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MAPPING GLOBAL TO LOCAL CARBON INEQUITIES IN CLIMATE GOVERNANCE- A CONCEPTUAL FRAMEWORK

[1,2]*Mahendra Sethi

[1]National Institute of Urban Affairs, New Delhi, India
[2]United Nations University - Institute for the Advanced Study of Sustainability, Tokyo, Japan

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ABSTRACT

Earth systems are increasingly becoming vulnerable to rampant use, misuse and abuse of natural resources by the humankind, carbon being the most critical. Across the globe, there is an unprecedented demand of fossil-carbon to fuel national economies, while it is their urban centres that act as the guzzling engines of energy and carbon rich fuels. As the world urbanizes further, the 21st century poses a serious challenge in tinkering the global inequities in access and allocation of carbon. Traditionally, disparities were evaluated and negotiated from purely economic or 'state of development' perspective. While current global climate governance is in policy paralysis over differences in access and allocation of the carbon space, this research attempts to address the fundamental issue of equity and fairness in this debate. It explores theoretical discourse on (a) how carbon inequities thrive within the prevailing climate regime (b) growing role of ethics, fairness and justice in climate governance, and (c) empirical access and allocation of carbon. The paper challenges the 'North-South' duality and devises a conceptual framework to empirically measure the varying patterns of carbon access from global to local scales. The research bridges links between major global changes- carbon space and urbanization and would be of utmost interest to researchers, policymakers and avid readers of international environmental governance. In view of the inclusion of cities as Goal 11 within the upcoming sustainable development goals and the COP21 to be held in Paris in 2015, this paper offers a shifting paradigm in global climate governance.

INTRODUCTION

The earth systems are undergoing a change at an unprecedented pace and scale. The Intergovernmental Panel on Climate Change (IPCC) emphasizes that "changes in atmospheric concentrations of greenhouse gases (GHG) and aerosols, land cover and solar radiation alter the energy balance of the climate system" (IPCC 2007) and present and anticipated impacts are going to be severe and widespread. Within this global change, earth systems are increasingly becoming vulnerable to rampant use, misuse and abuse of natural resources by the anthropos, fossil-carbon being the most critical; whether it is for access to energy on the terrestrial space or about carbon emissions in the atmospheric space. This forms a basis for an informed, logical and systematic understanding of who all are responsible for unwarranted carbon utilization and how could its *access and allocation* (AA) be mapped within an ethical, political and environmental governance framework. Traditionally, the most visible distinction in consumption of carbon cuts the globe across the lines of developed countries (or North) and the developing countries (or South) collectively termed as the North-South (NS) divide. The current multilateral climate regime, United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol broadly recognize this reality under the principle of ''common but differentiated responsibilities" (CBDR), as 'Annex I' countries who should ''take the lead'' in reducing carbon emissions, and, 'Non-Annex-I' countries who are given no such targets. Meanwhile, in addition to the traditional NS distinction, there is another line that has divided the globe quite recently, as greater-half of the world has become urbanized for the first time in the human history (UNDESA 2012). Some accounts strongly associated with production and consumption of energy within cities indicate that more than 70% of the global greenhouse gases are produced within the urban areas (Stern *et al* 2006) and that they consume 60–80% of final energy use globally (GEA

Corresponding author: Mahendra Sethi
[1]National Institute of Urban Affairs, New Delhi, India
[2]United Nations University - Institute for the Advanced Study of Sustainability, Tokyo, Japan

2012). The issue is of a serious concern in the developing world, because as these countries urbanize, the contributions of carbon and GHG emissions from cities starts becoming disproportionately high in comparison to their population share (Satterthwaite, 2009). This is in line with evidence from recent UNDESA data on urbanization and carbon emissions across different geo-political regions (Table 1). This research investigates the hypothesis that: *the existing inequities in the international climate governance, evident in the so called global 'North-South' divide, is actually an 'Urban-Rural' emission disparity in the making.*

interdependence is a defining characteristic as well as a key challenge of earth system governance that requires an effective institutional framework for global co-operation, more so than most other areas of foreign policy. The interdependence is evident for carbon space in multiple ways (i) the countries mutually share the carbon space as 'global commons' both to avail and as a sink to sequester (ii) the rich and high emitting people share the global terrestrial space, irrespective of their nationality or NS duality in the sense they exist everywhere (Chakravarty *et al*., 2009, Kartha *et al*., 2012).

Table 1. State of economy, urbanization and carbon emissions across various regions

Regions	(1) Total Population (in 000's) 2010	(2) Urban Population (in 000's) 2010	(3) Urban population (% of total) 2010	(4) Annual rate of Urbanization 2005-10	(5) GDP/capita at PPP 2005 constant international dollars 2009	(6) Carbon Emissions (tons/ capita) 2007
World	6 895 889	3 479 867	50%	1.9%	9547	5.8
More Developed Regions	1 235 900	928 853	75%	0.7%	28670	8.18
Less Developed Regions	5 659 989	2 551 304	45%	2.4%	5218	5.51
Least Developed Countries	32 330	242 769	29%	4.0%	1252	0.49

Source: UNDESA (2012)

1. Knowledge Gaps

Though inequalities in the past were evaluated and negotiated from purely economic or 'state of development' perspective, it seems likely in the 21st century, that an increasingly urbanizing world will pose a serious challenge in reshaping the contours of internationally evident disparities in carbon AA. The research paper does so by exploring intermittent research gaps within the prevailing knowledge domains of three cross-cutting themes, viz: (i) Access and allocation of carbon (ii) Governance and (iii) Ethics, fairness and justice (Figure 1).

