

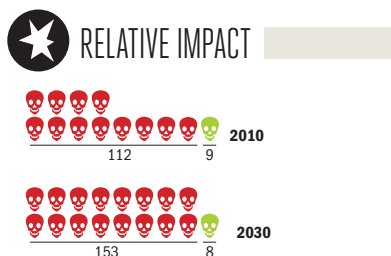
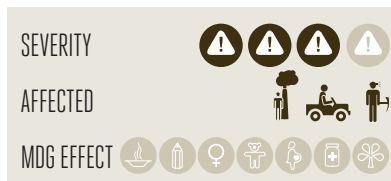
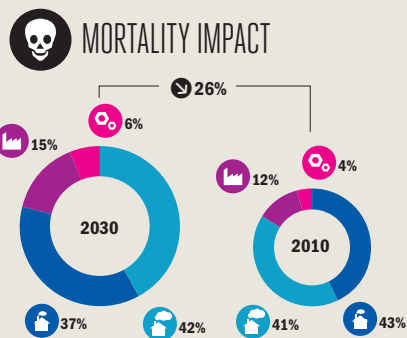
OCCUPATIONAL HAZARDS



ESTIMATES GLOBAL CARBON IMPACT

2010 EFFECT TODAY
 DEATHS PER YEAR
55,000

2030 EFFECT TOMORROW
 DEATHS PER YEAR
80,000

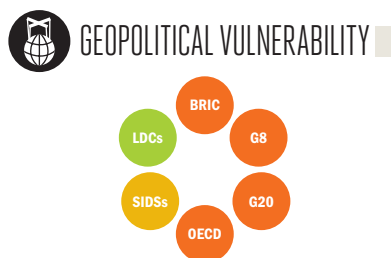
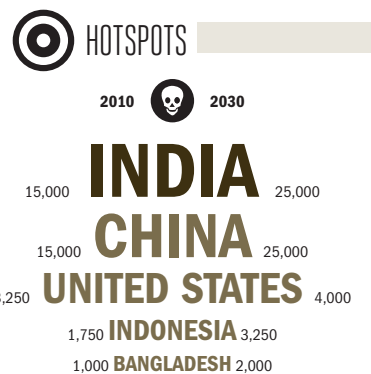


➤ A world economy relying on carbon-intensive forms of energy for 90% of its needs puts the health of millions of exposed workers at risk

➤ Hazardous professions range from coal miners facing elevated risks of stomach cancer to thermal power plant workers or truck drivers disproportionately exposed to chronic lung diseases

➤ Population level vulnerabilities are as high for developed countries as for the lowest-income developing countries

➤ Renewable and low-carbon forms of energy, such as windmills or solar panels, are significantly safer for the health and safety of industry workers and consumers alike



☠ Deaths
 🏠 Developing Country Low Emitters 🏭 Developed
 🏠 Developing Country High Emitters 🏭 Other Industrialized

☠ = Deaths per 10 million
 ↻ Change in relation to overall global population and/or GDP

Mining accidents that kill hundreds of workers, such as the 2005 Sunjiawan mine disaster in Fuxin, China, are vivid reminders of the risks faced as the world strives to feed a growing carbon economy. Coal is set to nearly double its contribution to global energy needs over the next 20 years (US EIA, 2011). Most occupational health risks linked to the carbon economy are less attention grabbing than mining explosions but cause a much more significant human toll. While miners face the highest dangers, elevated occupational risks also apply to power generation workers in thermal plants burning coal and gas, for example, and to commercially active drivers, especially in urban settings (Burke et al., 2011). In situations where workers do not have access to adequate social protection, the risk to livelihoods and families is significant (Marriot, 2008). Carbon-intensive forms of energy exploitation are much more hazardous for human health than low-carbon or renewable alternatives (IPCC, 2012b). A carbon-neutral world economy would see virtually all of these health risks eliminated. In a transition phase, numerous measures and policy

solutions exist to reduce the hazards workers face (Driscoll et al., 2004). Companies are, however, largely not implementing the necessary measures or covering the health costs resulting from a lack of safety measures. The soundest measures would considerably increase the costs of exploiting fossil fuels, so regulations to protect workers often result in an increase in outsourcing to companies not subjected to the same requirements as firms seek to regain profitability (Giuffrida et al., 2002; Johnstone et al., 2005).

