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Energy Equity and Environmental Security

Ethics and Climate Change in Asia and the Pacific (ECCAP) Project

Working Group 7 Report

Energy Equity and Environmental Security

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ACRONYMS

ADB :	Asian Development Bank
ASEAN:	Association of Southeast Asian Nations
CBD:	Convention on Biodiversity
CCPWCNH:	Convention Concerning the Protection of the World Cultural and Natural Heritage
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ECCAP:	Ethics and Climate Change in Asia and the Pacific (Project)
ESCAP:	Economic and Social Commission for Asia and the Pacific
ETS:	Emissions Trading Scheme
FAO:	Food and Agriculture Organization of the United Nations
IPCC:	Intergovernmental Panel on Climate Change
IUCN:	International Union for Conservation of Nature
LDCs:	Least Developing Countries
LPG:	Liquid Petroleum Gas
MDGs	Millenium Development Goals
NGO:	Non-Governmental Organization
SUVs:	Sports Utility Vehicles
TEEB:	Study on the economics of ecosystems and biodiversity (TEEB, 2009).
UNDP:	United Nations Development Programme
UNEP:	United Nations Environmental Programme

PREFACE

The report stems from the work of Working Group 7 established by the Regional Unit in Social and Human Sciences in Asia and the Pacific (RUSHSAP) at UNESCO Bangkok under the Ethics and Climate Change in Asia and the Pacific (ECCAP) project. The project has the aim to encourage science and value-based discussions on environmental ethics to produce substantive cross-cultural and multidisciplinary outputs that will be relevant for long-term policy making. Equity within and between generations is essential for a just world that we aspire to. This report introduces the important concept of environmental security, which includes and goes beyond human security.

The aim of the ECCAP project is not to formulate universal economic or political plans of how to deal with these issues. Rather, the working groups of the project aim to increase awareness and discussion of the complex ethical dilemmas related to energy and the environment, and to identify scientific data, and available ethical frameworks of values and principles for policy options that have proven useful in facing the challenges in certain communities and countries. The projects are ongoing, and the details of this report that extends the Asia-Pacific Perspectives on Bioethics series, can be found in the Executive Summary. The report was developed by working groups, whose members participate as individuals in the highest standards of intellectual vigour and integrity, integrating engineers, philosophers, policy makers, experts, youth, and persons of many different cultural backgrounds and experiences. The reports are subject to ongoing open peer review, and the principal authors are listed.

There is ongoing discussion of numerous reports on the yahoo group, unesco_eet@yahoogroups.com, that are in various stages of drafting. For all reports, drafts and outlines of others, and specific requests for further case studies and analyses, please examine the working group webpages which list the members, and the overall website, http://www.unescobkk.org/rushsap/energyethics. The report writers thank all members of the ECCAP project, and in particular WG7 and Mr. Amarbayasgalan Dorjderem, Prof. N. Manohar and Prof. Ravichandran Moorthy for comments. Feedback and comments are invited to Dr. Darryl Macer, Regional Advisor in Social and Human Sciences in Asia and the Pacific, Regional Unit in Social and Human Sciences in Asia and the Pacific (RUSHSAP) at UNESCO Bangkok, or email rushsap.bgk@unesco.org

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Executive Summary

This report provides an overview of the ethical, economic and legal issues associated with energy equity and environmental security. The reasons for focusing on energy and environmental security are compelling. Establishing access to an effective, reliable and safe set of energy resources is one of the most important development goals for Asia Pacific nations. Without access to energy resources people will continue to be denied important goods such as food and water security, health services, economic opportunities, education and a safe environment.

Achieving an ethical energy infrastructure is a complex task, especially against a backdrop of poverty and a lack of resources. It involves political as well as technical knowledge of what kind of infrastructure is required, and the impacts it will have on people's lives and the environment. This report considers some of the broad technical options that could provide impetus for energy security from a range of perspectives.

Conducting research on the range of energy options requires engagement with a broader set of questions regarding the likely social justice and environmental impacts of the different energy options. These two considerations—the social justice impacts and the environment—are crucial to understanding which of the energy options are the most feasible. Social justice considerations matter because, ultimately, energy provision has to be of benefit to people and communities, according to their needs.

The challenge of delivering energy equity is therefore— roadly—to ensure that all people have access to the level of energy needed to provide for their security or wellbeing, while at the same time ensuring that our energy consumption behaviours do not jeopardise the wellbeing and security of others. Meeting this challenge involves reducing existing energy poverty through the development of renewable and sustainable energy infrastructure. This raises a number of important technical as well as ethical questions, including which technologies can best be employed to meet energy needs most sustainably and who should pay any additional costs associated with meeting energy needs through the provision of renewable energy infrastructure. Secondly, ensuring that our energy consumption behaviours do not jeopardise the wellbeing and security of others will also require a major shift in the way that all people, and especially affluent ones, today utilise existing energy resources.

Closely connected to the social justice implications of energy provision are the environmental impacts. Whether energy technologies are sustainable is obviously crucial to whether they will provide lasting benefits. There are many ways in which something could have an environmental impact, both today and in the future. Energy infrastructure could reduce reliance on solid biofuels such as trees, for instance, if electricity replaced wood as the fuel for cooking. Changes in local and global pollution is a consequence of most technologies, so proper enivronment impact assessment is required. The issue of CO_2 emissions also raises important questions about climate change.

The report presents a series of policy options informed by human rights, environmental security and economics that are useful to consider when we introduce new technologies to achieve change in the energy sector. The first chapter canvasses the meaning of human security and environmental security in the context of energy equity and climate change, and how these approaches compare to traditional economic perspectives. The second chapter outlines the ethical principles and approaches that ought to guide the development of energy policy and the distribution of energy resources and services within and between generations. It also considers what principles should determine who bears the cost of climate change mitigation and adaption action. The third chapter argues that access to energy should be considered a fundamental human right and examines which human rights documents support this aim. The fourth and final chapter provides an overview of two key market-based instruments proposed for reducing carbon emissions—a carbon tax and emissions trading scheme. It discusses the benefits and disadvantages of both, as well as the equity considerations that should be taken into account at various stages of policy formation.

1. Energy Equity and Environmental Security

Summary

This chapter outlines some of the key issues associated with energy equity, climate change and environmental security. Access to energy is critical in enabling people to meet essential needs linked with health and wellbeing. The availability of modern forms of energy generates wide benefits for individuals and the community through time savings, reduction of illness from indoor air pollution, extended hours for work and study and the enhanced operation of health services.

Climate change is a clear threat to human security, but at the same time, the use of energy to alleviate poverty will continue to contribute to climate change unless energy needs are met in a sustainable way. In addition, the risks to human security from dangerous climate change are not the product of ecological risk alone, but are also determined by individuals and groups' capacity to adapt and respond to environmental change. This adaptive capacity is in turn influenced by social, economic and political factors. Finally, the impact of climate change on ecosystems must also be considered and in this context, human security is replaced with environmental security to reflect the interaction of humans with their environment.

A number of options are available for tackling energy poverty through the provision of additional infrastructure and the development of robust regulatory and policy instruments to achieve a more equitable distribution of existing resources. These range from extending existing grids reliant on carbon-intensive fuels to installing distributed systems and micro-grids, and employing renewable sources of energy such as solar. Any policy initiatives to tackle energy poverty, however, must be mindful of the risks to human and environmental security from climate change caused by carbon-intensive energy consumption behaviours.

An economic approach to the management of climate change differs from an environmental security approach in a number of important ways. An economic approach typically characterises the problem of climate change as one of maximising utility, while an environmental security approach may require us to choose mitigation policies that impose economic costs that exceed the expected economic benefits of such policies in order to achieve equity and safeguard human and environmental security.

1.1 The Importance of Energy Use

Without access to a dependable and affordable supply of energy, people would struggle to meet basic and essential needs fundamental to health and wellbeing such as heating, lighting, cooking and hygiene. In addition, the operation of many essential medical devices depends crucially upon energy use, which is also needed for the refrigerated storage of food and vaccines. As the International Energy Agency (2002, p. 366) explains in regards to the importance of energy for health and wellbeing,

"Electric lighting extends the day, providing extra hours for reading and work. Modern cook-stoves save women and children from daily exposure to noxious cooking fumes. Refrigeration allows local clinics to keep needed medicines on hand. And modern energy can directly reduce poverty by raising a poor country's productivity and extending the quality and range of its products—thereby putting more wages into the pockets of the deprived."

It is not just access to energy that is important but access to a reliable and affordable supply of *modern energy*—liquid fuels such as kerosene and LPG, along with electricity, that are used in more developed societies rather than traditional energy sources that have been used for centuries in developing countries (Khandker et al., 2010, p. 2). Many poor people are dependent on traditional biomass fuels (wood, agricultural residue, and dung) for heating and cooking needs, which exposes them to a number of severe health hazards. In India, for example, it is estimated that respiratory illnesses caused by the burning of biomass fuel leads to 500,000 premature deaths each year among women and children under 5 years of age (Gaye, 2007, p.7). Globally, indoor air pollution from the burning of solid fuels is responsible for more than 1.6 million premature deaths each year, 63% of which occur in Asia (Wilkinson et al., 2007, p. 966). In addition to causing loss of life, there is evidence that the inhalation of carbon

monoxide produced by the burning of solid fuel increases women's risk of giving birth to under-weight children (Gaye 2007, p.7). Indoor air-pollution is also associated with tuberculosis, cancer, cataracts, and possibly asthma and heart disease (Wilkinson et al., 2007, p. 967). Moreover, acute respiratory infection in children—often caused by indoor air pollutants—is one of the main reasons children do not attend school in many developing countries (Gaye, 2007, p. 6).

In addition to the direct health costs, collecting firewood to burn in cook-stoves can increase the risk of injury or assault, especially as firewood resources are often located far from people's homes (Gaye, 2007, p. 8; Patrick, 2007, p. 40).[1] Another concern is the opportunity cost of collecting firewood and other biomass fuels. For instance, Timorese families spend between 8 and 15 hours each week collecting firewood; time that could be spent in education or employment (MercyCorps, 2009, p.10). Often the burden of collecting fuel wood is shared among family members, meaning that children are expected to collect fuel wood on weekends and after school hours. This reduces the time available for study, which is compounded by the fact that poorer households may not have enough energy for lighting to enable children to study in the evening (MercyCorps, 2009, p.11). Hence, the quality of energy sources that are available for key energy services such as cooking, heating, and lighting is as equally important for people's wellbeing and flourishing as the quantity of energy sources available.

It is important to recognise the role that cost considerations play in individual and household energy choices. Merely connecting households to electricity will not necessarily ensure that those households are in a position to access modern energy services if, for instance, electricity tariffs are prohibitively high or if the costs of the equipment that is needed to convert energy into a service such as cooking or lighting are too high (Shonali Pachauri & Daniel Spreng, 2004, p. 273). For example, more than 98 percent of the population of Timor-Leste's capital, Dili, still cook with firewood, even though the vast majority of households are connected to the electricity grid network. (World Bank, 2010a, p. 2). This is because firewood is a low-cost energy source compared to electricity, which costs 12 c/kWh (World Bank, 2010a, p. 7).

Reducing the reliance of families on biomass fuels can generate time savings, which, in turn, can lead to better educational and employment opportunities for family members. (Khandker et al., 2010, p. 2). It can also alleviate some of the health problems and gender inequities associated with the burning of biomass fuels, particularly as women and young girls are primarily responsibility for fuel wood collection and food preparation in many cultures and subsequently incur the health and educational costs from fuel wood collection and use. Improving access to modern energy is therefore critical to promoting greater gender equality. Electricity can pump water to households instead of household members (usually women) collecting water. Radio and television can increase women's access to knowledge and information concerning their rights and health. In one Bangladeshi study, for instance, access to electricity was a greater determinant of women's knowledge on gender equality than other variables, such as income (Barkett 2002, cited in Cabraal et al. 2005, p.119).

The benefits of having greater access to modern energy extend to the wider community. According to the Asian Development Bank (ADB, 2009, p. xiii), in Asia and the Pacific alone, about 930 million people did not have access to electricity in 2005. Electricity enables schools to introduce better lighting and operate fans, allowing schools to deliver services over a greater period of the day and to offer night classes, thereby maximizing educational resources. Indeed, a stable and reliable supply of electricity is required if students are to make use of computers and other forms of information technology. Access to electricity is also crucial to the delivery of a broad range of health services, for instance, the maintenance of cold-chain vaccine services, the operation of diagnostic equipment and to light medical theatres. Moreover, public health and educational campaigns, such as on HIV/AIDS, are often more effective when they are employed using mass media that depend on energy use, such as television and radio (Gaye, 2007, p. 8). In addition, the use of electricity for street lighting in towns and villages has important personal security and public safety benefits, with street lighting improvements being associated with reduced risk of assault, lower crime incidence, and reduced anxiety amongst pedestrians when dark (Painter, 1996, p. 200). Finally, access to electricity services can facilitate the creation of greater

1 For example, in 2005, Medicins sans Frontieres reported more than 200 assaults per month on women and children collecting fuel wood in Darfur (Patrick, 2007, p. 40).

economic opportunities, raising incomes and contributing to the alleviation of poverty. For example, access to modern energy enables farmers to pump water for irrigation, thereby enhancing crop yields, while mechanical power and lighting increases manufacturing productivity (Gaye, 2007, pp. 11-12). For these (among other) reasons, access to a dependable and affordable supply of (modern) energy can be considered vital to *human security*.

Although the Asia Pacific region has rich energy resources—renewable and non-renewable—widespread inequalities in access to energy between and within countries persist throughout the region: around 30 percent of the region's population lack any access to electricity (Asian Development Bank, 2007, p. 31). In India, for instance, 94 percent of households in urban areas had access to electricity in 2005, while only 57 percent of households in rural areas had access to electricity. This disparity is even higher for LPG use, with 71 percent of urban households using LPG in 2005 compared to just 17 percent of rural households (Khandker et al., 2010, pp. 4-5). In Timor-Leste, the problems of energy poverty are even more severe. Only one in five houses in Timor-Leste are connected to the electricity grid and in rural areas, where three quarters of the population lives, less than 10 percent of households are connected (World Bank, 2010a, p. 2). The poor state of energy infrastructure has contributed to the lack of adequate sanitary and health services in many parts of the country, with most households having little or no access to safe water supplies and sanitation facilities. Moreover, nearly all Timorese households still rely on the burning of traditional biomass fuels for their cooking needs, which has severe consequences for their health and wellbeing.

This pattern is repeated in many of the poorer Pacific Island nations; the average rate of household electrification for Pacific Island countries (excluding Timor-Leste) is 48 percent (Hook, 2009, p. 9). Pacific Island countries face particular difficulties in meeting energy needs since few possess indigenous energy resources that can be exploited on a large-scale. Instead many rely on importing petroleum-based fuels to power their electricity generation,[2] making them highly dependent on other countries for meeting their energy needs and vulnerable to energy price shocks (Hook, 2009, p. 2). In July 2008, for example, the Marshall Islands were forced to declare a State of Economic Emergency following an accelerated increased in the price of oil in late 2007 and early 2008 (Hook, 2009, p. 6).

1.2 Human Security and Energy Poverty

The concept of human security relates to *multiple dimensions* of human freedom (O'Brien et al., 2010, p. 5). Human security encompasses more than military threats to also include issues of food security, health security, personal security, political security, community security, economic security, and environmental security, all of which are interconnected (UNESCO, 2008). It is about "the protection and fulfilment of people's vital freedoms and the development of capabilities to create satisfying lives for all people" (O'Brien et al., 2010, p. 5). Human security discourse has become increasingly attune to the needs of marginalized groups and people with disabilities, who are often most vulnerable to threats to their security. Such groups often do not match cultural and social norms and their needs are therefore most likely to be neglected in the solutions developed to enhance human security (see Section 1.3 on *Ability Security*).

The relationship between energy use and poverty is twofold. First, at the household level, poverty generally correlates to low energy usage, heavy biomass fuel use and a lack of access to more modern, efficient energy sources, equipment and electricity (Pachauri et al., 2004, p. 2083). This relationship is the same even in highly developed countries, such as Australia, with the exception of the increased dependence on biomass. Australian households receiving income support consistently use 15% less energy than other households. Lower-income earners are also more reliant on electricity for heating, cooking, and hot water than higher-income households, who have greater access to reticulated gas, a more efficient fuel (McGann and Moss, 2010, pp. 21-22). Similarly, poorer households and those in rural areas in developing countries are less likely to have access to gas, which is typically supplied first to more densely populated and higher-income markets, just like electricity grids are initially established in

2 As a result, the intensity of oil use in the Pacific is over 80 percent (Hook, 2009, p. 2).

urban areas, then expand to wealthier rural areas and finally to the most isolated areas (Pachauri et al., 2004, p. 2083).

While poverty is associated with less and more inefficient energy use, providing clean and reliable modern energy sources to disadvantaged households and areas in the first instance is itself an important means of alleviating poverty and stimulating development (Pachauri et al., 2004, p. 2083). Indeed, the 2002 Johannesburg Summit on the Millennium Development Goals (MDGs) explicitly acknowledged the relationship between poverty alleviation and the provision of greater access to modern energy in stating that access to affordable energy services are a prerequisite to achieving the goal of halving the proportion of people living on less than USD1 per day by 2015 (Pachauri et al., 2004, p. 2083). Improving access to modern forms of energy has been identified as vital to achieving a number of other MDGs, including universal primary education (Goal 2), promoting sex equality and the empowerment of women (Goal 3), and reducing the under-5 child mortality (Goal 4) (Wilkinson et al., 2007, p. 975). Unfortunately, an estimated 1.6 billion people worldwide still have no access to electricity networks, and many more have no reliable access to electricity (World Bank, 2008, p. 4). The number of people reliant on traditional biomass fuels for meeting heating and cooking needs is even greater, at around 2.4 billion (Wilkinson et al., 2007, p. 970).

A major obstacle to implementing improved access to energy is that states and communities do not have the financial means or the technology to do so. In calling for energy access for all, the World Commission for the Ethics of Science and Technology (COMEST) has emphasized the responsibility of industrialized countries to cooperate with developing countries in an endeavour to reach energy equity (Kimmins, 2001). As we discuss in chapter 2, industrialized countries' greater wealth and ability to contribute to the costs of achieving energy equity places an onus on these countries to assist developing countries to meet their energy needs in a sustainable and efficient way. In the Asia-Pacific context, this means technology transfer and mutual assistance with the installation of new, more sustainable and efficient energy production and distribution technologies. Policy should be coordinated at a cross-national level since energy is a global commodity (ESCAP, 2008).

The Asian Development Bank (ADB, 2009) highlighted the international dimensions of energy security in a recent report. Domestic policy should therefore take into account how various countries' energy security needs overlap and interact. The ADB (2009) has identified some of the key energy security concerns in the region as:

- lack of access to energy;
- lack of diversification of energy resources;
- high dependence on traditional fuel;
- an increasing gap between energy supply and demand;
- overdependence on imported energy; and
- lack of adequate infrastructure.

There are various strategies to enhance energy security, the most obvious being the diversification of energy sources and resilience against shocks and disruptions. A cross-border approach is also crucial so that entire supply chains can be protected effectively (Yergin, 2006). ESCAP (2008) envisions that a regional integrated energy system, connecting subregional energy systems, would be capable of achieving energy self-sufficiency in Asia.

1.3 Ability Security and Equity

We can also consider threats to human security from difficulties accessing or affording energy use. Ability security is another form of human security that is of particular importance for people with disabilities. One form of ability security that is rarely highlighted within the human security discourse is the assurance that one is accepted, and able to live one's life with whatever set of abilities one has, without being labeled as impaired if one lacks a prescribed set of abilities.

Ability security is concerned with preventing these kinds of insecurities and minimizing the second form of ability inequity which relates to unfair distribution of access to goods (e.g. unequal access to food products or education) and protection from abilities generated through human interventions (such as destruction through weapons or global warming and climate disasters). Ability inequity (at least the non-body related one) of course is not only experienced by disabled people but also other marginalized groups.

People with disabilities are especially vulnerable to energy price increases and to supply shortages and shortfalls.[3] Take the example of people with multiple sclerosis (MS) in Australia. People with MS rely heavily on the use of climate control—especially air-conditioning—as they are especially sensitive to changes in temperature, particularly increases in temperature which can lead to blurred vision, extreme fatigue, and muscle weakness (Summers and Simmons, 2009, p. 3). As a result, people with MS are likely to need to use much more energy for cooling than people without MS, all else being equal. Indeed, households in Australia where a member has MS spend almost ten times as much on air-conditioning as the average Australian household (Summers and Simmons, 2009, p. iii).

The vulnerability of MS sufferers to higher energy costs stems not just from the fact that they need to use large volumes of energy for cooling when others do not. Disability and chronic illness are also linked to other factors that further affect vulnerability to higher electricity costs, such as unemployment and poorer quality housing. The majority of people with MS in Australia, for instance, are unable to work because of their illness—80% of MS sufferers are unemployed 10 years after diagnosis despite being of working age—and so spend a greater proportion of their time at home than most non-MS sufferers (Summers and Simmons, 2009, p. 4). Not only do people with MS therefore need to use air-conditioning at lower temperatures than those without MS, they also are more likely to be at home for longer periods and therefore to have to fund climate control for longer periods (when others benefit from climate control at work). Moreover, because they are unemployed through disability, there is an increased likelihood that they may live in poorer quality housing and either public or private rental accommodation, all of which adds to their vulnerability to higher electricity costs.

1.4 Climate Change and Human Security

Poverty alleviation and economic development require more widespread provision of energy resources and services, which will adversely impact on human and environmental security unless energy needs are met in a sustainable way through the use of more efficient and sustainable distribution, generation, and consumption technologies.

The increasing use of fossil fuels poses a danger to human security for a number of reasons (Kimmins, 2001, p. 6). First, the limited nature of fossil fuels is likely to lead to conflicts over these finite resources that could turn violent. In Asia there are growing tensions over national boundaries in oceans as countries seek to explore fossil fuel reserves in the ocean.

If oil-dependency is not reduced, there will be significant competition for remaining oil resources, which is likely to create further conflicts and considerable oil-price volatility (Wilkinson et al., 2007, p. 974). Countries reliant on oil-use for meeting their energy needs could find themselves heavily exposed to any resulting volatility in the price of oil. To avoid the risk of rising fuel costs and enhance its energy security, a country might elect to develop and use indigenous renewable fuel sources to power its electricity network rather than relying on imported fossil fuels (such as in Pacific Island countries).

Second, GHG emissions from the burning of fossil fuels are one of the major causes of climate change, posing a number of severe threats to the human security of existing and future populations as well as to the integrity and survival of ecosystems. The last decade has seen the highest growth in CO_2 emissions for several decades, even surpassing IPCC projections (World Bank, 2008, p. 5). The IPCC predicts that by 2100, average global temperatures will increase by at least 1.1°C, and possibly as much as 6.4°C

3 For a detailed discussion of how disability imposes additional energy needs (and costs) on people within the Australian context see McGann and Moss, 2010, pp. 47-50.

if nothing is done to reduce GHG emissions (IPCC, 2007, p. 13). We are already witnessing the effects of climate change on ecosystems, with glaciers beginning to disappear, sea ice melting, warming of lakes, a number of plant and animal species relocating towards the poles and shifts in the range and abundance of marine organisms (Barnett, 2010, p. 48). The predicted changes to ecosystems resulting from climate change are increasingly being recognised as a threat not only to ecosystems but also to the security of the human populations who depend on them.

A sea-level increase of even just one metre, for example, would inundate 17% of Bangladesh, a country with little resources to cope with such flooding (Pew Center on Global Climate Change, 2008, p. 4). Climate change is also likely to impact severely on water availability, increase the frequency and intensity of extreme weather events causing, among other things, higher incidences of crop failures, storm damage, and heat stress, and also leading to an increase in the spread of illness and disease. In India, for example, major crop yields are projected to decline between 4.5 and 9 percent over the next 30 years as a result of climate change (World Bank, 2010b, pp. 40-41).

This has led some to argue that our current dependence on fossil fuels is unjust since it is undermines the enjoyment of fundamental human rights. People, argues Simon Caney (2010a, p. 116), "have rights to health, subsistence, and to be economically independent, *and these rights are threatened by dangerous climate change*." This is clear from the risks to human security identified by the IPCC in its Fourth Assessment report (2007) including:

- An increase in drought-affected areas, affecting, for example, up to 250 million people in Africa;
- Decreasing flows in rivers that supply water to millions in Latin America and a billion people in Asia;
- Declining crop productivity in low latitudes, including a 50% decline in yields in some parts of Africa and 30% decline in yields in some parts of Central and South Asia;
- Millions of people exposed to flooding in the densely populated and economically productive deltas of Asia; increases in malnutrition in low-income societies;
- Increased deaths, diseases and injuries associated with extreme weather events, such as droughts, floods, heatwaves, fires and storms;
- Decreasing yields of fish from most of the world's freshwater and coastal fisheries; and
- Loss of lands, homes and possibly entire islands in many of the small island states in the South Pacific, Caribbean and Indian and Atlantic oceans.

Added to these threats to human security is the predicted 150 million (and possibly as many as 250 million) climate refugees who will be displaced from their homes in countries such as Indonesia, Bangladesh, and low-lying Pacific Island nations that are expected to seek refugee in countries, such as Australia, that are better protected against the risks to human security from climate change (Walker, 2009, pp. 177-78).

1.5 The Role of Social, Political, and Economic Systems

It is important to recognise that the risks to human security from dangerous climate change are not the product of ecological risk alone. As Barnett and Adger (2007, p. 641) argue, *"environmental change does not undermine human security in isolation from a broader range of social factors....the risks of climate change to social systems is as much about the characteristics of those systems as it is about changes in environmental systems."* The vulnerability of individuals and groups to the impacts of climate change is not just a function of their environmental or geographical circumstances—whether they live in low-lying regions vulnerable to flooding from rising sea-levels or whether they live in climatic conditions vulnerable to extreme heat events-but is also determined by their capacity to adapt and respond to changing temperatures and weather patterns. This adaptive capacity is in turn a function of both the distribution of economic resources and social and political power. Social, economic, and political factors such as the distribution of income in society, the type of employment opportunities available, levels of social capital and the degree to which governments provide public services and support all affect the level of threat that climate change poses to the human security of individuals and communities (Barnett and Adger, 2007, p. 641).

Existing global inequalities in the distribution of power, opportunities and resources between countries means climate change will impact some countries more than others. The economic benefits that developed countries have derived from their fossil-fuelled development, for instance, leaves them well-placed to adapt and respond to threats to health and wellbeing from climate change. Governments in Australia and the Netherlands, for example, can afford to spend billions of dollars drought-proofing their cities (by building desalination plants) and protecting coastal areas from flooding (by augmenting dikes). In contrast, monsoonal floods affect more than 4 million people in India each year, leaving communities without safe drinking water or sanitation for lengthy durations (Singer, 2009, p. 46).

Countries such as Timor-Leste, where the majority of the population derive their livelihoods from subsistence agriculture activities, are especially vulnerable to the effects of climate change for both bio-physical and socio-political reasons (Barnett and Adger, 2007, p. 641). In Timor-Leste, maize is the primary source of food and its production is acutely sensitive to rainfall shortages since few Timorese farmers use irrigation. For instance, between 2002 and 2003, maize production in Timor-Leste fell by 34% because the wet season arrived late, resulting in 110,000 people needing food-aid (Barnett et al., 2007, pp. 375-76). If climate change causes lower rainfall in Timor-Leste, this could lead to hunger and malnutrition, especially since the Timorese government provides little social security to communities to help them cope with poverty and disadvantage. Climate variability causing widespread crop failures could also put the livelihoods of many who depend on agricultural production at risk (Barnett and Adger, 2007, p. 642).

