

**Josef Baum**

[www.josefbaum.at](http://www.josefbaum.at)

[josef.baum@univie.ac.at](mailto:josef.baum@univie.ac.at)

University of Vienna – Department of Geography  
and Department for East Asian Studies  
Altes AKH, Spitalgasse 2-4, Hof 2, 1090 Wien,  
T: +43 1-4277-43852 , M: +43 664 1142298

**Preliminary version**

**RSA-conference, 2012, Beijing**

**Path : sustainability**

**Paths to sustainability under the context of climate change deadlines –  
regional, class and other distributions matter**

**Abstract**

The highly unsustainable level of social metabolism in the developed countries together with the broad industrialisation and a compressed catch-up process<sup>1</sup> of emerging countries is causing new situations unprecedented increases of material flows and unprecedented implications on the resource and emission side.

The international community unanimously accepted the target of not transcending 2°C, but there is no consensus on the path. So the probability to proceed beyond “safe operating space”<sup>2</sup> towards “unknown territory”<sup>3</sup> is decreasing continuously. Further business as usual seems to be an “utopian fantasy”<sup>4</sup>.

Environmental crises are no new phenomena; on regional levels they have existed for a very long time and also on global scales at least since decades. But there are essential news: by climate change there are DEADlines. Since about twenty years there is a significant and increasing concordance in science about this, and since the last twenty years the probability of dramatic consequences of a business-as-usual path has been increased (not to be confounded with uncertainty in the sense of high variance of concrete realisation).

These irreversible tipping points change the rules of the game: Until now distributional conflicts often have been solved also at the cost of the environment or at the costs of future generations, but they environmental debts has been somehow redeemable (or seemed to be). In the next years and decades the things will be changing: not to consider future harms will hurt mid term and sometimes even short term assets.

---

<sup>1</sup> UNDP (2011): Human development report – sustainability and equity: a better future for all. P.106

<sup>2</sup>Rockström et al (2009): [A safe operating space for humanity](#) Nature461, 472-475 (24 September 2009)

<sup>3</sup> Stern Review: The Economics of Climate Change (2006) p.iv

<sup>4</sup>Foster Bellamy (2009): The ecological revolution – making peace with the planet. P.259 (citing Raskin)

Environmental issues substantially (also) are distributional regional, class, gender and other conflicts with strong weight on the vertical time axis (future generations).

We see an asymmetric structure of the stakeholders in climate change. First the causation is different. Basically the richer and more powerful have caused much more pollution. The need for adaptation and the vulnerability mostly is inverse: the poor are hit relatively stronger. So we have to analyse power, domination, and inequality in the environmental space. We can see causations, impacts, and contributions for solutions differentiated along classes and other distributional criteria.

Increasing commodity prices reflecting (relative) scarcity and increasing (mining) costs can be generally positive climate change solutions but on the other hand raise serious distribution issues. E.g. for food because this sector is determined by energy development to a high degree - food prices are highly correlated to energy prices.

There are complex patterns of many losers and only few winners of climate change and other environmental issues; and probably the "poor" are hit relatively stronger than the rich (although the poor hardly caused the mess), but uncurbed climate change developments also will significantly strike the "rich" (worldwide and regional) which will also absolutely have to lose a lot and they will only partly be able to shift this incidence.

**"Common but differentiated responsibility"** was agreed by the international community in Rio 1992 and probably will be agreed again in Rio conference 2012, but the interpretation of this principle is very different. A "grandfathering" strategy to integrate developing countries on the basis of differentiated reduction rates in the Kyoto mechanism hardly recognizes the development issues and the historic realities. The "Brazil proposal" and similar models consider the historical emissions per capita and takes account of justice in a much more comprehensive way.

As seen also in Copenhagen stable solutions for the fundamental resource and emission problems are probably possible only by "fair" distribution (on global and various other levels) and solidarity. And "simultaneous" solutions for many problems – resources, emissions, distribution and development - are necessary and possible<sup>5</sup>.

**JEL Classifications:** Q54, Q56, Q57

**Keywords:** climate change, equity, sustainability

### **Introduction:**

The issue of sustainable development is to be reframed by the necessities to react globally to climate change. The fundamentally new: There are "deadlines" for the solution to the climate issue, becoming an existential question of humanity.

In relation to the tremendous dimension of challenge there is a relatively short window of opportunity of about the next 15 years to turn the trends and to keep the drastic world wide change of the foundations of human existence still controllable.

---

<sup>5</sup> UNDP (2011): Human development report – sustainability and equity: a better future for all

There seems to be a strong majority opinion in science: The latter mankind starts with effective mitigating the more there will be sacrifices.<sup>6</sup> The former we start we can minimize harm und increase positive effects. So these “deadlines“ will create fundamental pressure for simultaneous solutions.

But why we don't see an effective global climate mitigation policy until now? What are the reasons why burden sharing (effort sharing) of global mitigation of climate change up till now is not solved? The issues basically were on the agenda of the Copenhagen-process and are on the agenda of the Post-Copenhagen-process.

The basic argument here is: **without comprehensive distributional solutions effective climate policy will not be realized.** Firstly a global solution therefore requires the inclusion of almost all countries. Since the Rio-conference 1992 the phrasing “common but differentiated responsibility” has been adopted but obviously is interpreted quite differently. And obviously there is the necessity and possibility for simultaneous global solutions by global distribution and sustainable development. So ecological and (global) distribution issues are now inextricably linked by necessities of climate change policy.

The **Methodological** approach of this paper is:

- Overview: summarizing articles of scientific journals on the issue
- Some reasoning on historical basics of climate change and distribution on different levels
- Short description of current burden sharing in the EU and possible development
- Identification and comparisons of distributional principles for climate change policy
- Some numerical evidence of implications of distributional principles of climate change policy shall be given.

So this is some kind of meta or policy paper designing a framework for basic distributional calculation schemes to be further developed.<sup>7</sup>

### **The climate issue in the socio-ecological context**

---

<sup>6</sup> In the following the well-known Stern report is cited although there could be much criticism on methodology: “...the Review leads to a simple conclusion: the benefits of strong and early action far outweigh the economic costs of not acting. Climate change will affect the basic elements of life for people around the world – access to water, food production, health, and the environment. Hundreds of millions of people could suffer hunger, water shortages and coastal flooding as the world warms. Using the results from formal economic models, the Review estimates that if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more. In contrast, the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year. The investment that takes place in the next 10-20 years will have a profound effect on the climate in the second half of this century and in the next. Our actions now and over the coming decades could create risks of major disruption to economic and social activity, on a scale similar to those associated with the great wars and the economic depression of the first half”. Stern Review. Summary and Conclusions p. vi

<sup>7</sup> The paper also is intended to be the foundation for a research proposal

There are a lot of global environmental hot problems, somehow interconnected with each other, but also “independent”. In the seminal work of Rockström et al (2009)<sup>8</sup> global problems are ranked: in three fields (climate change, biodiversity and the phosphorus cycle) are ranked beyond of a “safe operating space”. Maybe the biodiversity field in a very long run is even more severe; but evidently in the climate crisis we are very near to irreversible tipping points which question basics of existence of mankind.

These irreversible tipping points change the rules of the game: Until now distributional conflicts often have been solved also at the cost of the environment or at the costs of future generations. Now (= in the next decades) the things are changing: not to consider future harms will hurt short and mid term assets.

There are complex patterns of losers and few winners of climate change; and probably the “poor” are hit relatively stronger than the rich (although they did hardly cause the mess), but uncurbed climate change developments also will strike the “rich” which will absolutely have to lose a lot and they will only partly be able to shift this incidence.

This will be a new situation shifting the parallelogram of power.

