

ARTICLE

A Fossil Fuel-Funded Climate Disaster Response Fund under the Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts

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Abstract

Three sets of social institutions deal with catastrophic risk: government regulation through rule making, the market, and civil liability. Climate disasters expose the limitations of all of these social institutions and often result in extensive uncompensated losses, particularly in developing countries. The author proposes the establishment of a fossil fuel-funded Climate Disaster Response Fund to compensate victims for the ‘residual’ risk of climate disasters in developing countries that are particularly vulnerable to the impacts of climate change. This Fund, established under the UNFCCC’s Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts, would comprise levies placed on the world’s top 200 fossil fuel companies. This proposal is modelled on various domestic and international funds which have been established to overcome the difficulties posed by tort law and which require companies to pay for the hazardous consequences of their activities and products. Precedents include funds to compensate for the damage caused by toxic chemicals, oil pollution spills, asbestos and nuclear accidents.

Keywords: Extreme weather events, Climate disaster law, Intergovernmental Panel on Climate Change (IPCC), Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts, Insurance, Fossil Fuel-Funded Climate Disaster Response Fund

1. INTRODUCTION

Extreme weather events and disasters, in recent times, have resulted in loss of life, property, infrastructure and livelihoods, and have severely disrupted the normal functioning of affected societies. These climate extremes are at the limits of modern human experience.¹

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¹ See United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), The World Bank, World Resources Institute, *World Resources Report 2010–2011: Decision*

As Farber has noted,² the European summer of 2003 was the worst natural disaster to strike the developed world in modern history. It was the hottest summer in at least 500 years and claimed 70,000 lives.³ Three recent scientific reports authored by the Intergovernmental Panel on Climate Change (IPCC) leave the international community in no doubt that climate change is human induced and is influencing, and will continue to influence, these extreme events and climate disasters to the end of the 21st century.

Three sets of social institutions deal with catastrophic risk: (i) government regulation through rule making; (ii) the market; and (iii) civil liability.⁴ Government regulation complements the two major private sector responses to catastrophes – civil liability and insurance – the primary purposes of which are to promote equity by making the risk creator pay and to spread risk.⁵ Yet, climate disasters expose the limitations of all of these social institutions and often result in extensive uncompensated losses for the individual, particularly in developing countries.

In light of these limitations, I propose the establishment of a fossil fuel-funded Climate Disaster Response Fund to compensate victims in developing countries that are particularly vulnerable to the impacts of climate change for the uncompensated harm risk of climate disasters. This Fund, established under the United Nations Framework Convention on Climate Change's (UNFCCC)⁶ Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts (Warsaw Mechanism), would be made up of funds derived from a levy placed on the world's top 200 fossil fuel companies. These companies produce the majority of the feedstock used in the global energy system and yet the greenhouse gas (GHG) emissions associated with their use are not effectively controlled or internalized under any existing international or domestic legal regimes.

There are ample international and domestic legal precedents of funds established to clean up and/or compensate for the damage caused by toxic chemicals, oil pollution, asbestos and nuclear power. I argue that climate disasters should no longer be dismissed as 'Acts of God' for, as Farber has commented, 'environmental disasters are not simply accidents or Acts of God – they stem from the failure of the legal system to effectively address risks'.⁷

Making in a Changing Climate: Adaptation Challenges and Choices, available at: http://pdf.wri.org/world_resources_report_2010-2011.pdf.

² D. Farber, 'Environmental Disasters: An Introduction', UC Berkeley Public Law Research Paper No. 1898401, p. 1, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1898401.

³ A. Telesetsky, 'Insurance as a Mitigation Mechanism: Managing International Greenhouse Gas Emissions through Nationwide Mandatory Climate Change Catastrophe Insurance' (2010) 27(3) *Pace Environmental Law Review*, pp. 691–734, at 692.

⁴ W.K. Viscusi & R.J. Zechhauser, 'Addressing Catastrophic Risks: Disparate Anatomies Require Tailored Therapies', Vanderbilt University Law School, Law and Economics Working Paper, 2011, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1960742.

⁵ *Ibid.*, at p. 11.

⁶ New York (NY) US, 9 May 1992, in force 21 Mar. 1994, available at: <http://unfccc.int>.

⁷ Farber, n. 2 above, at p. 9.

2. THE CHARACTERISTICS OF CLIMATE DISASTERS AND THE LOSS AND DAMAGE THEY CAUSE

The IPCC defines climate disasters as:

severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.⁸

The IPCC's 2013 Fifth Assessment Report⁹ and the 2012 Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)¹⁰ evaluate how natural climate variability and anthropogenic climate change influence the climate extremes that can contribute to disasters, as well as the exposure and vulnerability of human society and natural ecosystems to these extremes. They consider how patterns of development exacerbate exposure and vulnerability, with implications for disaster risk. Consequently, the Reports also discuss how the integration of disaster risk management and climate change adaptation can increase resilience.

The IPCC states that there is evidence of change in some climate extremes from observations gathered since 1950,¹¹ and makes the following observations with regard to future extreme weather events:

- It is *very likely*¹² that, globally, the number of cold days and nights overall has decreased and the number of warm days and nights overall has increased on a global scale since 1950.¹³ There is *medium confidence*¹⁴ that heat waves have increased on a global scale.¹⁵ It is now *very likely* that human influence has contributed to observed global scale changes in the frequency and intensity of daily temperature extremes since the mid-20th century, and *likely* that in some locations human influence has more than doubled the probability of occurrence of heat waves.¹⁶ It is *likely* that there will be further changes in the early 21st century and *virtually certain*¹⁷ that the frequency and magnitude of warm daily temperature extremes and decreases in cold extremes will occur on a global scale

⁸ IPCC, 'Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation' (SREX), at p. 33, available at: <http://www.ipcc-wg2.gov/SREX>.

⁹ IPCC Working Group I, Fifth Assessment Report, 'Climate Change 2013: The Physical Science Basis, Summary for Policymakers' (IPCC 2013 Summary), available at: http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf. The IPCC Working Group II, Fifth Assessment Report, 'Climate Change 2014: Impacts, Adaptation, and Vulnerability' was released on 31 Mar. 2014 and elaborates further on these matters: see Section 4.2 and n. 42 below.

¹⁰ SREX, n. 8 above.

¹¹ IPCC 2013 Summary, n. 9 above, at p. 4.

¹² The IPCC expresses its confidence in accordance with the IPCC Uncertainty Guidance Note and 'very likely' means >90% probability: see http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1s1-6.html.

¹³ IPCC 2013 Summary, n. 9 above, at p. 4.

¹⁴ Ibid., about 5 out of 10 chance.

¹⁵ Ibid., at p. 23; SREX, n 8 above, at p. 8.

¹⁶ Ibid., at p. 13. Note that there has been further strengthening of the evidence of human influence on temperature extremes since the SREX.

¹⁷ Ibid., at p. 23, >99% certainty of occurrence.

in the late 21st century. A 1-in-20 year hottest day is likely to become a 1-in-2 year event in most regions by the end of the 21st century. The 1-in-20 year daily maximum extreme temperature is likely to increase by 1°C to 3°C by the middle of the 21st century and by 2°C to 5°C by the late 21st century.¹⁸

- There is *medium confidence* that anthropogenic influences have contributed to intensification of extreme precipitation at the global scale since the 1950s.¹⁹ It is *likely* that the frequency and intensity of heavy precipitation will increase over many areas of the globe in the early 21st century. This is *very likely* to occur over most of the mid-latitude land masses and over wet tropical regions in the late 21st century.²⁰ A 1-in-20 year maximum daily precipitation event is likely to become a 1-in-5 year to a 1-in-15 year event by the end of the 21st century in many regions.²¹
- There is *medium confidence* that the projected increases in heavy *rainfall events* will contribute to local flooding in some catchments or regions.²²
- There is *medium confidence* that droughts will intensify on a regional to global scale in the late 21st century.²³
- It is *very likely* that since the 1970s there is a *substantial* anthropogenic contribution to the global mean sea level rise. This is based on the IPCC's *high confidence* in an anthropogenic influence on the two largest contributions to sea level rise, namely thermal expansion and glacier mass loss.²⁴ It is *very likely* that mean sea level rise will contribute to upward trends in extreme coastal high-water levels in the late 21st century.²⁵ There is *high confidence*²⁶ that locations already experiencing erosion and inundation will continue to do so as a result of increasing sea levels. It is *very likely* that sea level rise, coupled with the likely increase in tropical cyclone maximum wind speed, will be a specific issue for tropical small island states.²⁷

As the IPCC explains, the attribution of changes in individual climate events to anthropogenic forces is complicated.²⁸ Losses over time must be controlled for exposure and vulnerability as most studies attribute the losses to the exposure of people and assets in high-risk areas and to underlying societal trends. These include the demographic, economic, political and social factors which shape vulnerability to impacts.²⁹

¹⁸ SREX, n. 8 above, at p. 13.

¹⁹ *Ibid.*, at p. 9.

²⁰ IPCC 2013 Summary, n. 9 above, at p. 23.

²¹ SREX, n. 8 above, at p. 13.

²² *Ibid.*

²³ *Ibid.*

²⁴ IPCC 2013 Summary, n. 9 above, at p. 13.

²⁵ *Ibid.*, at p. 23.

²⁶ *Ibid.*, about an 8 out of 10 chance.

