bank, and with contributions by researchers at the London School of Hygiene and Tropical Medicine (LSHTM), University of East Anglia (UEA), and the University of Wisconsin-Madison (UW-Madison).

Methods and Sources

A brief overview of the methodologies and key assumptions for the WHO UNFCCC climate and health country profiles is included below, along with the full citation of any source. This document presents information in the same order as the layout of the country profiles.

If you have any further questions, please contact Tara Neville at nevillet@who.int

Overview

Demographic estimates, economic and development indicators, health estimates

- a) World Population Prospects: the 2015 Revision, UNDESA, 2015
(Available at: <http://esa.un.org/unpd/wpp/>)
- b) World Urbanization Prospects: The 2014 Revision, UNDESA, 2014
(Available at: <http://esa.un.org/unpd/wup/>)
- c) World Development Indicators, World Bank, 2015/2016
(Available at: <http://data.worldbank.org/indicator>)
- d) Global Health Expenditure Database, WHO, 2014

- e) United Nations Development Programme, Human Development Reports, 2014
(Available at: <http://hdr.undp.org/en/content/human-development-index-hdi>)
- f) Global Health Observatory, WHO, 2014
(Available at: http://www.who.int/gho/mortality_burden_disease/life_tables/en/index.html)
- g) Levels & Trends in Child Mortality Report 2015, UN Inter-agency Group for Child Mortality Estimation, 2015(Available at: http://www.unicef.org/media/files/Levels_and_Trends_in_Child_Mortality_2014.pdf)

Current and Future Climate Hazards

Mean Annual Temperature, Days of Warm Spell, Days with Extreme Rainfall, Consecutive Dry Days

The four national time series plots are country-specific projections up to the year 2100 for climate hazards under a ‘business as usual’ high emissions scenario (in orange) compared to projections under a ‘two-degree’ scenario with rapidly decreasing emissions (in green). The panels include: mean annual surface temperature, days of warm spell (WSDI), days with extreme rainfall (R20mm) and consecutive dry days (CDD). For some countries, days of cold spells (CSDI) and warm nights (TN90p) are also shown. A ‘warm spell’ day is a day when maximum temperature, together with that of at least the six consecutive previous days, exceeds the 90th percentile threshold for that time of the year. Warm nights are those when minimum temperature exceeds the 90th percentile threshold for that time of the year. The model projections are from CMIP5 (Coupled Model Intercomparison Project Phase 5), and use two climate scenarios: Representative Concentration Pathway 2.6 (RCP2.6) (green) and Representative Concentration Pathway 8.5 (RCP8.5) (orange). We use the modelled projected changes above the 1961-1990 period, smoothed with a 30-year Gaussian filter. The multi-model mean is the average across about 20 models (thick line). The figures also show each model individually as well as the 90% model range (shaded) as a measure of uncertainty and, where available, the annual and smoothed observed record (in blue).

The time-series plots were produced by interpolating all observed and simulated data to a 0.5 degree grid, and then aggregating this to the individual country level. For the observed data, changes in station coverage over time caused some inconsistencies for some countries. We minimised those inconsistencies by working with anomalies from the 1961-1990 average, using data only where at least 15 years of data were available during 1961-1990. Outside of the baseline range the data was further constrained so that the number of grid boxes available for a particular year was greater than 50% of the maximum number possible for that country and greater than 80% of the maximum number ever available for that country. The second pair of conditions was applied primarily to remove unreliable early data. Any bias in the GCM data was removed by aligning with the observed baseline where available, otherwise it was aligned with the multi-model mean. Finally we performed a consistency check across a larger set of variables for each country.

a) Model projections are from CMIP5 for RCP8.5 (high emissions) and RCP2.6 (low emissions). CMIP5 is a project of the World Climate Research Programme's Working Group on Coupled Modelling, and it is used by IPCC. Indices of extremes from CMIP5 model projections were provided by <http://www.cccma.ec.gc.ca/data/climdex/> (Silman et al., 2013a, 2013b).

b) Observed historical record of mean temperature is from CRU-TSv.3.22 (Harris et al., 2014).

c) Observed historical records of extremes are from HadEX2 (Donat et al., 2013).

The data analysis was done by the Climatic Research Unit and Tyndall Centre for Climate Change Research, University of East Anglia, 2015 (Goodess *et al.*, in prep).