There are further new conditions of the first decades of the 21<sup>st</sup>:

The unsustainable level of social metabolism (input from nature and “output” to nature) in the developed countries together with the **broad industrialisation** of emerging countries and of almost the entire world with unprecedented increases of material flows with unprecedented implications on the resource and emission side. Currently we face peak oil, and we will face peak of almost everything on the input side of economy. On the output side there are emissions with various implications most important the greenhouse gases causing climate crisis.

### **Analysis: historical dimension of distribution of emission matters**

Concepts like “global but differentiated responsibility” or “contracting and converging” are found in the documents of IPCC and UNFCCC since the beginning. But almost all the details in the process of burden sharing are open and evidently these are the greatest obstacles for the start of an effective global climate policy or the after-Kyoto process at all.

The topical IPCC document states: “All sorts of climate change policies related to vulnerabilities, adaptation, and mitigation will have impacts on intra- and intergenerational equity. These equity impacts apply at the global, international, regional, national and sub-national levels. Article 3 of the UNFCCC (1992, sometimes referred to as ‘the equity article’) states that Parties should protect the climate system on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country parties should take the lead in combating climate change and the adverse effects thereof. Numerous approaches exist in the climate change discourse on how these principles can be implemented.”<sup>9</sup>

---

<sup>8</sup> Rockström et al (2009): [A safe operating space for humanity](#) *Nature* 461, 472-475 (24 September 2009)

<sup>9</sup> IPCC, 2007: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R.

Rather new is: The expected harms by climate change are huge also for developed countries so that it does not matter if these harms are relatively less for developing countries.

Burden sharing of climate change on the global level is completely unsolved. The logic of the process seems to be: there will comprehensive solutions for some fundamental problems implicating global convergence and cohesion.

“Social welfare functions and other value functions, when applied to the assessment of the costs and benefits of global climate change policies, run into a number of crucial equity questions. These include issues that are related to the asymmetry between the concentration of major GHG emission sources in industrialized countries and the relatively large expected damages in developing countries, the treatment of individuals with different income levels in the social welfare function, and a number of inter-generational issues.”<sup>10</sup>

The international negotiations are focussed on the distribution between countries. This is determined by the structure of institutions. But if there will be any substantial results in burden sharing anyway then under the actual circumstances possibly this could result in transfers from the more poor in the industrialized countries to the more rich in the developing countries. So not only the level of distribution between states has to be seen but also the comprehensive global (personal) distribution.

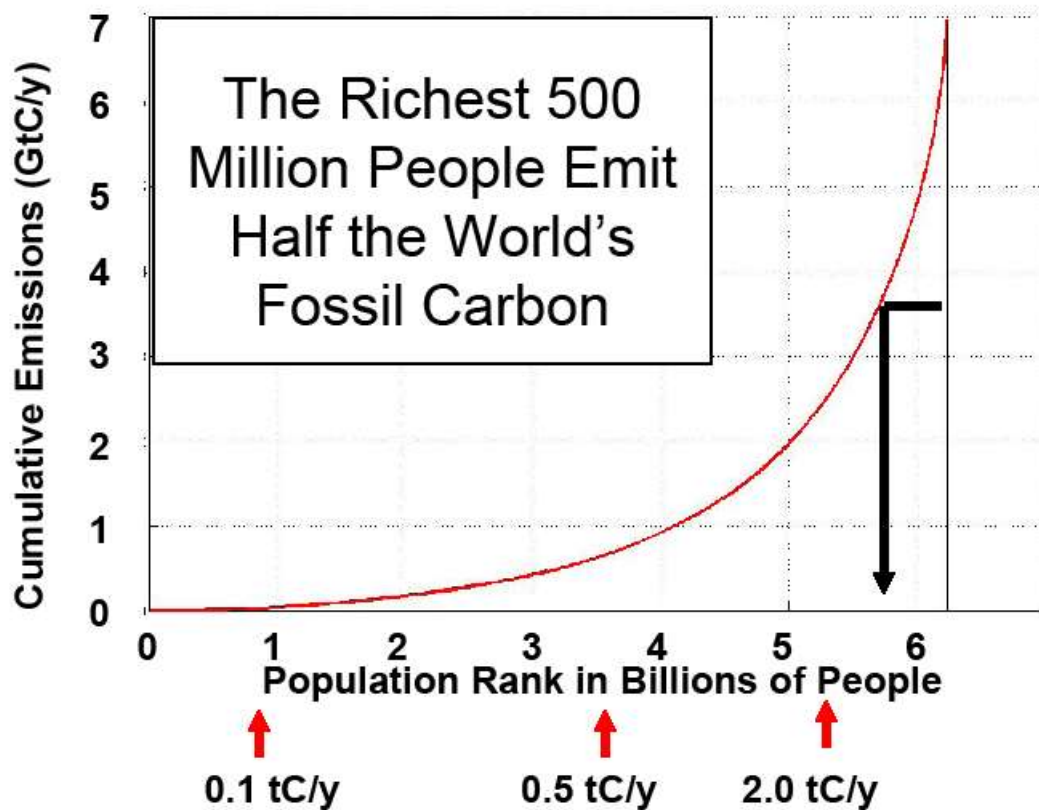
The distributional problems by climate change are set worldwide, but also on all other levels: local, regional, national, continental.

In the following diagram we can see this on the global level:

---

Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA., p. 145f

<sup>10</sup> IPCC, 2007: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA., p. 146



Source: Pacala S.W.: *Equitable Solutions to Greenhouse Warming: On the Distribution of Wealth, Emissions and Responsibility Within and Between Nations*. Princeton, at IIASA, November 2007 <http://www.iiasa.ac.at/iiasa35/docs/speakers/speech/ppts/pacala.pdf>

The implication of differentiated contributions in efforts generally is broadly accepted

Within the Kyoto-process there are binding obligations only for industrialized countries. Binding obligations for developing are most contested area. But developing countries probably will join only on the basis of equity and equality. "Fairness" in this sense puts the questions on the "historical responsibility" of the accumulation of greenhouse gases (because e.g. CO<sub>2</sub> remains in the atmosphere more than 100 years)

Historical Responsibility has a long agenda in the history of UNFCCC<sup>11</sup>. Concepts like "global but differentiated responsibility" or "contracting and converging" are found in the documents of IPCC and UNFCCC since the beginning. But almost all the details in the process of burden sharing are open and evidently these are the greatest hurdles for the start of an effective global climate policy or the after-Kyoto process at all.

As mentioned we see globally and generally socially differentiated emissions per capita. But additionally to these axes there is the time axis. And both directions of the time axis, backward and forward, are important for "fairness" calculations. So the already complex

<sup>11</sup> Friman M.(2007): Historical Responsibility in the UNFCCC. Centre for climate and Policy Research

global distribution is enriched by the distribution between generations. Former generations had or had not consumed fossil energy and created capital and infrastructure.

One of the most disputed fields<sup>12</sup> is the measurement of future values for future generations: Via discount rates ("time preference rate"), future values are transformed to present values: Discount rates are used for evaluating future harms or positive effects. The extension of discount rates is derived from "market", and is often assumed in practical terms in cost-benefit analyses as high as the average profit rates of about 5-6%. But discount rates, which are not close to zero, devalue future values (positive or negative values) beyond the immediate next few years or decades to a value close to zero.

The historical dimension, the integration of historical responsibility (and foreseeable development) would be still more complicated if not only the costs for mitigation would be considered but also adaptation and the issues of vulnerability and risk.