²⁷ *Ibid.*, at p. 14.

²⁸ *Ibid.*, at p. 368.

²⁹ *Ibid.*

2.1. *The IPCC and Insurers Compute the Loss and Damage of Climate Disasters*

The IPCC acknowledges with *high confidence* that economic losses from weather- and climate-related disasters have increased, although with large spatial and inter-annual variability. Between 1980 and 2004, the total costs of extreme weather events amounted to US\$1.4 trillion, of which only one quarter was insured. The human impact of natural disasters is unequally distributed across regions, with Asia experiencing the highest number of weather- and climate-related disasters in the period 2000 to 2008. Economic loss was distributed as follows: the Americas, 54.6% of total loss; Asia, 27.5%; and Europe, 15.9%. Africa accounted for only 0.6% of the global economic losses, but economic damages from natural disasters are under-reported in this region compared with other regions.

The IPCC notes that its loss estimates are likely to underestimate actual losses because many impacts, such as the loss of human lives, cultural losses, and ecosystem services are difficult to monetize and so are poorly reflected in estimates of losses. Impacts on the informal or undocumented economy, as well as indirect economic effects, are substantial in some areas and sectors but are not factored into reported estimates.³⁰ This fact is critical in understanding that such losses would comprise a significant proportion of the disaster losses experienced in developing countries with informal economies. Yet there is no record of their cost.

The data collected on climate disasters by insurers and reinsurers provides a useful supplement to the IPCC's reports. Worldwide insured losses alone from weather-related disasters have risen from US\$5.1 billion per year between 1970 and 1989 to US\$27 billion annually over the past two decades. Current climate risks could cost emerging economies anywhere between 1% and 12% of gross domestic product (GDP) by 2030 rising, under a high climate change scenario, to 19%.³¹

3. THE UNFCCC ESTABLISHES THE WARSAW LOSS AND DAMAGE MECHANISM

In 2013, the 19th Conference of the Parties (COP) to the UNFCCC established the Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts³² under the Cancún Adaptation Framework.³³ Crucially, this Framework acknowledges that adaptation and risk management strategies address loss and damage associated with climate change impacts but that these losses cannot all be reduced by adaptation.³⁴ It is to the limitations of existing institutions – government, insurance and civil liability – in compensating the victims of climate disasters that the discussion first turns to illustrate the need for additional

³⁰ SREX, n. 8 above, at pp. 9 and 266.

³¹ Swiss Re, 'Weathering Climate Change: Insurance Solutions for More Resilient Communities', 2010, p. 3, available at: http://europa.eu/epc/pdf/workshop/2-3_pub_climate_adaption_en.pdf.

³² Decision 2/CP.19, Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts, FCCC/CP/2013/10/Add.1, available at: <http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf>.

³³ See <http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=4>.

³⁴ *Ibid.*, Preamble.

compensation mechanisms. In the remainder of this article, I develop a proposal for such a mechanism, namely, a fossil fuel-funded Climate Disaster Response Fund.

4. THE GOVERNMENT AS REGULATOR IN THE FACE OF LOSS AND DAMAGE

Virtually all approaches to climate disasters and catastrophic loss conclude that the scale of losses is such that the government is compelled to act, whether in the form of *ex ante* regulation to reduce exposure to the risk or *ex post* disaster assistance.³⁵ This is because the financial impact on business and individuals may be significant, thus causing large welfare losses and broad macroeconomic consequences. Public assets, including buildings and infrastructure, may be impaired. Moreover, government will be under strong political pressure to compensate victims.³⁶ More generally, government is expected to take into account the welfare of all parties and is accustomed to dealing with externalities.³⁷ Consequently, government is expected to play a role in all four stages of the responses to disasters: prevention; management; risk transfer post disaster; and post-disaster reconstruction.

4.1. *The Hyogo Framework for Action*

The principal international disaster instrument applicable to governments is the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters (HFA).³⁸ The HFA is regarded as the most comprehensive framework for building resilience to disasters.³⁹ The priorities for government action are:

- to ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation;
- to identify, assess and monitor disaster risks and enhance early warning;
- to use knowledge, innovation and education to build a culture of safety and resilience at all levels;
- to reduce the underlying risk factors; and
- to strengthen disaster preparedness for effective response at all levels.⁴⁰

³⁵ G.L. Priest, 'The Government, the Market, and the Problem of Catastrophic Loss' (1996) 12 *Journal of Risk and Uncertainty*, pp. 219–37. See also H. Kunreuther, 'Reducing Losses from Catastrophic Risks through Long-Term Insurance and Mitigation' (2008) 75(3) *Social Research*, pp. 905–30, at 905.

³⁶ A. Monti, 'Climate Change and Weather-related Disasters: What Role for Insurance, Reinsurance and Financial Sectors?' (2009) 15 *Hastings West and Northwest Journal of Environmental Law and Policy*, pp. 151–72, at 153.

³⁷ R. Zeckhauser, 'The Economics of Catastrophes' (1996) 12 *Journal of Risk and Uncertainty*, pp. 113–40, at 128.

³⁸ United Nations International Strategy for Disaster Reduction, 'Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disaster', 2005, available at: http://www.unisdr.org/files/1037_hyogoframeworkforactionenglish.pdf.

³⁹ R. Djalante, F. Thomalla, M.S. Sinapoy & M. Carnegie, 'Building Resilience to Natural Hazards in Indonesia: Progress and Challenges in Implementing the Hyogo Framework for Action' (2012) 62(2) *Natural Hazards*, pp. 779–803, at 781.

⁴⁰ 'Hyogo Framework', n. 38 above, Art. 14.

4.2. Governments Passing Climate Adaptation and Disaster Risk Reduction Laws

In accordance with the HFA, a primary risk reduction task for governments would be to design climate adaptation laws that prevent disasters from occurring in the first place. This includes undertaking risk and vulnerability assessments⁴¹ combined with ‘soft’ and ‘hard’ preventative strategies. Yet, the report of the IPCC Working Group II entitled ‘Climate Change 2014: Impacts, Adaptation and Vulnerability’⁴² has found a significant lack of climate disaster preparedness at *all* levels of development.⁴³ Although the IPCC calls for integrated disaster risk management and climate change adaptation, it acknowledges that least developed countries and vulnerable communities have limited ability to cope.⁴⁴ It states that adaptation planning and implementation should occur across all levels, from individuals to governments (*high confidence*). National governments should coordinate the adaptation activities of local and subnational governments by providing policy and legal frameworks as well as financial support.⁴⁵ For example, the integration of adaptation into planning and decision making should occur to promote synergies between development and disaster risk reduction.⁴⁶ Unfortunately, the literature reveals that pre-disaster spending is generally lower than post-disaster spending.⁴⁷

4.3. ‘Soft’ and ‘Hard’ Disaster Risk Reduction Strategies

‘Soft’ strategies are regarded as cost-effective ‘no regrets’ options⁴⁸ and include the adoption of appropriate spatial land-use planning laws and building codes, and ecosystem protection and restoration.⁴⁹ However, many major coastal cities lack updated master or land-use plans, or they have been produced for only part of the city with other parts occupied by informal and unregulated settlements.⁵⁰ This is of great concern given that there are now 26 megacities with more than 10 million people. The United Nations (UN) has estimated that by 2050 70% of the world’s population will be urban.⁵¹ The design and enforcement of building legislation, regulations, codes and standards are equally problematic.

⁴¹ R.J. Fuchs, ‘Cities at Risk: Asia’s Coastal Cities in an Age of Climate Change’, East-West Center No. 96, July 2010, pp. 1–12, at 7, available at: <http://www.eastwestcenter.org/fileadmin/stored/pdfs/api096.pdf>; see also R. Fuchs, M. Conran & E. Louis, ‘Climate Change and Asia’s Coastal Urban Cities: Can they Meet the Challenge’ (2011) 2(1) *Environment and Urbanization Asia*, pp. 13–28.

⁴² Summary for Policymakers, available at: http://ipccwg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf.

⁴³ *Ibid.*, at p. 6.

⁴⁴ *Ibid.*, at p. 13.

⁴⁵ *Ibid.*, at p. 25.

⁴⁶ *Ibid.*, at p. 26.

⁴⁷ See World Bank, *Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention* (2010), p. 106, available at: http://publications.worldbank.org/index.php?main_page=product_info&products_id=23659.

⁴⁸ Fuchs, Conran & Louis, n. 41 above, at p. 24.

⁴⁹ *Ibid.*, at p. 25.

⁵⁰ Fuchs, n. 41 above, at p. 8.

⁵¹ *Natural Hazards*, n. 47 above, at p. 170.