HAZARD MECHANISM

Exposure to toxic fumes, carcinogenic airborne compounds and fine particles from exhaust emissions, silica and mining dust in addition to other carbon-intensive industrial hazards causes asthma, chronic respiratory diseases and, in the case of coal miners, coal worker's pneumoconiosis (Driscoll et al., 2004; Aydin, 2010). Coal miners additionally face greatly elevated risks of lung cancer as well as stomach cancer, since toxic particles inhaled are also understood to reach the stomach (Swaen et al., 1995). Men are disproportionately affected by the sweeping health implications of these



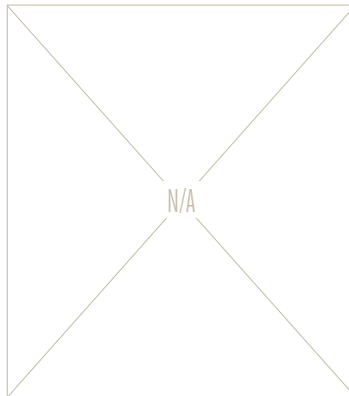
hazards since they make up the largest share of the workforce in these risk sectors (ILO, 2005).

IMPACTS

The annual global impact of carbon-intensive industries on the occupational health and safety of workers was estimated at 50,000 deaths for the year 2010, with the health of 5 million people affected. By 2030, the death toll is expected to increase to 80,000 deaths per year, with the health of 7 million people affected. Effects are widespread globally in

line with the comprehensive breadth of a carbon-intensive economy in all but the lowest-income low-emissions developing countries. Industrialized countries figure among those worst affected. China and India are estimated to have the largest total impact, each with occupational mortality in excess of 10,000 deaths per year. The health of an estimated half million people in China and nearly one million in India is negatively affected. Other countries experiencing large-scale losses include the US, Indonesia, Russia and Bangladesh.

BIGGER PICTURE



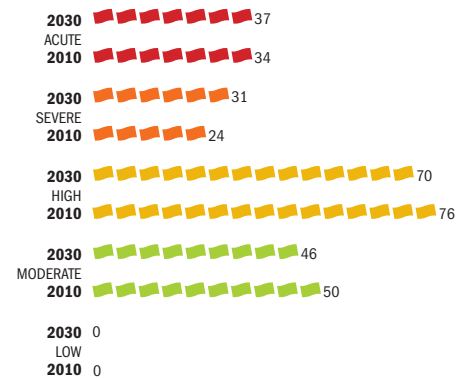
SURGE



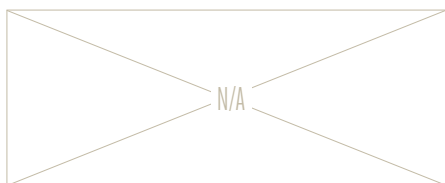
OCCURRENCE



VULNERABILITY SHIFT



PEAK IMPACT



GENDER BIAS



INDICATOR INFORMATION

MODEL: BP, 2012; Mathers and Loncar, 2006
 BASE DATA: Aydin, 2010; CDCP, 2012; Driscoll et al., 2004; Swaen et al., 1995; World Energy Council, 2010; WHO, 2009



THE INDICATOR

The indicator measures the impact of the carbon economy on the health and well-being of people in professions that expose them to heightened safety risks, such as in GHG emissions-intensive industries and/or sectors comprising a core link in the supply chain that fuels the carbon economy. The indicator has two main components. The first concerns occupational risks related to asthma and chronic obstructive pulmonary disease among workers in the electricity generation, transportation and mining sectors based on ILO data, with corrections to achieve broad sector accuracy (Driscoll et al., 2004; ILO LABORSTA, 2012). The second concerns occupational risks specific only to coal-mining industry workers, including coal worker's pneumoconiosis (CWP), stomach cancer and unintentional accidents (Aydin, 2010; Swaen et al., 1995; IMFR, 2012). The indicator's main limitations relate to corrections for occupational employment data from the ILO that was not designed to identify GHG-intensive industries.