From the beginning of industrialisation from the 19<sup>th</sup> century there is a significant correlation and co-evolution between

- ❖ The emergence of industrialization
- ❖ global asymmetrical accumulation of capital (and infrastructure "capital", "human resources", "social capital")<sup>13</sup>
- ❖ (Industrial) use of fossil energy and
- ❖ CO<sub>2</sub>-emissions and other greenhouse gases, and thus the accumulation of greenhouse gases in the commons of the atmosphere<sup>14</sup>

Fortunately for the calculation of practical schemes the historical dimension (backward) is correlated with the emission of CO<sub>2</sub> pc, with the some exceptions like late starting emerging countries with high growth rates (like China or Asian "tigers").

Unfortunately in the literature on climate change the distributional issues are dealt to a small degree and only seldom comprehensively; and even when distributional issues are treated more in detail a historical a functional view is lacking often. There are exceptions<sup>15</sup>, which could be the basis of a global convergence<sup>16</sup> resulting in effective climate policy

### **The "20-20-20" targets and burden sharing in the EU**

2007 and 2008 the EU decided for a reduction in EU greenhouse gas emissions of at least 20% below 1990 levels, a target of 20% share of renewable energy, a 20% improving of

<sup>12</sup> See the discussions on Stern; especially Nordhaus

<sup>13</sup> „Inequality of world distribution of income worsened from the beginning of the 19<sup>th</sup> century to World War II and after that seems to have stabilized or to have grown more slowly. In the early 19<sup>th</sup> century most inequality was due to differences within countries; later, it was due to differences between countries.“ Bourguignon, F., Morrisson, C. (1999): Inequality among World Citizens, 1820 – 1990. American Economic Review (September 2002): p. 727

<sup>14</sup> Compare: Nicolas Stern delivered also the conclusion "Climate change is the greatest market failure the world has ever seen".

<sup>15</sup> Wissenschaftlicher Beirat der Bundesregierung – globale Umweltveränderungen (2009): Kassensturz für den Weltklimavertrag – der Budgetansatz. Berlin

<sup>16</sup> Pan Jiahua, Chen Ying (2010): Carbon budget proposal: A framework for an equitable and sustainable international climate regime. Social Sciences in China. Vol 31, No.1.Beijing. P.5-34

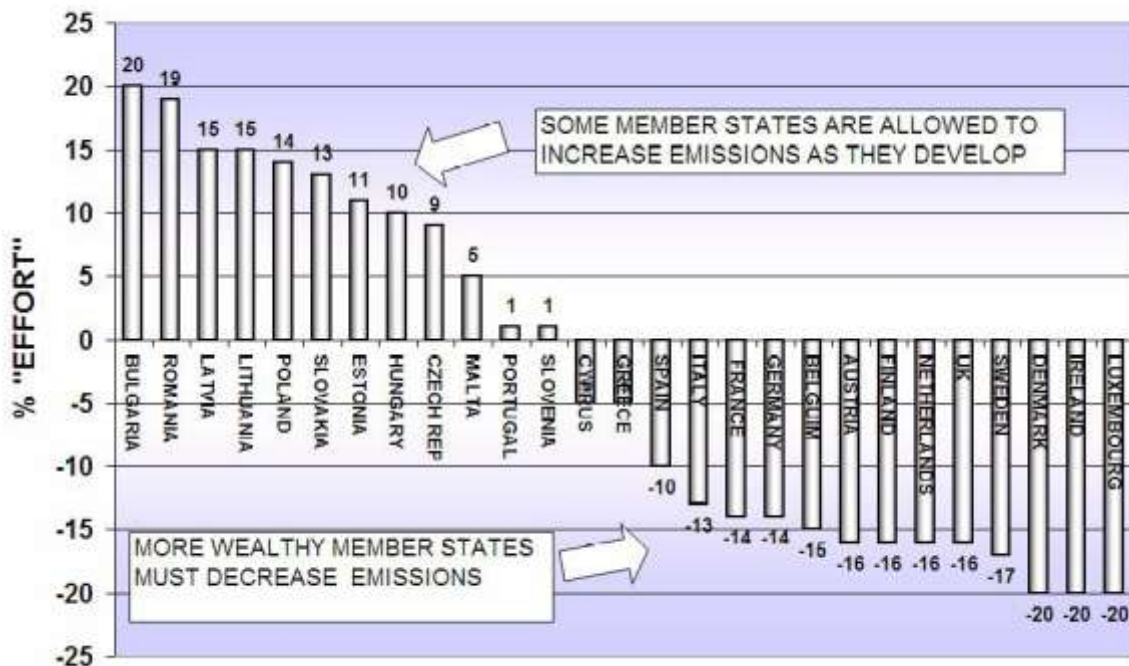
energy efficiency. The EU also offered a reduction of emissions to 30%, when other relevant countries commit to relevant reductions within the context of a global climate agreement. 2010 the European Commission renewed this offer in a more precise form. But for this improvement there is no burden sharing scheme up to now.

Whereas under the Kyoto regime one national target has been to be achieved the EU differentiated targets for the relevant producing industries on the European level and national targets for the remaining parts and the share of renewable energy.

In relevant producing industries on the company level free allowances will be available but cut annually within a revised Emissions Trading System (ETS) beginning with 2013. Saved allowances or on the other side additional allowances should be bought and sold by auctioning. So this would mean distribution along a market mechanism (there are discussions about inadequate design of therefore are doubts on efficient results).

For the remaining sectors (e. g. transport, housing, agriculture, waste) and the share of renewable energy the burden sharing (effort sharing) is oriented to the national level.

Basically the burden sharing in the non-ETS sectors is based on the level of wealth in the form of GDP pc. But there are limits: reduction not less than - 20 % for economically best performing, and not more than + 20% for the “poorest “ countries:



NonETS: GHG Emissions Effort Sharing (2005 vs. 2020)

Source: Stephenson Paule (2007): Climate Change, Equity and European “Effort Sharing”. Institute of Policy Studies. Working Paper 08/07

Similar reasoning applies for the differentiated targets of the share of renewable energy.

An very important point is that some countries can increase their emission until 2010, because this basic model could be used also on the global level.

Following somehow the historic approach and allowing developing countries still to increase emissions for some time would implicate significantly higher targets for industrialized countries to achieve global targets. It could be supposed that under such circumstances



distributional conflicts would increase within the EU and a more developed scheme for burden sharing based on principles would be useful.

### **Fundamental principles of distribution**

In the fundamentally blocked process of global climate policy anyway positions differ in such a huge degree that it seems useful to agree on basic principles, which hardly could be separated from ethical values.

There is some discussion whether basic principles for feasible solutions for climate policy should be simple or more sophisticated. The argument for the simple is that agreements on simple principles seem more probable; the argument for the sophisticated is that reality is complex, and the scheme should fit to very different circumstances.

There are at least some dozens of different concepts for equity and fairness in climate policy. E. g. the Bush administration advocated the principle of equal carbon intensity per unit of GDP. In the following there is some overview with highlights and first trials to categorize the principles:

In a heuristic approach the starting points for the view of equality and fairness in connection with the climate change can come e. g. from:

- ethical moral reasons,
- obligations from international documents,
- concepts of the sustainable development.
- Or from the fact that necessary international contracts simply will not come into being otherwise

Basically we can see

- procedural,
- cost oriented or
- outcome based

definitions of equity and fairness.

Principles of procedural equity and fairness would be:

- ❖ Market mechanism
- ❖ Willingness to pay
- ❖ auction
- ❖ consent (can mean very different: from discretionary to fixed rules)

It seems usefully to approach to distributional aspects from more basic principles:

Fundamental principles of distribution can be e. g. – (pre-scientific/political/ethical):

- ❖ Parity
- ❖ Proportionality
- ❖ Priority

Oxfam uses three principles:

- ❖ Fairness,
- ❖ capability,
- ❖ simplicity

CICERO-ECZ mainly stress

- ❖ “guilt”,
- ❖ capacity und
- ❖ need

For each possible principle there can be found again different indicators for measurement. (The problems of indicators will not be dealt here).

