

Notes*

Chapter 1 • How we got to where we are

- 1 Figures from International Energy Agency (IEA), *CO₂ Emissions from Fuel Combustion – Highlights, 2012 Edition*, Excel file, from: www.iea.org/publications/freepublications/publication/name,32870,en.html
- 2 IEA (2010), *Energy Poverty: How to make modern energy access universal*. Special early excerpt of the World Energy Outlook 2010 for the UN General Assembly on the Millennium Development Goals, page 11. www.worldenergyoutlook.org/media/weowebiste/2010/weo2010_poverty.pdf
- 3 Oliver August, 'A hopeful continent'. *The Economist*, 2 March 2013. www.economist.com/news/special-report/21572377-african-lives-have-already-greatly-improved-over-past-decade-says-oliver-august
- 4 Fareed Zakaria (2011), *The Post American World: And the rise of the rest*. Penguin: London.
- 5 Fareed Zakaria (2011), *The Post American World: And the rise of the rest*. Penguin, London.
- 6 Keisuke Sadamori / IEA. 'Medium-term Coal Market Report 2012'. Presentation on 18 December 2012. www.iea.org/newsroomandevents/speeches/121218MCMR2012_presentation_KSK.pdf
- 7 Figures from *BP Statistical Review of World Energy June 2012*.
- 8 IEA (2011), *Climate & Electricity Annual Data and Analyses 2011*, Figure 6, page 83. www.iea.org/publications/freepublications/publication/Climate_Electricity_Annual2011.pdf

* These notes are available as a pdf with live hyperlinks at <http://uit.co.uk/files/b-nuclear/links.htm>

- 9 Calculated using 'net summer capacity' via US Energy Information Administration (EIA) 'Independent Statistics & Analysis' / Electricity / Electricity generating capacity: www.eia.gov/electricity/capacity
- 10 UK coal-fired generating capacity is currently 23GW – see Table 5.7, Chapter 5 (page 140) of *Electricity: Digest of United Kingdom Energy Statistics (DUKES)*, Department of Energy & Climate Change. www.gov.uk/government/uploads/system/uploads/attachment_data/file/65818/DUKES_2013_Chapter_5.pdf
- 11 IEA, 'Medium-Term Coal Market Report 2012 Factsheet', 18 December 2012. www.iea.org/newsroomandevents/news/2012/december/name_34467.en.html
- 12 All figures in this section are from *BP Statistical Review of World Energy June 2013*.
- 13 EIA 'Independent Statistics & Analysis' / International Energy Statistics / Petroleum: www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=50&pid=53&aid=1&cid=&syid=2013&eyid=2013&freq=M&unit=TBPD
- 14 'Supply shock from North American oil rippling through global markets', IEA press release, 14 May 2013: www.iea.org/newsroomandevents/pressreleases/2013/may/name_38080.en.html
- 15 For an example, see Figure 1, page 3, in Indur Goklany (2012) 'Humanity Unbound: How fossil fuels saved humanity from nature and nature from humanity'. *Policy Analysis*, 20 December. www.cato.org/download/sites/cato.org/files/pubs/pdf/pa715.pdf

Chapter 2 • The carbon challenge

- 1 Michael Shellenberger, Ted Nordhaus and Jesse Jenkins, 'Energy Emergence: Rebound and backfire as emergent phenomena'. *The Breakthrough*, 17 February

- 2011: http://thebreakthrough.org/archive/new_report_how_efficiency_can
- 2 Chris Goodall and Mark Lynas, 'It's a myth that wind turbines don't reduce carbon emissions'. *The Guardian Environment* blog, 26 September 2012: www.guardian.co.uk/environment/blog/2012/sep/26/myth-wind-turbines-carbon-emissions
 - 3 Energy figures in this chapter are from *BP Statistical Review of World Energy June 2013* except where stated.
 - 4 This suggests a CO₂ intensity of energy displaced of 600g CO₂/kWh, which seems reasonable since wind is more likely to substitute for fluctuating gas than baseload coal. Source: Greenpeace / Global Wind Energy Council (2012), *Global Wind Energy Outlook 2012*, pages 18 and 19. www.gwec.net/wp-content/uploads/2012/11/GWEO_2012_lowRes.pdf
 - 5 Vaclav Smil (2010), *Energy Myths and Realities: Bringing Science to the Energy Policy Debate*. AEI Press: Washington, DC.
 - 6 'The Plowboy Interview with Amory Lovins', *Mother Earth*, November/December 1977. www.motherearthnews.com/Renewable-Energy/1977-11-01/Amory-Lovins.aspx?page=14#ixzz2NcynCUkl
 - 7 Roger Harrabin, 'Renewable energy: Burning US trees in UK power stations'. BBC News Science & Environment, 28 May 2013: www.bbc.co.uk/news/science-environment-22630815
 - 8 Roger Harrabin, 'Biofuels: MPs to consider subsidies for power stations'. BBC News Science & Environment, 6 March 2013: www.bbc.co.uk/news/science-environment-21672840