‘Hard’ options include the construction of flood protection infrastructure such as sea walls and dikes, and the climate proofing of essential infrastructure.⁵² Where extreme weather events overwhelm these, retreat may be the only option. This represents one of the greatest losses of value in land and infrastructure and the largest transfer of economic wealth in human history.⁵³ However, land-use rules could be developed to encourage agriculture that can withstand occasional storms, or the land could be used for nature conservation and recreational areas.⁵⁴

4.4. *Government Responsibilities under the Warsaw International Mechanism on Loss and Damage*

At COP19 in Warsaw (Poland), the Parties acknowledged that the adverse effects of climate change might exceed adaptation responses. It established the Warsaw International Mechanism for Loss and Damage⁵⁵ under the Cancún Adaptation Framework,⁵⁶ as well as an Executive Committee of the Warsaw International Mechanism.⁵⁷ The specific function of the Warsaw Mechanism is to promote the implementation of all the measures agreed to at COP18⁵⁸ in Doha (Qatar) in a comprehensive, integrated and coherent manner.⁵⁹ The COP in Doha reaffirmed the need for governments to scale up their efforts to develop a comprehensive climate risk management strategy⁶⁰ by:

- assessing the risk of loss and damage;
- designing country-driven risk management strategies and approaches, including risk reduction, risk transfer and risk-sharing mechanisms;
- the systematic observation and collection of data on the impacts of climate change, in particular slow onset impacts, and accounting for losses;
- implementing comprehensive climate risk-management approaches;
- promoting investment and stakeholder involvement in climate risk management, including vulnerable communities and civil society, and the private sector; and
- enhancing access to and sharing of data at the regional, national and subnational levels, such as hydrometeorological data.⁶¹

The Executive Committee is to develop a two-year work plan in this regard.⁶² Governments are requested to work through the UN and other relevant institutions,

⁵² Fuchs, n. 41 above, at p. 8.

⁵³ *Natural Hazards*, n. 47 above, at p. 180.

⁵⁴ Queensland Floods Commission of Inquiry, ‘Final Report’, p. 272, available at: <http://www.floodcommission.qld.gov.au/publications/final-report>.

⁵⁵ See Decision 2/CP.19, n. 32 above.

⁵⁶ *Ibid.*, Art. 1.

⁵⁷ *Ibid.*, Art. 2.

⁵⁸ Available at: <http://unfccc.int/2860.php#decisions>.

⁵⁹ *Ibid.*, Art. 5.

⁶⁰ *Ibid.*, Art. 3.

⁶¹ *Ibid.*, Art. 6.

⁶² *Ibid.*, Art. 9.

specialized agencies, experts, networks and processes to develop coherent approaches to address the loss and damage associated with extreme and slow onset events.⁶³ Developed countries are requested to provide developing countries with finance, technology and capacity building for implementing their obligations.⁶⁴

5. PUBLIC AND PRIVATE INSURANCE FOR CLIMATE DISASTERS

Just as government is called upon to intervene in the form of *ex ante* regulation to reduce exposure to the risk,⁶⁵ so too are its powers invoked to spread the *ex post* financial risks of extreme weather events and climate disasters.

Bruggeman and her co-authors⁶⁶ provide a useful taxonomy of several policy approaches which governments could take to manage catastrophe risks and compensate attendant losses. These include:

- relying primarily on the private insurance market;
- providing direct compensation to victims of catastrophe;
- instituting mandatory comprehensive insurance;
- providing catastrophe insurance itself;
- acting as re-insurer of last resort;
- providing an additional layer of insurance above a private insurer's financing; and
- acting as lender of last resort.

Each of these approaches is considered in turn.

5.1. *The Role of Private Insurance*

It is claimed that the market for private insurance provides substantially greater hope for dealing with catastrophes than do governments.⁶⁷ Private insurers, in comparison with government insurers, are better able to determine the level of catastrophe exposure to accept and its aggregation function may thus be more effective than that of government.⁶⁸ This suggests that private insurance markets may be able to effectively exclude risks that are uninsurable where moral hazard and adverse selection cannot be controlled.⁶⁹

Theoretically, actuarially fair rates can provide appropriate incentives for parties to reduce the personal costs of climate disasters. However, fair actuarial pricing for catastrophes is difficult as insurers do not have sufficient experience in dealing

⁶³ Ibid., Art. 12.

⁶⁴ Ibid., Art. 14.

⁶⁵ Priest, n. 35 above; see also Kunreuther, n. 35 above.

⁶⁶ V. Bruggeman, M. Faure & T. Heldt, 'Insurance Against Catastrophe: Government Stimulation of Insurance Markets for Catastrophic Events' (2012) 23(1) *Duke Environmental Law & Policy Forum*, pp. 185–241, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2213772.

⁶⁷ Priest, n. 35 above, at p. 220.

⁶⁸ Ibid., at p. 226.

⁶⁹ Ibid., at p. 228.

with them.⁷⁰ Insurers base their rates on the history of premiums and losses for a particular type of insurance that requires sufficient historical data. If there are catastrophic events generating an unprecedented scale of damages, it is difficult to provide appropriate and viable insurance cover.⁷¹

Catastrophic climate risks, characterized by high-magnitude, low-probability harms, pose a unique set of risks to insurer solvency. Firstly, they are unpredictable and this makes it difficult to price the risks. Secondly, catastrophic events generate risks that are highly correlated with each other as a single storm can destroy millions of homes and livelihoods. Thirdly, catastrophic weather events are often regionally specific, which makes it difficult to spread the risk between higher- and lower-risk policyholders.

Finally, catastrophic risks may strain the availability of capital.⁷² From a compensation perspective, climate change could affect insurance markets in a number of ways. Increased demand for insurance could arise from changes in the types of natural disaster and their level of risk. More frequent or extreme weather events could result in larger insurance payouts. Risks might become more difficult for insurers to diversify as losses become correlated across geographic areas, or affect a larger proportion of policyholders. As the climate changes, historical data might become less useful and insurers might need to rely more on climate projections and models;⁷³ this could affect the cost of insurance as insurers need to set aside more capital or purchase more reinsurance. Yet, reinsurance poses a challenge to the profitability of insurers as they charge significant risk premiums when insurers rely on them to raise capital or purchase reinsurance.⁷⁴ Moreover, higher excess amounts might be charged to limit their exposure to certain hazards, or insurance might be withdrawn altogether.⁷⁵

Private insurance is not limited to playing simply a compensatory role. It should also be regarded as a mechanism for providing price signals and risk communication that influences individuals, governments and businesses to reduce their vulnerability through loss prevention or mitigation.⁷⁶ It can enhance resilience by influencing land use and development decisions.⁷⁷ Private insurers can also determine optimal building codes and implement them through underwriting decisions, and decide that

⁷⁰ Zeckhauser, n. 37 above, at p. 133.

⁷¹ Viscusi & Zeckhauser, n. 4 above, at p. 14. For a discussion of the various responses to this problem in the European Union see R. Schwarze et al., 'Natural Hazard Insurance in Europe: Tailored Responses to Climate Change are Needed' (2011) 21(1) *Environmental Policy and Governance*, pp. 14–30, at 14.

⁷² S. Hecht, 'Insurance', in M.B. Gerrard & K. Fischer Kuh (eds), *The Law of Adaptation to Climate Change* (American Bar Association, 2012) pp. 511–42, at 513.

⁷³ See Australian Government, Productivity Commission, 'Barriers to Effective Climate Change Adaptation', 14 Mar. 2013, at p. 300, available at: <http://www.pc.gov.au/projects/inquiry/climate-change-adaptation/report>.

⁷⁴ Hecht, n. 72 above, at p. 514.

⁷⁵ Productivity Commission, n. 73 above, at p. 300.

⁷⁶ Hecht, n. 72 above, at p. 515. Note that compulsory insurance has also been held up as a GHG mitigation instrument. It is suggested that insurers could become substantially involved in underwriting the climate change catastrophe risks of major emitters, in which case the emitters would need to satisfy the risk tolerances of the insurers: see Telesetsky, n. 3 above.

⁷⁷ Hecht, n. 72 above, at p. 515.

new and existing homes will be insurable only to the extent that they comply with the code.⁷⁸

Yet, the role of private insurance is complex. While it may 'soften the blow' in post-disaster scenarios, it may also affect prevention.⁷⁹ Insurance may dilute the incentive to prevent disasters unless the insurance premium accurately reflects the risk and the prevention measures that need to be taken. Many individuals forego insurance where premiums are too high so private insurance invariably draws in the government as regulator, as provider of insurance, or as reinsurer. This results in lower premiums through subsidies but, if the premium is too low, construction in hazard-prone areas will be encouraged.⁸⁰

5.2. Governments Providing Direct Compensation to Disaster Victims

Governments can facilitate the payment of post-disaster financial assistance directly to individuals, small businesses and certain industry sectors.⁸¹

For example, following the 2010–11 flood disasters, the Australian Commonwealth government established the Natural Disaster Relief and Recovery Arrangements under Appropriation Act (No. 2) 2006–07 (Cth). This allows the Commonwealth to assist state governments with the partial reimbursement of disaster relief and recovery payments, as well as infrastructure restoration.⁸² Payments are made for various categories of relief, which include: emergency assistance to individuals; the restoration of essential public assets; loans and subsidies to businesses, primary producers and voluntary non-profit bodies; and exceptional disaster assistance.

In December 2012, United States (US) President Barack Obama, by Executive Order, established the Hurricane Sandy Rebuilding Task Force to provide the coordination necessary to rebuild public housing, transportation and utilities.⁸³ The Task Force comprises the heads of at least 24 federal government agencies and must work with the Federal Emergency Management Agency (FEMA) to implement its rebuilding mandate. In January 2013, US Congress approved a further US\$50.5 billion;⁸⁴ in addition, state charities collected almost US\$400 million to aid victims.⁸⁵

⁷⁸ Priest, n. 35 above, at p. 233.

⁷⁹ *Natural Hazards*, n. 47 above, at p. 18.