References:

Donat, M.G., et al. (2013), Updated analyses of temperature and precipitation extreme indices since the beginning of the twentieth century: The HadEX2 dataset, *Journal of Geophysical Research: Atmospheres*, 118, 1-16, doi:10.1002/jgrd.50150.

Goodess, C.M., Harpham, C., Le Quéré, C. and Jones, P.D. Country-level time series (1900-2100) of temperature and precipitation extremes for health and other impact studies, in preparation for submission to *Nature Scientific Data*.

Harris, I., Jones, P.D., Osborn, T.J. and Lister, D.H. (2014), Updated high-resolution grids of monthly climatic observations – the CRU TS3.10 Dataset. *Int. J. Climatol.*, 34: 623-642. doi:10.1002/joc.3711

Sillmann, J., V. V. Kharin, F. W. Zwiers, X. Zhang, and D. Bronaugh, (2013a), Climate extremes indices in the CMIP5 multi-model ensemble. Part 1: Model evaluation in the present climate. *J. Geophys. Res.*, doi:10.1002/jgrd.50203.

Sillmann, J., V. V. Kharin, F. W. Zwiers, X. Zhang, and D. Bronaugh, (2013b), Climate extremes indices in the CMIP5 multi-model ensemble. Part 2: Future projections. *J. Geophys. Res.*, doi:10.1002/jgrd.50188.

Current and Future Health Risks due to Climate Change

Exposures to Flooding Due to Sea Level Rise

National data for flooding due to sea level rise is taken from the Met Office's Human Dynamics of Climate Change project. This demonstrates the annual number of people flooded as a result of sea level rise from 2070-2100 using the DIVA (Dynamic Interactive Vulnerability) model across a range of sea level rise scenarios described by Hinkel et al. (2014). The diagram presented considers impact with and without the presence of mitigation and adaptation.

For this data, 'with mitigation' and 'without mitigation' refers to scenarios RCP2.6 and RCP8.5 respectively. The presence of adaptation principally considers the construction of new dikes and

levees. 'Without adaptation' considers a scenario where dike heights are 'maintained but not raised', whereas 'with adaptation' considers a scenario where dikes are raised and new ones constructed. More information is available in the methods section of Hinkel et al. (2014).

In all cases, SSP2 (a 'middle of the road' socio-economic scenario projecting future social demographic changes) is used.

The results shown assume a medium ice melting scenario and values have been rounded to the nearest 100.

Source: Human Dynamics of Climate Change: Technical Report, Met Office, UK, 2014
(Available at: http://www.metoffice.gov.uk/media/pdf/n/d/HDCC_technical_report.pdf)

Reference:

Hinkel, J., Lincke, D., Vafeidis, A. T., Perrette, M., Nicholls, R. J., Tol, R. S. J., Marzeion, B., Fettweis, X., Ionescu, C. and Leveanu, A. (2014). Coastal flood damage and adaptation cost under 21st century sea-level rise, *Proceedings of the National Academy of Sciences*: 111 (9), 3292—3297.
DOI:10.1073/pnas.1222469111

River Flooding

Data for river flooding was taken from the World Resources Institute's Aqueduct Global Flood Analyzer. The tool provides an estimate of the annual population at risk of flood currently (2010) and in 2030. Scenario B (reported in the country profiles) uses RCP8.5 and SSP2, measuring the additional exposure to flood risk attributable to socio-economic change and to climate change.

The model assumes a country-wide average flood protection level for each country based on its income level as grouped by the World Bank. For low-income countries, it assumes a 10-year flood protection; for lower-middle income countries, it assumes a 25-year flood protection; for upper-middle income countries, it assumes a 50-year flood protection; for high-income countries, it assumes a 100-year flood protection.

Source: World Resources Institute, Aqueduct global flood analyzer, 2015
(Available at: <http://floods.wri.org>)

Infectious and Vector-Borne Diseases

Malaria

Analysis by Rocklöv, J., Quam, M. et al. 2015

Estimates for the population at risk of malaria were calculated using an empirical-statistical model created at the Umea University (Béguin et al., 2011). The model uses climate and socioeconomic factors to estimate the spatial and temporal distribution of endemic malaria transmission.