Other factors besides emissions will be relevant for concrete solutions. For instance natural resource endowments or higher heating bills because of geography probably are relevant. Anyway there are a lot of complex questions like how to integrate „land use changes“ or how to integrate sinks of GHGs.

But also within some categories we see quite a lot of different sub-categories: E. g. „Efficiency“ targets:

- ❖ Equal CO<sub>2</sub>-emissions per unit GDP
- ❖ Equal marginal mitigation costs
- ❖ Mitigation costs in proportion to emissions per unit of GDP

„Grandfathering“ is very important because it is aligned to existing distribution, in the only real process (Kyoto) is designed along this principle: but there are also very different possibilities:

- ❖ Equality of absolute CO<sub>2</sub>-reductions per capita (could be negative at poor countries, therefore logically not possible)
- ❖ Equality of relative CO<sub>2</sub>-reductions per capita (for industrial countries - Kyoto),
- ❖ Equal proportion of reductions in relation to historical accumulation of emissions
- ❖ “Ability to pay”: equal proportion in mitigation costs/GDP
- ❖ Outcome based, “horizontal”: Equal net welfare change (equal proportion of GDP)
- ❖ compensation for net-losing countries: “No nation should be made worse off” –

A special category would be grandfathering with „minimum securing“, like

- ❖ Rawls - Maximin (Maximization of lower incomes within the existing environment)
- ❖ “No purchase“: poor countries get CO<sub>2</sub>-certificate without payment within a basis scenario
- ❖ „No harm“: No costs for more poor countries

The political foundation of democracies would be “Equal Rights” (for the atmosphere), again with various different forms:

- ❖ “Outcome based – vertical”:  
(Net)gains inverted to GDP, losses proportional to GDP
- ❖ Egalitarian: Equal right for pollution (per capita) – *territorial*:  
This is the position of the G-77. Here the date of convergence has to be fixed
- ❖ Egalitarian: Equal right for pollution (per capita) – *functional*:

Trade – net is considered. Compare the comprehensive view of the „ecological footprint“ . This would be some extended polluter pays principle. We ask: Production (incl. emissions)

for whom (not : where). Note: “*Net exports (in China) accounted for 23 % of China’s total CO<sub>2</sub> emissions.*”<sup>17</sup>

- ❖ Egalitarian: causal *historical* responsibility for greenhouse gas emissions – *territorial*  
Former economic and ecological asymmetric distributions are integrated. This is the “Brazil proposal” within the UNFCCC - MATCH-process (In the context of the Kyoto process Brazil made a proposal which aims at differentiated emission reduction after accounting the sums of the historical contributions of greenhouse gas emissions by various countries.
- ❖ Egalitarian: causal *historical* responsibility for greenhouse gas emissions – *functional*  
Clearing up of trade – net. Historical polluter pays’ principle. To ask for :Production (incl. emissions) for whom (not : where)
- ❖ Egalitarian: Equal right for pollution (per capita) – *control view*  
Rights of property and power of decision are considered. Who controls the value added? Example: 58% of Chinese exports are controlled by transnational companies.
- ❖ Egalitarian: Equal right for pollution (per capita) – *control view* for the whole viewed era - *historical*  
The question would be: Who has had the property and disposal rights also in previous time periods? The historical world-system theory (Wallerstein) approach can be used as the background for asymmetric accumulation of capital and similarly asymmetric emissions of pollutants.

## Results show high amounts of redistribution

Gruebler-Nakicenovic<sup>18</sup> presented one of the first scenarios with different emission allocation rules (reductive and distributive aspects) in the nineties. 13 regions of the world by 2050 were regarded with the focus on the principle of „Equal emission right person“.

These calculations and also the following similar ones showed very high amounts of redistribution along the principle of equal emission right for each person.

Calculations are also possible on the global personal level. See e.g. Baer along world regions und quintiles of income within the regions: The upper two quintiles in the USA would have a need for redistribution of some 144 billion \$.<sup>19</sup>

Boyce-Riddle<sup>20</sup> calculated for US deciles of households budgetary expenditure on food, services, electricity, fuel, other modes of transport and industrial goods, and corresponding

<sup>17</sup> Watson J., Tao Wang, Is the west to blame for China’s emissions? December 20, 2007

<http://www.chinadialogue.net>

*CO<sub>2</sub> emissions from China’s net exports in 2004 in comparison to other countries’ total emissions*

“A number of other studies have been conducted, some of which reach similar conclusions. A report in 2005 by Bin Shui, of the US National Centre for Atmospheric Research, indicated that 7% to 14% of China’s CO<sub>2</sub> emissions in the period from 1997 to 2003 were due to exports to the US alone. Jiang Kejun of the Energy Research Institute, which is based in the Chinese government’s National Development and Reform Commission, [suggests](#) exports account for around 20% of China’s total national energy consumption.

These results are inevitably subject to uncertainties and simplifications, not least because of a lack of data on the carbon intensity of different exported products. However, the implications are clear. The extent of “exported carbon” from China should lead to a re-think by government negotiators working towards a new climate-change agreement beyond 2012.”

<sup>18</sup> Gruebler A, Nakicenovic (1994): International Burden Sharing in Greenhouse Gas Reduction, IIASA, 1994

<sup>19</sup> Baer, P. (2006): Adaptation: Who pays whom? In: Adger W.N., J. Paavola, S. Hug and M. J. Mace (eds.) (2006): Fairness in Adaptation to Climate Change. – Cambridge, Mass, p. 148

CO2 emissions per capita for the year 2003. A limit to the total emission (“Cap”) is defined, and this limit can be gradually reduced according to climate goals. On the other side CO2 taxes are levied, which will be collected at producers (as the production is concentrated, it is an effective approach). The revenue is to be placed in a fund “Sky Trust”. Equal rights implicate per capita emissions. Those that are under the threshold emission limit receive net disbursements. The results are net monetary benefits for the first six deciles, with by far the greatest benefit to the bottom decile.

The basic scheme (the emission limitation, the egalitarian distribution of the burden, and the monetary transfer to the low emitters) of this allocation of resources can be achieved at different levels from the regional to a global level.

### **Basic background: political ecology and political economy**

In short sketches basic backgrounds and highlights shall be indicated in the context of political ecology and political economy.

Basically we know the drive and self-accelerating **speed of M-C-M’** (money-commodity-money’) and we know further that the implicated “capital accumulation system – including the externalization of social costs on the poor, less developed countries, and the planet at large that goes with this system of accumulation has increasingly become a hindrance to human development and even to the survival of humanity (along with most ‘higher’ species)”<sup>21</sup>.

A central role belongs to the social **discounting**, which practically is similar to the profit rate: “If the pollutant’s lifetime is very long as compared to the time horizon of the decision maker, for example for some greenhouse gases or radioactive wastes, the standard result of capital theory is completely reversed”<sup>22</sup>

Risk in the mainstream economic justification is a reward for the profit but the fundamental implications of global risks are attached to whole mankind. Basic concepts to analyze capitalist market economies in regard to sustainability are information deficiencies about material flows and possibilities of recycling, externalization of costs, deregulation of trade, impacts of automation - economies of scale and economies of scope.

**Blocking factors** on the path to circular economy firstly are contra productive incentives (material resource prices not reflecting full “costs”, inappropriate taxes), **lock in, path dependency, sunk costs, rebound effects, and oligopolistic market power** of incumbents.