⁸⁰ *Ibid.*, at p. 18.

⁸¹ See, e.g., the Australian Government Disaster Recovery Payment and the Disaster Income Recovery Subsidy, available at: [http://www.disasterassist.gov.au/Currentdisasters/Pages/QLD/Queenslandfloods\(November2010February2011\).aspx](http://www.disasterassist.gov.au/Currentdisasters/Pages/QLD/Queenslandfloods(November2010February2011).aspx).

⁸² See Australian Government, Attorney-General's Department, 'Natural Disaster Relief and Recovery Arrangements: Determination 2012', available at: <http://www.disasterassist.gov.au/FactSheets/Documents/NDRRADeterminations/NDRRA%20Determination%202012.doc>. A means-tested levy, set at 0.5% of taxable income in excess of AU\$50,000, was imposed on Australian taxpayers for the 2011–12 financial year to assist with the costs of rebuilding infrastructure following the floods.

⁸³ Available at: <http://www.whitehouse.gov/the-press-office/2012/12/07/executive-order-establishing-hurricane-sandy-rebuilding-task-force>.

⁸⁴ House of Representatives (HR) 152. For a summary of the Act see <http://www.govtrack.us/congress/bills/113/hr152#summary/libraryofcongress>.

⁸⁵ L. Nahmias, 'State Charities Collect Nearly \$400 Million in Sandy Donations', *The Wall Street Journal*, 3 Jan. 2013, available at: <http://blogs.wsj.com/metropolis/2013/01/03/state-charities-collect-nearly-400-million-in-sandy-donations>.

Following the 2011 floods in Thailand, the Thai government established a National Disaster Fund of US\$1.6 billion to support the provision of natural disaster risk coverage to households, small firms and industries. The fund was designed by the Office of Insurance Commission, the General Insurance Association, the Thai Chamber of Commerce and the Federation of Thai Industries. The Fund is intended to operate for three years until such time as reinsurers re-evaluate their exposure in Thailand.⁸⁶

5.3. *Mandatory Disaster Insurance*

Government has the advantage of being able to constrain adverse selection because it can make insurance compulsory.⁸⁷ Governments have required the purchase of insurance and have provided subsidized insurance for disasters, especially floods. Mandatory insurance requires certain individuals to purchase insurance against defined damage caused by natural hazards and can be offered in the market by a variety of companies.⁸⁸ Without any such requirement, only high-risk groups would decide to buy insurance and the risk may become uninsurable. Compulsory catastrophe insurance avoids adverse selection, allows a cross-subsidization of high risks by low risks, and may be justified on the grounds of national solidarity.⁸⁹ In France, for example, catastrophe insurance is mandatory and is linked to ordinary property and car insurance. The insurer is liable for catastrophic damages only if the government declares an incident to be a natural disaster.⁹⁰

5.4. *Government as Insurer and Reinsurer*

One justification for state provision of catastrophic risk insurance, or reinsurance beyond normal coverage, is that the scale of climate loss and damage is often so great that private insurance is unable to cope.⁹¹ The rationale for government-sponsored flood insurance, for example, arose from the apparent failure of the private insurance market. Reasons for this include the following factors:

- losses are virtually certain in some areas;
- flood losses can be catastrophic;
- consumers are not willing to pay the real cost of their risk exposure in the form of high premiums; and
- the risks cannot be pooled as consumers at low risk of flood will not purchase insurance.⁹²

⁸⁶ See AON Benfield, '2011 Thailand Floods Event Recap Report: Impact Forecasting – March 2012', at p. 25, available at: http://thoughtleadership.aonbenfield.com/Documents/20120314_impact_forecasting_thailand_flood_event_recap.pdf.

⁸⁷ Priest, n. 35 above, at p. 226.

⁸⁸ Schwarze et al., n. 71 above, at p. 16.

⁸⁹ R. Van den Bergh & M. Faure, 'Compulsory Insurance of Loss to Property Caused by Natural Disasters: Competition or Solidarity' (2006) 29(1) *World Competition*, pp. 25–54, at 27.

⁹⁰ Bruggeman et al., n 66 above, at p. 194.

⁹¹ Viscusi & Zeckhauser, n. 4 above, at p. 31.

⁹² M.J. Browne & R.E. Hoyt, 'The Demand for Flood Insurance: Empirical Evidence' (2000) 20(3) *Journal of Risk and Uncertainty*, pp. 291–306, at 293.

Governments that invest in flood mitigation works might provide individuals with a sense of security which encourages development in floodplains and reduces the value of insurance in the minds of individuals.⁹³

In the US, the National Flood Insurance Program (NFIP) was established to provide homeowners and businesses with flood insurance at subsidized rates. It also offers government reinsurance for private insurers and disaster loans to assist in the recovery process. Insurance is available only if the community agrees to adopt and enforce flood mitigation and land-use measures.⁹⁴ However, one of the risks of underinsurance is the vulnerability of the government insurer itself. In 2011, the NFIP was forced into debt and needed to borrow US\$19 billion from the US Treasury to cover floods caused by hurricanes in 2005 (Katrina) and 2008.⁹⁵

Another option for governments in the face of catastrophic damages is to finance an additional layer of government insurance outside the insurance market on an *ex post* basis. Government simply supplements the amount of compensation available from insurers to better protect victims where damages exceed certain limits.⁹⁶ An example of this is represented by the nuclear liability conventions of the 1960s in accordance with which the state provided a second level of insurance above the compensation payable by licensees of nuclear power plants.⁹⁷

Yet another option is for the government as reinsurer to auction excess-of-loss contracts to insurers and reinsurers whereby the government is liable only for losses that exceed some threshold of industry losses. This could also reduce the government's obligation to make disaster relief payments to victims following a catastrophe.⁹⁸

However, some argue that in the context of catastrophic loss the ability of the government to aggregate loss is problematic as its insurance must be available to all citizens desiring coverage.⁹⁹ Yet, providing universal coverage is contrary to the risk reducing function of aggregation.¹⁰⁰ Also, since government is seldom able to engage in risk segregation¹⁰¹ to control adverse selection, government insurance plans typically face severe budgetary problems. Here, governments would rather lower the average insurance benefits than discriminate on the basis of adverse selection and thus shift the risks to the insured;¹⁰² therefore, government insurance may not be ideal if it

⁹³ *Ibid.*, at p. 296.

⁹⁴ *Ibid.*

⁹⁵ E. Michel-Kerjan & H. Kunreuther, 'Redesigning Flood Insurance' (2011) 333(6041) *Science*, pp. 408–9, at 409.

⁹⁶ Bruggeman et al., n. 66 above, at p. 200.

⁹⁷ M.G. Faure, 'Insurability of Damage Caused by Climate Change: A Commentary' (2007) 155 *Pennsylvania Law Review*, pp. 1875–99.

⁹⁸ See Bruggeman et al., n. 66 above, at p. 202.

⁹⁹ Insurance reduces the risk level by aggregating uncorrelated risks because, for statistically independent risks, the sum of the aggregated risk is less than the sum of the risks taken individually: see Priest, n. 35 above, at p. 222.

¹⁰⁰ *Ibid.*, at p. 226.

¹⁰¹ Like aggregation, segregation according to risk level improves an insurer's ability to predict expected loss, making possible greater predictive accuracy: *ibid.*, at p. 223.

¹⁰² *Ibid.*, at p. 227.

requires heavy government subsidies which could adversely affect behaviour. This may include providing an unintended incentive to build in flood- or hurricane-prone areas as residents would not be paying the full cost for their expected risks. This is a problem of ‘moral hazard’.¹⁰³

5.5. *Less Conventional Climate Disaster Insurance Products*

Given the challenges of climate change, insurers are increasingly providing less conventional insurance products. These include:

- parametric and index-based insurance where the insurer agrees to make a pre-defined payout when a ‘trigger’ is reached that has no relation to the actions or losses of the policyholder – for example, weather derivatives are used to insure agricultural activities where the actions or losses of policyholders are difficult or costly to monitor;¹⁰⁴
- multi-crop peril insurance, which could be developed to insure against hazards that have historically been difficult to cover.¹⁰⁵

At the micro level, households and businesses in low- and middle-income countries are beginning to access new index-based insurance, thereby reducing transaction costs. These schemes can also reduce the danger of moral hazards (when guaranteed compensation for losses encourages risk-taking behaviour, leading in turn to higher premiums) and adverse selection (when only high-risk households sign up for the insurance, with the result that insurers are unable to spread the risk). Micro-insurance can support disaster risk reduction in a variety of ways. One approach is to bundle the insurance with loans to promote investment in risk reduction. This can also promote productive investment that helps the most vulnerable to escape disaster-related poverty traps.¹⁰⁶ Index-based micro-insurance can be linked not only to observed but also forecasted hazards so that funds for risk reduction activities are available before a disaster occurs. However, micro-insurance reaches only a small fraction of risk-prone households and reviews of micro-insurance pilot initiatives reveal substantial obstacles to scaling up these initiatives.¹⁰⁷

5.6. *Shifting the Risks of Climate Disasters to the Capital Markets*

Insurers and reinsurers, both public and private, may transfer catastrophe risk to capital markets through instruments such as catastrophe bonds.¹⁰⁸ These bonds allow an investor to provide capital to cover the occurrence of a pre-defined extreme

¹⁰³ Viscusi & Zeckhauser, n. 4 above, at p. 32.