There are and will continue to be substantial inequalities in people's vulnerability to climate change impacts *within countries* (O'Brien et al., 2010, p. 8). Although climate variability and extreme weather events do not discriminate by income, wealthier individuals and communities are better equipped to adapt to these changes (World Bank, 2010b, p. 42). In Timor, for example, households in Dili and Bacau have a greater capacity to cope with the impacts of climate change on food production than rural households because they are better off and derive their income from sources other than food production (Barnett et al., 2007, p. 377). In Australia, the urban poor and those living in rural communities will be most adversely affected by climate change. Rates of suicide, depression, and anxiety are already disproportionately high in rural communities in Australia, with farmers struggling to make a living, provide for their families, and meet debt repayments due to drought conditions. Warmer temperatures resulting from climate change are likely to increase the economic pressures responsible for increased rates of suicide and depression within rural communities—especially amongst younger and older men—unless suitable mental health programs and other support systems are implemented (Wooton, 2007, pp. 72-3). Low-income households in urban and coastal areas are also disproportionately exposed to the impacts of climate change. An increase in flooding and the severity of storms in coastal areas due to rising sea levels and changing weather patterns will put pressure on people to strengthen the structural integrity of their buildings or relocate. The homes most at risk are those constructed from the cheapest materials, disproportionately affecting lower-income households who may not have the financial resources to equip their homes for flooding and storms or relocate (Sherrard and Tate, 2007, p. 27). In addition, many lower-income earners may not be able to afford to adequately insure their homes against extreme weather events and so will have fewer resources to cope with the anticipated impacts of climate change. Similarly, low-income households who cannot afford to install shading and cooling devices in their homes to protect against an increase in the number and severity of extreme heat days will be more exposed to the health risks from climate change (Fritze, 2007, pp. 8, 18-9).

In short, regional variations in the rate and type of climate change, differing capacities to adapt to climate change, and differences in the vulnerabilities of populations arising from societies' political and economic circumstances mean that the impacts of climate change are being—and will continue to be—distributed unequally between and within countries. In the future, it is expected that the loss of healthy life years from climate change will be 500 times greater in Africa than in Europe (Costello et al., 2009, p. 1701). Consequently, unless we greatly reduce GHG emissions and adopt policies and measures specifically targeted at assisting the most vulnerable groups to adapt, climate change will exacerbate levels of inequality within and between countries" (Barnett, 2009, pp. 132-133). As the Third IPCC Assessment Report warns, *"the impacts of climate change will fall disproportionately upon developing countries and the poor persons within all countries, and thereby exacerbate inequities in health status and access to food, clean water, and other resources."*[4]

4 Cited in Moellendorf, 2009, p. 204.

This expected inequality raises important questions of social justice, particularly as those who stand to be most adversely affected by climate change are the people who bear least responsibility for the threat posed to human security from GHG emissions: the poorest 1 billion people are responsible for only 3% of global GHG emissions (Costello et al., 2009, pp. 1700-01). In contrast, the United States has produced approximately 30% of CO_2 emissions released in the 20th century from the burning of fossil fuels.[5] Developing countries simply cannot absorb the costs of protecting themselves against threats to human security from climate change, particularly as these are estimated to be USD75-100 billion per year (at a minimum) even if global warming is kept below 2°C (Gore, 2010, p. 1). In its 2010 World Development Report on climate change and development, the World Bank estimated that the total cost of climate change mitigation and adaptation could potentially be much greater, at USD275 billion per year by 2030 (Schalatek et al., 2010, p. 3; World Bank, 2010b). This raises questions of fairness in the distribution of GHG emission benefits and burdens as developing countries bear the burdens of a costlier, low carbon route of development (Gore, 2010, p. 1). Should those responsible for causing climate change therefore have to pay the costs of climate change mitigation and adaptation? Should polluters have to compensate the victims of climate change for their excess consumption? As we will see in chapter 3, these are difficult questions to resolve, but they cannot be avoided. Henry Shue (1993, pp. 43-44) reminds us that, *"Today is already the morning after. Even if starting tomorrow morning everyone in the world made every exertion she could possibly be expected to make to avoid as much addition as possible to today's concentration, we would continue to add CO_2 much faster than it can be recycled without a rise in temperature for an indeterminate number of years to come."*

Some costs of coping with future climate change are inevitable; they will have to be paid. Recognising this—and the need for richer countries to assist poorer and emerging countries in adapting and responding to climate change—developed countries pledged in Copenhagen to give USD10 billion per year to developing countries from 2010 to 2012, rising to USD100 billion per year by 2020 (Schalatek et al., 2010, p. 1). This USD100 billion is supposed to be new and additional funding to overseas development aid currently pledged to poorer countries for other purposes, and priority is to be given to assisting adaptation in the least developed countries and small island states (Schalatek et al., 2010, p. 2). Unfortunately, there is evidence that many developed countries are planning to count monies pledged towards climate financing towards their long-standing promise to increase their annual expenditure on overseas development aid to 0.7 percent of gross national income (Gore, 2010, p. 3). Some countries have furthermore proposed counting investments made in Clean Development Mechanism (CDM) projects under the flexibility mechanisms of the Kyoto Protocol as climate financing even though the purpose of the CDM is to enable Annex-I countries to meet their Kyoto obligations more cheaply by investing in emissions reductions in developing countries instead of making their own domestic emissions (Anderson, 2010, p. 4). Some consider it unjust for developed countries to meet their responsibilities to contribute to climate change mitigation and adaptation in developing countries using funds that had previously been designated for health and education causes. Instead, new and additional resources are needed to address these extra burdens on developing countries (Gore, 2010, p. 3).

1.6 From Human Security to Environmental Security

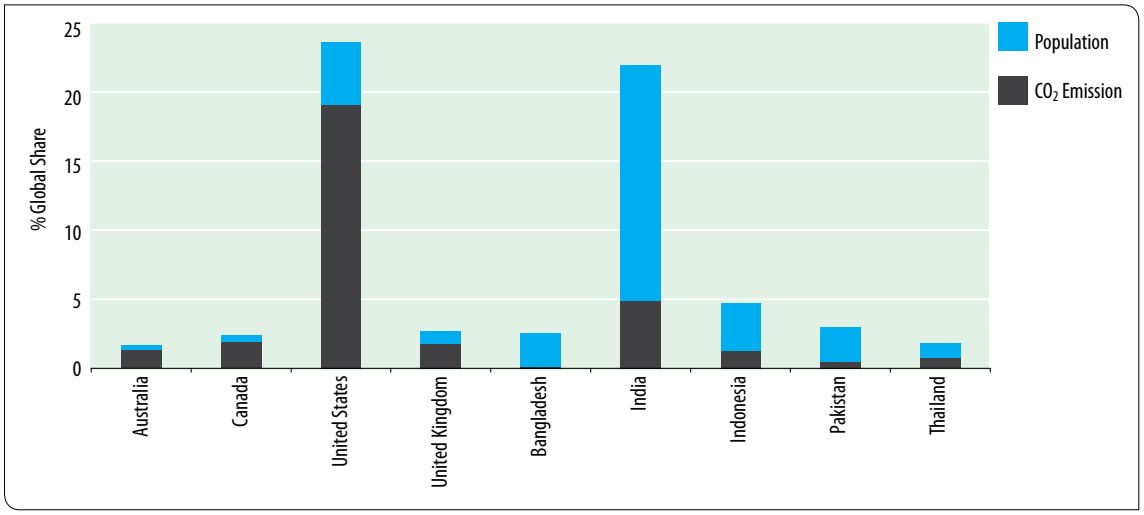
We have considered the severe risks climate change poses to human security and how poorer countries and disadvantaged groups are most vulnerable to these risks. But it is not only humans who are profoundly affected by climate change. The survival of many plant and animal species and the integrity of entire ecosystems is also at risk from climate change. As a review in the journal *Nature* written a decade ago highlighted, ecological communities *"are already undergoing re-assembly that is attributable to climate change…and the projected warming for the coming decades raises even more concern about its ecological and also socio-economic consequences"* (Walther et al., 2002, p. 394). Importantly, a change in the population density of even a single species can have wide ramifications for ecosystems. For example, in the Southern Ocean, krill is an important food source for higher predators including penguins and other seabirds, whales, and seals (Walther et al. 2002, p. 393). If ocean warming continues, researchers expect coral bleaching to be increasingly common, killing coral reefs and putting fish and other creatures that depend on reefs at risk (Pew Center on Global Climate Change, 2008, p. 7).

5 Figure quoted in Singer, 2009, p. 41.

Human behaviours are profoundly changing the ecosystems upon which their wellbeing, and that of other living organisms, depends. While all forms of life influence their environment, none do to the same degree and extremity as humans. It is, as Dale Jamieson argues (2010a, pp. 441-2), *"as if we have scaled up slash-and-burn agriculture to a planetary scale."* The threat to other species and ecosystems from anthropocentric climate change provides additional reasons for mitigating further dangerous climate change, since humans should respect the "the intrinsic value" of animals, plants and ecosystems as much as other human beings (Bosselmann 2001, p. 127). How extensively the interests of other species and the integrity of ecosystems should matter to us is a question of debate (Bosworth et al, 2012). But it seems obvious that harm to other species ought to carry important weight, as reflected in research ethics codes and humane slaughtering laws which impose obligations on people to minimise animal suffering in research and food production. Moreover, as we will see more thoroughly in chapter 3, there are grounds for according value to the integrity of ecosystems outside the role they have in contributing to human wellbeing and security: *"ecosystems generate and support life, keep selection pressures high, enrich situated fitness, and allow congruent kinds to evolve in their places with sufficient containment"* (Rolston, 2001, p. 241).

We have therefore opted to replace the term human security with environmental security. Although human security is a multidimensional concept, its goal is 'people centric' in that the different types of security the concept invokes relate to the protection of *human beings* from various threats. From a human security perspective, the integrity of ecosystems and other species' wellbeing only merit consideration insofar as they relate to human wellbeing (Bosselmann, 2001, p. 125).

Figure 1: Share of Global CO_2 Emissions from Fuel-Use vs. Population Share in 2008 (IEA, 2010)



1.7 Climate Change and Energy Equity

A number of options are available for tackling energy poverty through the provision of additional infrastructure and the development of robust regulatory and policy instruments to achieve a more equitable distribution of existing resources. These range from extending existing grids reliant on carbon-intensive fuels to installing distributed systems and micro-grids, and employing renewable sources of energy such as solar. Any policy initiatives to tackle energy poverty, however, must be mindful of the risks to human *and environmental* security from climate change caused by carbon-intensive energy consumption behaviours.

It is estimated that we will have to limit global carbon emissions to around 6 billion tonnes of carbon per year (or 0.9 tonne per person) even if we are only to stabilise the concentration of GHGs in the atmosphere at existing levels. But in 2004, Americans on average produced more than five tonnes of carbon each.[6] Moreover, energy use in richer countries more generally is up to 20 times higher per person than in the poorest countries of the world (Wilkinson et al., 2007, p. 970).

6 Figures taken from Singer, 2002, p. 43.

The challenge of delivering energy equity is therefore—broadly—to ensure that all people have access to the level of energy needed to provide for their security or wellbeing, while at the same time ensuring that our energy consumption behaviours do not jeopardise the wellbeing and security of others. Meeting this challenge is a two-fold process. First, it involves reducing existing energy poverty through the development of renewable and sustainable energy infrastructure. This raises a number of important technical as well as ethical questions, including which technologies can best be employed to meet energy needs most sustainably and who should pay any additional costs associated with meeting energy needs through the provision of renewable energy infrastructure (given that reason for having to meet energy needs through more costly sustainable generation and distribution infrastructure based on renewable fuel sources is largely a function of the over-consumption of fossil fuels by developed countries). Second, ensuring that our energy consumption behaviours do not jeopardise the wellbeing and security of others will require a major shift in the way that affluent people today utilise existing energy resources. The ethical principles and approaches that ought to guide the development of energy policy and the distribution of energy resources and services will be considered in further detail in the next chapter. Before considering these principles and approaches in detail, it is helpful to briefly contrast the environmental security approach to energy equity outlined in this report with economic analyses of climate change mitigation policies since there are a number of key differences between the approaches.

1.8 Economics and Climate Change Mitigation

As an economic problem, the problem of climate change is one of *maximising utility*, which, according to classical economic theory, is understood in terms of preference-satisfaction which, in turn, is measured in terms of people's consumption behaviours: acts of consumption equate to the satisfaction of preferences. Hence, if we are concerned with maximising utility (i.e. preference satisfaction), we will be concerned with maximising consumption. The issue here as far as climate change is concerned is that people's consumption behaviours in a carbon reliant economy impose opportunity costs on future generations that are not yet adequately captured by the market and which will result in a decline in the utility enjoyed by future generations compared to a situation in which harmful climate change does not occur. In other words, in seeking to maximise our own immediate utility through our consumption behaviours we are putting future utility at risk as climate change will lead to significant losses in consumption. The challenge, then, is to work out the rate of emissions reductions that will maximise overall utility. This is not simply a matter of working out the level of emissions reductions that is necessary to stabilise the concentration of greenhouse gases or to keep temperature increases below a certain threshold. For what also must be considered are the costs involved in reducing greenhouse gas emissions and the impact of these costs on overall utility. Seen from this perspective, reducing GHG emissions by changing our energy consumption behaviours is akin to an investment in the world's climate, where the return on this investment is *"lower damages and therefore higher consumption in the future"* (Nordhaus and Boyer, 2000, p. 170). Hence, the challenge in delivering an efficient (or optimal) climate change policy is to ensure that we cut current emissions enough to avoid future losses in consumption but not so much that the losses we incur today to do so are not worth the benefits we will obtain in the future from such emissions reductions. Indeed, it may be more efficient to eschew extensive mitigation policies and to invest in adaptation measures instead, especially if the cost of achieving deep emissions cuts turn out to be quite high.

An economic approach to the management of climate change differs from an environmental security approach in a number of important ways. Firstly, utilitarian approaches famously have regard only for total utility or wellbeing, ignoring important ethical considerations concerning the distribution of wellbeing and the separateness of persons. As a consequence, utilitarianism is vulnerable to the objection that it sacrifices the wellbeing of some for the sake of increasing overall utility. This is evident in cost-benefit analyses of climate change. If the harms of dangerous climate change are concentrated on only a relatively small proportion of the population and a much larger proportion of the population would have to incur costs for the sake of avoiding or mitigating these harms, it is not clear that a utility maximising (or cost-benefit analysis) approach supports climate change mitigation. This is true even if (a) the harms done to the victims of climate change would be severe in terms of loss of life and threats

to human security and (b) the costs to individuals of mitigation relatively minor, since significant costs to some can always be outweighed by minor benefits to a much greater number of people. John Broome (2006, p. 1) here gives the example of a choice between two alternative mitigation policies, where A is better than B on balance from a utility-maximising perspective inasmuch as *"it brings extra benefits that outweigh the harms it causes."* Although B results in fewer threats to the human and environmental security of future generations, it does so at considerable cost to existing persons. As Broome points out, if we are interested in maximising utility alone, we should conclude that A ought to be chosen. However, if the extra benefits from choosing A are benefits that accrue to people in developed countries, *"whereas the harms are suffered by people in developing countries, it might be unjust...to choose this policy."* An approach to climate change that is fundamentally concerned with equity and safeguarding human and environmental security, in other words, may require us to choose mitigation policies that impose economic costs that exceed the expected economic benefits of such policies.

A more common criticism of economic and cost-benefit analysis approaches to managing climate change, however, is their use of *discounting*. This is the practice of attributing less value to a unit of economic value if it is received in the future rather than the present. The ethical issues involved in the use and choice of discounting rate will be considered in more detail in chapter 4, when we consider carbon tax proposals in greater detail.

A final criticism of economic approaches to the management of climate change is that the uncertainties involved in assessing the impacts of climate change on eco-systems and on human security are too great to permit the use of cost-benefit analyses. This criticism is considered in detail below.

1.9 Scientific Uncertainty and the Precautionary Principle

Cost-benefit analyses are only as robust as the accuracy of their assumptions and predictions. Current models rely heavily on assumptions of scientists and economists that may or may not be correct, but which cannot be known with any degree of certainty. Comparing a business-as-usual scenario to a Kyoto-scenario or other possible alternative, for instance, depends entirely on the accuracy of predictions about future economic, technological, and population growth; assumptions that are likely to be little more than guesswork, particularly in the developing world. Furthermore, the science behind the relationship between GHG emissions and climate change is still very uncertain. To take one example, the effects of GHG emissions on rainfall patterns are less well understood than the effects on temperatures. So there is a high degree of uncertainty associated with projections about the impacts of climate change on agricultural production and on food security. The threat to food security from climate change may be far greater than we currently think (or it may be less). Also, although we know that climate change will affect nearly all regions of the world, precisely *how* it will affect the economies of particular societies and regions is difficult to say since we know relatively little about how environmental impacts will translate into social, political, and economic impacts in some parts of the world, especially small pacific island nations (Barnett, 2010, pp. 51-55). Consequently, as Dale Jamieson (1992, p. 146) argues, *"the idea that we [can] predict the impact of global climate change reliably enough to permit meaningful economic analysis seems fatuous indeed."*

Another issue is the difficulty of putting a value on the cost of environmental impacts even if we can be confident in our predictions about the impacts of temperature changes on eco-systems. As the World Bank (2010b, p. 48) points out, *"monetising costs and benefits can too easily omit nonmarketable environmental goods and services and becomes impossible if future risks (and attitudes toward risk) are highly uncertain."* For instance, how do we assign a value to the destruction of eco-systems or to the loss of species diversity? Or, if there is a risk of human distinction from catastrophic climate change, how can we measure the value of this risk? (Broome, 2006, p. 2). The majority of integrated assessment models model the social costs of marginal GHG emissions as rising smoothly, and none account for the possibility of climatic catastrophes like the shut down of the North Atlantic Ocean Conveyor Belt or the melting of the polar ice caps. Yet, it is the possibility of such catastrophes occurring that is most troubling about climate change. The failure to consider such possibilities in the cost-benefit models of climate change means that we are *"essentially gambling on our future [and] betting against the possibility of catastrophic global-warming events"* (Reay, 2002, p. 2949). But catastrophic climate change is far from inconceivable.

While integrated assessment models presently assume that the impact of marginal GHG emissions will be gradual, *"mounting scientific evidence suggests that natural systems could exhibit nonlinear responses to climate change as a consequence of positive feedbacks, tipping points, and thresholds"* (World Bank, 2010b, p. 49). As Dale Jamieson (2010b, p. 267) warns, *"GHG forcing may quite suddenly drive the climate system into some unanticipated, radically different state to which it is virtually impossible to adapt."* This could happen if GHG forcing results in positive feedbacks—e.g. warmer temperatures causing the permafrost to thaw, realising methane and leading to further warming—or if regular circulation systems in the atmosphere and oceans shut down or radically alter. Given such dangers and the extremity of the risks involved for future generations, have we any right to presuppose that the effects of climate change will be far from catastrophic?

Many philosophers argue that exposing others to even the *risk* of incurring severe or substantial harm is morally unacceptable, regardless of whether any severe or substantial harm actually happens. As Henry Shue (2010, p. 152) argues, *"[i]f I play Russian roulette with your head for my amusement as you doze and the hammer of the revolver falls on an empty chamber, I will have done you no physical harm. But I will have seriously wronged you by subjecting you to that unnecessary risk."* Postponing emissions cuts is in some ways like putting a revolver to future people's heads and hoping that there is no bullet in the chamber. We know how some of the mechanisms that could lead to catastrophic or extreme climate change work. We also know that increasing the concentration of GHG in the atmosphere heightens the possibility that these mechanisms will be triggered, even if we can't say for certain that they will be triggered or estimate the probability that they will be triggered. In other words, we know enough to be aware that by doing little to reduce GHG emissions now we are subjecting future generations to the risk of severe harm (Gardiner 2004, p.576).

Given that the cost of stabilising GHG emissions may be as little as 1 percent of global GDP at 2050—and that the costs to future generations of runaway or catastrophic climate change would be no less than extreme—the mere risk of causing extreme climate change by doing nothing supports adopting deep emissions cuts today even if the possibility of catastrophic climate change is uncertain. As Catriona McKinnon (2009, p. 200) explains,

"the nature of [climate change catastrophes] requires us to take drastic precautions against further [climate change] that could lead us to pass the tipping points that cause them. This is the case notwithstanding the fact that we are in a state of strong uncertainty with respect to these events; indeed, our strong uncertainty with respect to them—given their nature—makes the case for action to prevent them even more persuasive, from the point of view of justice."

Likewise, the 2010 World Development Report (World Bank, 2010b, pp. 37-38) argues that *"[t]he unacceptability of irreversible and potentially catastrophic impacts and the uncertainty about how, and how soon, they could occur compel bold actions."* This is all the more so because any delay in implementing emissions cuts could lock the world into a high emissions development path that would make stabilising the atmospheric concentration of CO_2 almost impossible.

1.10 Conclusion

This chapter has highlighted the importance of access to modern energy for the fulfilment of needs associated with health and wellbeing. Millions of people across the Asia-Pacific region remain in energy poverty. Climate change clearly has the potential to severely impact human security and energy equity. This chapter has demonstrated the importance of going beyond mere human security to also consider ability security and ultimately environmental security. Ultimately it is more compelling to take an environmental security approach to climate change than an economics approach since the former takes a broader view on questions of equity and social justice. The next chapter goes onto consider the ethical principles and approaches that ought to guide the development of energy policy and distribution of energy resources and services, in line with an environmental security approach.

2. Ethical Approaches and Principles

Summary

This chapter considers a number of ethical approaches and principles that can inform how we improve access to energy and achieve carbon emission reductions. It discusses the distribution of energy in current generations, the potential impacts of our energy technology choices on future generations, and on other species and the environment.

The chapter also considers whether policy initiatives should also consider future generations in their choice of energy technologies, which raises a number of moral arguments as to how this responsibility should be conceptualised:

- It is not clear that there is a strong moral obligation to consider the interests of people who do not yet exist;
- We cannot have caused people harm by leaving them a heavily polluted environment if the alternative is a state of affairs where those people do not exist (the non-identity problem);
- Relying on principles that are independent of identity such as utilitarianism places onerous obligations on current generations;
- The Lockean proviso which requires each generation to leave the global commons in at least as good a condition for future generations as that generation has inherited it raises the issue of whether it is fair that existing generations should have to pay the costs of previous generations' environmental degradation;
- The use of Rawls's original position can be applied to climate change, placing parties behind a veil of ignorance when determining the distribution of burdens and benefits across generations. This leads to the principle of intergenerational equality which requires not meeting energy needs through the continued use of carbon-intensive energy technologies if the additional costs associated with meeting energy needs in a more sustainable way as a proportion of GDP are less than the costs that the GHG emissions associated with the use of carbon-intensive energy technologies would impose upon future generations as a proportion of their GDP.

There are also obligations on existing generations to limit the impact of their energy-consumption behaviours beyond just future generations to the wellbeing of other species and the environment in recognition of the value that that ecosystems provide for humans. A number of ethical frameworks assist in conceptualising approaches to ecosystems (see also Rai et al., 2010; Bosworth etal., 2012):

- Anthropocentric ethics emphasizes the consequences of interference with the environment *for human beings* in the present and in the future.
- Biocentric perspectives extend some form of moral status to all living beings, not just humans.
- Ecocentrism goes even further in extending the domain of moral concern to attribute value to ecosystems in their entirety and not just to individual organisms within those systems or bioetic communities.
- In setting policy, policy makers need to be clear on the relative emphasis placed on human beings versus the environment as a whole and it is arguable that environmental security should be framed as an ecocentric ethic.

It is important to consider not just how the costs of climate change mitigation should be shared across generations but also across and within countries. There are three principles that can guide the distribution of climate change mitigation and adaptations costs within and between countries:

Polluter Pays Principle

The Beneficiary Account: whoever has benefited most from carbon pollution should pay for adaptation and mitigation measures.

Ability to Pay: whoever has the greater ability to pay the costs of responding to climate change should bear this burden.

Cooperation between countries is crucial to secure equitable, sustainable, and efficient energy generation and supply that is considerate of the environment and the welfare of future generations and non-humans.

2.1 Introduction

Around 30 percent of people living in the Asia region still have no access to electricity. For those that do, the cost of energy use prevents many from taking full advantage of the limited energy services available to them (Asian Development Bank, 2007, p. 31). As a result, many in the region are unable to meet essential needs critical to their health and wellbeing. At the same time, dangerous climate change precipitated by the carbon-intensive energy consumption behaviours of the developed world's population is undermining environmental security, and will increasingly do so in the future, especially if energy consumption behaviours in developing countries come to mirror those in OECD countries. The challenge of achieving energy equity is how to ensure that all have access to the level of energy use they need to meet basic and essential needs, while at the same time reducing the carbon footprint of our energy consumption behaviours. For, as a 2007 *Lancet* report on energy and health highlights, *"[w]ith a growing world population of perhaps 9 billion by 2050, current patterns of fossil-fuel-dependent consumption of North America or even Europe would have catastrophic consequences if they were enjoyed by the entire world population over extended periods."* Indeed, according to the report, four planet Earths would be needed to sustain life *"if all the world's population had consumption patterns equal to those in North America"* (Wilkinson et al., 2007, p. 971).

This chapter provides an overview of important ethical principles that can guide the development of energy policy in light of energy equity and environmental security concerns.[7] Reaching agreement on these principles is difficult, particularly in culturally diverse regions such as the Asia-Pacific. Some would argue that since ethical frameworks and moral principles vary across cultures, reaching agreement at a regional level on the ethical principles that ought to guide national and regional energy policies is impossible. While many of the dominant cultural traditions in the world—Abrahamic, post-Enlightenment, Indic and Confucian—accept the existence of universal values and objective norms, there is disagreement between the traditions concerning the extent to which these values and norms can be successfully understood and enshrined within cultures given the subjectivity of human experience (Rai et al., 2010, p. 4). Even so, there are a wealth of ideas that can be used as models among the multiple worldviews, beliefs and ethos existing in the Asia-Pacific region. Despite the variations in ethos, regional cooperation is crucial to secure equitable, sustainable, and efficient energy generation and supply with consideration of the local environment. These objectives are in the interest of all countries and communities in the region as a whole.

With this in mind, this chapter considers the role that key ethical approaches and principles of social justice can play in guiding policy development on energy equity and environmental security at several different levels: (i) analysing how we measure disadvantage and distribute resources; (ii) how we weight the interests of future generations and non-humans in the choice of energy-technology; and (iii) sharing the costs of sustainable development and climate change mitigation between countries. We begin by considering the range of moral arguments in favour of reducing energy poverty in the region.

2.2 Energy Poverty and Disadvantage

Social justice, broadly construed, consists in the distribution of benefits and burdens. Since people need access to a reliable and affordable supply of energy to meet essential needs critical to health and wellbeing, energy poverty can be seen as a form of disadvantage that ought to be alleviated as a matter of social justice. That energy poverty is a form of disadvantage is clear from a number of perspectives.

7 For more detailed analysis on these questions, see the ECCAP WG1 report on ***Universalism and Ethical Values for the Environment*** (Rai et al., 2010) and ECCAP WG2 working group on 'Ethical Worldviews of Nature'.

Many philosophers (welfare egalitarians) argue that disadvantage consists of having reduced opportunities for wellbeing (Cohen 1989). Access to energy is clearly important for wellbeing given the connection between, for example, health and modern energy usage. Others (resource egalitarians) argue that disadvantage consists of having fewer resources than others (Dworkin 1981). By resources, philosophers usually mean goods such as income and wealth, as well as important background conditions, which provide an all-purpose means for people to effectively pursue their various life-projects and to advance their interests (Rawls 1999, p. 79). Since having fewer resources in this sense means having less opportunity to pursue our projects and to advance our interests, inequality in resources is a form of disadvantage. From this perspective, access to a reliable and affordable supply of energy is clearly important as energy use is required for a host of projects and ends that matter to people. Also, people's access to other resources and goods—for example education and income—is often conditioned by their access to energy use. Constrained access to electricity at a community level, for instance, hinders the development of economic and educational opportunities for people living in rural and remote areas. Note that providing people with additional other resources like income will not always by itself overcome the obstacles that people face in accessing energy if, for example, there is no access to electricity networks where they live. This is why energy poverty is less closely associated with income poverty in rural areas (Pachauri et al. 2004, p.5). Hence, access to a reliable and affordable supply of energy should be considered an important resource in its own right.

A third approach (the capability approach) to measuring disadvantage is the view that disadvantage consists of having poorer opportunities to achieve various important 'functionings' critical to our flourishing and freedom rather than merely having fewer resources. The issue with defining disadvantage in terms of a lack of resources is that it implies that two people with the same resources have equal life-chances. However, as Martha Nussbaum explains, *"in a nation where women are traditionally discouraged from pursuing an education it will usually take more resources to produce female literacy than male literacy' while 'a person in a wheelchair will require more resources connected with mobility than will the person with "normal" mobility, if the two are to attain a similar level of ability to get around"* (Nussbaum 2006, p.46). What matters are the functionings that people can achieve, not the resources that are at their disposal and some may need more resources than others to achieve the same functionings. By 'functionings', capability theorists mean the various things that people can be or do. This can vary from a simple state like being nourished to a complex condition such as being part of a community. They include things that one is actively able to do, such as reading and writing, and things which are passive states such as being free of disease.