Environment is also a new sphere of accumulation of capital producing new “vested interested” of half-way solutions for remaining within the paradigm (E. g. incineration of waste)

It would be a miracle if the “invisible hand” via the “efficient” capital market of Eugene Fama (Prices reflect all available relevant information) would achieve by chance only one target within the complex setting. It would be still an even bigger miracle if this “invisible hand”

---

<sup>20</sup> Boyce, J.K.; Riddle M. (2007): Cap and Dividend: How to Curb Global Warming While Protecting the Incomes of American Families, Political Economy Research Institute, University of Massachusetts Amherst, Working Paper Series Number 150

<sup>21</sup> Foster Bellamy (2009): The ecological revolution – making peace with the planet. P. 13

<sup>22</sup> Baumgaertner Stefan, Faber Malte, Schiller Johannes (2006): Joint Production and Responsibility in ecological economics. P. 342

would achieve necessary essential targets. And it would be a mega miracle if also the environmental problems would be solved integratively.

Important ecological commons like the atmosphere are not limited by nation-states. The former slogan “think globally act locally” has to be transformed in “*both think globally and act locally*”<sup>23</sup>. Production and social development require on the one hand some intact local and regional ecosystems (e.g. water) and on the other hand also intact global ecosystems (e.g. climate); some limits and tipping points on the local/regional and global level must not be exceeded. So on the other side sustainability per se stresses local and regional action, adaptation and resilience. There is no recipe with one size fits all.

On the other hand joint production - or “economies of scope” - and the implicated system of economic and ecological causations, the “socialization” of production is an often forgotten fact, it is crucial for the adequate socio-ecological transition: “A thorough understanding of joint production and its consequences is... an indispensable prerequisite for taking responsible action that meets the challenge of sustainability.”

We need a “revised concept of efficiency which takes into account all inputs and outputs of a particular productive activity (and not just those are measured in the profit margins in particular enterprises.” This requirement can be delivered by combined ecological-economical input-output schemes.

Revised concepts of rationality and (eco-)efficiency has to be agreed therefore. For an “optimal” or sufficient development the adoption of limits on the input side (resources) and limits on the output side with (complex) implications of emissions and waste require a **revival of democratic planning** will be on the agenda.

Referring to Feuerbach Marx mentioned that philosophers interpreted the world in different ways but the point is to change it. The necessary addition would be **not only to change the world but to protect it**.

## Conclusions

Ecological issues, and distribution issues will be inextricably linked by necessities of climate change policy. Globally there will be big and comprehensive solutions for many fundamental - or there will be no solutions. The burden sharing scheme of the EU could be some progress in relation to Kyoto and in this sense basically also some example because countries in different stages of development are dealt very differently.

A fair global solution for costs of climate change mitigation and adaptation could implicate convergence and cohesion on various levels. Because the positions of negotiations are very differently the approach to agree firstly on principles could be preferred. But there is a surprising high number of various principles to reflect efforts in climate mitigation “fairly”. Numerical results for (varieties of ) the principle of equal rights show high amounts of volumes for redistribution.

---

<sup>23</sup> Huan Qingzhi: Eco-socialism in an era of capitalist globalization bridging the west and the east. In: Huan Qingzhi (ed) (2010): Eco-socialism as politics – rebuilding the basis of our modern civilization. P. 4

## Literature:

- Ackerman F. (July 2007): Debating Climate Economics: The Stern Review vs. Its Critics - Report to Friends of the Earth-UK
- Adger W.N., J. Paavola, S. Hug and M. J. Mace (eds.) (2006): Fairness in Adaptation to Climate Change. – Cambridge, Mass.
- Agarwal, A., Narain, S. (1991): Global Warming in an Unequal World: A Case of Environmental Colonialism. New Delhi: Centre for Science and Environment
- Agyeman J., R. D. Bullard and B. Evans (eds.) (2003): Just Sustainabilities: Development in an Unequal World. – Cambridge, Mass
- Aidt, T., Greiner S.V. (2002): Sharing the climate policy burden in the EU, Hamburg: HWWA
- Akerlof George A.: “Thoughts on global warming” 28-6-2006
- Amin, S., Arrighi, G., Frank, A. G., Wallerstein, I. (1990): Transforming the Revolution. Social Movements and the World System. New York. Monthly Review Press.
- Arler, F. (2001): “Global Partnership, Climate Change and complex Equality.” *Environmental Values* 10: 301-329
- Arrighi, G. (1994). *The Long Twentieth Century. Money, Power and the Origins of Our Times.* London.
- Arrow, K. J. (June 2007): “Global Climate Change: A Challenge to Policy,” *Economists’ Voice*
- Arrow, K.J., Cline, W., Maler K.G., Munasingh, M. and Stiglitz, J. (1995): “Intertemporal Equity, Discounting, and Economic Efficiency” in *Global Climate Change: Economic and Policy Issues*, M. Munasinghe (ed.), World Bank, Washington D.C.
- Athanasiou T. and P. Baer (2002): *Dead Heat: Global Justice and Global Warming.* – New York
- Athanasiou, T, Baer, P. (2002): *Dead Heat: Global Justice and Climate Change.* New York: Seven Stories Press
- Azar, C. (2000): “Economics and Distribution in the Greenhouse.” *Climatic Change* 47: 233-238
- Baer P. (2006): Adaptation: Who pays whom? In: Adger W.N., J. Paavola, S. Hug and M. J. Mace (eds.) (2006): *Fairness in Adaptation to Climate Change.* – Cambridge, Mass.
- Baer P. (December 23, 2006): “The Worth of an Ice-Sheet: A Critique of the Treatment of Catastrophic Impacts in the Stern Review,”
- Baer P., Harte J., Haya B., Herzog A. V., Holdren J., Hultman N. E., Kammen D. M., Norgaard R. B. and Raymond L. (2000): *Equity and Greenhouse Gas Responsibility.* – Science 289:
- Baer Paul, *The Worth of an Ice-Sheet: A Critique of the Treatment of Catastrophic Impacts in the Stern Review*, December 23, 2006.
- Baer, P. (2002): “Equity, Greenhouse Gas Emissions and Global Common Resources.” In S. H. Schneider, A. Rosencranz, and J. Niles, eds., *Climate Change Policy: A Survey.* Washington, D.S.: Island Press, 393-408
- Barnes, P. (2001): *Who Owns the Sky? Our Common Assets and the Future of Capitalism.* Washington, D.C.: Island Press
- Barnes, P., Breslow, M. (2003): “The Sky Trust: The Battle for Atmospheric Scarcity Rent,” in James K. Boyce and Barry G. Shelley, eds., *Natural Assets: Democratizing Environmental Ownership.* Washington D.C.: Island Press, pp. 135-149
- Bode, S. (2003): *Equal Emissions per Capita over Time – A Proposal to Combine Responsibility and Equity of Rights.* HWWA Working Paper No. 253
- Bode, S. (2007): *European Burden Sharing Post-2012.* *Intereconomics*, March/April 2007