¹⁰⁴ Productivity Commission, n. 73 above, at p. 301.

¹⁰⁵ *Ibid.*, at p. 301.

¹⁰⁶ GAR 2011, ‘Global Assessment Report on Disaster Risk Reduction, Revealing Risk, Redefining Development, Summary and Main Findings’, UN GAR 2011, at p. 124, available at: <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/executive.html>.

¹⁰⁷ *Ibid.*, at p. 125.

¹⁰⁸ *Ibid.*, at p. 106.

event upon which insurers pay interest. Should the event occur, the investor forfeits some or all of the capital and interest to the insurer. Bonds may draw on the resources of the capital markets and may be issued as indemnity insurance (based on actual losses) or parametric insurance, or may be linked to total insurance industry losses.¹⁰⁹ The Caribbean Catastrophe Risk Insurance Facility (CCRIF), for example, provides 16 Caribbean governments with short-term liquidity in the event of hurricanes and earthquakes. It was launched in 2007 following Hurricane Ivan, which caused losses in Grenada and the Cayman Islands of 200% of annual national GDP, with donors providing US\$67 million in start-up capital.¹¹⁰ During the period 2010–11, CCRIF's aggregate exposure was just over US\$600 million with US\$20 million retained by the CCRIF, and an additional US\$110 million purchased from the international reinsurance and capital markets.

Shifting insurance to capital markets may provide a temporary increase in capacity. However, capital markets are also part of the global economy and may themselves be vulnerable to the impacts of climate change. Some suggest that this strategy invites systems failure on a larger scale and opens up the insurance system to new vulnerabilities grounded in the relationship between the insurance system and the global economy. Following the 2008 global financial crisis, the potential for failure arising from the integration of insurance and financial markets via insurance-linked securities (ILS) has attracted attention.¹¹¹

6. THE PITFALLS OF CIVIL LIABILITY

Theoretically, civil liability could be an appropriate mechanism for addressing the loss and damage suffered as a result of climate disasters; after all, the basic goals of tort law are to provide corrective justice¹¹² and to allocate the costs of harm to the defendants.¹¹³ However, many legal, institutional and practical obstacles limit the efficacy of tort-based climate change litigation. Legal obstacles include issues of causation, the large number of defendants and plaintiffs, the variety of remedies, and types of present and future harm. Identifying defendants, tracing harm to their actions and apportioning damages among them could be a complicated and onerous task for a court.¹¹⁴ Although recent research suggests that these obstacles are not insurmountable,¹¹⁵ major climate change tort litigation in the US has not been successful and has been ruled to be non-justiciable.

¹⁰⁹ Productivity Commission, n. 73 above, at p. 301.

¹¹⁰ Swiss Re, n. 31 above.

¹¹¹ P.L. Phelan et al., 'Ecological Viability or Liability: Insurance System Responses to Climate Risk' (2011) 21(2) *Environmental Policy and Governance*, pp. 112–30, at 117, available at: doi 10.1002/eet.565, at p. 6.

¹¹² D.A. Grossman, 'Warming Up to a Not-So-Radical Idea: Tort-based Climate Change Litigation' (2003) 28 *Columbia Journal of Environmental Law*, pp. 1–61, at 4.

¹¹³ Ibid., at p. 3. See also P. Cashman & R. Abbs, 'Liability in Tort for Damage Arising from Human-induced Climate Change', in R. Lyster (ed.), *In the Wilds of Climate Law* (Australian Academic Press, 2010) pp. 235–71.

¹¹⁴ Grossman, n. 112 above, at p. 7.

¹¹⁵ D. Kysar, 'What Climate Change Can Do About Tort Law' (2012) 41(1) *Environmental Law*, pp. 1–71, at 41.

The non-justiciability of tort claims for the climate change damage caused by fossil fuel companies is apparent in an important US case – *Native Village of Kivalina v. Exxon Mobil (Kivalina)*.¹¹⁶ At issue here was whether a US federal statute, namely the Clean Air Act (CAA),¹¹⁷ displaces federal common law public nuisance actions.

The facts of *Kivalina* are closely associated with the subject of this article. Residents of the Village of Kivalina, on the northwest coast of Alaska, brought a federal common law nuisance action for damages, individually and collectively, against several energy producers (including Exxon Mobil) for their past emissions and consequent destruction of their land. Kivalina is heavily affected by storm waves and surges that erode the land; if the village is not relocated, it may soon cease to exist. These impacts are the result of melting sea ice attributed to global warming caused in part, according to the villagers, by the emissions of the defendant energy producers.¹¹⁸ The Ninth Circuit found that it did not need to engage in complex issues of whether Congress had sufficiently covered the field of GHG emissions and fact-specific analysis, because it could rely on *American Electric Power v. Connecticut (AEP)*.¹¹⁹ Consequently, the Court held that *AEP* ‘extinguishes *Kivalina*’s federal common law public nuisance damage action, along with the federal common law public nuisance abatement action’.¹²⁰ The US Supreme Court declined to hear *Kivalina* on appeal.

7. TRANSFERRING THE ‘PRIVATIZED’ RISKS OF CLIMATE DISASTERS TO THE TOP 200 FOSSIL FUEL COMPANIES

The foregoing discussion has demonstrated the weaknesses of relying upon the social institutions of government, insurance and civil liability for managing and transferring the risks of climate disasters.¹²¹ While they might in theory have some appeal, in practice these institutions have thus far played an extremely modest role in governing climate change risks and compensating for the associated loss. Ultimately, damage that cannot be prevented, insured against, or compensated must simply be borne by the victims of climate disasters in developing countries, who must resort to informal coping mechanisms embedded in tradition and custom. Individuals may secure emergency loans from family, micro-credit agencies or money lenders, or they may sell or mortgage assets and land. Inevitably, many households and businesses must rely extensively on post-disaster public assistance¹²² or international aid.¹²³ However, in the aftermath of disaster, low-income developing countries face

¹¹⁶ 696 F.3d 849 (9th Cir. 2012).

¹¹⁷ Clean Air Act of 1963, 77 Stat. 392.

¹¹⁸ *Kivalina*, n. 116 above, at 11649.

¹¹⁹ *Ibid.*, at 11654. In *American Electric Power v. Connecticut*, 131 S.Ct. 2527 (2011), at 3, the US Supreme Court held that the Environmental Protection Agency’s regulatory actions to reduce GHG emissions displaced any federal common law right to seek abatement of carbon dioxide emissions from fossil fuel plants based on an interstate nuisance action.

¹²⁰ *Kivalina*, n. 116 above, at 11655.

¹²¹ Viscusi & Zeckhauser, n. 4 above, at p. 10.

¹²² J. Linnerooth-Bayer et al., ‘Insurance, Developing Countries and Climate Change’ (2009) 34 *The Geneva Papers*, pp. 381–400, at 384.

¹²³ *Ibid.*, at 384. See also *Natural Hazards*, n. 47 above, at p. 19.

exhausted tax bases, depleted reserves and declining credit ratings, which make external borrowing difficult.¹²⁴ These states may attempt to raise post-disaster capital by diverting funds from other budgeted programmes, borrowing money domestically, or taking out loans from international financial institutions.¹²⁵ These informal finance mechanisms are often unreliable and inadequate for catastrophic events. On average, international post-disaster assistance has approximated 10% of direct economic losses and can be much less.¹²⁶

Consequently, I propose an innovative vehicle for transferring the financial risk of climate disasters to fossil fuel companies. The proposal is based on international and domestic precedents in which funds have been established to clean up and/or compensate victims for a number of hazardous activities, such as toxic chemicals, oil pollution spills, asbestos contamination, and nuclear damage.¹²⁷ These regimes provide a rough set of starting assumptions and legal principles for establishing a fossil fuel-funded Climate Disaster Response Fund. They include the following:

- All of the activities are hazardous and common law tort litigation is not an appropriate mechanism for apportioning liability and awarding damages.
- Governments have intervened, through both domestic and international law, to establish funds to ensure clean-ups and/or compensation, while at the same time making operators engaged in hazardous activities strictly liable, usually on a joint and several and sometimes on an unlimited basis.
- A compensation fund is established either by a tax on upstream hazards entering the economy (petroleum and chemicals under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)¹²⁸), or levies on private companies (oil spills).
- The entities which contribute to the funds are finite and identifiable.
- Liability to contribute is strict and is based on a pro rata contribution to the harm.
- Liability to contribute to a fund may attach to future unknown losses (asbestos).
- Different tiers and types of compensation scheme between liable parties, insurers and compensation funds can co-exist for the purposes of risk transfer between them (global oil and nuclear).
- Types of compensation to be paid may be categorized by an agency (global oil and nuclear).
- Environmental damage might also be compensated (CERCLA,¹²⁹ OPA¹³⁰).

¹²⁴ Linnerooth-Bayer et al., n. 122 above, at p. 385.

¹²⁵ *Ibid.*, at p. 385

¹²⁶ *Ibid.*, at p. 385.

¹²⁷ This article does not aim to establish an international mechanism to facilitate the bringing of civil law actions in domestic courts to remedy the harm. For reflections on international mechanisms, see, e.g., N. Sachs, 'Beyond the Liability Wall: Strengthening Tort Remedies in International Environmental Law' (2008) 55 *UCLA Law Review*, pp. 837–904, at 837.