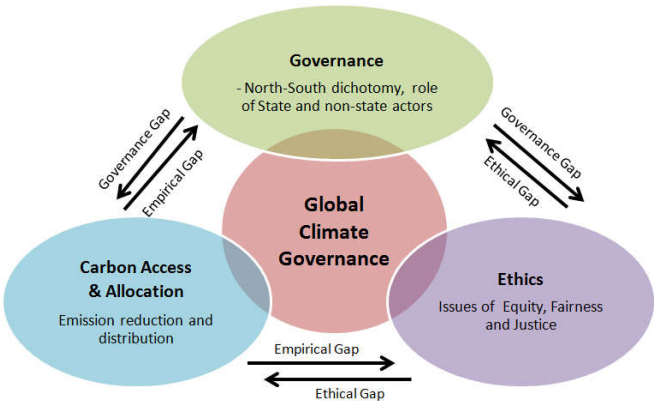


Figure 1. Effective global climate governance for fair access and allocation of carbon can be understood through interlinkage of three distinct themes. They represent prevailing knowledge domains and help identify intermediate research gaps

First, the *empirical gap* that seeks to scientifically understand the complex transformations at play from diverse perspectives, beyond the obvious norms of economy (GDP) or NS bi-polarity. Anthropogenic transformation of the earth system creates new forms and degrees of (global) spatial interdependence (Biermann, 2007). It is further noted that spatial ecological interdependence binds all nations. This creates a new dependence of states, even the most powerful ones, on the community of all others. This spatial

As such, empirical research into spatial (location) basis of emissions is necessary to understand who is the actual looser of carbon. The need to have a first-hand spatial perspective– of the carbon space in the atmosphere and urbanization on ground could become fundamental to the debate on fair AA and for informed transformation to sustainability. The *ethical gap* looks into what could be fresh insights from our understanding of ethics and equity to this practical challenge of global change. It has been thoroughly recognized that allocation mechanisms and criteria will become vital interrogations for social scientists and decision-makers, considering the fact that North-South dichotomy has taken centre stage in environmental governance, particularly climate (Gupta, 1997; van Harro *et al*., 2005). It has been regularly suggested (Biermann *et al*., 2012, Prum 2007, Adger *et al*., 2005) that fairness, equity and justice need to be at the heart of global environmental change and strong regime. They regard new principles devised to ethically address state interests as a pre-requisite to any outcomes in future negotiations on climate change. They seek deeper ethical understanding of the situation which steers ahead of the conventional norms to access and allocation of carbon.

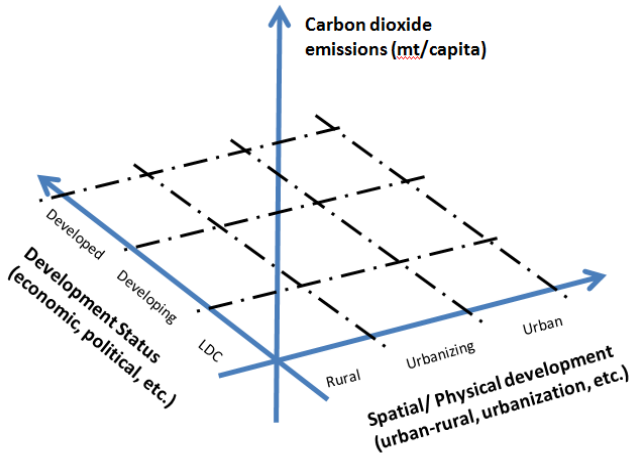


Figure 2. A conceptual framework to analyze shifting inequities from global North-South to local urban-rural

Yet, it has been acknowledged that research in this field has been scarce in the past, in particular regarding empirical research programmes that could lend substance to the more *policy-oriented*, *philosophical treatises on equity* (Biermann 2007). The *governance gap*, is in search of appropriate means and methods by which the global society could attain sustainable governance. Governance must be oriented towards the long term, but must also provide solutions for the near future (Biermann, 2007). Normative uncertainty requires the development of new norms and conceptual frameworks for global collective action in uncharted territory. Climate governance seeks a system for allocation of emissions and access to the carbon space. It has been argued that more efforts should also be focused on building principles empowering citizens to more effectively push their governments to become greener (Prum, 2007). It suggests initiatives from within, where actors are involved in ways other than the conventional regime.

The International Human Dimension Programme on Global Environmental Change (IHDP) in its conclusive Earth System Governance Project Report, famously known as 'The Science Plan' sums up this research gap exceptionally as "the influence, roles and responsibilities of actors apart from national governments, such as business and non-profit organizations, the ways in which authority is granted to these agents, and how it is exercised. Core questions advanced in this Science Plan are: What is agency? Who are the agents of earth system governance (especially beyond the nation state)? How do different agents exercise agency in earth system governance, and how can we evaluate their relevance?" (Biermann *et al*., 2009; The Science Plan). The paper addresses in detail the three knowledge domains in section 2 (North-South dichotomy in international governance), section 3 (Access and allocation of carbon) and section 4 (Growing role of ethics, fairness and justice). The last section of the paper concludes with the main findings to recommends a conceptual framework to map global and local carbon inequities.