- Bohle H.-G., O'Brien K. (2006): The Discourse on Human Security: Implications and Relevance for Climate Change Research. A Review Article. *Die Erde* 137 (2006) (3), pp. 155-163
- Böhringer C., Welsch H. (2006) Burden sharing in a greenhouse: egalitarianism and sovereignty reconciled, *Applied Economics* 38, 981 – 996.
- Bourguignon, F., Morrisson, C. (1999): Inequality among World Citizens, 1820 – 1990. *American Economic Review* (September 2002): pp. 727-44
- Boyce, J.K. (2002): *The Political Economy of the Environment*. Northampton: Edward Elgar
- Boyce, J.K. (2004): "Green and Brown? Globalisation and the Environment," *Oxford Review of Economic Policy* 20(I): 105-128
- Boyce, J.K. (2007): *Is Inequality Bad for the Environment?* Political Economy Research Institute, University of Massachusetts Amherst, Working Paper Series Number 135
- Boyce, J.K.; Ndikumana, L. (2002): *Africa's Debt: Who Owes Whom?* Political Economy Research Institute, University of Massachusetts Amherst, Working Paper Series Number 48
- Boyce, J.K.; Riddle M. (2007): *Cap and Dividend: How to Curb Global Warming While Protecting the Incomes of American Families*, Political Economy Research Institute, University of Massachusetts Amherst, Working Paper Series Number 150
- Brenner, M.; Riddle, M.; Boyce, J.K. (2005): *A Chinese Sky Trust? Distributional Impacts of Carbon Charges and Revenue Recycling in China*. PERI, June 2005
- Brunnengräber, A. (2006): The political economy of the Kyoto protocol. In: Panitch, L., Leys, C. (eds.): *Coming to terms with nature*. *Socialist Register* 2007
- Burns, Thomas J., Byron L. Davis, and Edward L. Kick. (1997). "Position in the World-System and National Emissions of Greenhouse Gases." *Journal of World-Systems Research* 3: 432 - 466.
- Burns, Thomas J., Byron L. Davis, Kick E. (1997). "Position in the World-System and National Emissions of Greenhouse Gases." *Journal of World-Systems Research* 3: 432 - 466.
- Burtraw, D., Toman M.A. (1992): Equity and International Agreements for CO<sub>2</sub> Containment. *Journal of Energy Engineering*. Volume 118, Issue 2, pp. 122-135
- Campos C. P., Muylaert M. S., Rosa L.P., 2005: "Historical CO<sub>2</sub> emission and concentrations due to land use change of croplands and pastures by country", *Science of the Total Environment* 246, 1-3, pp 149-155
- Cantore N., Emilio Padilla, *Equity and CO<sub>2</sub> Emissions Distribution in Climate Change Integrated Assessment Modelling*, Working Paper DEIAgraWP-07-001 2007
- Cazorla, M., Toman, M. (2000): *International Equity and Climate Change Policy*. Climate Issue Brief No. 27
- Cedric, Ph. (2003): *Discounting the Future*
- Chao H., Peck S., 1998, Pareto optimal environment control and income distribution with global climate change. Discussion paper, electric Power Research Institute, Palo Alto
- Christian Aid (2000): *Who owes whom – climate change, debt, equity and survival*
- CICERO-ECZ: *Sharing the Burden of Greenhouse Gas Mitigation*. Final report of the joint CICERO-ECN project on the global differentiation of emission mitigation targets among countries. May 2001
- Cline W. R.(1992) , *The Economics of Global Warming*
- Cogoy, M. and K.W. Steininger (eds.), *The Economics of Global Environmental Change: International Cooperation for Sustainability*, Cheltenham: Edward Elgar, 2007
- Cutter S. (1995): *Race, Class and Environment Justice*. – *Progress in Human Geography* 19: pp107-118
- D'Arista, J. (2007): *U.S. Debt and Global Imbalances*. Political Economy Research Institute, University of Massachusetts Amherst, Working Paper Series Number 136

- den Elzen M. G. J., et al (2005) : Analysing countries' contribution to climate change: scientific and policy-related choices, Environmental Science & Policy, Volume 8, Issue 6 December 2005, Pages 614-636
- den Elzen M. G. J., Schaeffer M. (2002): "Responsibility for past and future global warming: Uncertainties in attributing anthropogenic climate change", *Climatic Change* 54. pp 29-73
- den Elzen M. G. J., Schaeffer M. , Lucas P.L. (2004): Differentiating future commitments on the basis of countries' relative historical responsibility for climate change: uncertainties in the 'Brazilian Proposal' in the context of a policy implementation, *Climatic Change Vol 71 Nr 3 pp 277-301*
- Dessai, S., Michaelowa, A. (2001): Burden sharing and cohesion countries in European climate Policy: the Portuguese example. *Climate Policy*, Volume 1, Issue 3, September 2001, pages 327-341
- Easterly, W. (2001): The Lost Decades. Developing Countries' Stagnation in spite of Political Reform, 1980-98. *Journal of Economic Growth* 6 (2): 135-57.
- Easterly, W.; Ross, L. (2001): It's Not Factor Accumulation: Stylised Facts and Growth Models. *World Bank Economic Review* 15 (2): 177-220
- EU Commission (2007) Communication from the Commission to the European Council and the European Parliament : Towards a European Strategic Energy Technology Plan - January 2007 COM(2006) 847 final) EC Brussels
- EU Commission (2008a): Proposal for a Decision of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020, Brussels, 23.01.2008
- EU Commission (2008b) Commission Staff Working Document Vol. II. Annex to the Impact Assessment Document accompanying the Package of Implementation Measures for the EU's objectives on climate change and renewable energy for 2020 -27February SEC(2008)85) EC Brussels
- Estrada-Oyuela, R.A.: Climate Change Mitigation and Equity. In: IPCC (2000): Development, Sustainability and Equity. Proceedings for the second IPCC Meeting on DES. Havana, Cuba 23 – 25 February 2000
- Faucheux S., Noel J.-F. (2001) : *Ökonomie natürlicher Ressourcen und der Umwelt* (French: 1995)
- Frederick, S, Loewenstein, G., O'Donoghue, T. (2002) Time discounting and Time Preference. *A critical Review*, 40 *J. Econ. Lit.* 351 (2002)
- Frey T., Schiedt H.-U. (2005): Wie viel Arbeitszeit kostet die Freizeitmobilität? – Monetäre Reisekosten in der Schweiz 1950-1910, In Gilomen H.-J., Schumacher B., Tissot L. (Hg.): *Freizeit und Vergnügen vom 14. bis zum 20. Jahrhundert*, Chronos, pp 157-171
- Galbraith, J.K. (2002): A Perfect Crime: Inequality in The Age of Globalization. *Deadalus* (Winter): 11-25
- Giljum, S., Eisenmenger, N. (2004): North-South trade and the distribution of environmental goods and burdens. A biophysical perspective. *Journal of Environment and Development* 13 (1): 73-100
- Grubb, M.J. (1995): "Seeking Fair Weather: Ethics and the International Debate on Climate Change." *International Affairs* 71: 463-496
- Grübler A, Nakicenovic (1991): *Evolution of Transport Systems: Past and Future*, IIASA, 1991
- Grübler A, Nakicenovic (1994): *International Burden Sharing in Greenhouse Gas Reduction*, IIASA, 1994
- Grübler A., Fujii Y. (1991): Inter-Generational and Spatial Equity Issues of Carbon Accounts, IIASA, *Energy* (1991) 16(11/12): 1397-1416