¹²⁸ 42 USC §§ 9601 et seq., as amended by PL 107–377, 31 Dec. 2002, available at: <http://www.epw.senate.gov/cercla.pdf>.

¹²⁹ *Ibid.*

¹³⁰ Oil Pollution Act, 33 USC § 2701 et seq (1990).

7.1. *Upstream Levies on Feedstocks*

There are at least two examples in law where upstream taxes, levies or excises are imposed on the introduction of harmful substances into the economy: the US Superfund scheme, and the global and US oil pollution regimes.

CERCLA and the Superfund

The difficulties of relying on common law tort to resolve the contamination of land and water by hazardous substances led the US federal government to enact CERCLA in 1980.¹³¹ This Act established a ‘Superfund’, financed primarily by excise taxes on petroleum and chemical feedstocks, to enable the government to pay for the cleaning up of hazardous chemicals. Although the tax on petroleum for the purposes of CERCLA expired in the mid-1990s, it is instructive for the proposed tax on fossil fuels to support the establishment of the proposed Climate Disaster Response Fund. The regime is set out in Chapter 38 of Title 26 of the Internal Revenue Code.¹³² A tax is imposed on crude oil received at a US refinery and petroleum products brought into the US for consumption, use, or warehousing.¹³³ Also, if any domestic crude oil is used in or exported from the US and before such use or exportation no tax was imposed, then a tax is imposed on the crude oil. An exception applies if the crude oil is used for extracting oil or natural gas on the premises where the crude oil was produced.¹³⁴ The rate of tax was specified for the Hazardous Substance Superfund at 9.7 cents a barrel. The tax on crude oil received at the refinery must be paid by the operator of the refinery, while the tax on imported petroleum must be paid by the person entering the product for consumption, use or warehousing.¹³⁵

Although liable parties are strictly, jointly, severally, and even retroactively liable for the costs of cleaning up, the US Environmental Protection Agency (EPA), relying on the Superfund, may begin short-term removal or emergency action to address a release or a threat of release of a hazardous substance into the environment, even before a finding of liability. Remedial actions address long-term threats to human health and the environment caused by more persistent contamination sources and should permanently and significantly reduce the risks associated with releases or threats of release of hazardous substances that are serious but lack the urgency of a removal action.¹³⁶

Consequently, the design of CERCLA evinces an intention to create a broad web of private liability, backed up by the Superfund. Although in practice the bulk of

¹³¹ N. 128 above. For a review of the Superfund see M.L. Judy & K.N. Probst, ‘Superfund at 30’ (2009) 11 *Vermont Journal of Environmental Law*, pp. 191–247.

¹³² 26 USC Subchapter A, ‘Tax on Petroleum’. Note that Chapter 38 is inserted into the Internal Revenue Code by CERCLA, Title II, ‘Hazardous Substance Response Revenue Act of 1980 Subtitle A – Imposition of Taxes on Petroleum and Certain Chemicals’.

¹³³ Internal Revenue Code, *ibid.*, s. 4611(a)(1),(2).

¹³⁴ *Ibid.*, s. 4611 (b).

¹³⁵ *Ibid.*, s. 4611 (d).

¹³⁶ See <http://www.epa.gov/compliance/resources/publications/cleanup/brownfields/handbook/section1-11.pdf>.

payments are covered by the general fund, now that the tax has expired, the principal target of CERCLA remains the liability of responsible parties.

Oil pollution funds

A further precedent for creating a Climate Disaster Response Fund can be found in the compensation funds established under the international and domestic regimes governing oil pollution spills at sea. The Global Oil Pollution regime comprises three instruments:

- the 1992 International Convention on Civil Liability for Oil Pollution Damage (CLC);¹³⁷
- the 1992 International Oil Pollution Compensation Fund (IOPC Fund); and
- the 2003 International Supplementary Fund for Compensation for Oil Pollution Damage.¹³⁸

This regime provides three layers of compensation available to victims of pollution damage resulting from maritime casualties that involve oil-carrying ships.¹³⁹ The first layer of compensation derives from the 1992 CLC, which covers damage caused by persistent oils in the territory (including the territorial sea and exclusive economic zone) of a State Party to the Convention. Barring a few specific exceptions, such as liability for acts of war or natural disasters, joint and several strict liability is placed upon the owner of the ship from which the polluting oil escaped or was discharged.¹⁴⁰

For present purposes, what is most relevant is the second layer of compensation arising under the 1992 IOPC Fund, of which a state is automatically a member upon ratification of the CLC. This Fund provides supplementary funding where the compensation available under the CLC is insufficient or where a tanker owner cannot be found, is uninsured or insolvent. Of particular relevance is the fact that, much like the CERCLA Superfund, compensation payments and the administrative expenses of the Fund are financed by contributions levied on private companies or other entities (private or public) in a Fund Member State which receives an annual quantity of ‘contributing oil’ greater than 150,000 tonnes of crude oil and/or heavy fuel oil following carriage by sea. As well as oil imported from other countries, coastal movements of crude oil and heavy fuel oil are classified as ‘contributing oil’.¹⁴¹

¹³⁷ London (UK), 27 Nov. 1992, in force 30 May 1996, available at: <http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-on-Civil-Liability-for-Oil-Pollution-Damage-%28CLC%29.aspx>.

¹³⁸ Information on both funds is available at: <http://www.iopcfunds.org>.

¹³⁹ See International Petroleum Industry Environmental Conservation Association (IPIECA) and International Tanker Owners Pollution Federation Ltd (ITOPF), ‘Oil Spill Compensation: A Guide to the International Conventions on Liability and Compensation for Oil Pollution Damage’, Feb. 2007, available at: http://www.ipieca.org/system/files/publications/Compensation_1.pdf.

¹⁴⁰ CLC, n. 137 above, Art. III.

¹⁴¹ IPIECA & ITOPF, n. 139 above, at p. 6.

The third layer of compensation is covered in the 2003 Supplementary Fund, which is also financed by contributions payable by oil receivers in the states that have ratified the Protocol.

The Director of the 1992 IOPC Fund settles claims for compensation.¹⁴² They must fall within the following four categories: (i) preventative measures (including clean-up); (ii) damage to property; (iii) economic losses; and (iv) reinstatement/restoration of impaired environments.¹⁴³

The US OPA¹⁴⁴ of 1990 established the Oil Spill Liability Trust Fund which, like CERCLA, allows the trustees to spend up to US\$2.5 billion on removal costs and damages for each incident. A tax on crude oil provides the majority of funds. It is set at 8 cents per barrel until 2016 and 9 cents in 2017.¹⁴⁵

7.2. *The Asbestos Example: A Fund for Long-tail, Mass Injuries*

A further precedent for a Climate Disaster Response Fund is the James Hardie Fund established in Australia. It is relevant here because it relates to claims which, like climate disasters, are characterized as ‘mass claims for long-tail torts ... due to the number of claimants, the amount of their losses, the tragedy of their injuries and the time period over which their claims emerge’.¹⁴⁶ The James Hardie group ceased its asbestos operations in Australia in 1987 following the development of fatal diseases. It then attempted to quarantine the two holding companies that had conducted the asbestos operations from legal liability by transferring them to a foundation from which payments would be made to satisfy compensation claims.¹⁴⁷ When it became apparent that these resources would not meet the anticipated claims for compensation in the medium and long term, the New South Wales government appointed the Special Commission of Inquiry into the Medical Research and Compensation Foundation.¹⁴⁸ The Commissioner found that the James Hardie group’s preference for treating its liability as a ‘legacy’ issue obscured the true legal situation, which he described as follows:

The negligence of the James Hardie companies occurred in the past, but the liabilities flowing from that negligence only arise day by day, now and in the future, as the diseases are acquired or manifest themselves. The exposure may not even yet have occurred.¹⁴⁹

¹⁴² *Ibid.*, at p. 7.

¹⁴³ *Ibid.*, at pp. 10–12.

¹⁴⁴ N. 130 above.

¹⁴⁵ See J. Liu, M. Faure & H. Wang, ‘Compensating for Natural Resource Damage Caused by Vessel-Induced Marine Oil Pollution: Comparing the International, US and Chinese Regimes’ (2014) 29(123) *Journal of Environmental Law and Litigation*, pp. 123–90, at 157.

¹⁴⁶ See H. Anderson, ‘Veil Piercing and Corporate Groups – An Australian Perspective’ (2010) *New Zealand Law Review*, pp. 1–35, at 1.

¹⁴⁷ See P. Redmond, ‘Directors’ Duties and Corporate Social Responsiveness’ (2012) 35(1) *UNSW Law Journal*, pp. 317–40.

¹⁴⁸ See D.F. Jackson, ‘Report of the Special Commission of Inquiry into the Medical Research and Compensation Foundation’, Sept. 2004, at p. 7, available at: http://www.dpc.nsw.gov.au/_data/assets/pdf_file/0020/11387/01PartA.pdf.

¹⁴⁹ *Ibid.*, at p. 13.

Political pressure brought to bear by a coalition of trade unions and victims groups led to the corporation entering into an Amended and Restated Final Funding Agreement with the New South Wales government¹⁵⁰ and agreeing to make annual payments from ‘free cash flow’ into the fund.