Chapter 3 • The N-word

- 1 Mark Lynas, 'Nuclear power: a convert'. *New Statesman*, 30 May 2005. www.newstatesman.com/node/150738
- 2 Barry Brook, 'Golf balls and elephants – energy density in 9 seconds', posting on BraveNewClimate.com, 22 June 2011: <http://bravenewclimate.com/2011/06/22/golf-balls-elephants-energy-density>
- 3 'The Austrian people said "no" to nuclear energy'. TheNuclearPowerPlant.net, 2010: www.nuclear-power-plant.net/index.php?lang=en&item=history
- 4 'Austrian nuclear plant goes 100% solar – at 0.003% capacity'. DepletedCranium.com, 21 August 2009: <http://depletedcranium.com/austrian-nuclear-plant-goes-100-solar-at-03-capacity>
- 5 'That day in December: The story of nuclear prohibition in Australia'. DecarboniseSA.com, blog posting on 12 September 2012: <http://decarbonisesa.com/2012/09/12/that-day-in-december-the-story-of-nuclear-prohibition-in-australia>
- 6 'List of cancelled nuclear plants in the United States'. Wikipedia webpage: http://en.wikipedia.org/wiki/List_of_canceled_nuclear_plants_in_the_United_States
- 7 This currently stands at about 310GW. See EIA, 'Independent Statistics & Analysis' / Total Energy / Annual Energy Review, Table 8.11c (Electric Net Summer Capacity: Electric Power Sector by Plant Type, 1989-2011): www.eia.gov/totalenergy/data/annual/index.cfm#electricity
- 8 EIA, 'Independent Statistics & Analysis' / Total Energy / Annual Energy Review, Table 7.3 (Coal Consumption by Sector, 1949-2011): www.eia.gov/totalenergy/data/annual/index.cfm
- 9 EIA statistics are not disaggregated into coal and other fossil fuels until 1989. See EIA, 'Independent

Statistics & Analysis' / Total Energy / Annual Energy Review, Table 8.11a Excel data (Electric Net Summer Capacity: Total [All Sectors], 1949-2011):

www.eia.gov/totalenergy/data/annual/index.cfm

- 10 Increase from 771TWh/year to 1341TWh/yr. See EIA, 'Independent Statistics & Analysis' / Total Energy / Annual Energy Review, Table 8.2b Excel data (Electricity Net Generation: Electric Power Sector, 1949-2011): www.eia.gov/totalenergy/data/annual/index.cfm
- 11 See EIA, 'Independent Statistics & Analysis' / Total Energy / Annual Energy Review, Table 8.2b Excel data (Electricity Net Generation: Electric Power Sector, 1949-2011): www.eia.gov/totalenergy/data/annual/index.cfm. This gives a total solar generation of 5.248GWh in 1984; total electricity generation was 2,416TWh in that year.

Chapter 4 • The case against: nuclear accidents and radiation

- 1 This part of the account relies heavily on the excellent ebook *Fukushima: the First Five Days* by Leslie Corrice.
- 2 Rick Wallace, 'Fukushima boss Masao Yoshida breaks silence on disaster'. *The Australian*, 11 August 2012. www.theaustralian.com.au/news/world/fukushima-boss-masao-yoshida-breaks-silence-on-disaster/story-fnblbrze-1226448211757
- 3 Readers may have heard that since the accident Yoshida received treatment for oesophageal cancer and sadly died on 9 July 2013. Given the latency period of radiation-induced cancers of 10 years or so, it is extremely unlikely that this is linked to his Fukushima experience. Instead it seems probable that Yoshida's cancer was smoking-related, given his quoted accounts