- Grünbuch der Kommission an den Rat, das Europäische Parlament, den Europäischen Wirtschafts- und Sozialausschuss und den Ausschuss der Regionen - Anpassung an den Klimawandel in Europa – Optionen für Maßnahmen der EU SEK(2007) 849 KOM/2007/0354
- Hayes, P., Smith, K. (1993): *The Global Greenhouse Regime: Who Pays?* London: Earthscan
- Heil, M.T., Selden, T.M. (2001): International trade intensity and carbon emissions: A cross-country econometric analysis. *Journal of Environment and Development* 10: 35-49
- Höhne N., Blok K. (2005): Calculating historical contributions to climate change – discussing the ‘Brazilian Proposal’, *Climatic Change*
- Höhne N., Harnisch J. (2004): Calculating historical contributions to climate change – discussing the ‘Brazilian Proposal’, *Climatic Change*
- Hornborg A. (1998): Towards an ecological theory of unequal exchange: Articulating world system theory and ecological economics. *Ecological Economics* 25: 127-136
- Howarth R.B. (2003): Discounting and Uncertainty in Climate Change Policy Analysis, *79 Land Economics* 369 – 38.
- Huan Qingzhi: Eco-socialism in an era of capitalist globalization bridging the west and the east. In: Huan Qingzhi (ed) (2010): *Eco-socialism as politics – rebuilding the basis of our modern civilization.*
- Ikeme J. (2003): Equity, Environmental Justice and Sustainability: Incomplete Approaches in Climate Change Politics. – *Global Environmental Change* 13: pp195-206
- IPCC (2000): Development, Sustainability and Equity. Proceedings for the second IPCC Meeting on DES. Havana, Cuba 23 – 25 February 2000
- IPCC (2007): Intergovernmental Panel on Climate change. Fourth Assessment Report. *Climate Change 2007: Synthesis Report. Summary for Policymakers*
- Islam, N. (2003): “What Have We Learnt from the Convergence Debate?” *Jour Economic Surveys* 17 (3): 309-62
- J. G. Canadell et al (2007): Contributions to accelerating atmospheric CO<sub>2</sub> growth from economic activity, carbon intensity, and efficiency of natural sinks. *PNAS - Proceedings of the National Academy of Sciences*, October 2007.
- Jamieson D. (2001): “Climate Change and Global Environment Justice.” In C. A. Miller and P. N. Edwards, eds., *Changing the Atmosphere: Expert Knowledge and Environmental Governance*. Cambridge: MIT Press, 287-307
- Jansen J. C., J. J. Battjes, J. P. M. Sijm, C. Volkers and J. R. Ybema (2000): The Multisector convergence approach of burden sharing – A flexible sector-based framework for negotiating global rules for national greenhouse gas emission mitigation targets. Report ECN-C--01-007, Petten, and CICERO Working Paper No. 5, CICERO, Oslo.
- Jenkins T.N. (1996): “Democratizing the Global Economy by Ecologizing Economics: The Example of Global Warming”, *Ecological Economics*; 16(3): 227-239
- Kammen D., Kinzing A. (1998): Aiming for equity, *Tiempo*, No 29, September 1998, International Institute for Environment and Development, and University of East Anglia
- Keefer P.; Knack St. (2002): “Polarization, Politics, and Property Rights: Links between Inequality and Growth.” *Public Choice* 111 (March): 127-54
- Kolshus, H.H., Torvanger, A. (2005): Analysis of EU member states “national allocation plans. Working Paper 2005:02. CICERO, 37pp.
- Krausmann F., Haberl H.(2002): The process of industrialization from the perspective of energetic metabolism Socioeconomic energy flows in Austria 1830-1995. *Ecological Economics* Volume 41, Issue 2 , May 2002, Pages 177-201
- Kvernokk, S. (1995): “Tradable CO<sub>2</sub> Emission Permits: Initial Distribution as a Justice Problem”, *Environmental Values*; 4: 129-48
- Laitko, H. (2006): Theorie und Programm: zum Verhältnis von Deskriptivem und Präskriptivem (Normativem) im Nachhaltigkeitskonzept. In: Meier, K., Wittich, E. (Hrsg.)

- (2006): Theoretische Grundlagen nachhaltiger Entwicklungen. Beiträge und Diskussionen. Berlin
- Lohmann, L. et al. (2006) Carbon Trading: A critical conversation on climate change, privatisation and power, development dialogue, no. 48, September
- Martinez-Alier J. (2004) : The Environmentalism of the Poor – A Study of Ecological Conflicts and Valuation. Oxford University Press
- MATCH (= Ad hoc Group Modelling and assessment of contributions to climate change): UNFCCC Overview status 2002 - Report of the expert meeting  
<http://unfccc.int/resource/docs/2002/sbsta/inf14.pdf>
- Metz B.( 2000) International Equity in Climate Change Policy. Integrated assessment 1 (2000) 111-126
- Miketa, A., Schrattenholzer, L. (2004): Burden-sharing Rules for Stabilizing Greenhouse-gas Concentrations and Their Equity Implications. IIASA, Interim Report IR-04-057
- Milanovic B. (2005): World Apart: Measuring International and Global Inequality. Princeton University Press, 2005
- Müller, B. (2001): “Varieties of Distributive Justice in Climate Change: An Editorial Comment.” Climatic Change 48: 273-288
- Müller, B. (2002): Equity in climate change: The Great Divide. Oxford Institute for Energy Studies
- Munasinghe, M.: Development, Equity and Sustainability (DES) in the Context of Climate Change. IPCC Guidance Paper for Lead Authors of the Third Assessment Report (TAR). In: IPCC (2000): Development, Sustainability and Equity. Proceedings for the second IPCC Meeting on DES. Havana, Cuba 23 – 25 February 2000
- Muylaert M. S., Cohen C., Rosa L.P, Pereira, 2004: “ Equity, responsibility and climate change” Climate Research 28, 1
- Muylaert M.S., Campos C.P., Rosa L.P. (2007): “GHG historical contribution by sectors, sustainable development and equity” Renewable and Sustainable Energy Reviews V. 11 issue5, p. 988-997, 2007.
- Nakicenovic N. (2004): Socioeconomic Driving Forces of Emissions Scenarios. In: The Global Carbon Cycle, Washington, 2004
- Nakicenovic, N. et al. (1998) (ed): Global energy perspectives
- Nakicenovic, N. et al. (2007): Assessment of Austrian contribution toward EU 2020 Target Sharing
- Nakicenovic, N. et al., (2000) Special Report on Emission Scenarios
- Narain S. (2007): Global Warming in an (even more)unequal world: A global deal for effective action. Presentation Potsdam October 2007
- Neumayer, E. (2000): “In Defence of Historical Accountability for Greenhouse Gas Emissions.” Ecological Economics 33: 185-192
- Nordhaus, W.D., Boyer, J. (2000): Warming the World. Economic Models of Global Warming. MIT
- Nordhaus, William: Critical Assumptions in the Stern Review on climate Change. SCIENCE Vol. 317, 13 July 2007
- O’Brien K., Leichenko R. (2006): Climate Change, Equity and Human Security. Die Erde 137 2006 (3), pp. 165-179
- O’Connor J. (1988): The Second Contradiction of Capitalism, Natural Causes, Essays in Ecological Marxism, New York
- OECD (1995): Climate change, economic instruments and income distribution, Paris
- Oxfam International (2007): Adapting to Climate Change.  
[http://www.oxfam.de/download/Adapting\\_to\\_climate\\_change.pdf](http://www.oxfam.de/download/Adapting_to_climate_change.pdf)