ESTIMATES COUNTRY-LEVEL IMPACT

COUNTRY	☠		♿	
	2010	2030	2010	2030
ACUTE				
Armenia	30	30	4,750	4,750
Australia	350	550	45,000	65,000
Austria	60	65	9,750	10,000
Bangladesh	1,000	2,000	150,000	200,000
Belarus	65	70	30,000	30,000
Belgium	150	150	20,000	20,000
Bulgaria	90	85	3,250	3,000
Canada	300	400	35,000	40,000
China	15,000	25,000	500,000	650,000
Colombia	300	450	20,000	20,000
Croatia	40	40	2,500	2,750
Cuba	85	100	7,750	8,750
Czech Republic	100	100	6,250	6,250
Denmark	75	75	7,750	8,000
Germany	700	750	100,000	100,000
Greece	90	90	5,750	5,750
Hungary	80	85	6,000	6,250
India	15,000	25,000	900,000	1,500,000
Indonesia	1,750	3,250	300,000	400,000
Italy	500	550	55,000	55,000
Kazakhstan	300	350	45,000	45,000
Macedonia	25	25	3,000	3,000
Malta	5	5	650	650
Mongolia	20	25	600	750
Netherlands	150	150	15,000	15,000
New Zealand	40	55	4,750	6,750
North Korea	200	300	30,000	40,000
Norway	55	55	8,500	8,500
Romania	150	150	8,250	8,250
Russia	1,500	1,500	350,000	350,000
South Africa	800	1,250	150,000	200,000