2. North-South Dichotomy in International Governance

International political debates have centered around the narratives of rich-poor, East-West, North-South, developed-developing, etc. and global climate governance is no exception, as evident in Annex-I and Non-Annex-I divisions within the Kyoto Protocol. There have been historical confrontations between the parties on multiple counts. For instance, during the making of the Framework Convention on Climate Change (FCCC), when the South demanded that the North provide technology and financial resources and that the South's involvement be predicated on such provision, the North advanced the opposite claim holding that any such provision should be based on how well the South would implement its commitment (Prum 2007). Some experts argue that even Kyoto, instead of being just, is 'one-sided' and has actually enhanced the NS divide (Atapattu 2008, Wheeler 2011), as in, there are differentiated commitments for North that are binding, while it contains no obligations for developing countries for the commitment period. Overtime, the NS divide has evolved to be both between and within (Prum, 2007).

The Kyoto Protocol treated the North differently in adherence to the principle of CBDR, as reflected in Annex I countries, Annex II countries. In the South, provision of clean development mechanisms saw unevenness in distribution of projects, where Asia/ Pacific and the Latin America/ the Caribbean benefitted from all the projects, with the poorest continent – Africa losing out. It has been repeatedly reported that the concerns of the least developed countries (LDC) are carried along by the narratives of the semi peripheries i.e. developing states such as China, India and Brazil (Kandlikar and Sagar, 1999, Ott *et al*., 2004, Roberts and Parks, 2007, Verolme *et al*., 2013). Diverging NS positions in climate governance bear a strong factual basis, for overview see Table 3. North has consumed more than its fair share of the earth's atmospheric space. The cumulative emissions of North forms the significant majority of all historical emissions (Miguez, 2002, Climate Debt ud) while per-capita emissions of North have been historically ten times greater than the south (Kartha *et al*., 2012) and even now at (8.8 t/capita) is over twice to South (4.2 t/capita).

Secondly, it is now accepted knowledge that the cause of the global warming was not global in the first place, but rooted in human activities taking place at local and national levels particularly the industrialization in North (UNFCCC, 2014, Kato, 2001). Thirdly, when it comes to climate vulnerabilities, the developing countries are the most severely affected. Some of the well-rehearsed poverty related climate effects include increase in frequency and severity of extreme climate events, reduced crop yield which give rise to food insecurity, lower incomes and scant economic growth, the displacement of poor from coastal areas and exposure to new health risks (Richards, 2003, Adger *et al*., 2005). Accordingly, for reasons of limited infrastructure and wealth, developing countries have the least capacity to respond to this challenge (IPCC, 2007, Climate Justice ud, Bulkeley and Newell, 2009). Beyond the facts, most of the NS disparity is due to diverging interests and motives. North has its share of concerns because of large scale emission cuts, coupled with financial and technological investments in climate mobilization, including massive support to the South, fear of a rising Asia, and its stubborn belief that the South is both unwilling and unable to restrain its own emissions (Kartha *et al*., 2012).

Beyond a lip-service to commitment, responding to this challenge will require inherent change in North's consumption patterns, lifestyle and business norms. On the contrary, South's concerns are numerous and multifarious as its composition. To begin with, with three hundred years industrialization, they consider developed countries as the sole culprit for today's climatic problem (Gupta, 2000, Climate Justice, ud). Secondly, their concerns are rooted in systematic discrimination of the South in the past (Mahabub-ul-Haq, 1976) and North's protracted history of self-interested and bad-faith negotiations in all sorts of other multilateral regimes like trade. North has repeatedly failed to meet UNFCCC and Kyoto commitments to provide technological and financial support for mitigation and action, holding South as hostage to its newly made commitments while continuing to dodge its own (Kartha *et al*., 2012). Thus South seeks equality in access to global commons, which is pioneered with agreement to equal per-capita emission right of cumulative carbon space.

Table 2. Review of 31 carbon AA schemes with equity principle, interpretation and actors identified