In a country such as Australia, the amount of energy that poorer households need to consume to meet basic needs can often be greater than the amount of energy that higher income households need to consume to meet equivalent needs. This is usually for reasons beyond their control, for instance, they cannot afford to purchase more efficient appliances, install solar, live in better built homes, or they have health or disability related needs that require the use of additional energy. The differences in circumstances that affect the amount of energy people use to meet equivalent needs are likely to vary even more between countries and climatic regions. The advantage of the capability approach is that, by focusing on what people can do and be rather than on the resources that they have, it can bring the different energy needs that people have into focus, enabling us to better capture what it means to experience energy poverty.

2.3 Distributive Justice and Access to Energy

Access to a reliable and affordable supply of energy is important from the perspective of social justice because energy use is important to our flourishing and freedom and it enables us to pursue important projects and ends. Consequently, the reduction of energy poverty ought to be a key goal of national and regional energy policies given that such a large percentage of the region's population has little or no access to electricity. But how focussed should energy policy be on the reduction of energy poverty compared to the pursuit of other goals; for instance, economic development? Should the goal of energy policy be to provide all people with the same level of access to energy resources—a goal that may be extremely costly to achieve in the case of rural and remote populations located far from existing grid networks—or is it sufficient to concentrate only on ensuring that all have access to the energy they need to meet basic needs, with widespread inequalities in access to and use of energy resources

permissible once basic needs have been met? This is an important question of distributive justice as far as the distribution of energy resources is concerned and philosophers are in disagreement concerning the extent to which inequalities in the distribution of forms of advantage and disadvantage are morally acceptable.

Given the importance of access to a reliable and affordable supply of energy to people's level of advantage or disadvantage, egalitarians would argue that the goal of energy policy should be to provide all with the same level of *access* to energy resources insofar as this is possible. For egalitarianism implies that inequalities in people's level of access to energy use are unfair except insofar as these inequalities can be said to follow from the different choices that people make. Clearly, the vast differences in the quality of people's access to and use of energy resources in the Asia-Pacific region is not the result of different personal choices but the result of the unequal circumstances into which people are born (for example, growing up in a rural and remote area rather than in a city). This is not to overlook the fact that, in certain cases, poor people will continue to use traditional forms of energy (e.g. for cooking) even when they have access to modern forms of energy, such as LPG or electricity. For example, in Timor-Leste, almost 99 percent of urban households still use fuelfood for cooking even though many of these households have access to electricity, a far cleaner and more efficient source of energy for cooking (World Bank 2010a, p. 2). One of the main reasons why poorer households that have access to LPG or electricity continue to use fuelwood is because they cannot afford the substantially higher costs of modern energy use given their low incomes (World Bank 2007).

An egalitarian energy policy would impose extensive obligations on governments to reduce energy poverty and to promote universal access to an affordable and reliable supply of electricity. These goals could, in certain cases, come into conflict with the targetted approach that many governments currently adopt to rural electrification and grid extension projects. For example, the Timorese government's Rural Electrification Master Plan gives priority to electrifying districts and towns 'with the highest economic activity and potential growth' (World Bank, 2010a, p. 5).

In contrast, while utilitarianism is a widely accepted approach to the distribution of resources amongst economists and even policy makers, many moral and political philosophers are highly critical of utilitarianism as a guiding ethical framework on the grounds that it fails to respect the `separateness of persons'. Utilitarianism's focus on maximising aggregate advantage can come at the expense of ensuring that each person has access to the resources and goods they need to achieve a minimum level of wellbeing. If, for instance, the goal of energy policy is to utilise energy resources so as to maximise GDP, governments might invest heavily in improving the quality and robustness of energy services in densely populated urban areas that are already well-off at the expense of investing in the provision of basic energy services in sparsely populated and poorer rural areas. This could be justified on the grounds that directing resources away from urban areas towards sparsely populated rural communities is an inefficient use of resources since GDP could be increased more effectively by improving the quality of energy services in urban areas.

A potentially less onerous ethical approach that permits some level of inequality in access to and use of energy resources (within limits) is sufficientarianism. According to sufficientarians, the point of justice is to ensure that all have the opportunity to lead a minimally decent life but once all have such an opportunity, that some should be better off than others is of no moral consequence. For 'what *is* important from the point of view of morality is not that everyone should have *the same* but that each should have *enough*' (Frankfurt 2003, p. 82). Of course, those who are worse off seldom have enough, which is why we find cases of inequality so troubling. But what is troubling about such cases, according to sufficientarians, is not that some people's lives go less well than other's but that they go so poorly. As Harry Frankfurt explains,

"*When we consider people who are substantially worse off than ourselves, we do very commonly find that we are morally disturbed by their circumstances. What directly touches us in cases of this kind, however, is not a quantitative discrepancy but a qualitative condition—not the fact that the economic resources of those who are worse off are* smaller in magnitude *than ours but the different fact that these people are so* poor" (Frankfurt 2003, pp. 89-90).

Consequently, on a sufficientarian approach, the goal of energy policy should not be to ensure that all have access to the same quality of energy services but rather that all have access to the energy

resources they need to meet basic and essential needs. This way of approaching issues of energy equity lies behind measures of energy poverty that characterise energy poverty in terms of households lacking the energy resources they need to achieve a particular basket of energy services (e.g. cooking, lighting, and so on) (Pachauri et al. 2004, p. 2089; Khandker et al. 2010, p. 5). On this approach, once all have the resources and energy they need to achieve a decent minimum of wellbeing (or a specified basket of energy services), priority can be given to directing energy resources to areas with the greatest potential for economic growth and development, even if this results in wide disparities between rural and urban populations in terms of quality of access to and use of energy resources.

While a sufficientarian approach to tackling energy poverty is potentially less onerous than an egalitarian alternative, the challenge in adopting any such approach to energy policy is to arrive at a workable understanding of what constitutes *enough* or a *decent minimum* of wellbeing. Most sufficientarians are ambiguous on this point and it is a problem that plagues definitions of energy poverty that measure energy poverty in terms of a lack of access to some threshold of energy services. As Pachauri et al. (2004, p. 2084) point out, *"while the centrality of energy for the provision of basic needs is recognised, there is no consensus on the amount of energy needed to meet basic human needs"*. For instance, estimates of the amount of energy that the average household in a tropical country like Bangladesh needs to meet its basic needs vary from between 27.4 and 32 kilograms of oil equivalent per person per month to only 50 kilograms of oil equivalent per person per year depending upon whether only cooking and lighting needs are included in the basket of essential energy services or whether a wider range of energy-using activities are counted as basic needs (Khandker et al., 2010, p. 6). Another criticism of sufficientarian approaches to energy poverty is that the understanding of basic and essential needs in the energy equity discourse is able-person centric. That is, lists of the energy services that people need access to if they are to escape energy poverty are insufficiently attentive to the needs of people with disabilities and severe illnesses.

A final issue concerning sufficientarian approaches to energy equity is whether the notion of a decent minimum of basic and essential needs is universal or societally relative. Some sufficientarians argue that *"the idea of a decent minimum is to be understood in a society-relative sense"* and that *"as a society becomes more affluent the floor provided by the decent minimum should be raised"* (Buchanan 1984, p. 58). Frankfurt (2003, pp. 93-4), for example, characterises having *enough* in terms of a person being content or satisfied with what he or she has; or, if a person is not satisfied with what they have, it may reasonably be expected that they should be content with what they have. But people's expectations about what is satisfactory or what constitutes a sufficiently good life differ substantially depending on the society in which they live. Consequently, adopting a sufficientarian approach to issues of energy equity may result in a societally relative approach to measuring energy poverty. This is not just in the sense that the amount of energy that people will need to meet the same basic and essential needs will vary according to climatic and personal circumstances, as well as according to the type of energy resources and quality of appliances that are available in different societies. But also in the sense that the list of basic and essential needs against which levels of advantage and disadvantage are benchmarked will vary according to soceital circumstances and social and cultural differences. As societies become increasingly developed, the threshold of needs that count as basic and essential needs will increase.

Notwithstanding the important differences between a sufficientarian and egalitarian approach to energy equity, both will require some level of universal energy provision and the reduction of extreme energy poverty. Where they differ from each other is principally in relation to marginal incidences of disadvantage in which, although there is some disparity in the level of access to and use of energy resources, the impact of this disparity on wellbeing is not extensive. Both an egalitarian and a sufficientarian approach to energy equity will therefore favour some level of government intervention in the energy sector to promote essential energy usage through, for example, the provision of concessions on electricty tariffs for low-income and poorer households, as well as through rural electrification programmes.

A deregulated or market-orientated approach to the provision of energy services is unlikely to guarantee access to basic and essential energy usage for a number of reasons.

First, such an approach would only provide energy services to those with the ability to pay. In cases where the generation capacity of energy infrastructure is limited either by supply capacity constraints

or by fuel costs, this approach could result in very high electricity tariffs that make energy use all but inaffordable to most people. A second reason why a deregulated approach to the provision of energy services would fail to protect essential energy usage stems from the fact that private firms who are driven by the pursuit of profit have little incentive to invest in providing energy to poorer people living in sparsely populated and remote areas. The economic returns on providing energy to people living in isolated areas are too minimal to encourage the development of robust energy markets in those areas. As a recent research paper written for the World Bank observes of the reasons why LPG is not more widely available in regional areas in India, *"the distribution of LPG is dictated by a network of retailers. Such retailers generally prefer to expand from the most densely population and higher income markets found in urban areas and once these markets are saturated only then will they continue to expand to rural areas"* (Khandker et al. 2010, p. 4).

2.4 Energy Policy and the Interests of Future Generations

2.4.1 Future Generations

We have seen the reasons why reducing energy poverty is important as a matter of social justice and considered some ethical approaches—egalitarianism and sufficientarianism—to the distribution of energy resources given the importance of energy use to people's life-chances. National and regional energy policy initiatives must not only target the reduction of energy poverty amongst existing generations, they must also be mindful of the needs and interests of future generations and other species in their choice of energy technologies. Not all ways of reducing energy poverty are sustainable or consistent with the moral obligations that we have towards future generations and towards the environment more generally given the risks to human and environmental security from climate change caused by carbon-intensive patterns of energy use.

As the World Development Report 2010 argues, *"[l]eft unmanaged, climate change will reverse development progress and compromise the wellbeing of current and future generations"* (World Bank, 2010b, p. 37). According to some estimates, stabilising the concentration of GHGs in the atmosphere at existing levels so as to avoid the worst risks to human and environmental security from climate change will require capping per capita GHG emissions at 4 tonnes of C02-equivalent in 2013 and just 1.5 tonnes of CO_2-equivalent in 2050, when the population is expected to reach 9 billion (Baer et al., 2010, p. 220). Given that the average energy-related carbon footprint of people living in middle-income countries is currently around 4.5 tonnes of CO_2-equivalent, rising to 15.3 tonnes in high-income countries, developing countries will not be able to develop at the same carbon-intensity as developed countries if we are to stabilise the concentration of GHGs in the atmosphere (World Bank, 2010b, p. 44). This will be so even if developed countries dramatically reduce their existing levels of GHG emissions. Consequently, we will have to find more efficient and more sustainable ways of reducing energy poverty and fostering development if we are to show consideration for the wellbeing of future generations and for the environment. This will essentially involve people having to make sacrifices today for the sake of the welfare of future generations and the environment. But why should people today have to make such sacrifices for people who do not yet exist and for the sake of other species and ecosystems? Do future generations and non-humans have rights and interests that we are obliged to consider as a matter of justice? Let us consider the first aspect of this question, the nature of our obligations to future generations.

Whether we have a moral obligation to respect the interests of persons who do not yet exist is a difficult question to answer. The following example illustrates the complexity of the issue. Suppose that a couple, Josep and Fatima, are considering whether or not to have a child. They decide that they will wait a year to have a child so that they can travel before starting a family. The result of this decision is that a potential person, let's call her Maria, who would have been born had they decided to start a family immediately, is neither conceived nor born. Is there anything morally wrong with Josep and Fatima's decision to postpone having children for a year, despite the fact that it means Maria is not

born? Most people would think that it is entirely within Josep and Fatima's right to decide not to have children; that they are under no obligation to consider how Maria would be affected by their decision since she is not an actual person, merely a potential—even hypothetical—person. Now imagine that many years later, Josep and Fatima, who now have two children, are deciding whether or not to have a third child. Although they can afford a third child, having another child would make it more difficult for them and their two children to have the quality of life that they are now accustomed to. So they decide not to have any more children. This again means that a potential child, let's call him John, is not born. Again, many people would think that Josep and Fatima are entirely within their right to decide not to have another child. Notice, however, the decisions that Josep and Fatima make go fatally against the interests of Maria and John since it is better to exist than to not exist. Insofar as many people think there is nothing wrong with the decisions that Josep and Fatima make, this suggests that our obligation to consider the interests of people who do not now exist is at best only a very weak obligation. This raises difficulties for the justifiability of burdensome mitigation policies insofar as such mitigation efforts involve existing persons paying substantial costs in terms of forgone consumption so that future (yet-to-exist) generations "*will not suffer so much from the spread of deserts, from the loss of their homes to the rising sea, or from floods, famines and the general impoverishment of nature*" (Broome, 2008, p. 98).

2.4.2 The Non-Identity Problem

In the case of climate change and the development of energy policy, the nature of our obligations to future generations is further complicated by the fact that the decisions we make today—whether to reduce GHG emissions or to continue on an unsustainable development path—will affect the identity of the people who come to exist in the future. This is an important point because one of the strongest arguments made for pursuing sustainable development is the need to avoid harming innocent others, in this case, future generations. As Onora O'Neill (1996, p. 115) writes, *"by burning fossil fuels prodigally we accelerate the green-house effect and may dramatically harm successors, who can do nothing to us."*

It is difficult to articulate how exactly failing to mitigate climate change causes harm to future generations. This is because any initiatives that we might take to curb GHG emissions will undoubtedly result in a different set of people being born in the future to those who would otherwise have been born if we had done nothing to reduce our GHG emissions. Edward Page (1999, p. 56) describes the problem at hand,

"As a consequence of the profound impact it will have on even the smallest details of all people's lives, whatever decision is made in regard to [climate change mitigation policy] will predictably, if indirectly, affect who mates with whom and when, and thus which individuals will be born in the future. This is because all persons owe their existence to the coming together of a singular egg and a singular sperm—and this 'coming together' is highly sensitive to antecedent events. In fact, after a few generations, and depending on which policy we choose, completely different sets of people will come into existence and these sets of people will owe their existence to this prior choice (they would not have been born if this choice had not been made)."

Since it is better to exist than to not exist, we cannot have caused people harm by leaving them a heavily polluted environment and more dangerous climate if the alternative is a state of affairs in which those people do not exist. This is known as the non-identity problem.

Much has been made about the force of the non-identity problem with respect to climate change mitigation policy insofar as it supposedly illustrates *"that there will be few, if any, cases where a future person will be rendered worse off by their ancestors' profligate emissions of GHGs, because these people would never have existed had these profligate actions not been performed"* (Page, 1999, p. 57). However, the scope of the problem is often more limited than people imagine since doing nothing to reduce the concentration of GHGs will affect the human security and wellbeing of many people who *already* exist and whose identity will not be affected by our choice of climate change policy. Climate change is already affecting people's health and wellbeing. Increasing the concentration of GHGs in the atmosphere will have a devastating effect on the future wellbeing of people who today are young children or infants. So we do not need to resolve the non-identity problem to justify taking action to reduce the concentration of GHGs in the earth's atmosphere since already existing people will be harmed if we do nothing to reduce GHG emissions. Nonetheless, the non-identity problem is relevant as far as the issue of avoiding harms to generations who do not yet exist is concerned. Counting their interests may cause us to adopt

more stringent emissions reductions targets than we might otherwise adopt so as, for example, to limit the impact of energy-consumption behaviours not only on the lives of people in 60 or 80 years time, but also on the lives of people 100 or 200 years from now.

2.4.3 Utilitarianism and Intergenerational Justice

One way of avoiding the non-identity problem is to ground obligations of intergenerational justice in identity-independent principles—i.e. principles which do not depend on avoiding harm to or benefiting particular individuals—such as the principle that we should maximise aggregate welfare (classical utilitarianism). However, the issue with utilitarianism as an approach to intergenerational justice is that it places excessively onerous obligations on current generations. This is because a maximising approach to justice between generations conceivably requires current generations to save almost all of their resources for the benefit of future generations insofar as the interest that would accrue over time from the saving of resources—presuming that these were invested prudently—would mean that the utility-function of the resources would be higher in the future than it is today. *"Giving up the consumption of part of our capital today,"* as Axel Gosseries (2008, p. 65) points out, *"may enable us—provided it is wisely invested—to consume much more of that capital at some more or less distant future time."* He gives the example of a bag of seeds that could either be consumed immediately or planted to multiply the volume of seeds. *"If you are a utilitarian,"* Gosseries points out, *"savings (in intergenerational terms) are not just authorised; they are required since the goal is to maximise the size of the intergenerational welfare pie."* And insofar as the number of future generations is uncertain and potentially indefinite, utilitarianism can lead to *"everlasting sacrifices"* that are ultimately to no one's benefit, as each successive generation saves its resources for posterity instead of consuming for its own benefit (Gosseries, 2008, p. 65). Thus, as Rawls (1999, p. 253) explains, *"the utilitarian doctrine may direct us to demand heavy sacrifices of the poorer generations for the sake of greater advantages for later ones that are better off."* Discounting benefits to future generations is one way that utilitarians try to get around this problem, though as we will see in chapter 4, the practice of discounting raises more problems than it solves.

2.4.4 Intergenerational Justice and the Lockean Proviso

An alternative approach to utilitarianism as a framework for assessing obligations of intergenerational justice is the Lockean idea that in using and acquiring external resources, each person must leave as much and as good for others. Locke initially formulated this principle as a way of explaining how people could come to acquire property in the natural world. Locke held that since individuals owned themselves—and, by implication, their labour—they could make claims on ownership of external resources by mixing their labour with those resources. However, since external resources are initially held in common for the benefit of all, Locke included the proviso that people must leave as much and as good of those resources for others so as not deprive others of the opportunity to derive their fair share of benefits from those resources. As Locke puts it,

"*Whatsoever then [one] removes out of the state that nature hath provided, and left it in, he hath mixed his labour with, and joined to it something that is his own, and thereby makes it his property.... For this labour being the unquestionable property of the labourer, no man but he can have a right to what that is once joined to,* at least where there is enough and as good left for others" *(Wolf, 1995, p. 795).*

As an approach to issues of intergenerational justice, the Lockean proviso seemingly requires each generation to leave the global commons—the atmosphere and the environment—in at least as good a condition for future generations as that generation has inherited it. There is some ambiguity, however, concerning what the requirement to leave as much and as good for others means within the context of intergenerational justice (Gosseries, 2008, p. 66). For instance, are we obliged to leave future generations with only as much and as good of external resources as they could have expected to appropriate had they been the first generation. If successive generations, by working on nature, have improved the quality of external resources compared to what they would otherwise have been like in a state of nature, then the Lockean proviso seemingly allows current generations to leave future generations with less or poorer external resources than they themselves have inherited. However, in

the case of the global commons, it is clear that the state of the Earth's atmosphere and climate has been worsened rather than improved by successive generations. As a result it is clear that existing generations have no right to leave future generations with a harsher climate than they themselves have inherited. Indeed, if we read the Lockean provision as requiring each generation to leave as much and as good of the global commons for successive generations as those generations could have expected to enjoy were they the first generation, the Lockean proviso arguably requires current generations to leave the environment in a *much* better state than they inherited it, although this may no longer be possible. This raises the question of whether it is fair that existing generations should have to pay the costs of previous generations' environmental degradation. Nonetheless, it is clear that, at the very least, existing generations are obliged to leave future generations with a climate that is in no worse condition than they found it.

2.4.5 Intergenerational Equality and Just Savings

A further solution to the problem of intergenerational justice as it applies to the issue of climate change and the choice of energy policy employs Rawls's device of the original position to determine the nature of mitigation obligations that different generations have towards each other. Rawls's original position is a heuristic device in which parties are situated behind a veil of ignorance that deprives them of knowledge of their place in society, their class, or social status, as well as of their religion and *"fortune in the distribution of natural assets and abilities"* (Rawls, 1999, p. 118). They are then asked to agree upon principles to regulate the terms and distribution of burdens and benefits of the social cooperation. The idea of the veil of ignorance is to ensure deliberative impartiality; that the interests of all people in society, regardless of their race, religion, gender, or social class are given equal consideration in the design of fair terms of social cooperation. Some, including Rawls, argue that we should adopt a similar approach to specifying the terms of cooperation between generations; namely, imagining an original situation in which people do not know their generation's place in history and asking them to agree upon terms of cooperation between generations that they would affirm as having bound all preceding generations as well (Moellendorf, 2009, pp. 211-2; Rawls, 1999, pp. 254-5). While each generation is interested in its own welfare (and so will want to avoid incurring onerous obligations towards future generations), each generation will at the same time *"want all generations to provide some savings (excluding special circumstances), since it is to our advantage if our predecessors have done their share"* (Rawls, 1999, p. 255). Depriving people of the knowledge of their generation's place in time therefore prevents people from appealing to reasons favouring only their generation when determining the extent of their obligations towards future generations.

Taking this approach to the issue of climate change and energy policy, Moellendorf (2009, p. 213) argues that we should adopt a principle of intergenerational equality, *"which requires not imposing climate change adaptation costs on future generations that are a greater percentage of the overall economic output than the percentage of mitigation costs for the present generation."* For were it our own generation that had to pay the costs of climate change we would consider it unjust that preceding generations had continued their carbon-intensive energy consumption behaviours with no regard for our wellbeing. At the same time, insofar we may be amongst the generations who have to curtail our energy-consumption behaviours for the sake of avoiding dangerous climate change; we have an interest in preceding generations not having to incur excessive mitigation costs for the sake of the wellbeing of future generations. The principle of intergenerational equality thus means that it would be unfair to meet energy needs via the augmentation and expansion of carbon-intensive energy technologies if the additional costs associated with meeting energy needs in a more sustainable way as a proportion of GDP are less than the costs that the GHG emissions associated with the use of carbon-intensive energy technologies would impose upon future generations as a proportion of their GDP.

Regardless of whether we adopt a Rawlsian or Lockean approach to the issue of intergenerational justice, there are clear obligations on existing generations to limit the impact of their energy-consumption behaviours on the wellbeing of future generations. Even if we are persuaded by the non-identity problem that the obligation to avoid causing harm to others provides no justification for reducing our GHG emissions for the sake of future generations' wellbeing, the obligation to avoid causing harm to people who are now young children and infants clearly imposes a duty on us to limit the impact of our energy-consumption behaviours on the environment. A further question is whether the interests of

other species—and indeed ecosystems—impose additional obligations on us to limit the impact of our energy consumption behaviours on the environment.

2.5 Energy Policy and Respect for Ecosystems and Other Species

2.5.1 Benefits of Ecosystems to Humankind

The issue of respect for nature is central to the energy equity and environmental security debate since energy production and use is directly and indirectly affecting the environment. Climate change, rising sea levels, and reduction of biodiversity are attributed to CO_2 and other GHG emissions, which are partially caused by energy production and use. Depletion of natural resources and pollution are other consequences of energy production and use. These environmental issues give rise to a number of ethical discussions on the consideration of the environment in any decision making process, especially as *"damage to nature may well be one of the most harmful consequences of climate change"* (Broome, 2006, p. 12).

Why should we care about damage to nature and to the environment resulting from our energy consumption behaviours? One reason is because nature and the environment have tremendous value for humans and our lives are far worse when the environment in which we live is degraded. As Broome (2006, p. 11) points out, nature *"brings benefits to human beings in many different ways. The beauty of nature refreshes and inspires us. Wetlands process our waste products. Wild plants provide us with powerful new medicines. And so on. These benefits contribute to people's quality of life."* Hence, *"we cannot survive without concern for the welfare of life as a whole"* (Bosselmann, 2001, p. 129). Extensive research carried out for the Millennium Ecosystem Assessment (MA) (2005) shows that human actions increasingly influence the functioning of ecosystems and the benefits they naturally provide for our lives. The MA identified various ecosystem services that enhance our quality of life, including *"*...provisioning services *such as food, water, timber, and fibre;* regulating services *that affect climate, floods, disease, wastes, and water quality;* cultural services *that provide recreational, aesthetic, and spiritual benefits; and* supporting services *such as soil formation, photosynthesis, and nutrient cycling"* (MA 2005, p. V). Moreover, the Secretariat of the Convention on Biological Diversity (CBD) also argues that biodiversity[8] and its ecosystem services contribute significantly to poverty reduction and economic sector development (Secretariat of the Convention on Biological Diversity 2009, p. 25). From an economic point of view, agriculture and food production, fishery and forestry industries directly rely on ecosystem services. Those economic sectors are especially strong in developing countries and the failure of ecosystem services affects their economies significantly.

Biodiversity contributes significantly to human wellbeing and has economic benefits. Yet humanity is contributing to accelerated losses of biodiversity. The loss of biodiversity on land alone in the last 10 years is estimated to cost USD500 billion (Turpie et al. 2004). Part of this loss can be attributed to climate change: "*Climate change is a key driver of biodiversity loss, and moderating climate change will, in the long term, safeguard ecosystem services,*" which are crucial for human survival and well-being (Secretariat of the CBD 2009, p. 20). The study on the economics of ecosystems and biodiversity (TEEB) attributes this loss of biodiversity to a lack of market prices for ecosystem services and biodiversity (TEEB 2009, p.2). They argue that the benefits derived from ecosystem services are neglected and subsequently these services are not given consideration in economical and political decision making processes (TEEB 2009, p. 2). TEEB proposes incorporating the value of ecosystem services into policy making. Policy change is shown to have impacts on ecosystems, leading to changes in ecosystem services. These, in turn, have impacts on human welfare from which the economic value of the changes in ecosystem services can be assessed (TEEB 2009, p. 8). Humanity is making use of these ecosystem services in order to fulfil human needs and increase levels of wellbeing, but, as the MA (2005, p. 1) shows, this is happening in unsustainable ways. As a consequence the gained increase in human well-being is often spatially and temporarily confined, derogating the capacity of this and other ecosystem services and therefore threatening human wellbeing in return. Although the conceptual framework of the MA (2005, p. v)

8 For an extended discussion of these issues, refer to ECCAP WG16 report, Bosworth, A. et al., 2012. ***Ethics and Biodiversity,*** UNESCO.

defines human beings as integral parts of ecosystems that are in continuous interaction with other parts of the ecosystems, the use of the terminology 'services' shows a tendency towards anthropocentric argumentation. If we merely see the environment as instrumental for human security, development and wellbeing, then we position humanity above all other parts of the environment.

2.5.2 Anthropocentric Ethics

Anthropocentric environmental ethics emphasizes the consequences of interference with the environment *for human beings* in the present and in the future. This perspective often accompanies the belief in humanity's ability to develop means to adapt to environmental changes. However, anthropocentrism is frequently criticized as too narrow an ethical framework since it does not attribute any direct or intrinsic value to nature—including ecosystems, rivers, or species—nor does it apply ethical principles to other living beings. For, on the anthropocentric view, although *"[w]e may have responsibilities with regard to the natural ecosystems and biotic communities of our planet…these responsibilities are in every case based on the contingent fact that our treatment of those ecosystems and communities of life can further the realisation of human values and/or human rights"* (Taylor, 2008, p. 139). This implies that provided our energy consumption behaviours do not harm the wellbeing of other *persons*, we are free to engage in those behaviours even if they have consequences that, although not devastating for humans, are detrimental to the security of other species and to the sustainability of ecosystems. Such privileging of the interests of humans over those of non-humans has been criticised as speciest. As Page (1999, pp. 59-60) citing Elliot (1995, p. 9) contends, *"the desire to restrict the concerns of environmental justice to the wellbeing of human beings represents a sort of 'human chauvinism' which ignores the fact that species membership is essential 'a morally irrelevant difference between individuals."* Echoing this criticism, Peter Singer (1993, pp. 55-6) argues that the prejudice against taking the interests of other species seriously is *"no better founded than the prejudice of white slave owners against taking the interests of their African slaves seriously."* In Singer's view, *"having accepted the principle of equality as a sound moral basis for relations with others of our own species, we are also committed to accepting it as a sound moral basis for relations with those outside our own species—the non-human animals."*

2.5.3 Biocentric Ethics

In recent years, a paradigm shift has take place away from anthropocentrism towards biocentric and ecocentric perspectives. Steffen et al. (2004) note that *"the earth is a single system within which the biosphere is an active, essential component; human activities are now so pervasive and profound in their consequences that they affect the earth at a global scale in complex, interactive and apparently accelerating ways".* Biocentric perspectives extend some form of moral status to all living beings, not just humans.