- of handing out 'smokes' during the crisis.
- 4 Sandia National Laboratories (2012), *Fukushima Daiichi Accident Study* (status as of April 2012). http://energy.sandia.gov/wp/wp-content/gallery/uploads/Fukushima_SAND2012-6173.pdf
 - 5 See 'Fukushima Accident 2011', World Nuclear Association: www.world-nuclear.org/info/fukushima_accident_inf129.html for core damage figures. Sandia/ORNL (see note 4 above) says 1.5m- (5ft-) deep intrusion into the concrete base from modelling.
 - 6 From TEPCO press release attachment: 'Exposure dose distribution', Table 2: www.tepco.co.jp/en/press/corp-com/release/betu12_e/images/120731e0401.pdf
 - 7 Average dose from The National Diet of Japan (2012), *The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission (NAIIC): Executive Summary*, Chapter 4, Table 4.1-3. http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/08/NAIIC_Eng_Chapter4_web.pdf
 - 8 United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) (2012), *Report of 59th Session*, 21-25 May 2012.
 - 9 The National Diet of Japan (2012), *The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission (NAIIC): Executive Summary*, Chapter 4, Table 4.1-3. http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/08/NAIIC_Eng_Chapter4_web.pdf
 - 10 'No immediate health risks from Fukushima nuclear accident says UN expert science panel'. UNSCEAR press release, 31 May 2013. www.unis.unvienna.org/unis/en/pressrels/2013/unisinf475.html
 - 11 'Global report on Fukushima nuclear accident details health risks'. World Health Organization (WHO) news

- release, 28 February 2013. www.who.int/mediacentre/news/releases/2013/fukushima_report_20130228/en
- 12 S. M. Javad Mortazavi, 'High background radiation areas of Ramsar, Iran': www.ecolo.org/documents/documents_in_english/ramsar-natural-radioactivity/ramsar.html
 - 13 P. Andrew Karam (2002), 'The high background radiation area in Ramsar, Iran'. Proceedings of the Waste Management 2002 Symposium. www.wmsym.org/archives/2002/proceedings/10/434.pdf
 - 14 This is shown in the film *Pandora's Promise* as microsieverts per hour, which is the real-time reading given by radiation dosimeters. I have transposed this to millisieverts per year by multiplying by 8760 and then dividing by 1000.
 - 15 Nathaniel Rich, 'Showdown at the Airport Body Scanner'. *The New York Times*, 25 May 2013: <http://opinionator.blogs.nytimes.com/2013/05/25/showdown-at-the-airport-body-scanner>
 - 16 'Airport Screening', Health Physics Society factsheet, May 2011. http://hps.org/documents/airport_screening_fact_sheet.pdf
 - 17 Dale L. Preston et al. (2004), 'Effect of recent changes in atomic bomb survivor dosimetry on cancer mortality risk estimates'. *BioOne* 162 (4), 377-89. See Table 3. www.bioone.org/doi/full/10.1667/RR3232
 - 18 World Health Organization (2006), *Health Effects of the Chernobyl Accident and Special Health Care Programmes: Report of the UN Chernobyl Forum Expert Group 'Health'*. http://whqlibdoc.who.int/publications/2006/9241594179_eng.pdf
 - 19 UNSCEAR (2008), *Sources and effects of ionizing radiation*, Volume II. www.unscear.org/docs/reports/2008/11-80076_Report_2008_Annex_D.pdf
 - 20 Stephen S. Lim et al. (2012), 'A comparative risk

- assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010'. *The Lancet* 380 (9859), 2224-60. See Table 3. [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(12\)61766-8/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61766-8/fulltext)
- 21 Pushker A. Kharecha and James E. Hansen (2013), 'Prevented mortality and greenhouse gas emissions from historical and projected nuclear power'. *Environmental Science & Technology*, DOI:10.1021/es3051197. <http://decarbonisesa.files.wordpress.com/2013/04/prevented-mortality-and-greenhouse-gas-emissions.pdf>
- 22 National Institute for Environmental Studies, Japan. *Japan's National Greenhouse Gas Emissions in Fiscal Year 2011 (Preliminary Figures): Executive Summary*. www.nies.go.jp/whatsnew/2012/20121205/pdf/gaiyou-e.pdf
- 23 'Abe looking to renege on emissions pledges'. *The Japan Times*, 25 January 2013. www.japantimes.co.jp/news/2013/01/25/national/abe-looking-to-renege-on-emissions-pledge/#.UQ-LuqX7VO3
- 24 IEA, *CO₂ Emissions from Fuel Combustion, 1971-2010*, Excel file, from: www.iea.org/publications/freepublications/publication/name_4010_en.html
- 25 For example, see this from the World Resources Institute (WRI): '5 achievements from Germany's "Energiewende"', Lutz Weischer, 13 May 2013: <http://insights.wri.org/news/2013/05/5-achievements-germanys-energiewende>
- 26 See my blog: 'Germany's "Energiewende" – the story so far', 15 January 2013, for numbers and German-language original sources: www.marklynas.org/2013/01/germanys-energiewende-the-story-so-far