Access and Allocation Scheme	Equity Principle	Interpretation	Name of the Scheme Citation/ Source	Number	Actors (in carbon governance or as beneficiary of the fair-share)
Equal per-capita emission rights, Contraction and convergence	Egalitarian	Every individual has an equal right to pollute or to be protected from pollution	Agarwal & Narain 1991, Singer P 2002, Meyer 2000, Jamieson 2001, Athanasiou 2002, Grubb et al 1999	6	National/ Individual
Status quo, grandfathering or equal percentage reductions	Sovereignty	All nations have an equal right to pollute or to be protected from pollution; current level of emissions constitutes a status quo right	Hoel 1992, Pearce and Warford 1993	2	National
Marginal costs reduction or equalization	Horizontal/ vertical	Countries with similar economic circumstances have similar emission rights and burden sharing responsibilities/ The greater the ability to pay, the greater the economic burden	Groot 2010, Duro & Padilla 2006, Heil and Wodon 1997, 2000; Wirth & Lashof 1990, Cline 1992	6	National/ Individual depending upon Horizontal/ vertical
Historic responsibility	Polluter pays	The economic burden is proportional to emissions (eventually including historical emissions)	Smith et al 1993 (Natural Debt), Bode S 2003, Jiahua et al 2008, Kanitkar et al 2010 (Carbon Budget), Den Elzen & Hohne 1999, Den Elzen & Schaeffer 2002, Neumayer 2000, Climate Debt, ud (Bolivian proposal),	8	National
Multi-criteria	A combination of above principles		Rose A, 1998, Brown 2002, Baer et al 2009 (Greenhouse Development Right), Chakravarty et al 2009, WBGU 2006	5	National/ Individual
Specific or ad-hoc	A derivative of either of the above principles		Costa et al 2011, Blok et al. 1997, Zickfeld et al 2009,	3	Variable
Kyoto Protocol	Applies common but differentiated responsibilities with respective capacities while following equal percentage reductions			1	National

Source: Adapted from IPCC 1996 and Ringius 2002

Table 3. Diverging North-South positions

Factual	North	South
Emissions	Higher cumulative, per-capita and historic emissions	Lower cumulative, per-capita and historic emissions
Growth in Emissions	Stabilizing emissions in many countries	Increasing rate of emissions from South
Vulnerability	Less vulnerable to catastrophic events	Large scale vulnerability to and threat from catastrophic events. Issue of survival for people living on small island states and lower elevations. Threat to livelihood security, basic needs and energy access
Resilience	Higher technical, financial and institutional capacities to respond to mitigation, adaptation and catastrophic challenge	Limited capacities to respond to mitigation and adaptation and catastrophic challenge.
Concerns, Interests and Motives	Concern of large scale emission cuts, forcing radical shift in lifestyle, behavioral and business patterns	Failure of North in meeting Kyoto commitments
	Large scale financial and technological investments at home	Subjugation of South and systematic discrimination in the past
	Massive support and financial assistance to the South	Impairment to right to economic development
	Fear of rising Asia and restructuring of World order	Issue of justice- to attain compensation from threats and impacts not caused by their own action
		Means to restructure the world order and having greater role in decision making

In addition to the above, south overtly claims its priorities for physical and socio-economic development. What has been viewed by some as South's aspiration of right to development (Gupta, 2000, Kartha *et al*., 2012), is in fact ingrained in its value of existence and sustenance. For small island, low-elevation or mountainous states, global change in their immediate surroundings is not a matter of choice or a development paradigm, but about imminent life and death. As numerous studies underscore, access to energy services is fundamental to the fulfillment of any development goals (UNDP/WHO, 2009, Purkayastha, 2010). The bottom line is that access to energy is central to the issue of South's existence/ survival first and then the fulfillment of its development goal for the burgeoning population. In addition to the South's priorities of economic development, sustenance and corrective/ restorative justice, there are political overtones to this issue, which could be better understood while looking beyond the economic connotations of NS (Atapattu, 2008; Najam, 2005). The South Commission (1990, p1) defines the south as not only characterized by economic weakness,

but political dependence on 'North' which makes them "vulnerable to external factors lacking functional sovereignty" thereby undermining their own control over their destinies. Najam 2005 argues that 'South' is a definition of exclusion and it includes those states which have been overlooked in international decision making. They view themselves as "existing on the periphery". As such it is being widely acknowledged that climate debate is one space where South states demand not only economic justice but have found an opportunity to alter this structural inequality and play a fundamental role in global decision making and balancing the world order (Roberts and Parks, 2007 and Najam, 2005). What has been largely understated in this narrative is how the North also treats this opportunity as a battleground, difficult to concede its declining prominence in modern world order. As such both global North and South fundamentally view climate negotiation as a leverage point. Over a time, the system or the regime itself tends to evolve as a vehicle to justice. This raises a fundamental question on the role of States in further brokering a truly equitable and acceptable solution.

There is a growing understanding to approach the global climate politics beyond the conventional statist view of international relations (Eckl and Weber, 2007). It is argued that it will be more fruitful to view the issue on "intra and transnational social and economic divisions" (Newell, 2005), institutions, corporate houses, national and transnational movements, NGOs and INGOs and others; though there are equally strong arguments in bringing the State back, for its capability to police the perpetrators and bring about the legislations (Pradhan, 2013). In spite of several doubts on the role of states in truly brokering a way out of the current impasse, it is evident that States owe and they do command a decisive role. The Rio Declaration on Environment and Development (and UNFCCC) establishes that States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction (for more refer UN 1992a, UN 1992b).

With so many differentiations, transformations and motives-apparent and inherent of several States abound, it becomes imperative to underpin the truly marginalized and under-represented in climate debate. At economic level, it is the poor half of world's population living marginally with less than $2.50 a day or even less (Shah, 2013, Chakravarty *et al*., 2009), at geopolitical level it is the less developing countries (LDC). As such, a more nuanced approach to governance, which looks beyond the NS differentiation and involves methods to account the LDC that are most closely affected by global change and associated delays in negotiations.