One reason why we might extend moral concern to other organisms is that humans are not the only organisms capable of suffering or experiencing pain. For example, animal liberationists argue that the interests of non-human animals ought to count in our decision making precisely because non-human animals are capable of suffering, and a world in which some individuals—be they animals or humans—needlessly suffer is worse than one in which they do not, all else being equal. As one of the founding figures of modern utilitarianism, Jeremy Bentham says that when determining whether or not to accord individuals moral status we should ask not "Can they *reason?* Or can they *talk*? But can they *suffer*?" (Quoted in O'Neill, 1997, p. 129). Peter Singer (1993, p. 57) today makes much the same point that, *"[i]f a being suffers, there can be no moral justification for refusing to take that suffering into consideration. No matter what the nature of the being, the principle of equality requires that the suffering be counted equally with the like suffering—in so far as rough comparisons can be made—of any other being."* Notably, however, Singer's and Bentham's approach only extends the domain of moral consideration to species that are capable of experiencing suffering or pleasure, with Singer (1993, pp. 57-8) arguing that *"[i]f a being is not capable of suffering, or of experiencing enjoyment or happiness, there is nothing to be taken into account."* Many environmental ethicists find this restriction on the domain of moral consideration too limiting. Goodpaster (2008, p. 158), for example, argues that, *"the capacities to suffer and to enjoy are ancillary to something more important rather than tickets to [moral] considerability in their own right."* Rolston III (2001, p. 232) likewise contents that *"the pains, pleasures, interests, and welfare of individual*

animals are only one of the considerations in a more complex environmental ethics that cannot be reached by conferring rights on them or by a hedonistic calculus, however far extended. We have to travel further into a more biologically based ethics." "A vital ethic respects all life, not just animal pains and pleasures, much less just human preferences" (Rolston III, 2001, p. 235).

Biocentric approaches hold that all living things—including plants and trees (not just animals)—*"are deserving of the concern and consideration of all moral agents simply in virtue of their being members of the Earth's community of life"* (Taylor, 2008, p. 141). That is, living things have intrinsic moral value that are not contingent on or derived from the benefits they bring to humans or their capacity to experience suffering but which are instead a function of their being *living* organisms: "the living individual, taken as a point experience in the web of interconnected life, is per se an intrinsic value" (Rolston III, 2001, p. 234). Insofar as living organisms have a natural telos (or goal)—namely, their own life and flourishing—we have an obligation to care for their flourishing and to avoid doing anything that would harm their development (Yang, 2006, p. 29). As such, *"we should live with minimum rather than maximum impact on other species and on the Earth in general"* (Devall and Sessions, 2001, p. 57).

2.5.4 Ecocentric Ethics

Closely related to biocentrism is ecocentrism, which extends the domain of moral concern even further to attribute value to ecosystems in their entirety (i.e. as whole systems or biotic communities) and not just to individual organisms within those systems or bioetic communities (Bosworth, et al., 2012). Ecocentrism, that is, holds that *"the ecosphere (inclusive of everything organic and inorganic), rather than individual life forms, is the source of all existence"* (Rai et al., 2010, p. 9) and that the integrity of ecosystems has a value of its own that deserves respect and consideration. Ecocentric approaches thus take a holistic approach to respect for nature that *"focuses on the integrity of the ecosystem and the value of species"* (Yang, 2006, p. 31). Moreover, insofar as they are also important parts of ecosystems, natural nonliving entities such as rivers, mountains, and landscapes (and not just individual living creatures) also have value from an ecocentric ethics perspective (Devall and Sessions, 2001, p. 59). We cannot exploit ecosystems for our own benefit at the expense of their integrity and the survival of other organisms, species, landscapes, and river-systems. An ecocentric ethic thus places potentially more onerous obligations on people to curtail their GHG emissions since even if our energy consumption behaviours pose no risk to human security, we still ought to limit our GHG emissions for the sake of avoiding harms to other species and upsetting the integrity of ecosystems. *"Humans count enough to have the right to flourish in ecosystems,"* as Rolston III (2001, p. 244) explains, *"but not so much that they have the right to degrade or shut down ecosystems, not at least without a burden of proof that there is an overriding cultural gain".* This principle of respect for the intrinsic value of the ecosphere is reflected in Article 2 of the 1995 Draft International Covenant on Environment and Development: *"Nature as a whole warrants respect; every form of life is unique and is to be safeguarded independent of its value to humanity"* (Quoted in Bosselmann, 2001, p. 130). Moreover, as the ECCAP Working Group 1 report on *Universalism and Ethical Values for the Environment* (Rai et al., 2010, p. 9) highlights, it is also a principle with deep roots in many of the world's religious and cultural traditions, including the Shinto religion in Japan and numerous Indic traditions, not to mention the cultures of indigenous peoples. For example, the principle of the sanctity of all life is deeply ingrained in the Hindu religion and *"all lives, human and non-human, are of equal value and have the same right to existence,"* not least because God, according to Hindu belief, has been incarnated in the form of various species (Dwivedi, 2008, pp. 312-3). Dwivedi (2008, p. 314) also points out that respect for flora has been a key part of Hindu belief systems and that "in the time of Regveda, tree worship was quite popular and universal." Indeed, Indic belief systems more generally hold that *"the human being is an integral part of the entire cosmos but not the essential part."* Therefore, we should not attempt *"to conquer or violate nature but rather to co-exist with the environment"* (Rai et al., 2010, p. 12).

2.5.6 Environmental Security as an Ecocentric Ethic

In setting policy, policy makers need to be clear on the relative emphasis placed on human beings (and the optimization of their energy supply and human security) versus the environment as a whole. As we saw in the previous chapter, the notion of *environmental security* has evolved from the understanding that the concept of *human security* reflects an anthropocentric approach that disconnects humanity from the environment. We can identify several cornerstones of ecocentric environmental security, including concepts such as the value of life, biodiversity, dignity and sustainability. Although the survival, safety, and resilience of all forms of life is the ideal, in reality this is impossible. Therefore it is important to understand the interdependence of various forms of life in order to prioritise the overall security of the environment. While human survival is the highest priority, this is only possible if we realize that we are part of a circle of life, together with the living and non-living environment. Thus, the preservation of biodiversity might be more important in cases where it is a prerequisite to sustain this circle of life (including human life). Examples of direct linkages between human life and the environment are medicinal plants or ecosystem services like water purification (Bosworth et al, 2012).

2.6 Sharing the Costs of Climate Change Mitigation

2.6.1 History

Considerations of social justice, we have seen, strongly support taking urgent action to reduce the severity and extent of energy poverty in the region so as to reduce the widespread inequalities that exist between and within countries in terms of people's level of access to dependable and affordable energy services that are critical to health and wellbeing (which are in turn leading to widespread inequalities in people's life-chances). At the same time, we have moral obligations to future generations and to other living organisms that necessitate meeting energy needs with minimal impacts upon the environment. Indeed, the moral obligations that we have to respect the dignity and equality of fellow persons alive today also impose important constraints on the types of energy choices that we can make inasmuch as dangerous climate change will profoundly affect not just the life-chances of future generations, but also the life-chances of younger generations that are alive today. One very important question that has yet to be sufficiently addressed is how the additional costs associated with choosing more sustainable development pathways ought to be shared. This question is important since it will be much more costly for countries to meet their energy needs using a mix of sustainable energy technologies rather than fossil fuels, at least in the short term. The emissions trajectory that rich countries have historically taken, in other words, has effectively increased development costs for poorer countries inasmuch as *"[e]merging economies and poorer countries must now pursue more expensive development paths than the ones rich countries followed,"* such as *"investing in a more expensive wind farm instead of a cheaper coal-fired power plant"* (Gore, 2010, pp. 1, 4). A related but separate issue is how global emissions rights should be allocated between countries and whether developing countries should be allocated a larger share of such emissions rights to allow for their economic growth and development (Baer et al., 2010). We will consider this issue at length in chapter 7. Regardless of whether particular countries are allocated a greater share of emissions rights to reflect their earlier stage of economic development, it is clear that all countries will have to adopt a more sustainable approach to meeting energy needs that, in the short term at least, will be more costly. This raises the question of whether countries in the Asia-Pacific region should have to shoulder the full costs associated with meeting their energy needs sustainably, or whether richer and already developed countries should pay at least some of these costs. There are a large number of considerations that influence whether or not people should contribute to the costs of climate change mitigation and adaptation, but we shall focus on just three here.

2.6.2 The Polluter Pays Principle

Perhaps the most obvious way of distributing the costs of climate change mitigation and adaptation is by appealing to a principle of fairness or equity, as it is often called. According to one understanding of fairness in a historical sense, if someone has taken unfair advantage of someone else, and imposed costs on them, then, in future they should bear burdens at least equivalent to costs imposed on the person

they have harmed. According to Henry Shue (1999, pp. 533-7), the 'you broke it you fix it' approach is exactly the sort of principle that many have thought appropriate for addressing climate change. The appeal of this principle of historical fairness, which is often referred to as the polluter pays principle, is obvious. It is a widely held idea, not specific to any particular theory of justice and, so long as we adopt countries as our agents, it clearly identifies who caused the problem in the first place and who is responsible for the cost.

The polluter pays principle implies that insofar as affluent countries or individuals are responsible for the problem of climate change they have a duty to pay the costs of climate change, including the additional costs that developing countries now face in meeting their energy needs due to the requirement to transition to more sustainable (and costly) energy technologies. As Eric Neumayer puts it (2000, p. 187), *"[a]ccording to the polluter-pays principle, those who caused the environmental damage in the first instance have to compensate for it. Because global warming is caused by cumulative emissions and the developed countries have contributed much more to cumulative emissions than the developing world, historical accountability ensures that the payment is undertaken by the polluter and not by the victims of pollution."* One empirical issue here that is all too neglected is whether it is in fact correct to say that the problem of dangerous climate change has been caused by rich *countries*. Simon Caney (2006, p. 467) identifies four different types of actors that the polluter-pays principle could be applied to—state institutions, corporations, individuals, and international institutions—pointing out that *"it is simply not true that [states] actions are the sole causes of global warming, for to say that fails to recognise the role played by corporations, individuals, and international institutions."*

A more general argument against the polluter pays principle is that affluent countries have not always been aware of the environmental costs of their energy consumption behaviours and so they cannot be held responsible for all those costs. However, this objection confuses the conditions for liability with those for blame. While we are rightly reluctant to blame people for unknowingly doing damage, we are typically prepared to insist that they pay compensation for any damages they have caused regardless of whether they acted intentionally or unknowingly. As Neumayer (2000, p. 188) points out, "*[i]t is an established principle of the legal system of almost every country that ignorance does not exempt one from liability for damage caused in the case of civil law or from punishment in the case of criminal law.*" Why, then, should the case of climate change be any different? Nonetheless, one remaining problem with the polluter pays principle is that the people who are now living in affluent countries are not the same individuals who have historically caused the problem of dangerous climate change. This is because most of the GHGs that are now concentrated in the atmosphere have been put their by earlier generations and not by people who are alive today. So how can we demand that current generations pay the cost of their nation's past emissions when they could have done nothing to prevent that pollution? (Beckerman and Pasek, 1995, p. 410). Applying the polluter-pays principle to the distribution of the costs of climate change mitigation becomes even more problematic when we consider that many people who now live in affluent, developed countries are migrants who have little in common with the earlier citizens of the country in which they now live (Caney, 2006, p. 470).

2.6.3 The Beneficiary Account

Another way in which we might approach the issue of who has obligations to pay for climate change is via the notion of who has benefited most from the polluting activity that has caused climate change. So called 'benefit accounts' entail that those who have benefited from, for instance, the 'dirty' industrialisation that has contributed to climate change should foot the bill for adaptation or mitigation measures. In addition, benefit accounts rely on the link that exists between one generation and the next. The reason is that those now living in developed countries have benefited greatly from the industrialization in the past. The contrast between the quality of life of a contemporary person in a developed country with that of someone in an undeveloped country is vast, and caused in large part because of the greater economic development (and associated GHG emissions) which many countries have undergone. As Shue (1999, p. 536) explains,

"today's generation in the industrial states is far from completely unrelated to the earlier generations going back all the way to the beginning of the Industrial Revolution. What is the difference between being born in 1975 in Belgium and being born in 1975 in Bangladesh? Clearly one of the most fundamental differences is that the Belgian infant is born into an industrial society and the Bangladeshi infant is not...Childhood nutrition,

educational opportunities and life-long standards of living are likely to differ enormously because of the difference between an industrialised and a non-industrialised economy. In such respects current generations are, and future generations probably will be, continuing beneficiaries of earlier industrial activity."

Accordingly, we are justified in holding affluent countries responsible for climate change mitigation costs precisely because those countries' citizens have benefited so substantially from the historical emissions of their predecessors. As Neumayer (2000, p. 189) argues, the fundamental counter-argument against not holding affluent countries responsible for climate change costs *"is that the current developed countries readily accept the benefits from past emissions in the form of their higher standard of living and should therefore not be exempted from being held accountable for the detrimental side-effects with which their living standards were achieved."* Asking developing countries to pay the costs of climate change mitigation amounts to allowing the citizens of developed countries to free-ride in the sense that they get to enjoy the benefits of pollution without having to pay for its costs (Gosseries, 2004, pp. 42-46).

Notwithstanding its intuitive plausibility, there are a number of difficulties with the beneficiary account. One is how to apportion the costs of pollution amongst beneficiaries when many of them are no longer living. Certainly the current citizens of industrialised countries enjoy many benefits as a result of past emissions. However, they are not the sole beneficiaries of past emissions since many people who are no longer alive today too enjoyed the benefits of previous generations' emissions. So while we might be entitled to ask the current citizens of affluent countries to pay a *portion* of the cost of their country's historical emissions, we cannot reasonably ask them to pay *all* of the costs. "*That would be unfair,*" as Simon Caney explains, "*for the aim of the beneficiary account is to ensure that each of the beneficiaries pays for their benefits—not that* some *of the beneficiaries should pay for* everyone's *benefits*" (Caney, 2006, p. 473). A related point is that at least some of the benefits of past industrialisation (and the associated GHG emissions) have accrued to people now living in developing countries, even if they have enjoyed a much smaller share of these benefits than people living in affluent countries. Nonetheless, people in developing countries now have access to public goods such as modern medicines and better technologies that they would not otherwise have had were it not for industrialisation (Grubb et al., 1992, p. 316).[9]

2.6.4 Greater Ability to Pay

A third motivation for requiring affluent countries to contribute to the costs of sustainable development in developing countries is their greater ability to pay these costs. Simply put, this kind of view holds that there is a strong prima facie case for those with the resources to bear the costs of responding to climate change. Peter Singer's example of the drowning child argument is a powerful example of this sort of view. Singer uses the example of a drowning child who can be saved at little cost by a passer by to draw attention to the analogous duties that wealthy countries and individuals have in relation to people in poor countries (Singer, 1972, p. 231). Singer's argument, in brief, is that where we can prevent someone's death or extreme suffering at little cost to ourselves, then we morally ought to do so.

The principle that those with the greatest ability to pay should shoulder a higher proportion of the costs of common enterprises, such as the provision of public services and responding to collective problems, is one that is widely (if not universally) accepted. Indeed, almost all countries' taxation systems operate on this principle insofar as citizens are taxed at a higher-rate the more they earn since higher-income earners can more easily bear the costs of providing public services without having to sacrifice their quality of life (Shue, 1999, p. 537). If we consider that meeting energy needs in developing countries through the use of sustainable technologies is part and parcel of a broader enterprise of climate change mitigation that all countries must contribute to, it follows from the ability to pay principle that affluent countries should assist developing countries in meeting their energy needs in a sustainable pay because they can afford to pay the additional costs associated with meeting energy needs sustainably whereas many developing countries cannot. There are a number of ways in which affluent countries might discharge their duty to assist developing countries, ranging from technology transfers, to knowledge transfers, capacity building, and resource transfers. The important point is that developing countries

9 Cited in Neumayer, 2000, p. 189.

cannot be expected to shoulder the burden of climate change mitigation by themselves. Cooperation between countries is crucial to secure equitable, sustainable, and efficient energy generation and supply that is considerate of the environment and the welfare of future generations and non-humans.

2.7 Conclusion

The analysis presented in this chapter illustrates a number of important points. First, energy poverty is a significant form of disadvantage, and ethical principles require that regional and national energy policies target the reduction of energy poverty as a matter of urgency. Moreover, these same ethical principles illustrate that priority must be given to reducing inequalities in people's access to and use of energy services over investing in electrification projects whose primary aim is to maximise economic growth and development (though facilitating growth and development is an important means to reducing poverty). It is also clear from a number of ethical perspectives that the interests of future generations, other living organisms and the integrity of ecosystems are important considerations in favour of meeting energy needs through the use of sustainable technologies. Finally, commonly accepted principles such as the 'ability to pay' principle necessitate that more affluent countries assist poorer countries in meeting the costs of sustainable development through, for example, resource and technology transfers. In the next chapter, we augment this analysis of the ethical principles and approaches to issues of energy equity and environmental security by considering how human rights perspectives and international documents lend support to the importance of reducing energy poverty through meeting energy needs in a sustainable way.

3. Human Rights and International Documents

Summary

Access to energy services is not formally recognized as a human right in any international human rights documents. Nevertheless a number of fundamental human rights are dependent on access to energy in order to achieve them, such as obtaining a standard of living adequate for people's health and wellbeing, which is provided for in Article 25(1) of the United Nations *Universal Declaration of Human* Rights. A number of other international documents recognize rights that depend on access to energy, such as the Earth Charter and the UN Convention on the Rights of Persons with Disabilities. [10]

This chapter also outlines a range of other reasons why access to energy should be considered a fundamental human right, including supporting the alleviation of poverty and promotion of greater opportunities for women.

3.1 Making Access to Energy Services a Human Rights Issue

The international community recognises a number of basic rights: the right to water, the right to food, the right to health, the right to adequate housing, the right to make a living through work and the right to take part in cultural life, but it is yet to recognise a right to clean, safe, sufficient and reliable energy supply. It is widely accepted that every human being needs energy to cook food, to heat the home, to earn a living, to benefit from good health and education services. In short, energy poverty denies people a basic standard of living which should be available for all; it robs them of their human rights.

Article 3 of the United Nations (UN) *Universal Declaration of Human Rights* outlines the concept that human beings have the right to life.[11] Article 25(1) states that:*"Everyone has the right to a standard of living adequate for the health and well-being of [themselves] and of [their] family …".* Central to this assertion is ensuring that reliable, affordable and sustainable energy services are recognised as basic human rights. While access to energy services is yet to be recognised as a independent human right, in contrast, the human right to water is well understood as being vital for the maintenance of health and wellbeing. The United Nations Committee on Economic, Social and Cultural Rights adopted water as a fundamental human right, independent of other rights, in 2002. Previously, 'the right to water' had been implied by Article 12(1) of the *International Covenant on Economic, Social and Cultural Rights*, which specifies the right to the determinants of health, including "water and adequate". Although energy is different to water in that it is not an "intrinsic good", arguably the right to energy is even more important than the right to water since in many cases access to clean water depends on having energy, such as to operate water pumps (Bradbrook and Gardam, 2006, p. 409).

Historically, energy issues were first addressed at the intergovernmental level in the context of climate change at the UN Conference on Environment and Development in Rio during 1992. Agenda 21 noted that *"energy is essential to economic and social development and improved quality of life"* and observed that *"all energy sources will need to be used in ways that respect the atmosphere, human health and the environment as a whole."* At the UN General Assembly's Special Session in 1997, governments called for

10 For a general analysis of ethical principles in international instruments, refer to chapter 2 of Rai et al. (2010) ECCAP WG1 report.

11 The Universal Declaration of Human Rights is 'a common standard of achievement for all peoples and all nations, to the end that every individual and every organ of society, keeping this Declaration constantly in mind, shall strive by teaching and education to promote respect for these rights and freedoms and by progressive measures, national and international, to secure their universal and effective recognition and observance, both among the peoples of Member States themselves and among the peoples of territories under their jurisdiction.'- http://www.un.org/en/documents/udhr/index.shtml

"concrete measures to strengthen international cooperation in order to assist developing countries in their domestic efforts to provide adequate modern energy services, especially electricity, to all sections of their population, particularly in rural areas, in an environmentally sound manner." At a regional level, there is consensus amongst the 62 Member States of the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) that the region *"will require more energy supplies and services to meet the basic needs and to improve the quality of life of its people,"* even though access to energy is not yet a basic human right.

The problem of ensuring access to essential energy services for all living human beings should be viewed through a human rights perspective. Such an orientation not only carries moral weight, but may empower consumers and their representatives in seeking judicial or other redress in the face of market failure. Characterising access to energy as an individual right emphasizes the government's obligation to deliver these services since they have undertaken to observe fundamental human rights (Tully, 2006, p. 533). Moreover a human rights approach highlights the equality between human beings and can therefore encourage governments to ensure those in rural and isolated areas still receive access to energy even though it is more costly to implement. Since energy access is not a human rights issue, there are consistent failures on both national and global levels to agree on any international targets, strategies, programmes or actions towards reducing energy poverty.

Energy access could be considered a basic human right for the following reasons:

- Energy is life and access to safe, clean and reliable energy underpins each of the Millennium Development Goals (MDGs);[12]
- Energy access is essential to poverty alleviation through improved productivity, greater income generating opportunities, and micro-enterprise development in all human societies;
- Full participation in society and the maintenance of acceptable levels of hygiene is highly or totally dependent on continued access to affordable essential services such as gas and electricity;
- Electricity access liberates females, through lowering the amount of time spent by children, particularly girls, in collecting fuelwood, thereby enabling school attendance, reducing drop-out rates, and facilitating the achievement of universal primary education (one of the MDGs);
- Energy access empowers men and women and helps to realize gender equity and equality in all societies;
- Electricity addresses the incidence of HIV/AIDS, malaria, and other diseases by supporting the ability of health clinics, hospitals, and operating theatres to refrigerate vaccines, boil water, sterilize equipment, incinerate used syringes, provide light, and transport patients;
- Improved cooking fuels reduce indoor air pollution, decrease respiratory infections, and prevent child mortality;
- Improved maternal health depends upon energy access;
- Energy is necessary for modernizing railways, enhancing telecommunications, increasing computer literacy, raising telephone density, and encouraging internet use;
- Access to affordable energy services is a prerequisite to achieving the goal of halving the proportion of people living on less than USD1 per day by 2015;[13] and
- Even though energy itself is not a basic human need, it is critical for the fulfillment of all human needs. Lack of access to diverse and affordable energy services means that the basic needs of many people are not actually being met.[14]

In light of the above imperatives, there is an urgent need to reframe existing energy policies in a way that embraces as well as reflects the human rights dimension of energy access. Central to this paradigm shift

12 Organisations such as UNDP, the World Bank, and the European Commission have recognised the strong link between energy access and seven out of the eight MDGs. It is now agreeable that achievement of the MDGs is dependent on adequate energy access for the poor.

13 U.N. Economic and Social Council, Commission on Sustainable Development. 2001. *Decision 9/1 on Energy for Sustainable Development, Report of the Ninth Session*, 6.22, U.N. Doc. E/CN.17/2001/19 (Accessed 27 April 2001)

14 Johannesburg World Summit on Sustainable Development, Water and Sanitation, Energy, Health, Agriculture and Biodiversity Working Group, *A Framework for Action on Energy*, 7.

is, of course, conceding that the role of public policy is to improve people's wellbeing. This commences with pushing for strong social imperatives and political pressures to expand energy supply to universal access levels. Policy experts and social activists (like human rights activists) should ensure that safe, accessible, clean and modern energy as a human right to all is available at an affordable price and on an equitable basis.

Since the hidden crisis of energy scarcity condemns millions of men, women and children in the developing world to continue to live in absolute poverty, every positive step should be made to reverse the current trend. Arguably if countries are genuinely committed to eradicating poverty and achieving the MDGs, international development agencies, donors and governments both in rich and in low-income countries need to make energy access for the poor a basic human right. Moving beyond the current anti-poverty rhetoric is important. We need more actions that include aggressive energy production and supply for poverty alleviation in the poorer regions of the globe (particularly in South East Asia). Many of the policy suggestions in this report will be ineffective unless access to ample, clean, safe, affordable, and sustainable energy supply is formalized as a basic human right.

3.2 Universal Declaration of Human Rights (1948)

The Universal Declaration of Human Rights (UDHR) was drafted as a set of guidelines to prevent the assaults on human dignity that had occurred during the First and Second World Wars. There has been continued concern that the UDHR has been created with a bias on Western cultural norms and values. The emphasis on the individual is especially contested as many cultures place a higher value on the common good. Furthermore, the UDHR is written from an anthropocentric point of view and thus ignores the importance of the environment for the realization of human rights. Nevertheless there are some provisions that relate to energy equity and environmental security.

Article 1 highlights the equality between human beings.[15] It also appeals to "*a spirit of brotherhood*", pointing out the need for empathy, solidarity and mutual assistance. This is also reflected in Article 29(1)[16] which highlights the duties of individuals towards the community. In terms of energy equity this means that individuals should be aware of the consequences of their energy consumption and be willing to restrict their energy intake for the benefit of others. Article 27(1) can be seen as extending this "*spirit of brotherhood*" to scientific advancements.[17] It is a human right to share the benefits of scientific advancements. In the context of energy equity, this would mean that new energy technologies have to benefit everybody, irrespective of their socio economic status. Article 27(1) thus calls on states to provide the highest possible quality of energy technology to all citizens. It also challenges richer states to share technology and assist countries who cannot afford to do so.

Article 25(1) presents one of the main reasons to adhere to the articles cited above and to strive for energy equity.[18] It underlines "*the right [of everyone] to a standard of living adequate for the health and well-being of himself and of his family*". The connection between standard of living and access to energy was previously discussed in chapter 2.

3.3 Convention on the Elimination of All Forms of Discrimination Against Women (1981)

The Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) states that parties should *"take all appropriate measures to eliminate discrimination against women in rural areas...*

15 Art.1: All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.

16 Art. 29(1): Everyone has duties to the community […]

17 Art. 27(1): Everyone has the right […] to share in scientific advancements or its benefits

18 Art. 25(1): Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, […]

and, in particular, shall ensure to such women the right...to enjoy adequate living conditions, particularly in relation to housing, sanitation, electricity and water supply, transport and communications." This provision places obligations on parties to ensure that women in particular have the adequate electricity provision and access to energy they need for adequate housing.

3.4 Report of the World Commission on Environment and Development: Our Common Future (1987)

The World Commission on Environment and Development emphasized the responsibilities of humanity towards our natural environment and future generations, and also the responsibility of the better-off to help the poor and vulnerable. Policies have to reflect these responsibilities by aiming to facilitate sustainable development. The commission also pointed out the global interconnectedness of the problems humanity is facing and the need for interlocking institutions to tackle these. The power inequality between the 'industrial' and 'developing' world was described as "*the planet's main environmental [and] development problem*".

The commission also stated that poverty, ecological and other catastrophes are enforcing each other. It is important to ensure equitable distribution of resources in order to facilitate sustainable growth. This also means that every individual's essential needs have to be covered while restraint from affluent life-styles has to be practiced. Next to food security and biodiversity, the energy choices were also given close attention. The report calls for the increase of energy efficiency and the ultimate goal should be *"to develop 'low-energy paths' based on renewable sources"*. Corporate social and environmental responsibility was also emphasized.

3.5 Agenda 21 (1992)

The Agenda 21 developed a global, sector crossing agenda in order to tackle development and ecological problems via sustainable development. It was drafted by government and non-government leaders during the United Nations Conference on Development and Environment in Rio de Janeiro. As noted above, Agenda 21 observed that *"energy is essential to economic and social development and improved quality of life"* and noted that *"all energy sources will need to be used in ways that respect the atmosphere, human health and the environment as a whole."* Agenda 21 was followed by the Earth Charter in 2000 and the Johannesburg Declaration on Sustainable Development in 2002, which both address similar issues.

3.6 Earth Charter (2000)

The Earth Charter is a declaration of 16 principles for building a more sustainable future. The preamble shows the different values on which the Earth Charter is based,

"We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace. Towards this end, it is imperative that we, the peoples of Earth, declare our responsibility to one another, to the greater community of life, and to future generations. […] We urgently need a shared vision of basic values to provide an ethical foundation for the emerging world community."