7.3. *The Japanese Nuclear Disasters: Deciding on Categories of Loss that can be Compensated*

The Japanese government’s liability regime for nuclear disasters is useful in considering how to determine the categories of loss that may be compensated given that the scale of a climate disaster is often comparable with that of a nuclear disaster, most notably that of the Fukushima incident. The earthquake and tsunami of 11 March 2011 left 15,870 dead, 6,119 injured and 2,813 missing, as well as over one million buildings damaged or destroyed. The total losses amount to several hundred billion Japanese yen (¥) and make the earthquake the most expensive recorded natural disaster in Japan.¹⁵¹

The Japanese nuclear liability regime is encapsulated in a package of legislative and administrative instruments.¹⁵² The main principles of Japan’s nuclear liability regime may be summarized as follows. The operator’s liability is strict, exclusive and unlimited, with an obligation to financially secure its liability up to ¥120 billion with private insurers to cover ‘normal’ nuclear accident events. Given that a nuclear accident has the potential to create catastrophic losses, insurers in Japan have established the Japan Atomic Energy Insurance Pool, which is a pooled insurance vehicle which includes 23 private insurers. Operators must sign an indemnity agreement with the Japanese government for the same amount for risks that are not insurable, such as earthquake, tsunami and volcanic eruptions. Where the damage

¹⁵⁰ Amended and Restated Final Funding Agreement in respect of the provision of long-term funding for compensation arrangements for certain victims of asbestos-related diseases in Australia, 21 Nov. 2006 as amended and restated as at 20 Dec. 2013, available at: <http://www.aicf.org.au/docs/AFFA%20Amended%20and%20Restated%20as%20at%2020%20December%202013.pdf>.

¹⁵¹ See M. Faure & J. Liu, ‘The Tsunami of March 2011 and the Subsequent Nuclear Incident at Fukushima: Who Compensates the Victims?’ (2012) 37(129) *William and Mary Environmental Law and Policy Review*, pp. 129–218, at 131–32. See also E. Osaka, ‘Corporate Liability, Government Liability, and the Fukushima Nuclear Disaster’ (2012) 21(3) *Pacific Rim Law & Policy Journal*, pp. 433–59; E.A. Feldman, ‘Fukushima: Catastrophe, Compensation, and Justice in Japan’, Public Law and Legal Theory Research Paper Series, Research Paper No. 13-7; H. Morita, ‘Rescuing Victims and Rescuing TEPCO: A Legal and Political Analysis of the TEPCO Bailout’, 21 Mar. 2012, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2026868.

¹⁵² Note that a comprehensive English compilation of articles, legislation and administrative instruments can be found in *Japan’s Compensation System for Nuclear Damage: As Related to the TEPCO Fukushima Daiichi Nuclear Accident* (OECD and Nuclear Energy Agency, 2012), available at: <http://www.oecd-nea.org/law/fukushima/7089-fukushima-compensation-system-pp.pdf>. These regulatory instruments include the following: Act on Compensation for Nuclear Damage (Act No. 147 of 1961, as amended by Act No. 19 of 17 Apr. 2009); Act on Indemnity Agreements for Compensation of Nuclear Damage (Act No. 148 of 1961, as amended by Act No. 19 of 17 Apr. 2009); Nuclear Damage Compensation Facilitation Corporation Act (Act No. 94 of 2011), accompanied by a number of Ordinances and Cabinet Orders for implementing the Act including: Order for the Execution of the Act on Compensation for Nuclear Damage, Cabinet Order No. 44 of 6 Mar. 1962 as amended by Cabinet Order No. 201 of 7 Aug. 2009; Order for the Execution of the Act on Indemnity Agreements for Compensation of Nuclear Damage, Cabinet Order No. 45 of 1962 as amended by Cabinet Order No. 201 of 7 Aug. 2009; Order for Enforcement of the Nuclear Damage Compensation Facilitation Corporation Act, and Cabinet Order No. 257 of 2011.

is greater than ¥120 billion, the government may elect to provide additional compensation.¹⁵³

Of importance for present purposes is that a Dispute Reconciliation Committee for Nuclear Damage Compensation establishes the guidelines for determining the damages that are to be paid.¹⁵⁴ For Fukushima, the Committee decided that the following heads of damage were to be compensated: evacuation expenses; business damage; lost income; loss or reduced value of property; medical examination expenses; property inspection expenses; personal injuries; damage to reputation; and mental suffering. Voluntary evacuations are also compensated, as is indirect damage where corporations and sole proprietors suffer loss as a result of their relationship with a primary damaged party.¹⁵⁵ This administrative approach avoids the substantial hurdles faced by those seeking damages under the tort system.¹⁵⁶

8. DESIGN OF THE PROPOSED CLIMATE DISASTER RESPONSE FUND

The proposed fund overcomes the many weaknesses of civil liability as a social institution to compensate for catastrophic climate risks. The design of the proposed fund would necessarily be the subject of international negotiations under the Warsaw Mechanism.¹⁵⁷

8.1. *Liable Entities*

The first question is who are the liable entities likely to be. It is often stated that it is impossible to identify the fossil fuel producers who could be held liable to contribute to such a fund as that proposed in this article. For argument's sake, and to initiate a discussion about who the liable entities should be, I propose that the top 200 listed companies by estimated reserves of fossil fuels, recently identified by a reputable non-governmental organization (NGO), Carbon Tracker,¹⁵⁸ should be targeted in this proposal. These companies have a combined value of US\$7.42 trillion as at February 2011 and have the most significant interest in bringing all of those reserves to market,

¹⁵³ Faure & Liu, n. 151 above, at p. 179.

¹⁵⁴ See, e.g., Preliminary Guidelines on Determination of the Scope of Nuclear Damage resulting from the Accident at the Tokyo Electric Power Company Fukushima Daiichi and Daini Nuclear Power Plants of 28 May 2011, which were followed by supplementary Guidelines on 31 May 2011, 20 June 2011, 5 Aug. 2011, 6 Dec. 2011 and 16 Mar. 2012; available in *Japan's Compensation System for Nuclear Damage*, n. 152 above.

¹⁵⁵ Faure & Liu, n. 151 above, at pp. 194–5.

¹⁵⁶ *Ibid.*, at p. 196.

¹⁵⁷ I acknowledge that the details of this Fund would need to be agreed in concert with the establishment of the loss and damage fund under the UNFCCC. This article provides rather the conceptual analysis and justification.

¹⁵⁸ See Carbon Tracker Initiative (CTI), 'Unburnable Carbon: Are the World's Financial Markets Carrying a Carbon Bubble?', 2013, at pp. 13–4, available at: <http://www.carbontracker.org/carbonbubble>. See also CTI, 'Unburnable Carbon 2013: Wasted Capital and Stranded Assets', 2013, available at: <http://www.lse.ac.uk/GranthamInstitute/publications/Policy/docs/PB-unburnable-carbon-2013-wasted-capital-stranded-assets.pdf>. Note that in July 2013, Carbon Tracker was named the NGO of the Year at the Business Green Leaders Awards.

absent any levy to account for the damage caused.¹⁵⁹ It is proposed that these companies be levied, consistently with the principles derived from the various case studies examined, for their annual historical production of fossil fuels and, going forward, in accordance with their annual introduction of fossil fuel feedstock into the global energy system. Tracing climate harm to their actions, while levying them for their contributions to the problem, is no longer a complicated and onerous task.¹⁶⁰ Of course, there may be some concern that the governments of Fund Member States would be reluctant, or unlikely, to impose a levy on publicly owned fossil fuel companies. However, this has not emerged as a constraint in other international law contexts, as demonstrated by the Global Oil Compensation Fund.¹⁶¹ Also, under many emissions trading scheme or carbon tax arrangements, liable entities may be state-owned enterprises.¹⁶²

8.2. *The Claimants*

Victims in all developing countries that are particularly vulnerable to climate disasters should be able to claim against the Climate Disaster Response Fund, provided it is the type of disaster which the Fund is authorized to cover, and their loss meets the Fund criteria for compensation. The claim should be brought against the Fund by a State Party claiming on behalf of its affected citizens. It is in these countries that the capacity of governments to institute effective disaster prevention and post-disaster relief strategies are limited, and where the penetration of insurance is low. However, it may be that the COP would prefer to limit claimants to least developed countries and small island states that are particularly vulnerable to climate disasters.

8.3. *The Levy*

A variety of formulae have been adopted to establish compensation funds. The 1992 IOPC Fund,¹⁶³ for example, is not a permanent fund in the sense that there is no regular levy on private companies and entities. However, the Assembly of the Fund, in which parties to the CLC¹⁶⁴ are represented, each year decides on the total amount that should be levied to cover operating expenses and an anticipated amount for

¹⁵⁹ CTI, 'Unburnable Carbon – Are the World's Financial Markets Carrying a Carbon Bubble?', *ibid.*, at p. 2.

¹⁶⁰ This research is part of a project developed in collaboration with a former Chief Risk Officer of a large insurance company to compute the rates of liability. Sources of funding to support the actuarial studies needed to calculate the technical details of this Fund are currently being sought.

¹⁶¹ IOPC Fund, n. 138 above. See also the liability of non-state and state operators under Art. 7 of Annex VI (entitled 'Liability Arising From Environmental Emergencies') to the Protocol on Environmental Protection to the Antarctic Treaty, 4 Oct. 1991, in force 14 Jan. 1998, available at: <http://www.polarlaw.org/1991protocol.htm>.