3. Access and Allocation of Carbon

43a. Global inequities

Fundamentally, access of carbon can be studied from the energy paradigm, rooted in utilization of electricity or cleaner fuels to meet basic needs of lighting, cooking, heating and human well being. World Energy Outlook (WEO*)* defines modern energy access as "a household having reliable and affordable access to clean cooking facilities, a first connection to electricity and then an increasing level of electricity consumption over time to reach the regional average". By that yardstick, 1.3 billion people i.e. about one-fifth of humanity are without access to electricity (IEA, 2013). Unfortunately, national level indicators and statistics to measure and monitor various dimensions of access are extremely scarce, particularly for the least developed countries and regions where the issue is the most pressing. Research in this area abstains from defining any global quantitative thresholds for the minimum amount of energy required to meet basic needs. This is because basic needs are normative and vary significantly between countries depending on their climate, social customs and norms, and other region or society-specific factors (GEA, 2012). Previous efforts at quantifying such equity thresholds provide estimates in useful energy terms in the range of 1–2 kW per capita to meet basic needs and much more (Goldemberg *et al*., 1985, Imboden and Voegelin, 2000). This per capita energy can be aggregated for each country.

How to meet this minimum energy demand subject to emission constraint is the key question for future energy and emission trajectory (Purkayastha, 2010). Hence, access to carbon in atmospheric space or climate is related to emission right and invariably linked to energy security or right to energy. While access implies an actual or potential opportunity to utilize a resource and allocation implies an entitlement, both the terms have been used interchangeably when it comes to a global common resource – the atmospheric carbon space. Depending upon the probability of exceeding a 2°C rise in global temperatures, climate models give 1000 – 1440 GtCO2 (273-393 GtC) for CO2 emissions and 1480 – 2000 GtCO2 (403-545 GtC) if Kyoto gases are also included. The world has already emitted approximately 66 GtC over 2000–2009 (estimates for 2007 through 2009). As Table 1 reveals, the developed countries command access to a major portion of carbon resources, thus disproportionately emitting 8.18 t/capita of CO2 per annum.

But, it is the remaining carbon space available over the 2010–2050 period which has to be, in physical terms, partitioned amongst all countries based on an appropriate principle (Kanitkar *et al*., 2013). Certain groups perceive 'access' within the context of climate negotiations as how to share this space between rich and the poor, including financing and technology required to live in this space (Climate Debt ud, UNFCCC, 2013). It has been argued that it involves one of the biggest distributions of resources between rich and poor countries in modern history. Some economists valued it in excess of a trillion dollars annually (Stern, 2006). The outcome of the negotiations are seen to literally shape the future wealth of nations in a carbon-constrained world, the overall stakes presumably bigger than the ones in world wars, the great game of Americas, Asia and Africa put together. Carbon AA amongst the parties scientifically is a pre-requisite to discussion, negotiations and attaining consensus between them. Kyoto Protocol was once such accepted instrument for 2008-12, followed by 2013-20 in which Annex-I countries have heavier burdens of emission reduction (UNFCCC, 2013).

Since the beginning of climate debate in late eighties till now, there have been almost thirty AA formulae or schemes proposed. They have varying degree of scientific basis, declared or implicit equity principles, assumptions and methodical complexity, to the extent that multiple classifications exist (IPCC, 1996, Ringius *et al*., 2002, Kartha *et al*., 2012) as summarized in Table 2. The most exhaustive understanding and application of these equity principles for burden sharing is presented by Ringius, 2002, that fundamentally classifies them as egalitarian, sovereignty, horizontal, vertical and 'polluter pays'. It follows with an interpretation of these principles as burden sharing rules through layers of distribution of responsibilities of emissions, vulnerabilities to impacts and capacities to influence a change. As scientific evidence is increasingly suggesting a shrinking carbon space and stronger correlation of cumulative emissions to global warming (Allen *et al*., 2009, Matthews *et al*., 2009), the AA proposals have shifted focus to equally share the entire cumulative carbon space, accounting the *historic responsibility* of the developed countries accrued a massive 'carbon/climate debt'. Some *multi-criteria proposals* modify or combine basic AA rules i.e. equal per capita, status quo, marginal costs and historical responsibility.

In addition to the above, there are several other AA mechanisms that are based on *specific or ad-hoc* principles like separate burden sharing targets between developed and developing countries, emission reductions based on nation's Human Development Index (Costa *et al*., 2011) or nation's economy sectors like Triptique Approach separating the economies of the member countries into domestic sector, heavy industry, and electricity generation (Blok *et al*., 1997; Ringius, 1999). It needs to be mentioned that certain schemes included within this analysis not just set rules for AA of the carbon space, but also the estimate impacts of climate change like adaptation efforts, damage costs, etc. In the post Durban attempt to redefine equity removing the prism of Annex-I countries and non-Annex-I countries (Kartha *et al*., 2012) and Copenhagen to include developing countries into mitigation activities (Wheeler, 2011), the Greenhouse Development Rights framework became one such 'effort-sharing' approach in which *responsibility* (in terms of emissions) and *capacity* (in terms of ability to afford mitigation and adaptation measures), were defined and quantified in a manner that seeks explicitly to safeguard a right to development and to account for the vast disparities found not only between but also *within* countries.