Chapter 7 is the most relevant as it concerns the use of energy,

"7b: Act with restraint and efficiency when using energy, and rely increasingly on renewable energy sources such as solar and wind;

7c: Promote the development, adoption, and equitable transfer of environmentally sound technologies;

7d: Internalize the full environmental and social costs of goods and services in the selling price, and enable consumers to identify products that meet the highest social and environmental standards."

These provisions provide a basis for choosing and promoting more sustainable energy technologies over carbon-intensive ones, although they do not touch on the issue of energy poverty.

3.7 Johannesburg Declaration on Sustainable Development (2002)

Building on Agenda 21, the Rio Declaration on Environment and Development, and the MDGs, the Johannesburg Declaration on Sustainable Development, which emerged from the World Summit on Sustainable Development, set out to renew the determination to tackle global poverty and environmental problems in a sustainable way. It is meant to represent the peoples of the world, recognizing their rights to dignity and their duties towards fellow humans and the environment. The declaration identifies past achievements, future challenges and a number of commitments to sustainable development. In particular, delegates included access to energy as a basic requirement for human dignity.19

The Johannesburg Plan of Implementation commits nations in paragraph 8 to take joint actions *"to improve access to reliable and affordable energy services...sufficient to facilitate the...goal of halving the proportion of people in poverty by 2015."* The Plan also recognizes that access to energy is necessary to provide other basic services and outlines a number of recommendations to achieve the stated target.

3.8 Promotion of Peace as a Vital Requirement for the Full Enjoyment of All Human Rights by All (2005)

This resolution emphasizes that peace is a prerequisite for people to be able to enjoy their human rights. In the preamble, the committee is,

"[r]ejecting the use of violence in pursuit of political aims, and stressing that only peaceful political solutions can ensure a stable and democratic future for all people around the world... Affirming that human rights include social, economic and cultural rights and the right to peace, a healthy environment and development, and that development is in fact the realization of those rights….Stresses that peace is a vital requirement for the promotion and protection of all human rights for all;"

The inclusive nature of human rights as characterised in this document presumably extends to access to energy, which supports many social, economic and cultural rights.

3.9 Universal Declaration on Bioethics and Human Rights (2005)

The Universal Declaration on Bioethics and Human Rights (UDBHR) developed out of the perceived need for a global response to the ethical implications of rapid developments in science and technology. Positive and negative effects of these developments on human life and on the biosphere are taken into account in the understanding that "*human beings are an integral part of the biosphere*". This statement shows a change in perspective on the relation between humanity and the environment. It is stated that human beings have the responsibility to protect each other and their environment in the present and in the future (Rai et al., 2010). The Declaration was adopted at the 33rd session of the General Conference of the UNESCO, with the aim of identifying universal principles based on shared ethical values in order to tackle the issues summarized above. Several articles of the declaration relate to energy equity and environmental security.

19 Paragraph 18: "We welcome the Johannesburg Summit focus on the individuality of human dignity and are resolved through decisions on targets, timetables and partnerships to speedily increase access to basic requirements such as clean water, sanitation, energy, health care, food security and the protection of biodiversity...."

As in the UDHR, the UDBHR postulates the equitable and just treatment of all human beings[20] as well as solidarity among human beings.[21] The UDBHR also addresses the responsibility of governments to promote health and social development.[22] Technology should be applied and shared for the benefit of the human beings, especially those in marginalized positions.[23] A departure from the UDHR is that the UDBHR explicitly mentions respect of cultural diversity. However, it is emphasized that human rights and fundamental freedoms should not be limited by the application of cultural values.[24] The requirement of environmental sustainability is incorporated in the articles on the protection of future generations, the environment, the biosphere, and biodiversity.[25]

3.10 UN Convention on the Rights of Persons with Disabilities (CRPD) (2008)

The UN Convention on the Rights of Persons with Disabilities (CRPD) came into force on May 3 2008. As of November 15 2009, there are 143 signatories to the Convention, 87 signatories to the Optional Protocol, 72 ratifications of the Convention and 42 ratifications of the Optional Protocol. The CRPD 's purpose,

"…is to promote, protect and ensure the full and equal enjoyment of all human rights by persons with disabilities. It covers a number of key areas such as accessibility, personal mobility, health, education, employment, habilitation and rehabilitation, participation in political life, and equality and non-discrimination. The convention marks a shift in thinking about disability from a social welfare concern to a human rights issue, which acknowledges that societal barriers and prejudices are themselves disabling."

Various CRPD articles provide guidance on energy security in relation to people with disabilities. A number of provisions in the Preamble and Articles 1 and 3-5 set the stage by referring to the inherent dignity, worth and the equal and inalienable rights of all members of the human family, by asking for the mainstreaming of disability issues into sustainable development strategies and the involvement of people with disabilities in decision-making processes about policies and programmes and by highlighting the value of existing and potential contributions by people with disabilities to the overall well-being and diversity of their communities (Wolbring, 2009ab, 2011). Article 9, 19, 20, 25, 28 and 32 are some other relevant articles that could be employed to guide actions in regards to energy security and people with disabilities. Article 8 highlights the obligation by states to combat stereotypes, prejudices and harmful practices relating to persons with disabilities.

Article 11 highlights that States Parties shall take, in accordance with their obligations under international law, including international humanitarian law and international human rights law, all necessary measures to ensure the protection and safety of persons with disabilities in situations of risk, including situations of armed conflict, humanitarian emergencies and the occurrence of natural disasters. The outcome of the energy discourse influences climate change and disasters. Therefore one can argue that Article 11 demands action that increases the visibility of people with disabilities in the energy discourse (Wolbring, 2009d).

20 Art. 10: The fundamental equality of all human beings in dignity and rights is to be respected so that they are treated justly and equitably.

21 Art. 13: Solidarity among human beings and international cooperation towards that end are to be encouraged.

22 Art. 14: 1. The promotion of health and social development for their people is a central purpose of governments that all sectors of society share...

2.c) Technology should advance improvement of living conditions and environment

23 Art.15: 1. Benefits resulting from any scientific research and its applications should be shared with society as a whole and within the international community, in particular with developing countries.

24 Art. 12: The importance of cultural diversity and pluralism should be given due regard. However, such considerations are not to be invoked to infringe upon human dignity, human rights and fundamental freedoms, nor upon the principles set out in this Declaration, nor to limit their scope.

25 Art. 16: Protecting future generations;

Art. 17: Protection of the environment, the biosphere and biodiversity

3.11 Human Rights and the Environment

Anthropogenic impacts on the environment are endangering human rights (Sachs, 2009). Changing weather conditions and rising sea levels are, for example, impairing agricultural production, food and water supply. Pollution of air, soil and water lead to lower living qualities and health threats. These threats are often most significant for vulnerable people who already have to deal with infringements on their human rights (Sachs, 2009, p. 88). In addition, it is difficult for these people to obtain any compensation for human rights violations since anthropogenic environmental problems can hardly be traced directly to the multiple originators of these problems. It is not possible to attribute responsibility to all those who have indirectly or directly contributed to environmental degradation and climate change. This is particularly the case with multinational corporations since human rights are generally owed by *states* to persons within their jurisdiction (Fowler, 1995).

Sachs (2009, p. 89) suggests that, nevertheless, this does not justify anyone refraining from preventing these impacts and assisting those affected to cope. Since rich countries are responsible for most of the climate induced difficulties in poor countries, the principle of extraterritorial obligations should be embraced. However, a human rights-based approach towards environmental protection might not adequately address the interests of other species and ecosystems since there is a bias towards anthropocentrism (Carlson, 2009, p. 26). In addition, a human rights perspective which places the emphasis on providing individuals with access to energy could come at a risk to the environment since it is unlikely to prescribe the method of implementation. States may decide the cheapest way of providing universal energy access is through fossil fuels rather than renewable energy (Tully, 2006, pp. 544-545).

3.12 Conclusion

Since most human rights documents neglect to even mention access to energy, prioritizing access to energy as a human right may ensure greater attention is paid to delivering this important service to those who need it. Although vulnerable peoples' human rights are already being infringed by environmental changes affecting their livelihoods, it is difficult to attribute responsibility for these violations given multiple causal processes. This demonstrates one of the shortcomings of the human rights approach. In addition, the focus on individual rights does not necessarily ensure energy needs will be met in a sustainable way. It may be that the broader ethical considerations that were discussed in chapter 2 need to be taken into account in this context.

4. Carbon Taxes and Emissions Trading

Summary

Although there is no consensus on what policy mechanisms are best to achieve carbon emission reductions, most economists favour market-based mechanisms to solve what is viewed as one of the greatest market failure in history. Economists generally favour carbon taxes and emission trading schemes (ETS), over command-and-control measures, since they believe market-based instruments can deliver emissions reductions at least cost. This chapter discusses the advantages and disadvantages of a carbon tax and ETS, taking into account ethical considerations.

A carbon tax is a price based market-based mechanism in contrast to an ETS, which is a quantity-based mechanism. There are two approaches that can be used to determine the correct carbon tax rate:

Standards and pricing approach: sets the tax on a tonne of carbon at the rate which is necessary to achieve the desired reduction in emissions.

Optimisation approach: sets the tax rate at a price that equals the social cost of carbon emissions.

Economists commonly calculate the true social cost of a tonne of carbon emissions by discounting the future costs of carbon emissions. This is not without ethical implications and several objections that have been raised are:

- The assumption that people's impatience for money reflects their preferences for immediate economic consumption over future environmental and human security; and
- Using a pure rate of time preference instead of a declining rate of time preference means that the wellbeing of earlier generations is valued more highly than future generations.

There are a number of other concerns relating to the distributive impacts of carbon taxes. The first is that a carbon tax will exacerbate energy poverty among the disadvantaged due to their limited ability to cope with rising energy prices. There is the option of recycling the revenues raised by the carbon tax to mitigate some of the impacts on low income households.

A second concern is the possibility of carbon leakage in the absence of a unilateral global carbon tax. Businesses that are exposed to trade may find themselves no longer competitive and move offshore to jurisdictions with a low or zero carbon tax. One way of addressing this problem is to apply a carbon levy to emission-intensive imports, but this may be restricted by free trade agreements. Nevertheless a global carbon tax may have severe equity impacts on the global poor since it would increase the cost of emissions-dependent goods.

A final ethical consideration is that carbon taxes allow companies to continue to pay to pollute and there is no guarantee that the carbon tax will succeed in delivering effective cuts to carbon emissions.

Another market-based policy instrument is an ETS, which will ensure actual reduction in emissions since it places a cap on the amount of carbon that can be emitted. The focus is on mandatory rather than voluntary schemes to ensure actual emission reduction targets are achieved and to avoid carbon leakage problems.

It is important to separate out the cap and trade components of the ETS in analysing its implications. The cap raises the initial question of what the total level of emissions should be. Subsequently, in determining the allocation of emissions allowances, there are a number of distributive principles, four of which are discussed:

- 'Grandfathering' emissions rights: emission permits are distributed unequally between countries to reflect historical differences in countries' emissions levels so that heavier emitting countries receive a greater share of emission permits.

Allocating emissions rights on an equal per capita basis: emission permits are either distributed using a no-fault approach, which determines the overall level of GHG emissions that can be emitted and dividing this between countries on an equal per capita basis; or using a historical accountability approach, which considers countries' historical emissions when dividing the total emissions between countries so that industrialised countries who have historically been major-emitters would receive fewer than an equal per capita allocation.

'Grandmothering' emissions:

- Egalitarian interpretation: emission permits should be allocated in a way that ensures all people have equal opportunities.
- Sufficientarian interpretation: emission permits should be allocated to ensure that all people can meet their basic needs, and any remaining emission permits distributed in any way.
- Auctioning emissions: emission permits should be auctioned, and the revenues raised from the sale of those permits used for the benefit of past and future generations.

Once the initial allocation of permits has been made, the question of whether emission permits should be transferable arises. There are a range of arguments for and against emissions trading: the mains ones in favour of trading point to the efficiency and distributive benefits, while critics argue that trading schemes unfairly allow rich polluters to buy their way out of their moral responsibilities, undermining the effectiveness of global climate change mitigation efforts.

4.1 Market Mechanisms vs. Command and Control

If dangerous climate change is to be abated for the sake of human and environmental security the concentration of GHGs in the atmosphere will need to be stabilised (and ultimately reduced). How this is best achieved is a matter of some dispute. A variety of abatement options have been canvassed, ranging from command-and-control measures, such as building, transport, and energy efficiency codes, to market-based instruments such as carbon taxes and tradable emissions permits. For instance, the EU Climate and Energy Package—passed into law in April 2009—is an example of a command-and-control response to climate change mitigation as it requires member countries to adhere to a series of legally binding energy efficiency targets, including achieving a 20 percent improvement in energy efficiency by 2020 in addition to using renewable energy sources to meet 20 percent of all demand by the same date (Page, 2009, p. 3). However, many economists favour market-based instruments, such as carbon taxes and tradable emissions permits, over such command-and-control measures on the grounds that market-based instruments can deliver emissions reductions at least cost.

Market-based instruments promote emissions reduction *"by making firms and other agents internalise the full social cost of their environmental behaviour"* (Page, 2009, p. 6). They deliver emissions reductions at lower cost than command-and-control measures because, under a market-based approach, the majority of emissions cuts will be undertaken by those firms and consumers who can reduce their emissions more cheaply. By contrast, command-and-control measures impose similar duties on all parties to comply with efficiency and emissions standards regardless of their different compliance costs (Hawksworth and Swinney, 2009, p. 9). In this respect, market based mitigation measures are said by their supporters to be more *efficient* than command and control measures. Another concern with employing command-and-control measures is the informational obstacles that regulators and bureaucracies face in monitoring GHG emissions and enforcing efficiency standards. As Page (2009, p. 4) citing Tietenbery (2006, pp. 25-6) argues, *"while national or supranational regulators possess the statutory responsibility to ensure that we avoid dangerous climate change, the amount and quality of information required to construct an efficient and efficacious architecture lies beyond their epistemic reach."* Finally, a further benefit of many market-based instruments over command-and-control measures is the so-called "double dividend." Unlike command-and-control measures, carbon taxes and the allocation of emissions permits (through auctioning, for example) raise revenues, which can then be used for important public purposes, such as funding adaptation programmes or redistributing wealth to the disadvantaged. A carbon tax of USD26 per tonne in Australia, for example, would generate USD11.5 billion in extra revenues (Garnaut, 2011, pp. 79-82).

A number of countries have already adopted, or are about to adopt, a market-based approach to climate change mitigation. A Europe-wide emissions trading scheme (EU ETS), for example, has been in operation since 2005, while the New Zealand government passed legislation to introduce a domestic ETS in 2008. The Australian government is also proposing to implement an ETS in 2015, although a carbon tax will be introduced in the interim, which is expected to begin in July 2012. Notably, Scandanavian countries have been taxing carbon emissions for the past two decades at a rate of between €10 and €100 per tonne of CO_2 e, while the French government has signalled that it will introduce a carbon tax of €14t/CO_2e rising to €100t/CO_2e by 2030 (Page, 2009, p. 7).

Although carbon taxes and tradable emissions permits have much in common and are often discussed in similar terms, there are a number of important differences between them. One key difference is that an ETS fixes the overall quantity of GHGs that can be emitted and leaves the market to decide the cost of emissions, while carbon taxes fix the cost of emissions and leave the market to decide what the overall quantity of emissions will be (Ekins and Baker, 2001, p. 330). For this reason, carbon taxes are often referred to as a 'price-based mechanism' in contrast to tradable emissions permits, which are a 'quantity-based mechanism' (Page, 2009, p. 6; Weitzman, 1974). Many consider this to be an important advantage of carbon taxes over alternative market-based instruments, since *"greenhouse taxes provide users the certainty of a ceiling on mitigation costs so long as the relevant taxes are set over an extended period; and only in exceptional circumstances"* (Page, 2009, p. 7). This should in turn enable agents to make better-informed investment decisions (Nielson, 2010, p. 9). A further advantage of carbon taxes is their relative simplicity, as the concept is easy to understand and existing taxation architecture can be employed to implement a carbon tax. In contrast, an ETS requires the development of complex trading and accounting systems, which may increase the costs of achieving emissions reductions (Hawksworth and Swinney, 2009, p. 17). One concern with respect to carbon taxes, however, is that they provide little certainty that emissions reductions will actually be achieved since polluters have the option of continuing to pay to pollute. A number of commentators therefore favour an ETS as it offers greater certainty that emissions reductions will actually be achieved (Chameides and Oppenheimer, 2007).

There are many additional considerations that need to be taken into account in evaluating the respective merits of carbon taxes and ETSs as preferred mitigation mechanisms—for instance, should people even be allowed to buy the right to pollute. This chapter provides an overview of some of these, paying particular attention to the social justice impacts of the different mechanisms and the key ethical questions that need to be addressed when designing and implementing either an ETS or a carbon tax.

4.2 Carbon Taxes

Climate change has been famously described by Sir Nicholas Stern as the greatest market failure of all time. "The appropriate response to substantial market failure," argues Stern (2009, p. 11), "is not to abandon markets but to act directly to fix it." In particular, Stern argues that we should act rapidly to introduce a global carbon tax, a mechanism favoured by economists for correcting market failures created by negative externalities (of which the social cost of carbon is a classic example) (Conway, 2007). The Australian government's climate change adviser, Ross Garnaut, has similarly argued for the introduction of a carbon tax, which would initially be set at between USD20 and USD30 per tonne (Garnaut, 2011, p. 72).

The rationale behind taxing carbon emissions is twofold. Firstly, carbon taxes can be thought of as a punitive device, or incentive mechanism, by which governments can motivate people to reduce their GHG emissions so as to achieve a particular abatement target. This abatement target could be determined by political processes, a desire to limit temperature changes below a certain level (for example, 2 degrees over the 21st century), or by cost-benefit analysis. Insofar as this is the function of carbon taxes, the price of carbon can be established by working out the level of economic penalty that is required to keep emissions at the agreed upon standard, which may require 'floating the price up or down until the desired level of environmental quality has been achieved' (Goodin 1994, p.590). Advocates of carbon taxes often defend their proposals in such terms. For example, in his 2011 Review, Garnaut (2011, p.71) defends putting a tax of between USD20 and USD30 on the emissions of a tonne of carbon on the grounds that doing so is necessary if Australia is to meet its commitment to reduce its emissions by 5 percent by 2020 (relative to 2000 levels). This approach to carbon taxing, which involves choosing an emissions target so as to abate a quantity of environmental damages "and then using environmental taxes on an iterative basis to bring levels of environmental damage down to the standards" is known as the *standards and pricing* approach (Ekins and Baker, 2001, p. 329). On this approach, there is no independent justification for the price of carbon being what it is other than it being "just a matter of what it takes to get people to cut back on their activities sufficiently to achieve our environmental targets" (Goodin 1994, p.590).

From a neo-classical economic perspective, the rationale behind pricing carbon is not to achieve a desired emissions reduction target, but to reflect the social cost of carbon-dependent energy

production and consumption which imposes costs on parties not involved in the market transaction, such as other persons, future generations, and eco-systems. These marginal social costs (or negative externalities) are not captured in the price that consumers pay for their energy use, with the result that the market is supplying more carbon-dependent energy than is optimal. Consequently, a tax on people's carbon consumption is needed to ensure the market adequately captures the *full* costs associated with providing carbon-dependent forms of energy for consumption,. This tax ought to be set so as to capture the value of the social (or external) cost of a tonne of carbon emitted so that this cost is factored into people's consumption choices. Only in this way can we ensure that the market supplies the optimal level of carbon-dependent energy. Garnaut and other economists who support carbon taxes frequently appeal to this sort of explanation for why a carbon tax is needed. *"With a price on carbon, individuals and businesses can take into account the costs of their actions that are borne by society at large."* Or as Garnaut (Garnaut, 2011, p. 67) also puts it, *"a market-based price on emissions reflects the costs that atmospheric carbon imposes on the rest of society and asks individuals and firms to adapt and create solutions that incorporate that price."* This neo-classical approach to carbon pricing, which was first developed by Pigou, is known as the *optimisation* approach. Notably, although the optimisation approach assumes that GHG emissions will be reduced once carbon taxes are introduced, the approach is in principle indifferent between whether people reduce their emissions in response to carbon prices or not (Goodin, p.575). For what matters according to the optimisation approach is that utility is maximized; not that GHG emissions are reduced. If people value the consumption of a tonne of carbon more than the full costs—including the negative externalities—associated with providing that carbon for their consumption, utility will be increased by the consumption of that tonne of carbon.

Using the optimisation approach, the rate at which carbon emissions are taxed should equal the social cost of those emissions. This is the (discounted) cost of the damages that the emission of a marginal tonne of carbon into the atmosphere will cause now and into the future, which is estimated using complex computer modelling that employs a number of environmental, economic, and demographic assumptions. Importantly, as the concentration of GHGs increases, the social cost of carbon rises. This is because the addition of a marginal tonne of carbon has a greater impact on the environment the higher the concentration of GHGs in the atmosphere. As a result, it is expected that the price of carbon will increase steadily until the concentration of GHGs in the atmosphere is stabilized. However, as we will see below, estimating the social cost of carbon can be problematic, not least because this cost occurs across decades and even centuries. The problem of calculating the correct cost of carbon emissions is more of an issue for the optimisation approach than the standards and pricing approach. The correct carbon price on the latter approach is merely the price that achieves the necessary level of emissions reductions rather than the price that adequately reflects the true social costs of those emissions over time. On the other hand, pricing carbon using the standards and pricing approach goes against one of the proclaimed advantages of carbon taxes over other market-based instruments; namely, their ability to deliver greater certainty regarding the costs of our emissions and future behaviours. This is because the price of carbon on the standards and pricing approach must be flexible to ensure emissions targets are met. The problem of calculating the correct carbon price is discussed in detail below, where particular attention is paid to the ethics of discounting future costs and benefits (an integral feature of carbon pricing). Following this, a range of additional concerns are discussed regarding the distributive impacts of carbon taxes, while we also consider whether people should have a right to pay to pollute in the first place.

4.3 The Ethics of Discounting

4.3.1 The Opportunity Cost of Capital

As noted above, according to the optimisation approach, the correct price of carbon (or the correct tax rate) is the price that reflects the true social cost of a tonne of carbon emitted into the Earth's atmosphere. But how do we calculate the true social cost of a tonne of carbon when the majority of these costs will not arise for decades, even centuries? Assume that we can reliably predict that a tonne of carbon emitted today will cause USD1,000 worth of damages in a hundred years time. Should we therefore be prepared to pay USD1,000 today to offset the future costs of a tonne of carbon emitted, whether this involves paying USD1,000 to reduce carbon emissions or paying USD1,000 in compensation to future generations for the privilege of emitting a tonne of carbon into the atmosphere? For several reasons,

most economists argue that the "present value" of USD1,000 worth of costs occurring in a hundred years time is significantly less than USD1,000 in today's currency. A levy of USD1,000 per tonne on carbon emissions would therefore be exceedingly high. This practice of converting the future costs of carbon emissions into a lower value today is known as *discounting*, and is one of the most controversial aspects of economic approaches to climate change.

One reason for discounting the future costs and benefits of climate change mitigation is that money invested today will earn interest over time. Hence, any policy decisions must take into account what is known as 'the opportunity cost of capital.' For example, suppose a government is deciding whether or not to commit USD100m worth of public funding to build a new school, which is expected to deliver net social benefits in the region of USD60m in ten years time. In deciding whether or not to commit the public's money to the project, the government must consider the opportunity costs of that capital investment. In this case, it would miss out on the opportunity of investing USD100m at an annual rate of return of 7%. If we assume that the interest will be compounded, the net benefit of such an investment would be in the region of USD96m. Thus, rather than committing public money to building a new school, the government would do better to instead invest this money.

Now consider the case of carbon taxes. One effect of pricing carbon is a reduction in the supply of carbon-intensively produced goods and services in cases where the addition of a carbon levy increases the cost of supplying those goods and services beyond their market value and there is no economically viable way of reducing the carbon emissions associated with their production. This does not necessarily mean that the introduction of carbon taxes will lead to an overall decline in economic output, however, since any drop in demand for the consumption of carbon-intensively produced goods and services may be offset by a rise in demand for other goods and services as consumers look to substitute their consumption of those goods and services. Moreover, if the revenue generated from carbon taxes is recycled in the form of a reduction in labour taxes, labour supply and demand may increase along with earnings, compensating for any decline in economic output from the introduction of carbon taxes (Ekins and Baker, 2001, pp. 335-338). Indeed, the potential for revenue-recycling is one of the key benefits of carbon taxes over regulatory and other market-based instruments.

Leaving the impacts of carbon taxes on overall consumption aside, we can nonetheless assume that in the case of goods and services that continue to produce economic surplus even when a carbon levy of say USD1,000 per tonne is applied, producers will prefer to pay up to just under USD1,000 to reduce the carbon emissions associated with the production of those goods and services by a tonne rather than having to pay the carbon tax. They might do so by purchasing carbon credits, substituting fossil-fuel use with other production inputs, such as an increase in labour or cleaner fuels. Alternatively they might continue to rely on fossil-fuels to power production but introduce more efficient machinery that requires less energy to achieve the same production output. Each of these options comes at a cost, but standard economic theory suggests that producers will prefer to pay just under USD1,000 to reduce their carbon-emissions by a tonne rather than pay the carbon tax. Within the context of the above example—where the emission of a tonne of carbon results in USD1,000 worth of damages a hundred years from now—this essentially means that producers will pay up to USD1,000 today for the sake of realising benefits in the region of USD1,000 in a hundred years time from avoided dangerous climate change. However, if we consider the opportunity costs of that decision we can see that it is not a wise investment. For, if instead of paying close to USD1,000 to reduce our carbon emissions by one tonne we were to invest that money in a savings account earning 5% compound interest over 100 years, we could give people living a hundred years from now more than USD130,000 worth of benefits. Hence, from a maximising utility viewpoint, we would do better to invest our USD1,000 rather than spend it on the reduction of GHG emissions. Moreover, setting aside as little as USD7.60 today at a compound interest rate of 5% could provide people living a hundred years from now with USD1,000, which would offset the expected costs that they are likely to incur as a result of our emitting a tonne of carbon into the atmosphere. Consequently, taxing the emission of a tonne of carbon today at USD1,000 dramatically inflates the social cost of that tonne of carbon. A tax in the region of USD7.60 would be more appropriate. This sort of argument for discounting is known as the positivist or descriptive approach (Nordhaus, 1999, p. 147; Posner and Weisbach, 2010, p. 150) and it implies that, when pricing carbon, we ought to discount the value of the expected future damages from the emission of a marginal tonne of carbon by the observed rate of return on capital.

4.3.2 Discounting and Social Time Preference Rate

An alternative to indexing the social discount rate against the observed rate of return on capital is the social time preference rate approach. On this approach, the rate at which we should discount future costs and benefits is held to be a function not of the rate of return on capital but of the fact that (a) future generations will be better off and that (b) people place a higher value on earlier over later consumption. Insofar as (a) and/or (b) is true, it follows that a benefit of USD1,000 is worth more to people living now than it is to people living a hundred years from now and that it is therefore legitimate to discount future costs when estimating the social cost of carbon. To see why, consider the principle of the declining value of marginal utility. According to this principle, an extra dollar is worth more to us when we are poor than when we are rich. Now, if we assume that future generations will be wealthier than current generations, and that taking a tonne of carbon out of the atmosphere will deliver benefits in the order of USD1,000 to persons living a hundred years from now, it follows that the value to future persons of this benefit will be worth less than USD1,000 worth of benefits enjoyed by people today. This is because 'an addition to our income now will be of more value than an addition in the future,' when we will be better off (Quiggan, 2009, p. 73). Hence, if people today pay in the region of USD1,000 to reduce their carbon emissions or to offset the future social costs of their carbon emissions, this will result in a net loss in utility. Thus, the fact that future generations will be better off is reason enough to discount future costs when estimating the social cost of carbon. John Quiggan calls this the 'consumption based discount factor' and, in the case of climate change policy, it is sensitive to assumptions about the speed at which the value of marginal utility declines as well as predictions about the pace of economic growth (Quiggan, 2009, p. 74). The higher the rate of predicted annual economic growth and the more quickly we believe the value of marginal utility declines, the more we ought to favour benefiting earlier over later born persons.