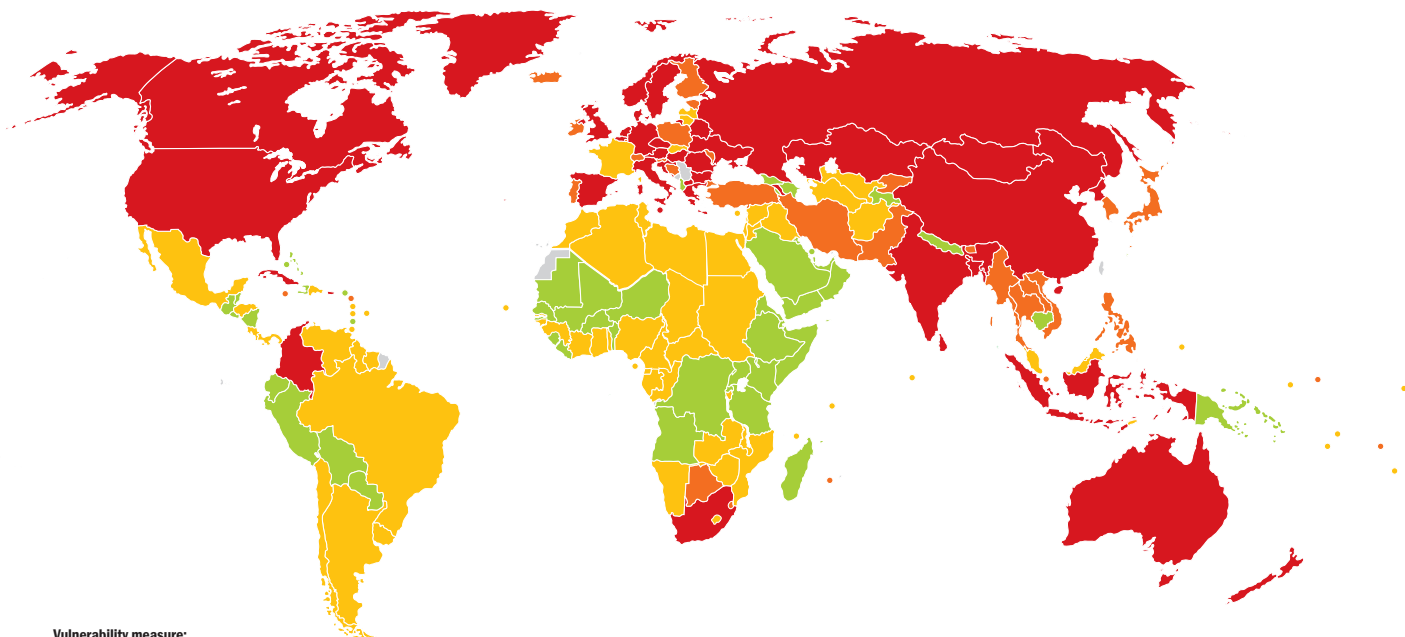
COUNTRY	☠		♿	
	2010	2030	2010	2030
SEVERE				
Spain	350	350	55,000	55,000
Sri Lanka	150	250	45,000	55,000
Sweden	65	70	10,000	10,000
Ukraine	350	350	45,000	45,000
United Kingdom	850	900	100,000	100,000
United States	3,250	4,000	300,000	400,000
BHUTAN				
Bhutan	1	5	200	300
Bosnia and Herzegovina	25	25	3,750	3,750
Botswana	5	10	1,750	2,750
Dominica		1	100	100
Estonia	5	5	1,000	1,000
Finland	30	30	6,750	6,750
Iceland	1	1	200	250
Iran	300	450	150,000	200,000
Ireland	30	30	4,250	4,250
Jamaica	20	25	1,750	1,750
Japan	450	650	150,000	200,000
Kyrgyzstan	35	35	1,750	1,750
Laos	30	45	2,000	2,750
Luxembourg	5	5	500	550
Marshall Islands		1	80	100
Mauritius	5	5	2,500	3,750
Moldova	20	25	1,000	1,000
Myanmar	200	400	35,000	45,000
Pakistan	900	1,250	75,000	100,000
Philippines	450	650	250,000	300,000
Poland	200	200	20,000	20,000
Portugal	50	55	7,000	7,000
Singapore	15	25	4,000	5,250
Slovenia	10	15	1,250	1,250
South Korea	200	250	150,000	250,000

COUNTRY	☠		♿	
	2010	2030	2010	2030
HIGH				
Swaziland	5	5	2,250	3,500
Switzerland	40	40	6,000	6,000
Thailand	250	450	20,000	25,000
Turkey	350	400	40,000	40,000
Tuvalu			10	10
Vietnam	400	550	50,000	65,000
AFGHANISTAN				
Afghanistan	80	100	20,000	30,000
Algeria	100	150	35,000	55,000
Argentina	80	100	10,000	10,000
Barbados	1	1	150	150
Brazil	500	600	55,000	65,000
Brunei	1	1	200	250
Burundi	15	25	5,250	8,500
Cameroon	35	55	8,250	15,000
Cape Verde	1	1	300	450
Central African Republic	10	15	3,250	5,250
Chad	15	25	3,750	6,250
Chile	55	70	5,750	6,750
Comoros	1	1	450	750
Congo	10	15	2,250	3,500
Costa Rica	15	15	1,000	1,250
Cote d'Ivoire	40	60	8,750	15,000
Cyprus	1	5	1,500	1,500
Dominican Republic	30	35	15,000	15,000
Egypt	150	200	40,000	55,000
Equatorial Guinea	1	1	600	950
Fiji	1	5	2,000	2,500
France	250	250	60,000	60,000
Gabon	1	5	1,000	1,500
Gambia	1	5	650	1,000
Ghana	30	50	6,750	10,000



CARBON VULNERABILITY

● Acute ● Severe ● High ● Moderate ● Low



Vulnerability measure:
comparative mortality
as a share of population
(national)