43.b. Local inequities

There is a growing body of literature that tends to explain local inequalities in AA of carbon space through economic or income inequalities. Heil and Wodon (1997) use the Gini-index to measure the inequality of per-capita emission across countries and the contribution of two income groups (poor and rich countries) to this inequality. They later employ this methodology for analyzing future inequality in per capita emissions using business-as-usual projections to the year 2100 (Heil and Wodon, 2000). One of the main conclusion is that both emission and income inequalities have decreased during past decades, later supported by Padilla and Serrano, 2006. They further emphasize that "If you belong to the same income group (per-capita), emission inequality will be less profound", especially in the low middle income group. Duro and Padilla (2006) applied the decomposable Theil index by decomposing Kaya identity and found that income per capita or simply put *affluence* is the main driver of emission inequality, although differences in energy intensity, and in carbon intensity of energy were also relevant. In addition, differences in per capita incomes between the richest and poorest persons, in both rich and poor countries, are bigger than the differences in per capita incomes between countries. But if all countries in fact had completely egalitarian income distributions, there would still be huge income differences based on the gaps in national incomes (Milanovic, 2005). This is reinforced by another set of findings that challenges our conventional means to address issues within development and environmental complex. It establishes that unlike other environmental pollution, Environment Kuznet Curve is not the most appropriate way to explain global warming against business as usual development, and that appropriate policies are required to reach a turning point in the relationship between income and emissions (Cantore and Padilla, 2009).

A summary of local case studies in energy access and consumption reveals local-spatial disparity in carbon access. World Energy Outlook (WEO) data on energy access (though this may invariably include non-fossil carbon derived energy forms too) that captures access to electricity as electrification rates in urban and rural areas in various countries across the world regions. It reveals that UR energy gap is typical to developing countries, where urban areas have electrification rates of 90.6%, while rural areas at 63.2%. Keeping electricity access in urban areas as the yardstick of maximum access within the respective regions, urban-rural energy differential for developing countries is derived as 1.4 (refer Figure 3). Similarly, for other world regions; Latin America, Middle East, Asia (excluding Japan) and Africa, the UR differential is 1.3, 1.4, 1.3 and 2.8 respectively. This shows relatively high availability and concentration of energy in urban areas, akin to emissions concluded from 3x3 matrix. The condition of rural constituencies of South Asia and Africa is that of the most disadvantaged, as their electrification rates are 59.9% and 25% respectively, with Sub-sahara Africa at the bottom with 14.2%. Meanwhile, selected cases of relative consumption levels in final energy use, an advanced indicator of fossil carbon (or carbon emissions in some cases) from urban and rural areas for 22 different countries over all world regions; including developed countries this time in the equation, explains the situation even better, refer Figure 4.

Again, for simplicity of units and comparison, keeping 1.0 as the urban baseline, it demonstrates a great inter-spatial divide in urban and rural energy use within their respective national context. There is apparently a great disparity in urban and rural energy-use patterns as revealed by this assessment drawing together a novel urban energy use data set. In many developing countries, urban dwellers use substantially more final energy per capita than their rural compatriots, as high as two to three folds in India, Bolivia, China, Peru, etc. This may primarily be because of their much higher average urban incomes. Conversely, in many industrialized countries the per capita final energy use of rural dwellers is often greater than the urban, by a factor of 1.2 to 2.0 as seen in Canada, US,