In addition to a consumption based discount factor, the social discount rate employed in estimates of the social cost of carbon is also composed of a 'pure time preference' factor or inherent discount rate (Quiggin, 2008, p. 200). This is to reflect the fact that people prefer immediate to postponed consumption, such as when we forgo savings opportunities in favour of immediate consumption. For example, suppose I have USD1,000 and there is an opportunity to invest this USD1,000 at an annual rate of return of 3.5%. I know that if I invest the money now I will gain interest and hence have more capital in 12 months time. But I decide that the magnitude of the interest that I would earn (USD35) is not worth forgoing USD1,000 worth of consumption today. In other words, USD1,000 worth of consumption today is worth as much as USD1,035 worth of consumption a year from now. Insofar as I opt to spend the USD1,000 instead of saving it, I have discounted my future utility at a rate of 3.5%. Now, of course, one reason why I may be justified in privileging my immediate over future consumption is that I expect to be better off in a year's time. Hence, USD1,000 worth of benefits will be worth more to me today than in a year's time (presuming that my income will be higher in a year's time). However, the pure rate of time preference is intended to capture only people's preference for earlier over later consumption and not any consumption based discount factor. Hence, if part of my reason for favouring USD1,000 worth of benefits today over USD1,035 worth of benefits in a year's time is that I expect to be earning a higher income in a year's time, the pure rate of time preference in this instance will be less than 3.5%. For this reason, the pure rate of time preference is often described as a measure of people's *impatience* for benefits now rather than later (Broome, 2008, p. 102; T. C. Schelling, 1995, p. 395).

4.3.3 Objections to Discounting

Insofar as economists take into account both the declining value of marginal utility and pure time preference when estimating the social costs of carbon, the social discount rate (*r)* is a product of a consumption based discount factor and a pure rate of time preference factor. This is expressed in the formula r = ñ + È*g*, where ñ is the pure rate of time preference, È is the absolute value of the elasticity of marginal utility, and *g* is the growth rate of per capita income (Lind, 1999, p. 177). Higher values for ñ, È, and *g* imply that the future costs of carbon emissions should be significantly discounted and that the value of a carbon tax ought to therefore be low. Conversely, low values for ñ, È, and *g* favour a high carbon tax. For these reasons, the details of which need not detain us here, it is assumed the social discount rate is equal to the observed rate of return on capital when the economy operates perfectly efficiently. Some economists therefore argue that the values for ñ and È ought to be chosen so as to reflect the real rate of return on capital (Nordhaus, 2007, p. 202). Thus, if the real rate of return in the market is high, this

suggests high values for both the pure rate of time preference and for the consumption based discount factor. However, adopting a high pure time preference rate is controversial for a number of reasons, and many economists (e.g. Stern) have eschewed including any significant pure time preference factor in their estimates of the social discount rate for reasons of inter-generational equity.

One issue concerns the appropriateness of assuming that people's impatience for *money* tells us anything meaningful about people's preferences for immediate economic consumption over future environmental and human security (McNeill, 2010, pp. 107-108). As Simon Caney (2010a, p. 120) argues,

"*empirical analyses of people's attitudes towards time preference have shown that people do not have a single uniform approach to time. Rather, they use different discount rates for different phenomena (depending, for example, on factors such as whether the good in question is a benefit or a loss, and depending on the magnitude of the benefit/loss). Given this we have no reason to suppose that any pure time discount rate that people adopt in market exchanges would be the same pure discount rate that those people would apply to climate change.*"

Another source of controversy is whether to employ a continuous pure rate of time preference or whether it should decline over time. Employing a continuous rate assumes that just as we would prefer to receive USD1,000 today rather than USD1,035 in a year's time, we would similarly prefer to receive USD1,000 in 50 years time rather than USD1,035 in 51 years time. But many people think that the rate at which we favour earlier over later consumption declines over time, and so a declining rate of pure time preference should be employed. This is important Because the costs and benefits of any further carbon emissions will be spread out over centuries, the use of a declining rather than a continuous rate of pure time preference can make a major difference to the evaluation of the social cost of carbon. Generally, employing a declining rate of pure time preference increases the social costs of carbon emissions with the result that we will be lead towards reducing emissions more quickly (i.e. taxing carbon emissions at a higher initial rate). However, by far and way the biggest source of controversy concerning the use of a pure rate of time preference concerns the ethics of valuing the wellbeing of earlier generations more highly than that of later born generations. For regardless of whether we adopt a high or low rate of pure time preference, employing a pure time preference factor when discounting the future costs of carbon emissions amounts to nothing less than privileging the wellbeing of existing polluters over future victims of climate change. This is fundamentally inconsistent with respect for the equality of persons,

"*A social allocation rule that incorporates pure time preference gives higher weight to the life-time utility of earlier-born generations. Assuming a 3 percent pure rate of time preference…and 25 years between generations, the lifetime welfare of those aged 50 or more is valued twice as highly as the welfare of their grandchildren. This is inconsistent with any form of utilitarianism in which all those currently alive are valued equally*" (Quiggan, 2009, pp. 75-76)

Even if individuals display impatience for earlier rather than later benefits, this, as John Quiggan (2008, p. 200) rightly argues, *"does not necessarily mean that [inherent discounting] is appropriate as a basis for social decisions."* It is one thing for individuals to prefer an immediate to a future benefit in their *own* life (as it is the same person who enjoys the costs and benefits of such impatience), but it is an altogether different matter for earlier born generations to prioritise their immediate utility over that of future *different* people (Caney, 2010a, p. 121).

The controversy over the use of a pure rate of time preference discount factor goes to the heart of the carbon tax debate. For whether estimates of the social cost of carbon are made using a significant pure time preference discount factor has a major bearing on the conclusions economists reach regarding carbon tax proposals. We see this in the very different estimates that Nicholas Stern and William Nordhaus arrive at regarding the correct price for carbon emissions. Stern, in his report for the UK Treasury on the economics of climate change, eschewed the use of a pure rate of time preference. Consequently, the value that he attributed to ñ was only 0.1%, which was intended to reflect the possibility of the extinction of the species. As a result, the overall social discount rate employed by Stern was only 1.4%, which resulted in him placing a very high value on the social cost of carbon. This led him to support immediate emissions reductions consistent with a USD300 per tonne tax on carbon emissions. By contrast, William Nordhaus, who endorses applying a pure rate of time preference of 3% (and an overall social discount rate of 5.5%) supports a carbon tax of only around USD30 per tonne, rising to USD85 per

tonne by 2050. Nordhaus openly admits that this difference in the estimate of the social price of carbon is almost entirely the result of the different assumptions that he makes when calculating the social discount rate (Nordhaus, 2007, p. 201). The high social discount rate that Nordhaus endorses "implies a very low level of concern for our descendents," as John Quiggan (2008, p. 202) explains. Indeed, in Nordhaus' discounting procedure, "the welfare of our great-grandchildren (whether or not they have yet been born) has about a tenth the weight we accord ourselves. Not surprisingly, this translates into a 'do nothing now' approach to global warming." What this shows is that the economics of carbon taxes cannot be separated out from the ethics of climate change. Carbon tax proposals implicitly rely on ethical judgments regarding the nature of our obligations to future generations. Insofar as we are committed to treating people with equal concern regardless of the generation into which they are born we will eschew the use of a pure rate of time preference when discounting the future costs of carbon emissions.

Rejecting pure time preference discounting as unethical, however, does not mean that social discounting is inconsistent with treating all persons with equal respect. Neither discounting according to the consumption based discount factor nor the positivist position of appealing to the opportunity costs of capital implies that we treat the wellbeing of later born generations with less consideration. For instance, it is consistent with respecting the equality of persons to eschew the pure rate of time preference factor and to calculate the social discount rate solely with respect to the declining value of marginal utility (È) and the expectation that future generations will be wealthier (*g*). Even so, it remains a matter of some controversy whether appealing to the declining value of marginal utility can in fact justify social discounting in the case of climate change.

Appealing to the declining value of marginal utility in order to justify discounting the future social costs of carbon assumes that those who will suffer the consequences of carbon emissions in the future will be less well-off than those emitting carbon today. This assumption is based on the observation that economies have been growing consistently over recent decades, and so future generations will be better off. Hence, USD1,000 worth of savings from avoided carbon emissions will be worth less to future generations than USD1,000 worth of benefits today. While this assumption may hold with respect to future co-nationals, it is unlikely to hold at a global level precisely because the lion's share of the social costs of carbon emissions will fall upon the world's poor. Indeed, as Thomas Schelling (1999, p. 100) points out, those who will have to pay the social costs of our carbon emissions may very well be poorer than us, *"the fact that the level of consumption is likely to be increasing in most of the world does not mean that the beneficiaries of GHG abatement will have higher levels of consumption than the people who invest in that GHG abatement. We in North America, Western Europe, and Japan will be investing in GHG abatement for the benefit of people who in fifty or seventy-five years will probably still be poorer than we are now."*

If this is right, then a benefit of USD1,000 in the future from avoided climate change is worth more than a benefit of USD1,000 enjoyed today from a tonne of carbon emissions. This suggests that we should be very conservative in our estimates of the consumption based discount factor and subsequently favour taxing carbon emissions more heavily.

This still leaves open the possibility that we might nonetheless do better to invest a small amount of money today in order to compensate for the future costs of our carbon emissions—money that could be raised through putting a small levy on carbon emissions—than forgo that consumption altogether in response to heavy carbon taxes. If a tonne of carbon emitted today is expected to cause USD1,000 worth of damages in a hundred years time, rather than taxing carbon emissions according to the undiscounted social costs of carbon we might do better to allow existing generations to invest a small sum in order to offset the costs that their carbon-intensive consumption behaviours will impose on future generations. However, there are a number of problems with appealing to the observed rate of return on capital in order to militate against putting a high price on carbon emissions today. One is the issue of whether greater financial savings can ever truly compensate people for damages to environmental and human security. Investing small amounts today may well leave future generations with more than enough additional capital to cope with the future economic costs they will incur from climate change. But having *more money* by no means makes up for the fact they will have to live in a much poorer environment. Environmental degradation, as Robert Goodin (1994, p. 587) argues, *"is a wrong that cannot be recompensed by cash payments."* Existing and future people harmed by our carbon emissions

might be made better off in some sense by the transfer of additional savings, *"But they will be better off, if at all, in dimensions altogether different from those in which their losses have been sustained. The cash offered in payment for environmental indulgences—through green taxes and such like—cannot possibly recompense them for the loss of that context that provided meaning, of a sort, to their lives."* Moreover, even if we suppose that additional savings might adequately make up for future environmental costs, there is no guarantee that we will be able to successfully achieve the sort of inter-generational savings that would be required to offset environmental costs. As Robert Lind (1999, p. 176) explains, *"We don't know how to set aside investment funds and to commit intervening generations to investing and reinvesting those funds for eventual delivery as consumer goods to the generation 200 years from now."* Insofar as Lind is right, it seems widely implausible to assume that we will be able to adequately compensate future generations for the social costs of our carbon emissions by investing small tax revenues today. For *"intergenerational transfers, either forward or backward, generally must be made through series of intervening generations."* The problem is *"the potential for an intervening generation to break the chain of transfer makes such transfer schemes impossible to implement"* (Lind, 1999, p. 175).

The difficulty of achieving intergenerational savings is further complicated by the high level of uncertainty involved in estimating the return on investments that are made over many decades, even centuries. There is risk associated with investments, and while we may be capable of predicting the rate of return on an investment over the next 5 to 10 years, estimates of the rate of return in 50, 60 or 100 years time are highly uncertain. The fact that we can invest at 5 percent compound interest today does not mean that we will be able to earn the same rate of return on our investments in 50, 60, or 100 years time. Hence, if we employ a discount rate of 5 percent per annum when estimating the social costs of carbon spread over a hundred years, we are gambling on future returns from investments being as high as they are today (Posner and Weisbach, 2010, p. 152). We cannot confidently make this prediction, especially as the rate of economic growth and return on investments is itself likely to be sensitive to the impacts of climate change. Again, this suggests that we ought to be very conservative when calculating the social discount rate and should therefore favour a higher rather than lower carbon tax rate.

4.4 Distributive Impacts of Carbon Taxes: Some Concerns

We have considered some of the key challenges that economists and policy makers face in calculating the appropriate tax rate for carbon emissions. Although academic literature has paid a lot of attention to the issue of discounting and its controversial underlying assumptions, public discussion of carbon taxes has paid relatively little attention to this aspect of carbon pricing. Public debates have instead tended to concentrate on the distributive impacts of carbon taxes on existing generations. Here, there are a number of concerns that merit serious attention. First and foremost is the concern that carbon taxes will exacerbate energy poverty among the disadvantaged due to their more limited ability to cope with rising energy prices.

4.4.1 Unequal Impacts of Carbon Taxes

Increases in energy costs impact particularly severely on low-income and disadvantaged households for three reasons. First, low-income households are often more reliant on dirtier forms of energy (e.g. electricity generated by coal-fired power stations rather than solar or gas) which means that the carbon content of their energy use is higher. Second, people on lower income households may have to use more energy to deliver the same quantity of energy services as people on higher incomes due to living in poorer quality housing and relying on a less efficient mix of appliances. For instance, people on lower incomes are less likely to be able to afford modern and efficient appliances and may have to rely on donated or purchased second-hand appliances for the provision of energy services. While higher-income groups generally spend more on heating and cooling their homes due to their *size*, the poorer construction of disadvantaged and lower-income groups' dwellings—little or no insulation, no window shading or heavy curtains, draughts around the windows and doors—means they use higher amounts of energy to heat or cool an equivalent area. Expenditure on energy also represents a greater proportion of lower-income households' overall income, so increases in energy costs have a

greater effect on their ability to afford other basic and essential goods. This is especially so because of the non-discretionary nature of poorer households' energy use, meaning that there is little energy use they can forgo without threatening their human security. In Australia, for example, households in the lowest equivalised income quintile (the poorest 20% of households) spend more than 5.5% of their weekly income on energy costs, whereas households in the top income quintile spend just over 1% of their weekly income on energy costs. Significantly, public housing tenants, people on government allowances, and pensioners spend nearly double the proportion of their weekly household income on energy costs as the average household despite using use less energy overall. Conversely, homeowners and people in paid employment use more energy than the average household but spend less of their income on this consumption (Australian Bureau of Statistics, 2005).

In short, meeting poorer households' energy needs is more energy and carbon intensive, meaning they are more exposed to the impacts of carbon taxes. This is especially insofar as low-income households need to use energy more regularly due to unemployment, disability, retirement, or being at home to care for young children or an elderly relative (factors that are more common amongst poorer households). Notably, analysis conducted for the 2008 Garnaut Review found that although the introduction of a USD23 per tonne tax on carbon emissions would lead to an increase of 1.1 percentage points in the consumer price index (CPI), lower-income households would likely face price increases in the order of 1.3 percentage points (Garnaut, 2011, p. 82). Any carbon tax initiative must therefore be mindful of its potential to exacerbate poverty and disadvantage—particularly a high carbon tax—which may cause poorer and disadvantaged groups to forgo basic and essential needs while better off groups continue to consume more than their fair share of energy resources because of their greater ability to pay. As the 2010 World Development Report (2010, p. 47) warns, "*Without revenue recycling, the impact of carbon pricing or green taxes…is likely to harm the poor because poor households spend as much as 25 percent of their income on electricity, water, and transport.*"

4.4.2 Revenue Recycling and Poverty Alleviation

Recycling the revenues raised by carbon taxes and redistributing these to low-income and disadvantaged groups in the form of either an increase in welfare payments, higher concessions on energy use, or the rollout of efficiency programs for low-income households (e.g. installing insulation, window shading, double-glazed windows, and more efficient heavy-usage appliances) are among some of the ways in which the regressive impacts of carbon taxes can be avoided. Alternatively, carbon taxes could be designed in such a way that so-called *subsistence emissions* are exempt from taxation. That is, the energy that people need to meet basic and essential needs critical to their wellbeing and security could be exempted from taxation in the same way that income taxes are applied only once earnings reach a certain threshold. The Netherlands, for example, grants all households a tax-free allowance of energy use (Ekins and Baker, 2001, p. 366). However, from an environmental security perspective, recycling carbon-tax revenues to assist disadvantaged and low-income households in the form of government-sponsored energy efficiency schemes is preferable to providing households with a tax-free allowance of energy use since this enables households not only to avoid the economic impacts of carbon taxes but also to *reduce* their GHG emissions (KPMG Management Consulting, Brotherhood of St Laurence, and Ecos Corporation, 2008, p. 4). As Garnaut (Garnaut, 2011, p. 78) likewise argues, "*If assistance is directly linked to the consumption of relatively emissions-intensive goods (for example, rebates related to the amount of electricity used), then it will remove the incentive for the household to switch away from more emissions-intensive goods and towards less emissions-intensive goods.*" Energy efficiency measures also have the added advantage that they protect low-income households against energy price increases more generally. However, any energy efficiency programs must be designed so as not to exclude low-income tenants from taking advantage of such programs. Moreover, safeguarding essential energy use and improving the efficiency of low-income household's energy use will not be enough to adequately protect vulnerable and disadvantaged groups from the potentially regressive impacts of carbon taxes. For carbon taxes will not only increase low-income households' energy costs, they will also increase household's consumption costs indirectly by raising the cost of purchasing goods and services whose production and distribution generates GHG emissions. In Victoria, for example, around half of the GHG emissions generated by household consumption are indirect emissions (Australian Conservation

Foundation, ACOSS, and CHOICE, 2008, p. 8). Nonetheless, if part of the revenue from carbon taxes is recycled in the form of an increase in welfare payments and other government benefits, or in the form of tax cuts for low-income households, these additional risks could potentially be avoided. Hence, as Ekins and Baker (2001, p. 367) argue, *"while a carbon tax could have a regressive effect on low-income households (or countries), it does not need to do so."*

4.4.3 Global carbon taxes and the problem of carbon leakage

A second issue concerning the distributive impacts of carbon tax initiatives concerns the issue of whether there should be a single price on carbon (i.e. a uniform global tax) or whether the rate of carbon taxation ought to vary between countries. For political as well as economic reasons, a unilateral global carbon tax is highly unlikely for the foreseeable future. *"The reality of widely differing and volatile exchange rates and differing administrative capacities,"* as a briefing report for the Australian Parliament (Nielson, 2010, p. 10) here acknowledges, *"makes a coordinated and effective set of emissions taxes on an international scale a difficult objective to achieve."* Carbon taxes are therefore likely to be implemented on a country-by-country basis, each of which may apply a different rate of taxation to carbon emissions. However, a global carbon tax is by far the preferred option amongst economists. One reason is that *"[a] patchwork approach to emissions reductions may lead to schemes in different countries undermining each other due to the exclusion of different industries and other inconsistencies"* (Hawksworth and Swinney, 2009, p. 14). This has been a problem in Scandinavia, where differences in the rate at which the carbon emissions of energy companies operating in different jurisdictions have been taxed has hindered abatement efforts. A patchwork approach also increases the risk of 'carbon leakage.' This is where carbon-intensive industries migrate offshore to avail of lower or zero carbon tax rates (Eckersley, 2009, p. 115). In the long run, carbon leakage increases the cost of emissions reductions as delays investment in the research and development of more efficient and renewable energy technologies. There is also a very high danger that *"no, or a limited, reduction in emissions"* will take place under conditions of carbon leakage, with the result that the imposition of carbon taxes will lead to an overall net loss in social welfare (Nielson, 2010, p. 10).

A second reason why a global tax initiative is preferable to a unilateral approach is that businesses in countries with a low or zero rate of carbon taxation will gain a significant competitive advantage over equivalent businesses in countries with a higher carbon taxation rate, impairing the international competitiveness of businesses and economic sectors in countries that adopt a higher carbon tax rate (Ekins and Baker, 2001, p. 349). For example, trade-exposed businesses and economic sectors may find themselves no longer able to compete in international markets. This is a key area of concern with respect to the Australian government's proposed carbon tax scheme, with mining and steel industries (among others) seeking reassurances from the government that the scheme will not undermine their ability to export their products overseas. Even businesses that trade primarily in the domestic market may find themselves at a competitive disadvantage if a uniform carbon tax is not implemented since businesses operating in carbon havens—economies with a zero or low carbon tax—may be able to sell goods and services into markets for less than domestic firms, who must pay to pollute. One way of addressing this form of competitive disadvantage is to apply a carbon levy to imports that have been produced using carbon-intensive forms of energy. The difficulty with doing so, however, is that it may violate free-trade agreements, which is why the European Union has been reluctant to embrace such an approach as a means to redressing the competitive disadvantage that European businesses face compared to US businesses as a result of the EU ETS (Eckersley, 2009, p. 115). Governments have instead responded to competitive disadvantage concerns by offering exemptions and subsidises to affected businesses.The danger of this approach is that it reduces the incentive for businesses and industries to contribute to carbon-abatement, placing a larger burden on the rest of the economy to respond to carbon taxes.

Notwithstanding the efficiency advantages of apply a global tax on carbon emissions, applying a uniform global tax on carbon emissions could have a devastating impact on human security and energy poverty in developing countries due to massive inequalities in the global distribution of income and resources. Whatever the ability of low-income and disadvantaged groups in developed countries to cope with the introduction of a USD30 per tonne tax on carbon emissions, the global poor are in no such position to cope with such an extensive increase in the cost of emissions-dependent goods. A global carbon tax therefore has the potential to be highly regressive.

In principle, there is nothing to stop carbon tax revenues being recycled at a global level to reduce existing radical inequalities in the global distribution of wealth and to reduce the regressive impacts of such taxes. According to some estimates, if even only half of the revenues generated by a carbon tax of between USD20 and USD50 per tonne were redistributed to developing countries, this could result in a net transfer of between USD45 billion and USD110 billion per year (Paavola and Adger, 2006, p. 603). However, while carbon tax revenues can be quite feasibly channelled towards improving the lives of those who are worse off in the domestic case, it will be much more difficult to do so at the global level. This is because carbon tax revenues will be collected, in the first instance, by national governments. Notably, this means that it will be the governments of the heaviest polluting countries that will be responsible for collecting the majority of carbon tax revenues. The existing pattern of global aid transfers suggests that the chances that such governments will pass on any significant proportion of these revenues to developing countries are extremely slim. National governments are already under pressure to redistribute carbon tax revenues to their own population in the form of tax cuts, subsidies to vulnerable industries, and increases in welfare payments and so are unlikely to utilise those revenues to achieve what would effectively amount to a massive increase in foreign aid (Posner and Weisbach, 2010, pp. 50-51).

4.5 Paying to Pollute

Carbon taxes fix the price of emissions and leave the rate of emissions reduction to the market. While the advantage of this approach is that it provides businesses and consumers with greater certainty regarding the costs of their consumption behaviours as well as the benefits of any abatement measures they might take, there is no guarantee that carbon tax initiatives will succeed in delivering effective climate change mitigation. This is especially a concern in the absence of a multi-lateral global approach to carbon taxes that would put an equivalent price on carbon emissions regardless of their geographical location. Similarly, any revenue recycling of carbon taxes that takes the form of providing concessions and subsidies to affected industries also increases the risk that carbon taxes will prove ineffectual. In light of these considerations, there is a legitimate concern that carbon taxes will prove ineffectual. Moreover, because carbon taxes allow agents to emit whatever quantity of carbon emissions they are prepared to pay for (even if this will lead to serious environmental degradation), many regard them as deeply problematic and unethical. Regardless of how much polluters are willing to pay for the privilege of using more than their fair share of environmental resources, they should not be allowed to do so. For example, why should people be entitled to emit carbon on a per capita basis that is in excess of what the atmosphere can safely absorb simply because they are prepared to pay to do so? The issue here is that in monetising GHG emissions we risk legitimising pollution in the same way that taxing people for speeding instead of issuing fines undermines the idea that speeding is inherently wrong and should never be permitted. The economic penalty of speeding may be identical under either a fine or a tax. But whereas fines convey the signal that that which is penalised is inherently wrong, taxes signal that the activities are perfectly permissible and that individuals have a right to engage in such activities should they so wish. As Page (2009, pp. 21-2) summarises this worry, *"the public endorsement of financial motivations to protect the atmosphere will, over time, weaken the moral stigma associated with degrading the atmospheric sink, by transforming what was once a matter of intrinsic wrongdoing into an activity that now merely commands a price."* This in turn threatens to weaken the motivations that exist for agents not to pollute in the same way that taxing rather than fining speeding might increase the incidence of speeding even if the size of the economic cost to the speeder doesn't change.

Robert Goodin (1994) draws the parallel between carbon taxes and the selling of indulgences by the Medieval Church. Just as the Medieval Church had no right to sell God's grave—since this is something that the Church has no authority to distribute—existing governments have no right to sell the privilege of polluting the global commons. While we recognise that people need to emit GHGs in order to meet needs vital to their wellbeing and that people should therefore be allowed to emit some level of GHGs, we have no right to allow people to emit whatsoever quantity of GHGs they are prepared to be for. As Goodin argues, *"we might forgive people who despoil the environment for certain sorts of reasons—but the pursuit of pure profit (as represented in 'willingness to pay' green taxes) is not one of them"* (Goodin 1994, p.580). This issue of whether people should be entitled to purchase environmental indulges is explored further on in the chapter when we consider the morality of emissions trading.

4.6 Emissions Trading

While carbon taxes provide certainty regarding the costs of emissions-intensive activities, they provide no guarantee that emissions reductions will actually be achieved, as people can always pay to pollute rather than cut back on their use of emissions-dependent goods. For this reason, a number of commentators argue that an ETS is preferable to a carbon tax since it caps the overall level of GHG emissions (Chameides and Oppenheimer, 2007). As noted earlier, a number of countries have already introduced an ETS, with 35 countries having implemented or proposed an ETS by July 2009 (Page, 2009, p. 9). The Kyoto Protocol also includes provisions for tradable emissions permits in the form of the flexibility mechanisms built into the protocol, such as the Clean Development Mechanism (CDM). Under this scheme, firms and governments in Annex I countries can purchase certified emissions reductions from clean development projects in Annex II countries to use against their own emissions targets.

Broadly, existing ETSs can be grouped into two different categories—voluntary and mandatory (Page, 2009, p. 8). Voluntary schemes involve firms and individuals not bound by any legal requirements purchasing emissions allowances to offset their GHGs. An example is airline passengers purchasing carbon allowances to offset the emissions created by their travel. Mandatory schemes, on the other hand, legally bind participants through domestic legislation or international treaties to keep their GHG emissions within certain limits or to purchase additional emissions allowances. Under such schemes, participants are generally allocated— ither free of charge or via auction—a fixed number of emissions allowances—each worth a tonne of CO_2e—that they must surrender against each tonne of CO_2e emitted during the commitment period. Some schemes allow participants to 'bank' their emissions allowances for future use or trade during future commitment periods while 'allowance borrowing' is also permitted under some schemes—this is where participants use future allowance entitlements against their existing emissions (Page, 2009, p. 9), The EU ETS is perhaps the best-known example of a mandatory ETS and, in 2008, it was estimated to be worth a total of USD126 billion. In contrast, an estimated 54 million tonnes of CO_2e were traded in voluntary carbon markets in 2008 at a value of USD397 million (Capoor and Ambrosi, 2009, pp. 1-2).[26] If ETSs are to play an effective role in abating dangerous climate change, participation in such schemes will need to be mandatory rather than voluntary, as otherwise carbon leakage will occur, as discussed earlier. We will concentrate here on the normative issues and concerns associated with mandatory ETSs.

To fully understand these concerns, it is important to distinguish between the *cap* and *trade* components of ETSs, as each raise different ethical issues. Before any trade of emissions permits can begin some initial cap on, and allocation of, emissions rights/permits/allowances must be agreed upon. This raises a number of important questions, not least of which is working out what the total quantity of emissions allowances should be. Should we resolve this issue by conducting a cost-benefit analysis of climate change abatement to decide on an optimal level of GHG emissions—in which case the issue becomes fundamentally an *economics* problem—or should we seek to limit GHG emissions to a level that the atmosphere can safely absorb—in which case the issue becomes a *science* problem? Once a given cap on GHG emissions has been agreed upon, the next task is to find a fair way of allocating these emissions allowances amongst the participants in the ETS. We shall call this the problem of 'justice in allocation', and it raises a number of difficult and highly controversial questions:

- Should permits be freely allocated on an equal per capita basis, according to polluter's existing emissions profile (known as 'grandfathering') or according to some other principle?
- Should we allocate emissions permits upstream to firms and businesses (perhaps via auction) who then pass on the costs of these permits to consumers, or should emissions rights be allocated downstream to consumers?
- Do the same principles that apply to the allocation of emissions permits/rights between countries also apply to the allocation of emissions permits/rights at an intra-national level?