Population data were used together with the risk areas from the climate and socioeconomic malaria model to estimate the future population at risk of malaria. In this manner, the model's designed output is the spatial and temporal occurrence of malaria, rather than predicting the number of cases. This means that for some malaria endemic settings it is possible that entire countries' populations are projected to be included in the population at risk, while the number of reported cases would be much lower. The differences between population at risk for malaria and the actual number of malaria cases reported during each year will vary country to country and year to year depending on numerous dynamics governing transmission intensity, which were not captured in this model. Most notably, the role of country- and local- level interventions to prevent malaria are not explicitly captured in the model; however, projected socioeconomic features, which tend to be associated with the capacity and resources for effective interventions, has been included. The country level analysis was based on methods outlined in the Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014. A limitation of some of the data sources having relatively coarse resolution (0.5 degree longitude by 0.5 degree latitude) may have resulted in the slight over- and/or under- estimations of total population at risk, once aggregated spatially over whole countries.

Malaria data is based on global malaria risk from the Malaria Atlas Project (Hay et al., 2009).

Shared Socioeconomic Pathway 2 (SSP2), which assumes continued socioeconomic growth, was used as the reference pathways. The quantitative elements of SSP2 include population, urbanization, rates of technological change, income, human development index and income distributions.

Climate data for temperature and precipitation variables were calculated for three 30-year periods: 1961-1990 (baseline), 2021-50 and 2041-2070. Climate data was provided by the Climatic Research Unit and Tyndall Centre for Climate Change Research, University of East Anglia, 2015.

Three Global Climate Models (GCMs) were used in the analysis. The three models chosen for this analysis were CanESM2, bcc-csm1-1 and MRI-CGCM3. The mean of the impact estimates across these GCMs are presented in the country profiles. Two climate scenarios were used in the analysis and are presented in the country profiles: Representative Concentration Pathway 2.6 (RCP2.6) and Representative Concentration Pathway 8.5 (RCP8.5).

Reference:

Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014.

Dengue Fever

Analysis by Rocklöv, J., Quam, M. et al. 2015

The dengue model created at the Umea University (Liu-Helmersson et al. 2014) uses an adaptation of the original Ross-MacDonald model for vectorial capacity, which has been parameterized dependent on temperature according to entomological findings for primary dengue vector, *Aedes*

aegypti. The mathematical model's output in terms of relative vectorial capacity assumes a constant human to mosquito ratio of 1:1 and a 5 day infective period for humans in all geographical locations, thereby allowing for spatial and temporal application globally based on temperature dynamics. The threshold of 0.2 or greater in this calculation of relative vectorial capacity corresponds to the point, at which the reproductive number (R_0) for dengue is equal to 1 or greater. In this manner, relative vectorial capacity over 0.2 can be interpreted as the potential for dengue outbreaks to occur and persist. Areas and countries, which have above threshold (>0.2) calculations of relative vectorial capacity, correspondingly experience greater intensity, geographic range, and temporal duration of dengue outbreaks and may even be areas of endemic dengue transmission. In a comparative sense, differences between spatial and temporal trends in relative vectorial capacity for dengue and the actual number of dengue cases reported should be expected, given that transmission of dengue is complex and depends on a number of factors not all of which are included in this model. Most notably, the current distribution and population density of dengue vector mosquito *Aedes aegypti* is not explicitly captured in the model. While, the relative vectorial capacity tends to spatially and temporally mirror vector population dynamics (where present) and describe possible expansion of vectors' geographical range in the future, it should be noted that dengue vectors are not currently present at all times in all countries. Furthermore, the model is parameterized only based on the primary dengue vector, *Aedes aegypti*, however, a secondary dengue vector, *Aedes albopictus*, is rapidly expanded its range across the globe and playing a role in the epidemic and endemic transmission of dengue, particularly in temperate areas. As the model describes epidemic potential based on environmental factors associated with climate change, the role of country- and local- level interventions to prevent dengue are not explicitly captured in the model. Given these limitations and assumptions, some areas relative vectorial capacity calculations may be slightly overestimated, while others may be slightly underestimated.

The country level analysis was based on methods outlined in the Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014.

Two outcomes were generated:

- mean relative vectorial capacity
- percent area of a country over a threshold (0.2) for at least three-months of the year

The mean relative vectorial capacity, considers the temporal and spatial risk of dengue transmission in a country and may be insightful to represent the potential for increasing intensity and/or frequency of dengue epidemic events in a world experiencing climate change. It is particularly useful for small countries near endemic areas of dengue transmission.