COUNTRY	☠		👤	
	2010	2030	2010	2030
Guinea	15	25	3,500	5,750
Guinea-Bissau	5	5	1,000	1,500
Guyana	1	1	650	750
Honduras	15	20	5,750	6,500
Iraq	70	100	10,000	15,000
Israel	25	30	5,750	5,750
Jordan	10	15	2,000	3,000
Kiribati			150	250
Latvia	5	5	1,250	1,250
Lebanon	10	15	950	1,500
Lesotho	5	5	1,000	1,500
Libya	10	15	2,250	3,500
Lithuania	15	15	1,250	1,250
Malawi	20	35	5,000	7,750
Malaysia	50	75	15,000	15,000
Maldives	1	1	200	250
Mexico	250	350	25,000	30,000
Micronesia	1	1	55	70
Morocco	50	70	6,750	10,000
Mozambique	45	70	10,000	20,000
Namibia	5	5	2,250	3,500
Nigeria	300	500	65,000	100,000
Palau			10	10
Panama	10	10	1,250	1,500
Saint Lucia	1	1	95	100
Saint Vincent			45	50
Samoa	1	1	85	100
Sao Tome and Principe		1	75	100
Seychelles			60	95
Slovakia	15	15	1,250	1,250
Sudan/South Sudan	100	200	15,000	20,000
Suriname	1	1	150	150

COUNTRY	☠		👤	
	2010	2030	2010	2030
Syria	40	60	15,000	20,000
Timor-Leste	1	5	350	450
Togo	10	15	2,500	4,250
Tonga	1	1	65	85
Trinidad and Tobago	1	5	900	1,000
Tunisia	15	25	1,250	2,000
Turkmenistan	10	10	6,250	6,000
Uruguay	10	10	1,500	1,750
Uzbekistan	55	60	9,500	9,500
Vanuatu	1	1	90	100
Venezuela	55	75	5,500	6,500
Zambia	35	50	10,000	15,000
Zimbabwe	20	35	3,250	5,500
MODERATE				
Albania	5	5	1,750	1,750
Angola	25	40	10,000	15,000
Antigua and Barbuda			35	40
Azerbaijan	5	5	3,250	3,250
Bahamas		1	450	500
Bahrain	1	1	450	650
Belize	1	1	85	95
Benin	10	15	2,250	3,750
Bolivia	10	15	3,750	4,250
Burkina Faso	15	20	3,250	5,250
Cambodia	1	1	200	300
Djibouti	1	1	250	350
DR Congo	85	150	20,000	30,000
Ecuador	20	25	2,500	2,750
El Salvador	10	10	2,750	3,000
Eritrea	5	10	2,000	3,250
Ethiopia	25	40	5,750	9,250
Georgia	5	5	3,750	3,750

COUNTRY	☠		👤	
	2010	2030	2010	2030
Grenada			25	30
Guatemala	10	10	2,000	2,250
Haiti	10	10	4,250	4,500
Kenya	45	70	9,000	15,000
Kuwait	1	1	1,000	1,500
Liberia	5	10	1,500	2,250
Madagascar	25	40	5,250	8,500
Mali	10	20	2,500	4,250
Mauritania	5	5	1,250	2,000
Nepal	25	40	4,250	5,500
Nicaragua	10	10	1,250	1,500
Niger	10	15	2,000	3,250
Oman	1	5	650	1,000
Papua New Guinea	5	5	850	1,000
Paraguay	5	5	850	950
Peru	35	40	10,000	10,000
Qatar			65	100
Rwanda	10	20	2,750	4,250
Saudi Arabia	20	25	15,000	20,000
Senegal	10	15	2,000	3,250
Sierra Leone	1	5	500	800
Solomon Islands	1	1	90	100
Somalia	10	15	1,500	2,000
Tajikistan	5	5	800	800
Tanzania	30	50	6,500	10,000
Uganda	30	50	7,000	10,000
United Arab Emirates	1	1	1,250	1,750
Yemen	20	30	3,500	5,000