Once we have determined an overall emissions cap and initial allocation of emissions permits, the issue of the limits that should be placed on the transfer or trade of emissions allowances arises (what we might call the problem of 'justice in carbon trading'). For instance:

26 Cited in Page, 2009, p. 8.

- Should emissions rights be transferable (i.e. should we allow trading)? After all, it is possible to cap emissions and not allow any trading of unused emissions permits.
- Should the banking and lending of emissions rights/permits be permitted?
- If emissions trading is permissible, should people be entitled to trade away essential emissions allowances?

Questions about justice in carbon trading are conceptually distinct from questions about justice in allocation. People who agree upon principles of justice that ought to guide the allocation of carbon allowances can have very different views about the permissibility of carbon trading and the restrictions that ought to be placed on the transfer of emissions allowances, particularly for monetary gain. That said, if emissions allowances are not allocated fairly in the first instance, it may exacerbate any resulting inequalities if carbon trading is then allowed in the context of unjust underlying conditions (Eckersley, 2009, p. 101). Below we consider a range of approaches to the allocation of emissions allowances before moving on to consider what restrictions, if any, should be placed on carbon trading once emissions allowances have been allocated fairly.

4.7 Allocating Emissions Rights

4.7.1 Responsibilities of Polluting and Non-polluting States

The debate concerning the allocation of future emissions remains a key area of disagreement amongst the various parties to international agreements on climate change. The US and Australia have in the past refused to sign up to climate change agreements that did not also require China and India to adhere to emissions targets. Developing countries, for their part, have repeatedly argued that any allocation of emissions rights must leave room for their future economic growth and development. As Michael Grubb (1995, p. 483) has noted, "The question of how future emissions (or abatement efforts) should be allocated, and who should pay for the abatement, is at the centre of some of the most potent equity issues in climate policy." Many competing distributive principles have been proposed, although we shall concentrate on just four here: 'grandfathering' emissions rights; allocating emissions rights on an equal per capita basis; 'grandmothering' emissions; and auctioning emissions. Before explaining the details of each of these proposals and the differences between them, it is important to note that in addition to determining what constitutes a fair distributive principle for allocating emissions rights, an issue that bears no less significance on the question of justice in the allocation of emissions is the question of *who* the initial recipients of emissions allowances should be.

It is almost universally taken for granted that questions of justice in the allocation of emissions are largely settled once we determine what constitutes a fair allocation of emissions *between states*. Grubb (1995, p. 483), for example, characterises the issue of justice in allocation as fundamentally about solving the following question: *"having discovered that the global commons—in this case, the assimilative capacity of the atmosphere—is a limited and hitherto unclaimed resource, how should it be divided between nation-states?"* But it is far from clear that this is a correct characterisation of the problem. After all, hardly anyone would accept that giving all countries the same number of permits regardless of their population size constitutes a fair allocation of emissions rights even if it treats countries *qua nation-states* equally. This type of allocation of emissions would award Ireland, a state with a population of less than four million, the same number of emissions permits as India, a country with a population some 300,000 times larger. This would be grossly unfair to Indians *as individuals* (Baer, 2002, pp. 399-400). Those who believe emissions rights ought to be allocated according to a principle of equality generally favour allocating emissions between countries on an equal *per capita* basis. For it is individuals "who benefit from emissions and need access to energy sources (including fossil fuels) to meet there needs and pursue their conceptions of the good" (Caney, 2009, pp. 135-6). But if it is treating individuals equally that matters, why frame the question of justice in allocation as a matter of working out a fair allocation of emissions allowances between *states*? As Caney (2009, p. 136) argues, "*If we start with a commitment to each individual's human rights then we need a very good argument to show why the state is then entitled to pool these rights and decide whether to sell these rights to others.*"

Political discussions concerning the allocation of emissions rights take for granted the allocatin of emission rights in a global cap-and-trade scheme to *countries*, who are then responsible for distributing emissions permits to members of their population. But there is no guarantee that countries will distribute those emissions rights fairly amongst their own population. According to Beckerman and Pasek (1995, p. 408), "*Only a minority of countries in the world have genuinely democratic political systems and reasonably egalitarian economic institutions.*" Despotic regimes, for instance, may decide to reward supporters by giving them a greater share of the nation's emissions quota. Alternatively, corrupt politicians may decide to trade much of their nation's emissions quota for personal gain via an international ETS (Pan, 2001, p. 6). An international ETS that allocates emissions to states rather than individuals could thus allow unjust states "to deprive their own people of emissions rights and sell the rights to foreigners" (Caney, 2009, p. 137). An additional difficulty is whether a tonne of carbon emitted within a country's borders should count against *that* country's emissions quota if the beneficiary of those emissions is foreign. China, for instance, is a major exporter of goods to the US and to Europe. Many of the beneficiaries of the industrial emissions that occur on Chinese soil are therefore Americans and Europeans rather than Chinese people while Americans and Europeans, in turn, could be said to be responsible for far more emissions than those that merely originate from within their countries' borders. Indeed, Bin Shui and Robert Harriss (2006, p. 4063)[27] estimate that as many as 14 percent of China's GHG emissions between 1997 and 2003 were the result of manufacturing goods for export to US consumers while they further estimate that aggregate US emissions would have increased by 3 to 6 percent if those goods imported from China had been produced in the US.

A final concern with adopting a statist approach to the allocation of emissions allowances is it ignores vast differences in emissions levels within states (Baer, Athanasiou, Kartha, and Kemp-Benedict, 2010, p. 218; Caney, 2009, p. 136). Some developing countries include very wealthy people who emit large quantities of GHGs while developed countries also include many poor people who are relatively low-emitters. Allocating emissions allowances to states rather than individuals can allow heavy-emitters in otherwise low-emitting countries to avoid curtailing their GHG emissions if those countries receive greater emissions allowances than what they need as a whole.

For these reasons, the issue of justice in the allocation of emissions allowances cannot be reduced to the question of what constitutes a fair allocation of emissions rights between states, even if this is the way the debate is all too frequently presented. Bearing that in mind, we now turn to consider four different proposals of how to allocate emissions rights. For the purposes of simplicity, we shall largely discuss these accounts as they apply to the allocation of emissions permits between states although this should not be taken to mean that a statist approach is preferable to alternatives.

4.7.2 Grandfathering Emissions

A number of richer countries—most notably the US—have argued that the burden of climate change mitigation should be shared between all countries and that the global allocation of emissions rights should reflect historical differences in countries emissions levels. Under this approach, known as grandfathering, emissions permits would be distributed unequally between countries, with heavier emitting countries and countries that contribute a larger share of global GDP being given a greater allocation of emissions permits. For example, in the lead up to Copenhagen, a controversial proposal known as the Danish Text was leaked that proposed requiring developing countries to cap their emissions at 1.44 tonnes of carbon per person by 2050 while allowing richer countries to emit 2.67 tonnes of carbon per person (Vidal, 2009). Developing countries reacted furiously to the proposal on the grounds that anything less than an equal per capita allocation of emissions rights would be grossly unfair. However, emissions rights are grandfathered amongst Annex-I countries in much this same way under the Kyoto protocol. This is because the protocol merely requires Annex-I countries to reduce their emissions by an average of 5 percent compared to 1990 levels. Since it does not differentiate between higher and lower emitting countries (with the exception of developing countries who are not bound by any emissions reduction targets) but imposes equivalent reduction targets on all Annex I countries,

27 Cited in Caney, 2009, p. 135.

the Kyoto protocol effectively allows heavier polluting countries to continue emitting more GHGs than lower emitting countries (Hyams, 2009, p. 246).

A number of reasons are given to justify the grandfathering of emissions permits. One sort of argument in favour of grandfathering is what Simon Caney (Caney, 2009, p. 129) terms *the priority argument*. According to this argument, our most urgent priority is to avert dangerous climate change and major emitters need to be involved in mitigation if we are to succeed. However, major emitters will refuse to play their part in averting dangerous climate change unless emissions permits are grandfathered. Thus, while the grandfathering of emissions rights might not necessarily be a *fair* way of allocating emissions permits, the consequences of insisting on fairness would be even worse since none of the major polluters would be willing to reduce their emissions if fairness was insisted upon. As Axel Gosseries (2005, pp. 300-1) explains, *"egalitarians may accept some extent of grandfathering, not because it would be fair…but because doing so is the only politically feasible option to get enough countries to become part of a viable international regime that will in the end benefit the least well off."* This represents a pragmatic rather than moral argument for grandfathering emissions rights.

Nonetheless, some have tried to mount a moral argument in defence of grandfathering by pointing to the fact that, in common law, past usage and custom are often taken into account when awarding usage rights over a commons that is being closed off. For example, when fishing quotas were introduced in Europe in response to dwindling fish stocks, fishing licences were not allocated equally amongst all potential fishers but according to historical fishing patterns. Those who had become reliant on fishing as a source of income were given greater license to fish than individuals and groups who had historically shown little inclination to fish. By the same token, it is argued that countries that have become accustomed to a carbon-intensive way of life should be allocated a greater share of global emissions permits (Yamin, 1994; cited in Grubb, 1995, p. 487). We should grandfather emissions rights, in other words, so as '*to avoid imposing additional unfair burdens on those with carbon-intensive life-styles, who would have to make radical changes to their lifestyles if they are not given more [permits] than other agents.*' (Hyams, 2009, p. 247). Indeed, when applied to other commons, a grandfathering rule seems a much better approach to distributing usage rights than more egalitarian approaches that would award all members of the population an equal claim over the commons regardless of whether or not they have historically availed of the commons or developed a lifestyle that depends upon usage of the commons. Luc Bovens (2011, p. 140) gives the example of a lake that is used for boating. At a certain point, the number of boats using the lake reaches a tipping point—any additional boats would pollute the lake and detract heavily from the ability of other users to enjoy the lake. In such circumstances, Bovens argues that it would be reasonable to grant all existing boat owners licenses for their respective vessels and to restrict the ability of new boat owners to use the lake, allowing some trading of licences. This respects the investments in recreation that have been made by users of the lake. Conversely, ignoring the historical investments that existing users of the lake have made by allocating licenses equally to all living in the vicinity regardless of whether or not they have used the lake in the past seems unfair to existing boat owners. Bovens draws on Locke's theory of property rights in support of his position.

Locke famously argued that individuals could acquire property rights over previously unmanaged, common, land by mixing their labour with that land, provided that in acquiring a portion of land for themselves individuals leave as much and as good for others (this is known as the Lockean Proviso). As Locke (1986, pp. 130-1) stated, *"As much land as a man tills, plants, improves, cultivates, and can use the product of, so much is his property. He by his labour does, as it were, enclose it from the common."* Locke goes on to say, *"he that leaves as much as another can make use of, does as good as take nothing at all. Nobody could think of himself injured by the drinking of another man, though he took a good draught, who had a whole river of the same water left him to quench his thirst. And the case of land and water, where there is enough of both, is perfectly the same."* Locke also went on to argue that individuals' claims over land and other resources previously held in common are enhanced by their productive use of those resources, especially when these resources produce benefits not only for the individual land-owner but for others as well. As Locke (1986, p. 133) explains, "*he who appropriates land to himself by his labour, does not lessen but increase the common stock of mankind. For the provisions serving to support to the support of human life, produced by one acre of enclosed and cultivated land, are…ten times more, than those, which are yielded by an acre of land, of an equal richness, lying waste in common.*" In short, provided that individuals make productive use of land and other resources previously held in common, and as long as in their use of

this land and resources they leave as much and as good for others, they acquire rights over the land and the resources. Importantly, people's claims over resources do not depend upon those resources being distributed equally amongst all potential users but on their being used productively and in a way that does not leave others worse off.

Bovens draws on this understanding of the basis of resource claims to explain why the grandfathering of emissions permits is morally justifiable. Before industrialisation, he explains, "the atmosphere was a relatively unproductive commons…capable of absorbing a certain amount of GHGs without adverse consequences" (Bovens, 2011, p. 129). Following industrialisation, individuals and businesses "started using portions of this atmospheric capacity" and, initially, "this was done within the constraints of the Lockean enough-and-as-good and no-waste conditions: Many benefited, nobody was made worse-off, and all usage was productive usage." The first steam engine, for instance, "did little harm—nobody in Tuvalu was worse off because of *that* little puff of GHG" (Bovens, 2011, p. 132). The industrial revolution brought many benefits for developing countries, not just industrialising countries. We now know that we have gone well beyond the point at which the atmosphere can safely absorb our GHG emissions and so we must close off the global commons. We know that, for many decades, parties' usage of the absorptive capacity of the atmosphere did not leave as much and as good for others. Does this mean that we should therefore negate any claims to the global atmospheric commons based on historical emissions and usage patterns? Not so in Bovens' view. For up until a certain point, parties' appropriation of the atmospheric commons was entirely consistent with Lockean principles. While we must now find a way of regulating future usage of the global commons, this does not justify ignoring usage claims based on historical appropriation completely. Bovens (2011, p. 133) returns to the earlier comparison with restricting access to a lake,

"*suppose that we cultivate orchards (of different sizes) through homesteading and then realise that these orchards are drawing on a common water source that cannot support fruit farming of such intensity. Or suppose that we only realise that we have permitted too many vessels to enter the lake when fish stocks are already in serious jeopardy…Do we say that everyone in the vicinity—fruit-farmer or not, fishers or not—should now have equal access to the fruit yielding capacity of the lake and hence that larger operations should drastically downscale? I do not think so. We would, at least to some extent, respect differential investments made, especially the investments made at the time when these were morally unproblematic.*"

The implications of Bovens' argument is that the case for allocating emissions rights on an equal per capita basis is not as clear-cut as it seems. We would eschew granting usage rights to other types of commons on a strictly equal basis, so why should we not do the same with regard to the allocation of emissions rights? However, once we consider the potential consequences of grandfathering emissions rights in this way, we quickly see why the grandfathering of emissions rights is considered so problematic. One key issue is that the grandfathering approach will entrench existing inequalities by preventing those who are worse off from having the same opportunities and life chances as affluent citizens of heavier polluting countries.

As we have noted throughout this report, around 1.6 billion people worldwide—many of who live in South Asia—still have no access to electricity, while per capita energy use is 20 times higher in richer countries than it is in poorer countries. Consequently, the CO_2 emissions of poorer and less economically developed countries will have to rise for some time if these countries are to reduce widespread energy poverty and provide a minimally decent standard of living for all members of their population (Shue, 1993, p. 42). The grandfathering of emissions rights would effectively prevent poorer and less economically developed countries from tackling energy poverty thus *"lock[ing] members of developing countries into a permanent state of poverty and underdevelopment"* (Caney, 2009, p. 128). This is a grossly unfair response to a problem that poorer and less developed countries bear little responsibility for. Paul Baer draws an analogy to two people living on an island, Nora and Sam, who each have a pump that pumps water from a shared aquifer. Nora has acquired a pump that pumps water from the well three times as quickly as Sam's pump, enabling her to irrigate much more farmland. She quickly becomes a profitable farmer, enjoying the advantages that her wealth brings her (she builds a better house, purchases a more reliable car, has health checks more regularly, and so on). Since Sam's pump only provides enough water to feed a few chickens, he only barely manages to survive and his health suffers as a result. Nora and Sam soon discover that the aquifer is only capable of supplying a limited amount

of water per year—much less than they are currently using—just as Sam discovers how to pump water as quickly as Nora. The grandfathering of emissions is effectively like asking Sam to hold off on using his new pump and to continue only pumping small amounts of water from the well so that Nora can maintain her water intensive way of life. But now that they each have a big pump, Baer asks (2002, p. 397), "*why shouldn't [Sam] be able to use his? Should he agree to remain permanently poorer?*" Indeed, forcing Sam to continue drawing less water from the well would amount to rewarding Nora for her over-consumption of the commons. Similarly, the grandfathering of emissions allowances runs contrary to principles of historical justice—the 'polluter pays' principle—inasmuch as grandfathering emissions rewards polluters for their heavy-emitting past (Caney, 2009, p. 128).

4.7.3 Equal per capita emissions

Because many essential and important needs require the emission of GHGs, many believe that the only fair way of allocating emissions permits is to distribute them equally among all persons (or on an equal per capita basis between countries). "*Why should anyone have a greater claim to part of the global atmospheric sink than any other?*" asks Peter Singer (2008, p. 677). *"It is hard to see why being American or Australian gives someone a right to more emissions, or why being Brazilian or Chinese gives someone less of a right,"* as Dale Jameison (2010, p. 272) explains. Since people's life chances are heavily influenced by their access to emission-dependent goods, anything less than an equal allocation of emissions rights would give rise to unfair inequalities.

Essentially, there are two versions of the equal per capita emissions approach: a no-fault or time-slice approach and a historical accountability approach. The no-fault or time-slice approach, favoured by Peter Singer, brackets the question of whether countries have historically emitted more or less than their fair share of GHG emissions and instead concentrates on working out the overall level of anthropocentric GHG emissions that is acceptable for now and for the future, allocating emissions permits accordingly between all countries on an equal per capita basis. The principle of 'contraction and convergence' is an example of a time-slice equal per capita allocation of emissions insofar as the idea of contraction and convergence is that developed countries' respective GHG emissions should contract until they eventually converge with an equal per capita allocation of emissions (Bode, 2004, p. 305). Some object to this approach on the grounds that it encourages population growth (i.e. countries have an incentive to increase their population as doing so increases their share of emissions rights). But this objection can easily be countered by indexing countries' share of global emissions permits to some baseline year. For instance, emissions permits might be allocated to countries on the basis of their projected populations at 2050 so as to avoid penalising countries with younger populations (Singer, 2008, p. 678).

A second variant of the equal per capita approach that was proposed during the United Nations Framework Convention on Climate Change discussions takes a more historical oriented approach to the allocation of emissions rights. According to this latter approach—often referred to as 'the Brazilian Proposal' or the 'equal emissions per capita over time' approach (Bode, 2004, p. 304), it is not enough to merely distribute future emissions permits on an equal per capita basis. We must also consider countries' historical emissions given that those who have polluted heavily have benefited considerably in the form of increased wealth and more developed infrastructure. Such countries therefore have an ecological dept to repay (Baer, 2002, p. 402). As Rose (1990, p. 66) explains of why a strictly forward looking equal per capita allocation of emissions rights is unfair, *"Industrialised countries have developed by abusing the global commons with little or no penalty. Ignoring the past-build-up and simply basing reduction requirements on subsequent emissions would be equivalent to penalizing developing countries for the progress, when no such sanction was imposed on industrialised countries."*[28] Neumayer (2000, p. 188) likewise argues that *"[t]o ignore historical accountability would mean to privilege those who lived in the past in the developed countries and to discriminate against those live in the present or will live in the future developing countries."* Thus it is argued that we should work out what an acceptable emissions trajectory over time would have been for countries based on an equal per capita allocation of emissions and allocate future emissions rights accordingly, bearing in mind the actual historical emissions of

28 Cited in Bode, 2004, p. 306.

respective populations. Countries that have historically been major-emitters should now receive less than an equal per capita allocation of permits in recognition of the ecological debt they owe, while countries that have under-used the absorptive capacity of the atmosphere are entitled to a greater share of remaining emissions permits. Indeed, a particularly heavy-emitting country might receive no emissions permits whatsoever, as Bode (2004, p. 311) acknowledges.

The equal per capita emissions over time approach is favoured by supporters of so-called 'greenhouse development rights', who challenge the prevailing orthodoxy that a strictly equal per capita allocation of all future emissions rights will work to the benefit of members of developing countries. Baer et al., for example, point out that any attempt to stabilise emissions at 450ppm CO_2 will require global emissions to be capped at 4tCO_2 per capita by 2013, falling to just 1.5tCO_2 per person by 2050 (when the population is expected to be much larger). Developed countries have benefited considerably from their historic over-use of the atmospheric commons but the need to mitigate dangerous climate change now means that an equal per capita allocation of all future emissions rights would deprive developing countries of the atmospheric resources they need to develop on a similiar pathway (Baer et al., 2010, p. 221), *"the allocation of emissions permits to countries based on equal emissions today (or at some point in the future) ignores the fact that there is a much lower per capita budget available going forward than was used by the rich countries during the course of their development. Unless and until low—or no—carbon energy is cheaper than fossil energy, this fundamentally disadvantages developing countries."*

There are, however, a number of problems with the equal per capita emissions over time approach, particularly insofar as it is interpreted as a version of the polluter pays principle and as an attempt to include considerations of historical responsibility for dangerous climate change in mitigation proposals. For instance, it seems unfair to hold current members of more affluent nations responsible for over-use of the atmospheric commons by their predecessors when there is little that they could have done to alter the energy choices of their ancestors. Why, therefore, should people now living in developed countries have reduced access to emission-dependent goods when there is nothing that they could have done to prevent their predecessors from polluting so heavily? Moreover, many people now living in major-emitting countries such as Australia, the United States and Britain are immigrants who have migrated from low-emitting countries. They and their family members have played no role whatsoever in the historical energy choices of the countries they now live in so why should they now have to pay the costs of those choices (Caney, 2006, p. 470)? This objection becomes particularly salient when we consider that the equal per capita emissions over time approach allocates emissions rights in a way that potentially leaves members of some countries with no emissions permits whatsoever. Why should poorer children born into more affluent countries find themselves with little or no access to emissions-dependent goods when they bear no responsibility for the fact that they were born into one country rather than another and when they could have done little to influence the energy choices of their forebears? Another issue is the legitimacy of indexing the distribution of emissions permits against *countries'* historical emissions over-time rather than say families' or some other social groups' emissions over time. While a person might live in an affluent country whose members historically emitted far more than their fair share of GHG emissions, that person and that person's familial forbears may themselves have been low-emitters who contributed far fewer GHG emissions to the atmospheric commons than they were entitled to. Similarly, someone who now lives in a developing country that has historically emitted relatively few emissions might nonetheless be a member of a family that, collectively, has been a heavy polluter over time.

One response to this line of objection is to point to the many advantages that younger people living in developed countries enjoy over their counterparts in developing countries today—advantages that are largely the result of their nations' historical GHG emissions. As Shue (1999, p. 536) explains of the reasons why whether one is a Belgian or a Bangladeshi should matter when determining one's fair share of the costs and burdens of climate change mitigation and adaptation, *"Clearly one of the most fundamental differences is that the Belgian infant is born into an industrial society and the Bangladeshi infant is not. Even the medical setting for the birth itself, not to mention the level of prenatal care available to the expectant mother, is almost certainly vastly more favourable for the Belgian than the Bangladeshi. Childhood nutrition, educational opportunities and life-long standards of living are likely to differ enormously because of the difference between an industrialised and a non-industrialised economy."* Following Shue, it is certainly the case that people living in richer countries now enjoy many advantages over people living in developing

countries largely as a result of their nation's carbon-intensive industrialisation. This fact has a bearing on the fair allocation of emissions rights (see immediately below). Nonetheless, the advantages are not so great as to negate the need for emissions-dependent goods such as energy for heating and for cooking altogether. Insofar as this is the case, an approach to the allocation of emissions rights that would conceivably deprive people of *any* access to emissions-dependent goods is unjust as it fails to ensure that people have access to the goods and resources they need to lead even a minimally decent life. But this is not to say that there is no case whatsoever for moving away from a strictly equal per capita allocation of emissions.

Although the equal per capita emissions over time approach has much in common with the polluter pays principle, they are not strictly equivalent. Rather than viewing the approach as an attempt to incorporate considerations of historical responsibility into the allocation of emissions rights, it is instead possible to view the differential allocations favoured by the approach as motivated by a sort of equality of opportunity principle—all countries should have equal development opportunities. The argument would then be that the level of development achieved by richer countries means that their members no longer need to emit as many GHGs as members of developing countries in order to enjoy the same opportunities and life chances. This is because developed countries already have well-established public services (schools, hospitals and the like) and transport infrastructure whereas many developing countries have yet to build such infrastructure and to provide such services. Arguably, developed countries need a greater share of emissions rights so that they can provide such services and infrastructure to their population. In other words, as a result of differences in their development trajectories, countries now have different levels of need with respect to GHG emissions. However, as we will see below, this observation that countries may have different needs as a result of differences in their circumstances points to a more general difficulty with allocating emissions on an equal per capita basis.

4.7.4 Grandmothering Emissions

One strong objection to allocating emissions on an equal per capita basis—whether on a time-slice or historical accountability approach—is that differences in people's circumstances and situation, not to mention environmental and climatic differences between countries, mean some people need to emit more GHGs than others to have similar life opportunities. Axel Gosseries (2005, p. 301) highlights people living in countries with extreme climates such as Canada, "which requires significantly larger heating costs and other expenditures to preserve the same average level of opportunity for welfare." Another example Gosseries raises is people who live in countries with a high dispersion of housing, such as Australia, as this "increases the need for transportation, which has a clear impact in terms of GHG emissions per capita." Within countries too, different people have varying emission-dependent needs due to differences in their personal circumstances (Hyams, 2009, p. 249). There are also differences in the availability of energy sources that need to be taken into account when determining a fair allocation of emissions rights (Caney, 2009, p. 131). For while some countries have an abundance of renewable energy resources that they can utilise to provide for the energy needs of their population without requiring the use of many emissions permits, other countries have fewer clean energy resources that they can exploit. Small pacific island countries are a case in point, as their geography and small size makes the large-scale development of local energy resources problematic and costly. Because of problems with storing and transporting energy produced by wind, solar, and hydro, such countries may have to rely on importing fossil fuels to meet their energy needs. Allocating emissions rights on an equal per capita basis would therefore penalise such countries for their reliance on importing fossil fuels when, unlike countries such as Australia that have abundant renewable energy resources, there is little that they can do to avoid using fossil fuels to meet their energy needs. In short, allocating emissions rights on an equal per capita basis is implausible as a distributive principle as "it is indifferent to differences in people's needs. Some have greater energy needs than others and it is unfair to allocate them the same emissions rights as those less needy" (Caney, 2010b, p. 213).

Emissions are valuable only because of what they enable us to do; they do not have an intrinsic value. Indeed, it is *energy* rather than GHG emissions that is important in enabling us to achieve various functionings. And although energy use often results in the emission of GHGs, emissions-intensive forms of energy are substitutable for alternative energy sources that are much cleaner (Caney, 2009, p. 137).

Hence, if we want to reduce inequalities in people's life chances, what we should be looking to reduce is not inequalities in people's share of emissions allowances but inequalities in the level of access to the energy they need to meet important needs. The problem with allocating emissions on an equal per capita basis is that it *"does not take into account the fact that emissions may play very different roles in people's lives"* (Gardiner, 2004, p. 584). A fairer allocation of emissions allowances would be one that ensures that permits are allocated in such a way that people have equal opportunities to achieve a given set of functionings that, for the time being at least, require the emission of GHGs. This may mean that we have to give some people a greater share of emissions allowances than others to reflect differences in their circumstance that give rise to a greater need for emissions-dependent goods (for example, living in a cold climate or a country with few exploitable renewable energy sources). This approach to allocating emissions is what's known as 'grandmothering' emissions (Hyams, 2009, p. 249).

There are two distinct interpretations of the grandmothering principle: an egalitarian and a sufficientarian interpretation. According to the egalitarian interpretation, emissions allowances are to be allocated *"so that, insofar as is possible, the distribution does not affect any agent's opportunities for welfare any more or less than any other agents, as a result of circumstances beyond the agent's control"* (Hyams, 2009, p. 250). That is to say, emissions allowances should be allocated in a way that ensures that all people have more or less equal opportunities and life-chances. This is not to say that emissions allowances should be distributed more or less equally, since some people may need more emissions allowances than others in order to have similar opportunities and more or less equivalent life-chances. Moreover, the egalitarian interpretation of the grandmothering principle sets no minimum on the level of emissions permits that people need: whatever the quantity of emissions allowances that are available for distribution is, they should be distributed in a way that equalises opportunities for wellbeing. This is in contrast to the sufficientarian interpretation of the grandmothering principle, which necessarily requires that people some minimum level of emissions allowances.

On the sufficientarian approach, emissions allowances are to be allocated so as to ensure that all people can meet their basic and essential needs and achieve normal functionings, what is often referred to as ensuring that people have access to *subsistence emissions* (Shue, 1993, pp. 55-8). Significantly, if the share of global emissions that is needed to secure subsistence emissions for all is less than the overall quota of emissions that can be safely absorbed by the atmosphere, the approach is indifferent as to how the remaining emissions allowances should be allocated (Hyams, 2009; Shue, 1995, p. 250). Conversely, if the overall level of emissions that the atmosphere can safely absorb is less than is needed to ensure that everyone's basic and essential needs are met, the approach requires us to increase the overall number of emissions allowances *"even if this leads to an overall allocation above the scientific optimum"* (Gardiner, 2004, p. 585). As Martino Traxler (2002, p. 107) explains, when this is the case, "*we may with good reason speak of having so strong or so rationally compelling a reason to emit that, in spite of the harm these emissions will cause to (future) others, we are excused of our maleficence. Much like self-defence may excuse the commission of an injury and even murder, so their necessity for our subsistence may excuse our indispensable current emissions and the resulting future inflection of harm they cause.*" Many consider this to be a major problem with the sufficientarian interpretation of the grandmothering principle, particularly given the difficulties involved in determining which emissions should count as necessary for subsistence.