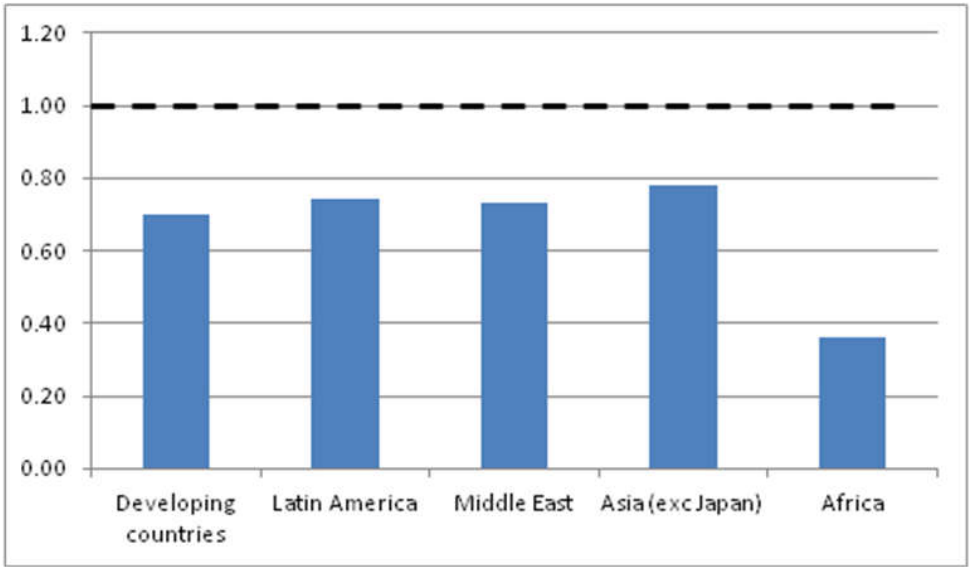
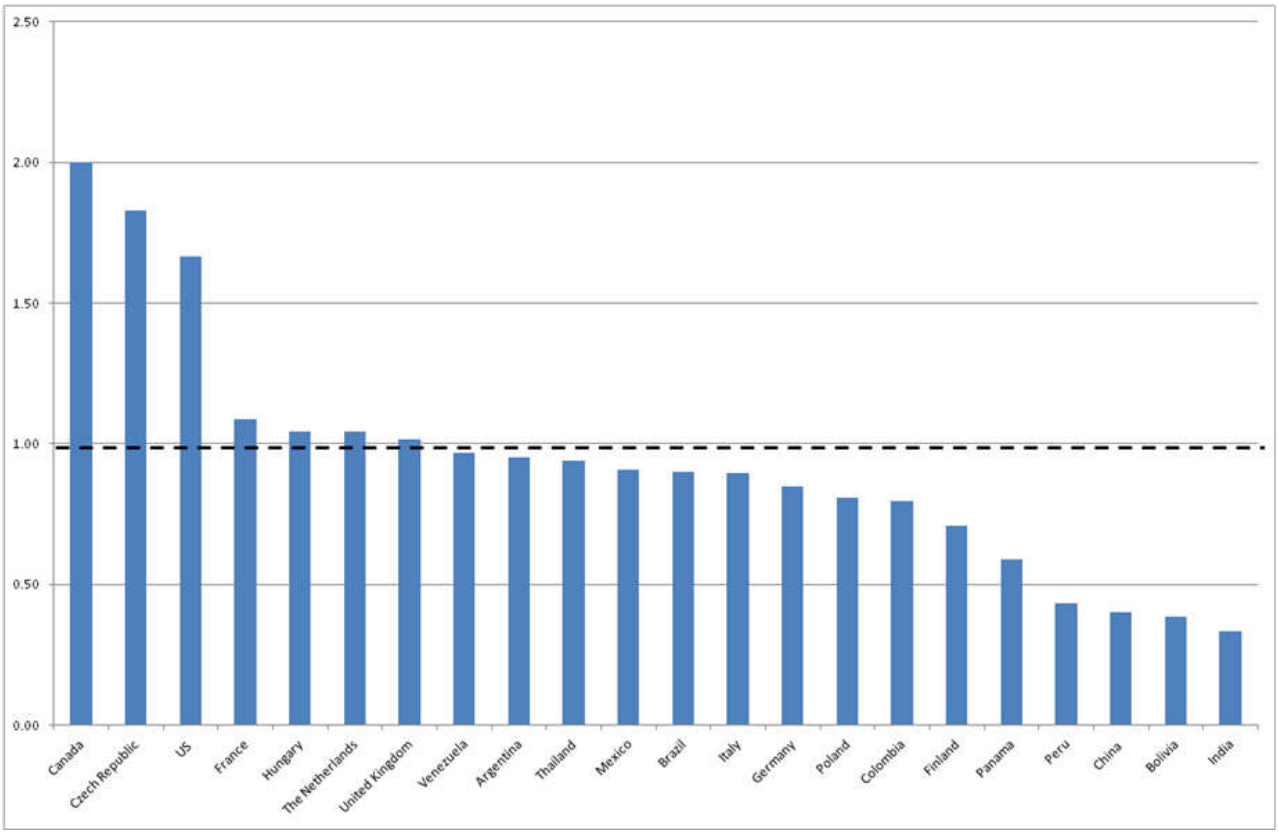


Figure 3. Differential in urban-rural energy access (keeping urban constant at 1.0) in various world regions. Source: IEA 2011



Source: Compiled from multiple sources, refer Annexure II

Figure 4. Differential in urban-rural energy consumption (keeping urban consumption as constant at 1.0) in various countries.

France, Czech Republic. This essentially reflects that in most parts of the world, urban areas in general have the biggest 'carbon footprint' responsible for excessive fossil-carbon use and emissions beyond their national average or fair share, though with high variability in terms of quantity and their NS origins. Meanwhile, in certain cases of exception, it is the rural areas, particularly from the North, that are consuming more carbon than their equitable share. Thus in a rapidly urbanizing world, a disaggregated analysis of urban and rural footprints increasingly gains significance.

4. Growing Role of Ethics, Fairness and Justice

It has been argued that the moral and political challenges of climate change are relatively neglected…because we tend not to see climate change as a moral problem (Jamieson, 2007). In the past, there were suggestions that the world should pay less attention to justice and development and get on with the more urgent task of stabilizing global greenhouse gas emissions (Susskind and Ozawa, 1990, p1), but with repeated failures to strike a universally acceptable pact to assign responsibilities

for dealing with global change, the role of ethics is seeing a steady revival. For a macroscopic view, one has to appreciate that the debates centered around climate change are within the context of global sustainability (Atapattu, 2008). It thus takes a huge onus to miss the key point that sustainable development is not merely an ethical priority when it comes to negotiations and politics around them (Kartha *et al*., 2012), or an ex-post facto to development (Atapattu, 2006) or a convenient alternative to the business as usual approach, but it is the only way forward. After all, "ethics in relation to climate change is not an intellectual luxury….something added on top of other issues ……but rather a constitutive part of all of the reasonably justifiable responses to the challenges of climate change" (UNESCO, 2010). While scientific approaches may fix responsibility and capacities, ethics evaluates the fairness of such an arrangement.