The percent area of a country which is over a threshold (0.2) for at least three-months of the year does not smooth temporal or spatial variation (as in the mean relative vectorial capacity), but rather indicates the % area of a given country with at least 3 months of the year in a condition that is believed to be suitable to dengue transmission. In this sense, larger countries with smaller areas of dengue transmission and/or countries with seasonally limited dengue transmission can also get an idea of potential changes in dengue transmission that exist or may later exist under climate change

projections. This is of importance in zones of dengue emergence and re-emergence which may be expected to experience rare epidemics of dengue, however, may be generally less prepared to control and manage dengue if it were to occur. Examples of areas where this information may be of importance could be more temperate areas of Europe, North Central and Eastern Asia and parts of the Americas including the US.

Shared Socioeconomic Pathway 2 (SSP2), which assumes continued socioeconomic growth, was used as the reference pathways. The quantitative elements of SSP2 include population, urbanization, rates of technological change, income, human development index and income distributions.

Climate data for temperature and precipitation variables were calculated for three 30-year periods: 1961-1990 (baseline), 2021-50 and 2041-2070. Climate data was provided by the Climatic Research Unit and Tyndall Centre for Climate Change Research, University of East Anglia, 2015.

Three Global Climate Models (GCMs) were used in the analysis. The three models chosen for this analysis were CanESM2, bcc-csm1-1 and MRI-CGCM3. The mean of the impact estimates across these GCMs are presented in the country profiles. Two climate scenarios were used in the analysis and are presented in the country profiles: Representative Concentration Pathway 2.6 (RCP2.6) and Representative Concentration Pathway 8.5 (RCP8.5).

References:

Liu-Helmersson J, Stenlund H, Wilder-Smith A, Rocklöv J (2014) Vectorial Capacity of *Aedes aegypti*: Effects of Temperature and Implications for Global Dengue Epidemic Potential. PLoS ONE 9(3): e89783. doi:10.1371/journal.pone.0089783

Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014.

Diarrhoeal disease

Analysis by Lloyd, S., 2015

The diarrhoeal disease model, as used in the Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s (WHO, 2014), applies gridded estimates of average annual temperature anomalies under climate change to a global-level temperature-mortality risk relationship. This is combined with future diarrhoeal disease mortality estimates in children aged under 15 years in futures without climate change, and estimates climate change-attributable diarrhoeal disease deaths at a regional level. Adjustments in the methods were made to aggregate gridded estimates to country level.

Results from this assessment are based on a model designed to operate across the globe. Consequently, while the model captures general processes through which climate and diarrhoeal disease are related, it does not capture national- or local-level particularities meaning national-level results should be seen as approximate only. The model itself involves a number of assumptions and approximations, which are

outlined in Chapter 4 of Hales et al (2014), "Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s".

Climate data for temperature and precipitation variables were calculated for three 30-year periods: 1961-1990 (baseline), 2021-50 and 2041-2070. Climate data was provided by the Climatic Research Unit and Tyndall Centre for Climate Change Research, University of East Anglia, 2015.

Estimates were generated for three socioeconomic scenarios (low, medium or high economic growth) and the medium scenario was presented in the country profiles. For each socioeconomic scenario, disease estimates were made based on a low, mid and high estimate of the temperature-diarrhoeal disease relation, of which the mid estimate was presented in the country profiles.

Three Global Climate Models (GCMs) were used in the analysis. The three models chosen for this analysis were CanESM2, bcc-csm1-1 and MRI-CGCM3. The mean of the impact estimates across these GCMs are presented in the country profiles.

Two climate scenarios were used in the analysis and are presented in the country profiles: Representative Concentration Pathway 2.6 (RCP2.6) and Representative Concentration Pathway 8.5 (RCP8.5).

Two climate scenarios were used in the analysis and are presented in the country profiles: Representative Concentration Pathway 2.6 (RCP2.6) and Representative Concentration Pathway 8.5 (RCP8.5).

Reference:

Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014.

Other references found in infectious and vector-borne disease country profile text (as footnoted):

- a) Atlas of Health and Climate, World Health Organization and World Meteorological Organization, 2012
- b) Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014.

Heat-related mortality

Analysis by Honda et al., 2015

A global model was developed to estimate future heat-related mortality due to climate change in people aged over 65 years. The model is derived from epidemiological studies that analysed the effects of ambient temperature on all-cause mortality, including external causes.