Traxler, for instance, proposes defining subsistence emissions in terms of what *"a society needs or finds indispensable in order to survive"* and in terms of *"what is needed or indispensable in order for members of a society to survive."* But as Gardiner (2004, p. 586) warns, "there is nothing to stop some people claiming that almost any emission is essential to their way of life." He gives the example of the first President Bush who, at the 1992 Earth Summit, declared, *"the American way of life is not up for negotiation."* Given that subsistence emissions are non-negotiable, adopting a rich notion of subsistence emissions could prove extremely dangerous. On the other hand, "*the claim that nonsubsistence emissions need not be distributed equally may lead some in developed countries to argue that what is required to satisfy the subsistence constraint is extremely minimal and that emissions above that level should be either grandfathered or else distributed on other terms favourable to those with existing fossil-fuel intensive economies"* (Gardiner, 2004, p. 585). Hence, notwithstanding the normative force of the idea that people should be guaranteed the share of emissions allowances they need to live a minimally decent life, the grandmothering of emissions will prove extremely difficult to implement in practice, particularly if we are to avoid increasing the overall quantity of emissions allowances beyond what the atmosphere can safely absorb.

4.7.5 Auctioning Emissions

The grandmothering approach delivered a major insight that emissions allowances have little value in their own right; what is most important is ensuring that people have access to the goods they need to achieve a decent minimum of wellbeing. The grandmothering approach drew on this observation to highlight the point that an unequal allocation of emissions allowances may be more consistent with egalitarian principles than an equal per capita allocation of emissions allowances precisely because of the latter's failure to consider differences in people's circumstances that give rise to varying energy needs and differences in the emissions-intensity of their consumption. In recent years, a number of commentators have developed this insight that GHG emissions have no intrinsic value to argue against the proposal that people have any fundamental right to be allocated a certain proportion of emissions allowances. Instead, it is argued that emissions permits should be auctioned off to the highest bidders rather than allocated according to a specific distributive principle, and the dividends from the auction should be used to combat poverty and to facilitate climate change adaptation and mitigation. For if what matters is that people have access to the goods they need to achieve a decent minimum of wellbeing, why should we think that providing them with emissions allowances rather than alternative goods best serves their interests? As Hayward (2007, pp. 440-1) argues, *"carbon emissions should not be the object of a human right because a decent human life does not inherently depend on them…Subsistence needs can be (and for the most of human history have been) met without fossil-fuelled economic development."* Simon Caney (2009, p. 137) similarly argues that *"fossil fuels are obviously not the only source of energy and they are substitutable by other energy sources…Therefore what we should seek are principles for the fair distribution of energy use (and its burdens)—not GHG emissions."*

The concern that critics of emissions rights such as Hayward and Caney have with the idea of a right to emissions allowances is that proposals to establish a right to minimum emissions *"tend to exacerbate rather than resolve the problem of excessive emissions"* (Hayward, 2007, p. 441). Rather than encouraging people to move away from emissions-dependent technology, such proposals can instead motivate people to claim a right to use emissions-dependent goods on the basis that such goods are essential to their wellbeing. Providing people with emissions allowances in itself does nothing to break their dependence on dangerous and harmful fossil-fuel technologies. Nor does it do much to reduce the disadvantages that poorer individuals and groups face in accessing the energy they need to meet basic and essential needs since those who are better off may be able to convert their emissions allowances into valuable energy services more efficiently due to their better quality housing, more fuel efficient vehicles, and more efficient appliance mix. Consequently, it is argued that we need to move beyond thinking of emissions allowances as basic goods to be distributed as a matter of justice and instead recognise that the salient human right is a subsistence right, *"not an emissions right"* (Hayward, 2007, p. 442). This is not to deny the role of GHG emissions in contributing basic goods and services that people need to achieve a decent minimum of wellbeing. However, that GHG emissions now play this role is largely a contingent historical fact; there is no necessary reason why a person's ability to secure the necessities of life should depend on her having a sufficient quantity of emissions allowances. Were sufficient affordable and dependable renewable energy sources widely available, people would not need to rely so heavily on emissions-dependent goods to secure their basic and essential needs.

While critics of emissions rights fully agree with those who argue that the atmospheric commons is a resource to which all have an equal claim, they argue that what people have an equal claim to is not so much equal *usage* of the global commons but an equal right to *benefit* from the commons. As Hayward (2007, p. 447) explains, "*it is not the distribution of emissions that is a primary concern of justice, but the distribution of benefits that are drawn from dramatically unequal ecological space usage. What the rich owe to the poor should be seen not as 'more emissions' but as an equitable share of the benefits they have derived from their unjust appropriate of more than their share of ecological space.*" In this respect, *"a fair emissions policy may take the form of disbursing the revenues raised from selling permits rather than allocating permits"* (Caney, 2009, p. 138). Barnes et al. (2008, p. 724), for example, propose auctioning off all emission permits and using the revenues from the sale of these permits to establish an Earth Atmospheric Trust to be used for the benefit of current and future generations. They propose returning *"a fraction of the revenues derived from auctioning permits to all people…in the form of an annual per capita payment"* and estimate that as much as USD285 per person could be returned if emissions permits achieve an auction price of USD80 per tonne. While this additional income may not make much

difference to those who are already wealthy, it would have a substantial impact on the quality of life of those living below the poverty line. For instance, the revenues from the auction might be distributed to the least advantaged *"to ensure that they have access to the energy sources they need to attain a minimum standard of living"* (Caney, 2009, p. 140). The remaining revenues from the auction would then be used to fund climate change mitigation projects, such as *"renewable energy projects, research and development on new energy sources, or payments for ecosystem services such as carbon sequestration"* (Barnes et al., 2008, p. 724). A proportion of auction revenues could also be used to pay for vital adaptation measures given that *"money is required to assist developing countries to adapt to the climate change to which the world is already committed"* (Caney, 2009, p. 140).

4.8 Should Emissions Rights be Transferable?

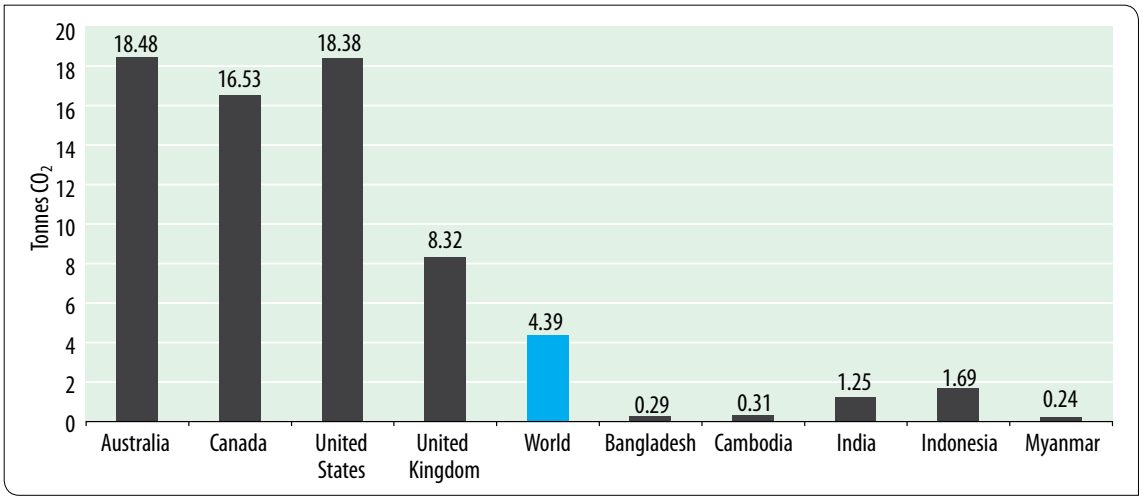
We have considered a range of approaches to allocating emissions allowances, each of which claims to provide a just way of allocating emissions permits. However, this is only one part of the picture, as we also need to consider the principles that should guide the trading of emissions once the initial allocation of permits has been made. Indeed, it is reasonable to ask whether any trading of emissions should be allowed at all. After all, if the initial allocation of emissions allowances is fair, what reason is there to allow departures from that just allocation? Below we consider a range of arguments for and against emissions trading and the limits that should be placed on the transferability of emissions allowances. The principal arguments in favour of allowing the trade of emissions permits appeal to the supposed efficiency and distributive benefits of emissions trading, while critics of emissions trading argue that it is ultimately a form of neo-liberal colonialism that unfairly allows rich polluters to buy their way out of their moral responsibilities.

4.8.1 Efficiency and Distributive Benefits of Emissions Trading

One reason in favour of allowing the trade of emissions permits is that it enables emissions reductions to be achieved at lower cost. From the perspective of mitigating further dangerous climate change, it makes little difference whether emissions reductions are achieved by everyone curtailing their emissions to the same extent or by some curtailing their emissions more than others provided that the aggregate emissions reduction is the same. The advantage of allowing emissions permits to be traded, however, is that it reduces the costs of achieving the desired emissions target in cases where polluters face different marginal costs in cutting back on their emissions. For instance, a firm or individual that finds it very costly to adhere to its emissions quota can try to minimise compliance costs by paying another firm or individual who can reduce its emissions more cheaply to do so in its place. Moreover, the possibility of profiting from the trade of emissions permits also creates an incentive for individuals and firms who can reduce their emissions at low cost to do so. This should result in emissions reductions occurring where they can be achieved most cheaply (Garnaut 2008, p. 302).

Alternatively, under the flexibility mechanisms of the Kyoto Protocol (discussed below), participants in ETSs that find it costly to keep within their emissions allowances can purchase carbon credits by investing in clean development projects, for which they receive certified carbon reductions that effectively enable them to increase their emissions quota. The purchase of emissions permits and carbon credits by heavier polluters from other parties should, in theory, also result in a significant redistribution of wealth, another supposed advantage of allowing the trade of emissions allowances particularly if a global cap-and-trade scheme is operationalised. Consider, for instance in Figure 2, that in 2008, average global CO_2 emissions from fuel use were 4.39 tonnes per person (IEA, 2010, p. 95). Now, if we suppose that any emissions permits must be allocated on an equal per capita basis, adopting even the extremely modest target of keeping CO_2 emissions to 2008 levels would mean that the United States, Canada, and Australia each have to acquire an addition 12 tonnes per person of emissions permits in order to sustain existing consumption behaviours. They could do so by purchasing unused emissions permits from countries such as Bangladesh, Cambodia, Indonesia, India, and Myanmar (amongst others), each of which emits considerably less than 4.39 tonnes of CO_2 per person. Such trading in emissions would result in a substantial transfer of economic resources from developed to developing countries, reducing socio-economic inequality.

Figure 2: CO_2 emissions per capita in selected countries for 2008



Source: IEA 2010, pp. 95-97

However, it is important to recognise that permitting the trade of emissions allowances will only succeed in reducing socio-economic disadvantage if emissions permits are allocated fairly in the first instance. If emissions permits are initially grandfathered, a cap-and-trade approach would most likely only exacerbate existing inequalities inasmuch as the global poor would have few additional emissions allowances to trade. Another potential problem with the idea that carbon trading will reduce inequalities is the complexity of ETSs. The worry here is that the information and knowledge that is required for people to participate effectively in and benefit from carbon trading—particularly if the banking and borrowing of allowances is permitted—is so complex that those who are worse off will inevitably find themselves in a position of unequal exchange due to lack of education and inability to purchase the advice they need to participate effectively in the scheme (Page, 2009, p. 12). These objections to carbon trading are explored below.

4.8.2 Distributive Concerns and Protecting Subsistence Emissions

If emissions permits are allocated on an equal per capita basis or on an equal per capita over time basis, permitting the trade of emissions allowances could result in a vast redistribution of wealth from the rich to the poor. However, if emissions permits are allocated initially to states rather than individuals, there is no guarantee that governments will pass on those emissions permits on an equal per capita basis to their own population. Instead, governments might decide to sell some of their emissions quota without passing on the proceeds to disadvantaged members of their population. Hence, the ability of an ETS to reduce socio-economic disadvantage depends heavily on the goodwill of governments and on emissions permits being allocated fairly in the first instance. Unfortunately, there is little reason to be confident that the benefits of emissions trading will reach the poor even if emissions permits are allocated fairly between countries in international agreements.

Many of the countries that stand to gain the most from the sale of their unused emissions permits are ruled by elites who have to date shown little concern for the welfare of the poorer members of their own population. Political inequality in developing countries might enable elites to gain control over the distribution and sale of their country's emissions allowances. As Pan (2001, pp. 6-7) argues, *"If the government officials were irresponsible or corrupt, all the emissions rights might be sold on the international market for the financial gain of a few, leaving no prospect for use by others or for the future."* Pan worries, in particular, that the lure of profit from the sale of emissions permits to firms and individuals in affluent countries might motivate powerful elites to trade away the emissions quota that politically excluded members of their own population need in order to meet their basic and essential needs (Pan, 2001, p. 10). This is especially a risk if governments decide to auction emissions permits to the highest bidder rather than distributing them fairly amongst the population. If no restrictions are placed on the auctioning

of emissions rights, there is a danger that affluent people living in industrialised countries who find it too much of a burden to alter their lifestyle might outbid poor farmers in developing countries for the emissions rights they need to grow essential crops (Shue, 1993, p. 57). There is also a danger that speculators might buy up large quantities of emissions rights so that they can hoard those emissions permits for the sake of increasing their value and making a substantial profit from their future resale (Eckersley, 2009, p. 109). Alternatively, affluent firms and individuals might acquire large quantities of emissions permits from developing countries merely so that they can 'bank' these permits to protect themselves against future increases in the price of emissions permits. In either case, there is a danger that the opportunity to profit substantially from the auctioning of emissions permits will motivate either governments or individuals to sell the emissions permits that are needed to meet basic and essential needs to affluent firms and individuals in developed economies that are willing to pay a premium to maintain themselves in luxury. To protect against such possibilities, Shue (1993, p. 57) proposes that the populations of poor regions be allocated an inalienable quota of subsistence emissions rights that cannot be traded on the international market, a proposal also supported by Pan (2001, p. 10),

"*It is possible under free trading that the poor would ultimately be deprived of their rights even though they were allocated the same amount as the rich in the beginning. To prevent this from happening, emissions rights may be separated into different categories. Basic necessity rights are associated with the satisfaction of basic needs of individuals. They should not be transferable and should not be manipulated by political processes. They should be assessed and allocated independent of any economic considerations. No market transactions on this part of emissions rights should be allowed.*"

The possibility that emissions trading might result in the poor having to forgo basic and essential needs is not necessarily a concern that is limited to the international trading of emissions rights. After all, the economic pressures of poverty coupled with the epistemic obstacles that disadvantaged participants face due to the complexity of ETS may mean they end up trading away their subsistence emissions in a domestic market. Nonetheless, what makes the concern particularly pertinent in the international case is the danger that poor and disadvantaged groups won't be given any say in trading decisions. It is for this reason that a number of commentators who are opposed in general to placing restrictions on the domestic trading of emissions permits are nonetheless willing to allow restrictions on the international trading of emissions rights. As Keith Hyams (2009, p. 244), for example, argues, *"in the international case, the consequences of a government's decision to sell emission quotas fall not only on the government itself, but also on the individual citizens whom it governs…we should not limit trading in order to protect individuals against themselves, but perhaps we should limit trading in order to protect individuals against their governments."*

4.8.3 Trading undermines Mitigation Efforts

Besides the worry that emissions trading may result in the poor having to go without basic necessities so that rich polluters can continue to enjoy their luxurious, carbon-intensive life-style, there is also a very real concern that permitting the trade of emissions allowances might in practice undermine the effectiveness of global climate change mitigation efforts. The concern is that allowing firms and individuals that find it too costly to keep within their allowances to purchase additional emissions permits minimises the incentives that exist for people to change their carbon intensive consumption patterns. As Tim Hayward (2007, p. 434) expresses this worry, *"If effective longer-term emissions reduction strategies require expensive structural changes, there is little incentive to make these when operators can meet their immediate targets by acquiring emissions credits more cheaply from the market or via CDM projects."* Moreover, if individuals who would otherwise happily reduce their carbon emissions for the sake of the environment come to believe that their government will simply trade their unused emissions allowances this could undermine abatement efforts. As Hasen (2009, pp. 2-3) argues, *"Consider the perverse effect cap and trade has on altruistic actions. Say you decide to buy a small, high-efficiency car. That reduces your emissions, but not your country's. Instead it allows somebody else to by a bigger S.U.V.—because the total emissions are set by the cap."*

The ability of participants in existing ETSs to purchase carbon credits from CDM projects is of particular to carbon trading critics. Under the Kyoto Protocol, Annex I countries bound by emissions reductions

targets can achieve part of their emissions reductions target by sponsoring clean development projects in non-Annex I countries in lieu of making domestic emissions cuts. The rationale for this is that the location of emissions reductions doesn't much matter so long as aggregate GHG emissions are reduced. Hence, it is unimportant whether Annex I countries achieve emissions cuts by cutting back on domestic emissions or by sponsoring clean development projects that achieve emissions reductions in developing countries. Hence, if it is cheaper for Annex I countries to sponsor CDM projects rather than reducing their domestic emissions they should be allowed to do so as this is an economically more efficient use of resources. Likewise, the EU ETS similarly allows firms to meet their emissions allowances by purchasing certified emissions reductions (CERs) from CDM projects in place of cutting back on their own emissions (Nicholas Stern, 2010, p. 69). This is justified on the grounds that the emissions reduction achieved by CDM projects would not otherwise be achieved were developing countries prevented from selling CERs to Annex I countries and to firms participating in ETSs. To take an example: it is cheaper for an energy generation company in China to build a coal-fired power station rather than a hydropower plant. Therefore, the company will ordinarily choose to build the dirtier coal-fired power station. However, if the company is allowed to sell the emissions reductions that would be achieved by building a hydropower plant instead of a coal-fired station, the economics of the situation change and the company might decide to opt for the lower-polluting technology on the grounds that it can earn increased revenues by selling CERs (Wara, 2007). But the problem with CDMs in their current form is that developing countries are not locked into any emissions targets under the Kyoto Protocol. This means that it is extremely difficult to know whether the emissions reductions achieved by CDM projects are *additional* emissions reductions or whether they are emissions reductions that would have been achieved regardless of Annex-I countries' and firms' willingness to purchase CERs (Caney, 2010b, p. 218). Indeed, there is a further danger that the possibility of profiting from selling CERs is itself motivating businesses in developing countries to 'manufacture' additional pollutants merely so that they can paid to destroy them. CDM projects in China involving the reduction of HFC23 emissions—a highly potent pollutant created in the production of refrigerants—are a case in point.

CDM projects involving the destruction of HFC-23 deliver more CERs per dollar of investment than alternative CDM projects, such as the construction of large-scale renewable energy infrastructure (Talberg and Nielson, 2009, p. 13). As a consequence, firms and governments in developed countries have shown much more interest in supporting CDM projects that involve the capture and destruction of HFC-23 over alternative, much more valuable types of project, such as projects that reduce CO_2 emissions from electricity generation. Indeed, CDM projects involving the destruction of HFC-23 are by far and away the most popular type of CDM project, accounting for around 30% of all projects (Wara, 2007, p. 595). This issue here is that *"the presence of cheap non-C02 credits such as HFC-23 in the market is a disincentive to developing new carbon-limiting energy projects."* This is major concern because, as Michael Wara (2007, pp. 596, 595) has pointed out, *"Although many gases cause global warming, CO_2 matters most because it is emitted in prodigious quantities and has a long atmospheric lifetime."* Moreover, because companies that are paid to reduce their HFC-23 emissions under CDM projects earn almost twice as much from capturing and destroying HFC-23 than they do from the sale of refrigerant gases, there is a very real worry that the existence of such schemes is creating an incentive for firms in China and elsewhere to produce even more HFC-23 emissions than they would otherwise have emitted (Caney, 2010b, pp. 217-218). Hence, insofar as parties to existing ETSs can acquire additional emissions permits by purchasing carbon credits from CDM projects, there is a very real danger that such ETSs will fail to achieve any significant reduction in GHG emissions. Since parties can always top up their emissions quotas by purchasing cheap CERs from CDM projects, *"investor countries have little incentive to undertake restructuring at home"* (Ott and Sachs, 2000, p. 21). For this reason, many commentators have argued for a cap on the number of CERs that firms and countries can use against their emissions quotas, while it has also been proposed that CERs be limited to CO_2-lowering projects to reduce the risk of the presence of cheap CERs undermining the development of carbon-limiting energy projects (Ott and Sachs, 2000, p. 21; Wara, 2007, p. 596).

4.8.4 Emissions trading and responsibility

The objections to emissions trading that have so far been considered are largely practical criticisms related to the claim that carbon trading is an effective abatement measure that simultaneously promotes redistribution to the disadvantaged. However, one of the strongest objections is that carbon trading is inherently unjust. According to this argument, even if we reformed the flexibility mechanisms of the Kyoto Protocol and allocated emissions permits to individuals so as to reduce the risk of political regimes trading away their citizens' subsistence emissions, emissions trading would still be unjust. A number of different objections to the very idea of carbon trading are given here. One sort of argument is that the commodification of atmospheric space that carbon trading involves will cause people to misvalue the environment inasmuch as it will encourage people to think of the environment as having only instrumental rather than intrinsic value. As Page (2009, p.17) puts this argument, *"emissions trading makes it impossible for an agent to appreciate the value of the atmospheric sink not merely as a mechanism for the absorption of human waste but also as an intrinsically valuable component of the natural environment, which, in turn, is related in a constitutive rather than instrumental way to the pursuit of a decent human life."* Another objection to carbon trading in any form is that it leads to the hollowing out of moral responsibility for climate change mitigation (Eckersley, 2009, p. 102).

The problem with carbon trading, it is argued, is that it shifts the burden of climate change mitigation onto the global poor by allowing rich polluters *"to buy their way out of their commitments."* For "*it is not enough that the polluter pays; the polluter has got to change as well"* (Ott and Sachs, 2000, p. 17). Everyone has a duty to limit the size of his or her carbon footprint to a sustainable level. Allowing those who are unwilling to reduce their own carbon footprint to pay others to further reduce their GHG emissions so that they don't have to change their consumption behaviours unfairly allows people to buy themselves out of their responsibilities. It also aggravates existing inequalities in people's access to emission-dependent goods by allowing those with a greater ability to pay to access more goods. As Eckersley (2009, p. 103) explains, *"Why should those with the capacity to pay have the right to pollute more than those who lack the capacity to pay? Why should anyone be allowed to exceed her 'fair share' of emissions or postpone her day of reckoning simply because she can afford to pay others, especially if it involves a purchase of subsistence emissions to enable the continuation of luxury emissions?"* This objection to emissions trading has been popularised by the website www.cheatneutral.com, which draws a comparison between the purchase of emissions rights and paying for the privilege of cheating on one's partner. According to the website, *"When you cheat on your partner you add to the heartbreak, pain and jealousy in the atmosphere."* The website offers those who find it too difficult to remain faithful to their partners the opportunity of offsetting the pain and suffering they are causing by *"funding someone else to be faithful and NOT cheat."*[29]

However, the analogy between (i) a polluter neutralising his or her carbon footprint by paying someone to reduce their GHG emissions and (ii) an unfaithful partner paying someone else to be faithful by way of offsetting his or her own unfaithfulness doesn't work. First, the duty to be faithful to one's partner is a duty that, logically, can only be fulfilled by the particular individual concerned. As Caney (2010b, p. 211) explains, *"my duty to be faithful to my spouse requires that I do certain things (or rather do not do certain things)."* It is a duty that cannot be performed by others on my behalf without compromising the good it is intended to promote. The same is not true of any duty to limit GHG emissions, since whether dangerous climate change is avoided by some limiting their emissions more than others or by all limiting their emissions equally is immaterial so long as aggregate emissions remain below the relevant threshold. Nonetheless, we might still think that there is something fundamentally wrong with the idea that people should be allowed to escape their climate change mitigation duties by paying others to perform these duties on their behalf, in the same way that no one should be allowed to escape their public duties by paying others to perform, for example, jury service, military service, or voting on their behalf.

However, this example is not analagous to climate change mitigation. Allowing people to pay others to perform jury duty on their behalf, or to vote on their behalf, would threaten the integrity of our democratic and judicial institutions. For the functioning of such institutions depends upon voters and

29 http://www.cheatneutral.com/ Accessed 15/05/2011. Emphasis added.

jurors being motivated by a concern for justice and the public good rather than by money (imagine the consequences of allowing voters to sell their votes and jurors to sell their verdicts). The same is not true of climate change mitigation efforts since whether each of us curtails our GHG emissions to the same extent or whether some limit their GHG emissions more than others makes no difference to the overall outcome of mitigation efforts. Nor does it matter whether it is self-interest and money that motivates people to reduce their GHG emissions or a concern for the wellbeing of others (Caney, 2010b, p. 200). That said, we might still think that allowing people to purchase additional emissions allowances is problematic on the grounds that the commodification of emissions cuts against people internalising a belief in the wrongfulness of pollution that, in the long-term, may undermine abatement efforts. This, as we have seen, is a charge that is also levelled against carbon taxes.

4.9 Conclusion

Carbon tax initiatives and ETSs in principle provide the possibility of achieving emissions reductions at less social cost than alternative abatement mechanisms. However, as this chapter has outlined, unless a global approach is adopted to either carbon taxes or an international ETS, neither market-based approach is likely to deliver significant emissions reductions due to problems of carbon leakage and the danger that carbon-offsetting under an ad hoc approach to emissions trading will allow parties to escape their emissions-reduction obligations. There are also important social justice and distributive concerns that must be addressed under any market-based approach to climate change abatement. Specifically, carbon levies are essentially a regressive form of taxation, especially if a single carbon tax is applied at the global level. Consequently, unless the revenues from carbon taxes are recycled and directed towards the alleviation of poverty and disadvantage, the introduction of carbon taxes could have a highly destructive effect on the human security of poor and disadvantaged groups. In the case of emissions trading, if initial emissions permits are not allocated fairly between *and within* countries, the auctioning of emissions rights could threaten basic and essential energy use for poor and disadvantaged groups. Finally, while many economists favour carbon taxes over alternatives because they provide certainty regarding the costs of pollution, calculating the 'correct' price of carbon emissions is extremely difficult, not least because many of the assumptions currently made when calculating the social cost of carbon are at best ethically suspect.

5. Conclusions

This report has examined the ethical, legal and economic implications associated with energy equity and climate change in the Asian Pacific region. These approaches each emphasize different factors that must be considered when forming regional and national energy and climate change policies. The report concludes that it is important to take a holistic approach to these issues and consider environmental security instead of merely human security.

Ethical principles require that regional and national energy policies target the reduction of energy poverty as a matter of urgency. These principles also support taking into account the interests of future generations, other living organisms and the integrity of ecosystems to ensure that energy needs are met in a sustainable way. Finally, commonly accepted principles such as the 'ability to pay' principle necessitate that more affluent countries assist poorer countries in meeting the costs of sustainable development through, for example, resource and technology transfers.

The human rights perspective highlights the need to recognise access to energy as a human right since it supports the achievement of other basic human rights. Using a human rights approach empowers individuals and groups to seek redress against governments, but there is also a concern that the emphasis on the individual will neglect to consider the environment in the choice of energy technology. The application of the ethical principles discussed in chapter 2 support the use of sustainable energy technology in this context.

Although economics applies a utility maximisation approach to the formulation of climate change mitigation policy, it is important to consider the ethical and social justice implications associate with the design of market-based mechanisms. The introduction of a carbon tax has the potential to undermine the human security of poor and disadvantaged groups if not implemented equitably. There are similar consequences if initial emissions permits are not allocated fairly between *and within* countries.

This report has demonstrated that policy options cannot be implemented in a vacuum, but must consider the various ethical, legal and economic concerns that have been highlighted throughout the report. While no doubt these perspectives sometimes lead to conflicting conclusions, it is important that policy-makers are fully aware of the implications when faced with policy choices.

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