- 27 The 32TWh figure comes from the *BP Statistical Review of World Energy June 2012* nuclear spreadsheet.
- 28 Vera Eckert and Christoph Steitz, 'Germany's clean energy drive fails to curb dirty brown coal', 29 April 2013. *Planet Ark*: <http://planetark.org/wen/68524>
- 29 'Efficient and highly flexible: BoA 2&3 makes important contribution to transforming German energy industry and climate protection'. RWE Power AG press release, 15 August 2012. www.rwe.com/web/cms/en/2320/rwe-power-ag/press-releases/press-release/?pmid=4008220
- 30 Stefan Nicola, 'Germany to add most coal-fired plants in two decades, IWR says'. Bloomberg.com, 27 February 2013: www.bloomberg.com/news/2013-02-27/germany-to-add-most-coal-fired-plants-in-two-decades-iwr-says.html

Chapter 5 • Next generation: Nuclear 2.0

- 1 Although no country has yet built and begun operating a deep geological repository for civilian nuclear waste (the US has a successful military repository in operation in New Mexico, the Waste Isolation Pilot Plant or WIPP), the idea that existing waste presents a serious danger to the environment is overblown. Waste is either being cooled in pools or in safe dry cask storage, although different countries have very different approaches. For a summary of the current situation, see the World Nuclear Association webpage 'Radioactive Waste Management': www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Nuclear-Wastes/Radioactive-Waste-Management
- 2 US Environmental Protection Agency, 'Radiation Protection' / Cesium: www.epa.gov/radiation/radionuclides/cesium.html

- 3 This figure assumes that depleted uranium from fuel enrichment, uranium-238 and other actinides in nuclear fuel can all be recycled in fast reactors – U-238, for example, is transmuted via neutron capture into Pu-239 and then fissioned. The ‘500 years’ figure was picked up by *The Guardian* (see Duncan Clark, ‘New generation of nuclear reactors could consume radioactive waste as fuel’, *The Guardian*, 2 February 2012: www.theguardian.com/environment/2012/feb/02/nuclear-reactors-consume-radioactive-waste) and confirmed by David MacKay, chief scientist at the UK Department of Energy and Climate Change.
- 4 Guy Chazan, ‘EDF raises heat at Hinkley C over price’. *Financial Times*, 13 March 2013. www.ft.com/cms/s/0/45610f04-8afa-11e2-b1a4-00144feabdc0.html#axzz2T5wLeL8H
- 5 ‘Westinghouse SMR Features’, WestinghouseNuclear.com: www.westinghousenuclear.com/smr/features.htm
- 6 ‘First fuel produced for Chinese EPR’. *World Nuclear News*, 11 March 2013. www.world-nuclear-news.org/ENF-First_fuel_produced_for_Chinese_EPR-1103134.html

Chapter 6 • The spectre of climate change

- 1 EIA (2011), *International Energy Outlook 2011*. www.eia.gov/forecasts/archive/ieo11
- 2 Assuming nuclear baseload substitutes for coal baseload globally, and coal has a carbon intensity of 958g/CO₂ per kWh. The latter figure is a world average given by the IEA for 2010 – see IEA, *CO₂ Emissions from Fuel Combustion – Highlights*, Summary table ‘CO₂ emissions per kWh from electricity generation using coal/peat’, page 114, which can be downloaded from: www.iea.org/publications/freepublications/publication/name,32870,en.html. The EIA reference

scenario projects nuclear at 4545TWh/yr in 2030, resulting in CO₂ abatement of 4.355 billion tonnes/yr, and projects global CO₂ at 40.6 bn. tonnes/yr; 2011 emissions were 31.639 bn. tonnes. Adding back nuclear's avoided CO₂ gives a total 2030 emission of 44,995 million tonnes.