The assessment was limited to the older population (aged 65 years or over) because this is the population considered most at risk of heat-related mortality, and also to avoid double counting with other outcomes, such as diarrhoeal disease mortality. Although the model was based on data from

Japan, it was tested against other populations and was evaluated as a reasonable model for other countries.

Model Assumptions:

Heat-related deaths were estimated under the following assumptions, that optimum temperature (=OT) was 83.8 percentile value of Tmax, the number of deaths at OT = daily mean number of deaths * 0.9. For a detailed description of the risk function, see the Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s, WHO, 2014. The model assumes no emigration/immigration.

Shared Socioeconomic Pathway 2 (SSP2), which assumes continued socioeconomic growth, was used as the reference pathways. The quantitative elements of SSP2 include population, urbanization, rates of technological change, income, human development index and income distributions.

Climate data for temperature and precipitation variables were calculated for three 30-year periods: 1961-1990 (baseline), 2021-50 and 2041-2070. Climate data was provided by the Climatic Research Unit and Tyndall Centre for Climate Change Research, University of East Anglia, 2015.

Three Global Climate Models (GCMs) were used in the analysis. The three models chosen for this analysis were CanESM2, bcc-csm1-1 and MRI-CGCM3. The mean of the impact estimates across these GCMs are presented in the country profiles.

Two climate scenarios were used in the analysis and are presented in the country profiles: Representative Concentration Pathway 2.6 (RCP2.6) and Representative Concentration Pathway 8.5 (RCP8.5).

Reference:

- a) Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: World Health Organization, 2014.

Heat stress and work productivity

Analysis by Kjellstrom, T. et al., Heat stress and work productivity report, Ruby Cost Research Centre, New Zealand, 2015

Estimates for the impact of heat stress on annual daily work hours lost is calculated as a function of the percentage of annual daylight work hours lost against global mean temperature (GMT), using a combination of projections in RCP2.6 and RCP8.5.

A risk function for reduced work capacity at different heat levels is then calculated for different levels of work intensity: light labour (200W, in an office without air conditioning), moderate labour (300W, in a factory), and heavy labour (400W, heavy work in agriculture or construction). This is expressed as the percentage of annual daylight hours lost (for a working age population of 15 – 64) due to heat.

Undernutrition

References:

World Food Project 2015 <https://www.wfp.org/content/two-minutes-climate-change-and-hunger>

World Health Organization, Global Database on Child Growth and Malnutrition
<http://data.worldbank.org/indicator/SH.STA.STNT.ZS/countries?display=map>

Current Exposures and Health Risks due to Air Pollution

Outdoor Air Pollution Exposure

Country profile presentation: Generally, the five most populated cities for which data was available were presented. If less than five cities were available, those cities for which data was available were presented.

Source: Ambient Air Pollution Database, WHO, May 2014

(Available: www.who.int/phe/health_topics/outdoorair/databases/AAP_database_results_2014.pdf)

Short-lived climate pollutants

Source: Shindell, D. et al. 2012. Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security, Vol. 335, Issue 6065, pp. 183-189, Science.

Household Air Pollution

Source: Household air pollution exposure, WHO Global Health Observatory data repository, 2013

Source: Burden of disease attributable to household air pollution, WHO Global Health Observatory data repository, 2012

(Available: <http://apps.who.int/gho/data/node.main.HAPBYCAUSEBYCOUNTRY?lang=en>)

Co-benefits to Health from Climate Change Mitigation: A Global Perspective

High Income Country References

Transport text box:

WHO Global status report on road safety 2013.

(Available at: http://www.who.int/violence_injury_prevention/road_safety_status/2013/en/)

WHO Global Health Risks Report (2009)

(Available at:

http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf)

Sims R., R. Schaeffer, F. Creutzig, et al. 2014: Transport. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. et al. (eds.)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

(Available at: <http://www.ipcc.ch/report/ar5/wg3/>)

Electricity Generation text box:

WHO Fact Sheet

(Available at: <http://www.who.int/mediacentre/factsheets/fs313/en/>)

Food & Agriculture text box:

Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. et al. (eds.)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

(Available at: <http://www.ipcc.ch/report/ar5/wg3/>)

WHO Fact Sheet

(Available at: <http://www.who.int/mediacentre/factsheets/fs311/en/>)

Healthcare Systems text box:

NHS Sustainable Development Unit. Saving Carbon, improving health: NHS carbon reduction strategy. Cambridge: Sustainable Development Unit, 2009.