There exist three major types of normative moral theory relevant to the ethical norms: *consequential (teleological) theories* that are goal-directed and may compromise on "means" to achieve them, *deontological norms* that regard both "ends" and "means" adopted to achieve that end as equally important and *areataic or axiologists' norms* that believe that hold that certain actions are inherently right because of the value that they intrinsically contain and not merely because of their consequences (Ghosh, 2013). Ethical challenges problematize various dimensions of climate debate because of the global dispersion of the causes and effects of climate change; its persistence, non-linearity and time-delayed nature, the fragmentation of agency and institutional inadequacy that makes it difficult to respond to global climate change (Gardiner, 2006). Accordingly, there are various facets of justice to perceive global climate change (UNESCO, 2010), i.e. *distributive justice, compensatory justice, procedural justice, issues of human rights.*

In absence of any accepted principle, *ethical values* form the basis of decision-making and action in accordance with an ideal accepted in a given moral system. They are expressed in the notions of right and wrong, just and unjust, etc. and *define our principles***.** While *instrumental values* mark objects that are important for their usefulness in gaining other values. The extreme opposite of instrumental values are *intrinsic values*, which identify the importance of objects for their own sake (UNESCO, 2010). There is already existing international consensus on the ethical values that should guide our responses to global climate change, through several treaties and declarations. These collectively emphasize upon – the right to life, liberty and personal security; the principle of protecting human rights; the right to a standard of living adequate for the health and well-being of people, including food, clothing, housing and medical care; the precautionary principle; the principle of common but differentiated responsibilities; the principle of safeguarding and promoting the interests of the present and future generations. In addition to these accepted principles of fairness, a Penn State University's research on ethical dimensions of climate change (Brown *et al*., ud) notes that a number of other identified principles could make equitable allocations of GHG emissions among nations. These include. *polluter pays and proportionality principles, satisfaction of basic needs, comparable burdens principle, rawlsian principle of justice* (Brown, 2002, Rose, 1998). But beyond these widely discussed principles that focus on distributive justice, there is a growing deliberation on its relevance to bring about a change (Paavola and Adger, 2006). It has been emphasized that procedures influence the legitimacy of decisions irrespective of outcomes (Lind and Tyler, 1988) and it encompasses issues such as recognition, hearing, participation, and fair distribution of power. Adaptive governance is one such approach to attain political consensus in an evolving situation of uncertainty within the global commons (Dietz *et al*., 2003).

As negotiations over various AA proposals show, differences between different interest groups, their opportunity costs could overshadow some of the most scientifically rational schemes. This section while reviewing ethics, justice and principles of fairness and equity highlights that the role of justice within the interphase of human development, sustenance and environment is pushing its frontiers, from human justice (UDHR) to compensatory justice (polluter pays principle), distributive justice (per-capita based fair-share proposals) to corrective and retributive justice (proposals taking into account responsibility of historic emission debt, ability to pay, inclusion of adaptation and emergency costs) to the epitome of procedural justice, a means or process in attaining an overarching balance in environmental governance, while realizing ethical values and principles to the most fundamental unit - the local. The failure in adopting any proposal so far compels the need to explore the deontological approach of justice. Any framework to map carbon inequity should take into account a dynamic system, where nation states and local entities are in a constant flux of economic and physical transformation.

5. Conceptual framework to map local carbon inequities

The research demonstrates inequities in carbon access and allocation, how they thrive in global climate governance, and the formative role of ethics in this arena. This paper derives the following inference: (a) Overtime, NS divide is weakening both between and within, there is a growing need to include under-represented groups like the LDC and other actors at trans-national and sub-national levels of governance (b) There is a crucial need for a framework that 'locates' these carbon AA inequalities within the countries; and allocates the carbon space to 'local' or 'sub-national' agencies. (c) A futuristic framework for emission stabilization ought to be rooted in deontological approach, where procedural justice or the mechanism to actualize a change for affected parties on the ground lays emphasis to the role of local entities in transformation, addressing inequities between and within nations. In order to further visualize and empirically measure this ongoing phenomenon of global change by mapping carbon footprint of countries within an increasingly differentiated and urbanizing world, the research recommends a conceptual framework. It is an analytical frame, a fundamental 3x3 spatial-development matrix (shown in Figure 2) that could empirically measure and exhibit carbon footprints of differentiated units and inequities between them, along with their development status. This framework adds several new dimensions to the conventional discourse in international climate governance by (a) bringing out the most unrepresented group i.e. the LDC in this equation (b) adding

spatial dimension to this argument to introduce the local entities in this relationship. At the local level, urban and rural are the most fundamental spatial, geopolitical and governance units. This model takes into consideration a rapidly transforming state whereby emissions from 'urbanizing' societies are also accounted for, as they develop. Meanwhile, the frame does not undermine the importance of State in negotiations. In view of the inclusion of cities as Goal 11 within the upcoming sustainable development goals and the COP21 to be held in Paris in 2015, this paper offers a shifting paradigm in global climate governance.

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