¹⁶² For example, generators liable under Australia's now repealed Carbon Price Mechanism in New South Wales are state-owned corporations. The same would be the case in jurisdictions, such as China, which are engaging in pilot emissions trading schemes.

¹⁶³ N. 138 above.

¹⁶⁴ N. 137 above.

major pollution incidents. The Secretariat then has regard to the total quantity of contribution oil received by Member States and calculates a levy. The quantity of oil received by each contributor is multiplied by the levy to arrive at an amount in United Kingdom (UK) pounds sterling (£) which must be paid. Invoices are then issued to individual oil-receiving companies and entities.¹⁶⁵

The following formula was used for the James Hardie Fund: the actuarial estimate of the expected proven claim liabilities of the former James Hardie companies for the financial year in which the payment is made and the next two financial years, calculated as at the end of the previous financial year, plus the estimated reasonable operating expenses of the Asbestos Injuries Compensation Fund (AICF)¹⁶⁶ for the financial year in which the payment is made, minus the net assets of the AICF as at the end of the previous financial year, as determined by the approved regulator.

With regard to the proposed Climate Disaster Response Fund, each year, or over an agreed time period, the Executive Committee of the Warsaw Mechanism could decide on the levy needed to cover operating expenses and the anticipated damages arising from major climate disasters. These could be calculated by relying on actuarial calculations which consider the average uncompensated damages arising from the various extreme weather events and disasters during the number of relevant years. As with the calculation of insurance premiums, the more likely an event is to occur, the higher the risk component of the contribution and the higher the levy. Each liable party's proportionate share of the total amount of fossil fuels introduced into the global fuel mix would determine its responsibility to pay into the Fund a proportionate share of the total amount required to cover the loss and damage.

It has been argued before that levies based on contribution to the problem are optimal as the contributors to the funds are given incentives for prevention.¹⁶⁷ Bad risks are punished by paying a greater contribution into the fund whereas good risks contribute less and are rewarded. Such a structure is efficient from the perspective of prevention and also incorporates an element of fairness.¹⁶⁸

8.4. *Any Limitations?*

Where a levy is imposed under the 1992 IOPC Fund¹⁶⁹ and CERCLA,¹⁷⁰ no limitation on the amount of the levy is envisaged. Consequently, it seems that there is

¹⁶⁵ IPIECA & ITOPIF, n. 139 above, at p. 6.

¹⁶⁶ See <http://www.aicf.org.au>.

¹⁶⁷ See, e.g., S. Caney, 'Cosmopolitan Justice, Responsibility and Global Climate Change' (2005) 18(4) *Leiden Journal of International Law*, pp. 747–75; S. Caney, 'Cosmopolitan Justice, Rights and Global Climate Change' (2006) 19(2) *Canadian Journal of Law and Jurisprudence*, pp. 255–78; D. Miller, 'Global Justice and Climate Change: How Should Responsibilities Be Distributed?', presented at Tsinghua University, Beijing (China), 24–25 Mar. 2008; E.A. Page, 'Distributing the Burdens of Climate Change' (2008) 17(4) *Environmental Politics*, pp. 556–75.

¹⁶⁸ Liu, Faure & Wang, n. 145 above, at p. 183.

¹⁶⁹ N. 138 above.

¹⁷⁰ N. 128 above.

no justification for limiting the fossil fuel company's liability to pay the levy. Indeed, given the already escalating costs of climate disasters, it seems highly likely that the amount of the levy will increase incrementally. As this occurs, fossil fuel companies will need to undertake a cost-benefit analysis of whether their operations remain financially viable and, if not, they would need to exit the energy resources market.

8.5. *Any Exclusions?*

It might be argued that fossil fuel companies that are covered by an existing carbon price mechanism (CPM) should be exempt from a disaster fund levy. Yet, very few current CPMs cover the 'upstream' introduction of fossil fuels into the economy.¹⁷¹ Most emissions trading schemes (ETS) around the world, including those proposed in developing countries, cover emissions from a wide range of facilities that emit above a certain threshold. This is typical of a 'downstream' imposition of a CPM. Thus, the imposition of a disaster fund levy on upstream fossil fuel companies does not subject them to a double jeopardy. However, if they are caught by domestic CPMs, which are likely to vary widely from jurisdiction to jurisdiction, it may be that the COP will agree that the amount of the carbon price already paid by them under a domestic CPM should be deducted from their liability under the Climate Disaster Response Fund.

8.6. *Categories of Damages*

It is at the point beyond the limits of government, insurance and civil liability that the proposed Climate Disaster Response Fund would operate to compensate victims for the uncompensated loss and damage of climate disasters. It is important to identify the categories of damages for which payments from the proposed Fund would be made. One option would be for the Executive Committee of the Warsaw Mechanism to exercise the same administrative functions as those of the Japanese Dispute Reconciliation Committee for Nuclear Damage Compensation. For example, for Fukushima the Committee defined the following as damage to be compensated: evacuation expenses; business damage; lost income; loss or reduced value of property; medical examination expenses; property inspection expenses; personal injuries; damage to business reputation; and mental suffering. Compensation for similar types of loss might be warranted for climate disasters. The UNFCCC's Subsidiary Body for Scientific and Technological Advice (SBSTA) should advise the Executive Committee of the Warsaw Mechanism, or provide guidelines as it so often does, on the making of administrative determinations about the type of loss that will be compensated.

¹⁷¹ Note that the Australian CPM as provided in the Clean Energy Act 2011 (Cth) covers emissions from the mining of coal and the embodied emissions of natural gas. However, this is under threat as the new Coalition government has announced its intention to abolish it.

8.7. *Should Damage to the Environment be Compensated?*

CERCLA specifically envisages that damage to the environment, including species, should be included.¹⁷² The US OPA¹⁷³ also provides that parties are liable for the diminution in the value of natural resources and not merely for the costs of restoration. Although it is difficult to value the environment, abstract quantification of environmental damage is allowed in accordance with prescribed assessment standards.¹⁷⁴ By contrast, no compensation is paid for damage to the environment under the Japanese nuclear disaster regime, although environmental cleaning up is funded under the Act on Special Measures concerning the Handling of Environmental Pollution by Radioactive Materials.¹⁷⁵ National and local governments have a financial responsibility for this cleaning operation.¹⁷⁶ In my view, there is no reason in principle why the proposed Climate Disaster Response Fund should not also cover the extensive damage to the environment occasioned by extreme weather events and climate disasters.

For example, extreme heat waves have impacted significantly on Australia's plants and wildlife with the 2009 and 2010 heat waves killing thousands of birds. Since 1994, 30,000 flying foxes have died in heat waves along the east coast while many of Australia's iconic marsupials are at risk. Heat waves and extended droughts have resulted in the mass mortality of koalas.¹⁷⁷ Extreme heat has also resulted in coral bleaching, and intertidal and estuarine species have experienced mortality and reduced reproduction.¹⁷⁸

It should be remembered that ecosystem protection and adaptation to climate change is a fundamental principle of the UNFCCC. It stands to reason that funds should be made available for their restoration following a climate disaster. The SBSTA, relying on actuarial advice, could develop the formula for valuing environmental damage.

9. CONCLUSION

Some argue that it is no longer equitable to expect governments to be the primary financiers of disaster relief as it absolves the private sector of its responsibility for contributing to the large pollution problem and provides no incentive to change any 'business as usual' practices.¹⁷⁹ Therefore, a portfolio of policies should be designed and coordinated which would have three principal objectives of providing for: (i) an

¹⁷² Note that Annex VI to the Protocol on Environmental Protection to the Antarctic Treaty, n. 161 above, Art. 6, imposes liability for damage to the environment. 'Environmental emergency' means any accidental event that has occurred, having taken place after the entry into force of the Annex, and that results in, or imminently threatens to result in, any significant and harmful impact on the Antarctic environment (Art. 2(b)); available at: http://www.ats.aq/documents/recatt/Att249_e.pdf.

¹⁷³ N. 130 above.

¹⁷⁴ Liu, Faure & Wang, n. 145 above, at p. 185.

¹⁷⁵ Available at: http://josen.env.go.jp/en/pdf/annex_01.pdf.

¹⁷⁶ Faure & Liu, n. 151 above, at p. 197.

¹⁷⁷ See L. Hughes & W. Steffen, *The Critical Decade: Extreme Weather* (Climate Commission, 2013), at p. 16., available at: <http://www.climatecouncil.org.au/extreme-weather-report>.

¹⁷⁸ *Ibid.*, at p. 17.

¹⁷⁹ Telesetsky, n. 3 above, at p. 702.

efficient level of protection from catastrophic risks; (ii) an efficient level of compensation for harm, such as optimal liability payments and insurance; and (iii) an adequate level of risk communication to enable people and institutions to protect themselves.¹⁸⁰ For all of the reasons articulated in this article, I propose that a crucial part of this portfolio of policies consists of the establishment of an international fossil fuel-funded Climate Disaster Response Fund under the Warsaw Mechanism to compensate climate disaster victims in developing countries most vulnerable to climate change disasters for their uncompensated losses. I acknowledge that the key features of the proposed Fund are inevitably preliminary and rudimentary. However, this article is explicitly presented as an invitation to others to develop and discuss the proposal further.

¹⁸⁰ Viscusi & Zeckhauser, n. 4 above, at p. 7.