- 3 'Today's level' means 2011 CO₂ figures, the last real figures in the EIA 2011 spreadsheets; 2012 and onwards are projections. A new *International Energy Outlook* was published in late July 2013, too late to be included here. See www.eia.gov/forecasts/ieo
- 4 This is intended to be a conservative estimate of emissions. There is no actual reason why emissions should peak in 2040 in this scenario and drop thereafter – but the principle here is that post-2040 energy use and emissions paths are too uncertain to be able to forecast accurately, hence this rather idealized scenario. However, with no peak in emissions, temperature rise would of course be much higher. The key figure inputting into the climate model is cumulative emissions during the entire century, so emissions paths post-2030 are crucial.
- 5 The MAGICC model parameters are as per Lowe et al. (2009), 'How difficult is it to recover from dangerous levels of global warming?', *Environmental Research Letters* 4 (1), DOI:10.1088/1748-9326/4/1/014012. http://nora.nerc.ac.uk/6700/1/lowe_et_al_09.pdf. Spreadsheet of emissions scenario inputs and temperature outputs for this whole exercise available from: www.marklynas.org/wp-content/uploads/2013/06/avoid_basesheet_210613.xlsx
- 6 See tables on page 295 of Greenpeace International / Global Wind Energy Council (GWEC) / European Renewable Energy Council (EREC) (2012): *Energy [R]evolution: A sustainable world energy outlook*.

www.greenpeace.org/international/Global/international/publications/climate/2012/Energy%20Revolution%202012/ER2012.pdf

- 7 Wind 2030 projection is from the Greenpeace/GWEC report *Global Wind Energy Outlook 2012* (page 11) (www.gwec.net/wp-content/uploads/2012/11/GWEO_2012_lowRes.pdf), and solar projections are from Greenpeace / GWEC / EREC: *Energy [R]evolution: A sustainable world energy outlook* (tables on page 295), as in note 6 of this chapter.
- 8 Assuming 2011 conversion rates of 1.98TWh electricity produced per GW installed of wind. Greenpeace, in *Global Wind Energy Outlook 2012*, projects 6289TWh of wind in 2030 in addition to today's generation, implying an additional installed capacity above 2011 by 2030 of 3171GW. Paul Denholm et al. (2009), *Land-use Requirements of Modern Wind Power Plants in the United States*, National Renewable Energy Laboratory technical report (page 22) (www.nrel.gov/docs/fy09osti/45834.pdf), averages out total area of 160 US wind farms per unit of capacity and ends up with a figure of 0.34 square km (0.13 square miles) per MW of nameplate capacity. (Remember: animal grazing, agriculture, etc. can continue in between the turbines, so this is not land used exclusively for wind.) Therefore, with 3171GW installed this would equal a land take of 1,078 million square km (416 million square miles). Bigger turbines in future will not much change this equation, as they need to be spaced commensurately further apart.
- 9 A good list of US states and land area in square km is here: <http://geography.about.com/od/usmaps/a/states-area.htm>. Build your own list!
- 10 For PV see US Department of Energy, 'Energy Efficiency and Renewable Energy: PV FAQs' factsheet

- (www.nrel.gov/docs/fy04osti/35097.pdf), which gives 5-25 square km (1.9-9.6 square miles) per TWh/yr of generation. The Greenpeace solar PV 2030 projection is for 2,634TWh/yr.
- 11 Nevada Solar One produces 0.134TWh/yr over 400 acres. Ivanpah is scheduled to produce 1.079TWh/yr over 3,500 acres. The efficiencies are roughly comparable despite the different technologies employed (solar mirrors vs. parabolic troughs). See 'Concentrating Solar Power Projects', National Renewable Energy Laboratory (www.nrel.gov/csp/solarpaces/project_detail.cfm/projectID=20) for this and other CSP details. In UAE, Shams 1 will produce 0.21TWh/yr over 617 acres, a similar rate of conversion. The Greenpeace 2030 projection for CSP is 2,672TWh/yr. For solar PV the Greenpeace 2030 projection is 2634TWh/yr.
 - 12 See Greenpeace / GWEC / EREC: *Energy [R]evolution: A sustainable world energy outlook*, Table 12.15, page 296. www.greenpeace.org/international/Global/international/publications/climate/2012/Energy%20Revolution%202012/ER2012.pdf
 - 13 Assuming a CO₂ displacement of 606g/CO₂ per kWh, which is reasonable as wind and solar do not displace coal baseload so much as gas, and gas has half the carbon intensity of coal. The figure I use here comes from the Greenpeace/GWEC report *Global Wind Energy Outlook 2012* (www.gwec.net/wp-content/uploads/2012/11/GWEO_2012_lowRes.pdf), which projects avoided emissions in 2030 of 4.007 billion tonnes with 6,678TWh/yr of wind, so 1TWh = 0.600 million tonnes CO₂ displaced. The total deployment is 10,463TWh/year in addition to the wind and solar generation that is already included in the EIA's reference scenario for 2030, and for which CO₂ reductions are

already included in the EIA baseline. I assume solar and wind have the same CO₂ displacement factor. The result is a 38.7 bn. tonnes annual CO₂ emission in 2030: 22% higher than 2011 emissions. Nuclear emissions abatement removed (added to derive the total) is 4.355 bn. tonnes, as per first nuclear-free scenario described here.