Low and Middle Income Country References

Transport text box:

WHO Global status report on road safety 2013.

(Available at: http://www.who.int/violence_injury_prevention/road_safety_status/2013/en/)

WHO Global Health Risks Report (2009)

(Available at:

http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf)

Sims R., R. Schaeffer, F. Creutzig, et al. 2014: Transport. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the

Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. et al. (eds.)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

(Available at: <http://www.ipcc.ch/report/ar5/wg3/>)

Electricity Generation text box:

Special Excerpt from WEO 2010

(Available at: [http://www.se4all.org/wp-content/uploads/2013/09/Special Excerpt of WEO 2010.pdf](http://www.se4all.org/wp-content/uploads/2013/09/Special_Excerpt_of_WEO_2010.pdf))

WHO Fact Sheet

(Available at: <http://www.who.int/mediacentre/factsheets/fs313/en/>)

Household Heating, Cooking and Lighting text box:

WHO Fact Sheet

(Available at: <http://www.who.int/mediacentre/factsheets/fs313/en/>)

Healthcare Systems text box:

WHO Report, Access to Modern Energy Services for Health Facilities

Emissions and commitments

Annual Greenhouse Gas Emissions by Sector (metric tonnes in CO₂-equivalent)

Country-level greenhouse gas emissions measured as metric tonnes of CO₂-equivalent, calculated by sector, were drawn from the national communiques to the UN Framework Convention on Climate Change. Where possible, the earliest and most recent data were used as a point of comparison.

Source: National Communiques to the UNFCCC, 1990-2012

(Available at: http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php)

National Response Table

Source: <http://web.law.columbia.edu/climate-change/resources/climate-change-laws-world/>

References :

a. Boden, T.A., G. Marland, and R.J. Andres (2010). Global, Regional, and National Fossil-Fuel CO₂ Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001_V2010.

- b. IPCC (2014) Blanco G., R. Gerlagh, S. Suh, J. Barrett, H.C. de Coninck, C.F. Diaz Morejon, R. Mathur, N. Nakicenovic, A. Ofosu Ahenkora, J. Pan, H. Pathak, J. Rice, R. Richels, S.J. Smith, D.I. Stern, F.L. Toth, and P. Zhou, 2014: Drivers, Trends and Mitigation. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom
- c. Pathways to Deep Decarbonization, IDDRI and SDSN, 2014
(Available at: <http://www.iddri.org/Projets/The-Deep-Decarbonization-Pathway-Project>)

National Policy Response

National Policy Response Table

For the purposes of these country profiles, WHO designed and carried out a survey of national member states with a total of 23 questions on the following areas in health and climate change:

- 1) Governance and policy,
- 2) Vulnerability, impact and adaptation (health) assessments,
- 3) Health adaptation strategies and action plans,
- 4) Preparedness, risk management and integrated risk monitoring,
- 5) Awareness raising and capacity building,
- 6) Research,
- 7) Financing.

Source: Supporting monitoring efforts on health adaptation and mitigation of climate change: a systematic approach for tracking progress at the global level. WHO survey, 2015.

Glossary

Cold spell duration index (CSDI): Annual count of days with at least six consecutive previous days when Minimum temperature < 10th percentile

Consecutive Dry Days (CDD): Maximum number of consecutive days with precipitation < 1mm

Intended Nationally Determined Contribution (INDC): Before the international climate change negotiations in Paris in 2015, countries have agreed to submit commitments of their intended

response to climate change (often both mitigation and adaptation) to the UNFCCC as a baseline for future negotiations.

R20mm: Annual count of days with precipitation $\geq 20\text{mm}$ (considered very heavy precipitation)

Representative Concentration Pathway (RCP): Scenarios of future emissions and atmospheric concentrations of a range of greenhouse gases and aerosols, as well as land use/land cover. Two RCPs are used in the country profiles, representing a world with strong and immediate mitigation intervention (RCP2.6), and a 'business as usual' response where emissions continue to rise at or above current rates (RCP8.5).

Shared Socioeconomic Pathway (SSP): provides a range of scenarios for projected demographic, social and economic changes over the rest of the century. For these country profiles, SSP2, a 'middle of the road' scenario has been used.

Warm spell duration index (WSDI): Annual count of days with at least six consecutive previous days when Maximum temperature $> 90\text{th}$ percentile

Warm Nights (TN90p): Annual count of days when Minimum temperature $> 90^{\text{th}}$ percentile