- 14 Greenpeace / GWEC / EREC's *Energy [R]evolution: A sustainable world energy outlook* claims CO₂ tonnage savings of 19.2 bn tonnes by 2030. But these are predicated on highly questionable assumptions, including vastly reduced use of cars globally, reduction in aviation, global deployment of passivhaus constructions, wide uptake of heat pumps and so on, which reduce energy use overall as compared with the reference scenario. It claims savings from power generation specifically of 9.3 billion tonnes of CO₂ by 2030, although how these are derived is not quantified. Either way, for any given scenario, if you remove the mitigation benefits of nuclear the emissions will be worse – that is my point.

Chapter 7 • All of the above

- 1 'Joint letter from heads of RenewableUK, CCS association and Nuclear Industry Association on need for 2030 carbon goal'. *The Guardian*, 5 November 2012: www.guardian.co.uk/environment/interactive/2012/nov/05/letter-renewableuk-ccs-nuclear-carbon
- 2 Oliver Wright, 'Nuclear, wind and wave power chiefs in joint appeal on green energy'. *The Independent*, 5 November 2012. www.independent.co.uk/news/uk/politics/nuclear-wind-and-wave-power-chiefs-in-joint-appeal-on-green-energy-8281122.html
- 3 To be clear, I still think CCS is worth supporting with public funds. I have not included it in these scenarios

because full-scale CCS has yet to be deployed anywhere, so there is no realistic basis on which to make quantified assumptions about potential CO₂ reductions. I have also ignored shale gas and its role in displacing coal, as I assume this to be taking place equally in all scenarios.

- 4 'Energy Bill completes Commons passage with overwhelming majority'. Department of Energy & Climate Change press release, 5 June 2013.
www.gov.uk/government/news/energy-bill-completes-commons-passage-with-overwhelming-majority
- 5 In 2009 the 420-odd reactors comprised 377GW installed capacity. Assuming 200 decommissioned are decommissioned by 2030, about 800 have to be built to reach the required 1,000 total by then. With 17 years left, 47 reactors have to be built per year, or about 4 per month. I'm also assuming 1,200GWe per reactor for a 1,000-strong reactor fleet.
- 6 'Nuclear Power in China', World Nuclear Association:
www.world-nuclear.org/info/Country-Profiles/Countries-A-F/China--Nuclear-Power
- 7 'Nuclear Power in India', World Nuclear Association:
www.world-nuclear.org/info/Country-Profiles/Countries-G-N/India
- 8 The EIA projects a baseline of 12,136TWh of zero-carbon electricity from nuclear, hydro and renewables in 2030. I have added 10,463TWh from Greenpeace's wind and solar projections, and 3,707TWh for my nuclear, both additional to what is already included in the EIA's reference scenario. EIA projects total electricity consumption of 31,940TWh in 2030, and this 'all of the above' scenario has 26,307TWh provided by nuclear, hydro and renewables, which is 82% of the total. Nuclear figures are based on an assumption of 6.878TWh/yr of electricity per

- GW of nuclear. This ratio is based on 2009 figures, pre-Fukushima to avoid low capacity factors of politically motivated closures. 2009 had 377GW installed nuclear capacity, production of 2594TWh.
- 9 For wind and solar CO₂ displacement factors, see note 13, Chapter 6. Wind and solar CO₂ displaced is 6278 million tonnes/yr and there is also 3551 m. tonnes/yr avoided from nuclear. (These are for nuclear and renewables generation additional to the EIA reference scenario, to avoid double-counting.) EIA has 2030 emissions at 40,640 m. tonnes/yr, this 'all of the above' scenario has 30,809 m. tonnes/yr, a 3% cut on 2011 total of 31,639 m. tonnes/yr. Yay.
 - 10 I was Climate Advisor to President Mohamed Nasheed of the Maldives from 2009 to 2011.
 - 11 United Nations Framework Convention on Climate Change (2011), *Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010*. <http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=2>