- Pacala S.W.: Equitable Solutions to Greenhouse Warming: On the Distribution of Wealth, Emissions and Responsibility Within and Between Nations. Princeton, at IIASA, November 2007
- Pan Jiahua, Chen Ying (2010): Carbon budget proposal: A framework for an equitable and sustainable international climate regime. *Social Sciences in China*. Vol 31, No.1.Beijing. P.5-34
- Paterson, M. (2001): "Principles of Justice in the Context of Climate Change." In U. Luterbacher and D. Sprinz, eds., *International Relations and Global Climate Change*. Cambridge, MA: MIT Press, 119-126
- Pettit J. (2004): Climate Justice: A New Social Movement for Atmospheric Rights. – *IDS Bulletin* 35 (3): 102-106
- Phylipsen G. J. M., Bode J. W., Blok K., Merkus H., Metz B. (1998): A Triptych Sectoral Approach to Burden Differentiation: GHG Emissions in the European Bubble, *Energy Policy*, Vol. 26, No. 12 pp929-943; zitiert nach Miketa, A., Schrattenholzer, L. (2004): Burden-sharing Rules for Stabilizing Greenhouse-gas Concentrations and Their Equity Implications. IIASA, Interim Report IR-04-057
- Podobnik B. (2002): Global Energy Inequalities: Exploring the Long-term Implications. *Journal of World-Systems research*, VIII, 2, spring 2002, 252-274
- Pomeranz, Kenneth (2000): *The Great Divergence: China, Europe, and the Making of the Modern World Economy*. Princeton. Princeton University Press, 2000.
- Raupach M. R, et al (2007): Global and regional drivers of accelerating CO<sub>2</sub> emissions. *PNAS - Proceedings of the National Academy of Sciences*, May 2007.
- Ringius, L., A. Torvanger and A. Underdal (2000): Burden differentiation of greenhouse gas abatement: Fairness principles and proposals. Working PaperNo. 13, CICERO, Oslo, and ECN C--00-013, Petten.
- Ringius, L., A. Torvanger and B. Holtmark (1998): Can multi-criteria rules fairly distribute climate burdens - OECD results from three burden sharing rules. *Energy Policy*, Vol. 26, No. 10, pp. 777-93, 1998.
- Ringius, L., Asbjorn, T., Underdal, A. (2002): „Burden Sharing and Fairness Principles in International Climate Policy.“ *International Environmental Agreements: Politics, Law and Economics* 2: 1-22
- Ringius, L., Torvanger, A., and Meze, E. (1996). *Climate Policy, Burden Sharing and the Nordic Countries*. TemaNord No. 572, Nordic Council of Ministers, Copenhagen, and CICERO Report No. 2, Oslo.
- Roberts J. T. (1999): "Extending the World-system to the Whole System: Towards a Political Economy of the Biosphere." J. Timmons Roberts and Peter E. Grimes. P. 59-83 in *The Global Environment and the World-System*. Greenwood's Press. Walter Goldfrank. David Goodman, an Andrew Szasz, editors.
- Roberts J. T., Parks B. C. (2007): *A climate of injustice: global inequality and climate change – vulnerability; responsibility and action*. MIT Press
- Rosa L.P, Ribeiro S. K., (2001): The present, past, and future contributions to global warming of CO<sub>2</sub> emissions from fuels, *Climatic Change* 48, Nr 2-3
- Rosa L.P, Ribeiro S. K., Muylaert M.S., Campos C.P, 2004: "Comments on the Brazilian Proposal and contributions to global temperature increase with different climate responses - CO<sub>2</sub> emissions due to fossil fuels, CO<sub>2</sub> emissions due to land use change", *Energy Policy* V. 32, 13, pp 1499-1510
- Rosa, L. P.: Sustainability and Equity in the Climate Convention. In: IPCC (2000): *Development, Sustainability and Equity*. Proceedings for the second IPCC Meeting on DES. Havana, Cuba 23 – 25 February 2000

- Rose A., Kverndokk S. (1999): Equity in Environmental Policy with an Application to Global Warming. – In: van den Bergh, J. C. J. M. (ed.): Handbook in Environmental and Resource Economics. – Cheltenham: 353-379
- Rose, A. (1992): Equity Considerations of Tradable Carbon Emission Entitlements. In: Combating Global Warming. Geneva, UNCTAD, 1992.
- Rose, A. and Stevens, B. (1998). A Dynamic Analysis of Fairness in Global Warming Policy: Kyoto, Buenos Aires and beyond. *Journal of Applied Economics* 1 (2)329-362.
- Rose, A., Stevens, B., Edmonds, J., Wise, M. (1998): “International Equity and Differentiation in Global Warming Policy.” *Environmental and Resource Economics* 12: 25-51
- Saikkku, L., Rautianinen, A., Kauppi, P.E. (2007): The sustainability challenge of meeting carbon dioxide targets in Europe by 2020. *Energy Policy* 36 (2008) 730 – 742
- Schmidt, H. (1997): Internationale Verteilungswirkungen des Klimaschutzes: eine Simulation der Verteilungswirkungen möglicher Klimaschutz-Abkommen und deren mögliche Auswirkungen auf das Ergebnis der Klimaverhandlungen, Hamburg
- Schmidt, T.F.N., Koschel, H. (1998): Climate change policy and burden sharing in the European Union: applying alternative equity rules to a CGE framework, Mannheim: ZEW
- Schneider, S.H. Lane, J. Dangers and Thresholds in Climate Change and the Implications for Justice. In: J.W.N., J. Paavola, S. Hug and M. J. Mace (eds.) (2006): *Fairness in Adaptation to Climate Change*. – Cambridge, Mass.
- Smith Steven (1993): Who Pays for Climate Change Policies? Distributional Side-effects and Policy Responses, OECD, Paris
- Smith, K.T. (1995): “The Natural Debt of North and South”, in T. Giambelluca et al. (eds.), *Climate Change: Developing Southern Perspectives*, Wiley
- Spash, C.L. (2002): *Greenhouse Economics – Value and ethics*. Routledge
- Spreng, D. (2005): Distribution of energy consumption and the 2000 W/capita target. *Energy Policy* 33 (2005) 1905 – 1911
- Steininger K., Gobiet W. (2005): Technologien und Wirkungen von Pkw-Road Pricing im Vergleich, Wegener Center Graz Bericht 1/2005
- Stephenson Paule* (2007): Climate Change, Equity and European “Effort Sharing”. Institute of Policy Studies. Working Paper 08/07
- Stern Nicholas: Bali – now the rich must pay, December 11, 2007  
<http://www.chinadialogue.net/homepage/show/single/en/1559-Bali-now-the-rich-must-pay>
- Stern Review: The Economics of Climate Change (2006)
- Thielmann, S. (2005): Fairness im Klimaschutz: Ansatzpunkte und Probleme einer internationalen Lastenverteilung zwischen Industrie- und Entwicklungsländern, Berlin, Logos-Verl.
- Tol, R.S.J., Downing T.E., Kuik, O.J., Smith, J.B. (2004): “Distributional Aspects of Climate Change Impacts.” *Global Environmental Change* 14: 259-272
- Tol, R.S.J., Verheyen, R. (2004): “State Responsibility and Compensation for Climate Change Damages – a Legal and Economic Assessments.” *Energy Policy* 32: 1109-1130
- Torvanger, A., Godal, O. (1999): A survey of differentiation methods for national greenhouse reduction targets. Report No. 5, CICERO, Oslo, and forthcoming as report from the Nordic Council of Ministers, Copenhagen
- Toth, F., (1999): *Fair Weather? Equity Concerns in Climate Change*. London: Earthscan
- Trudinger C., Enting J.(2005): Comparison of formalisms for attributing responsibility for climate change: Non-linearities in the Brazilian Proposal approach, *Climatic Change* 68, Nr. 1-2
- Underdal: A. (1998): Modelling International Negotiations: The Case of Global Climate Change. Paper presented at the Third Pan-European Conference on International Relations, Vienna, 16-19 September, 1998.

- UNFCCC: MATCH <http://unfccc.int/2860.php>  
[http://unfccc.int/methods\\_and\\_science/other\\_methodological\\_issues/items/1038.php](http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php)  
<http://unfccc.int/resource/brazil/meet080903/pres080903.html>  
[http://unfccc.int/resource/brazil/meet080903/present/nik\\_hohl.pdf](http://unfccc.int/resource/brazil/meet080903/present/nik_hohl.pdf) <http://www.match-info.net> <http://www.match-info.net/> (Presentation 7 May 2006 MATCH-Paper 1)
- Wallerstein I. (1974,1980, 1989): The modern world system”, 3 volumes
- Watson J., Tao Wang, Is the west to blame for China’s emissions? December 20, 2007  
<http://www.chinadialogue.net>
- Weitzman M., “The Stern Review of the Economics of Climate Change”, Book review for JEL. <http://www.economics.harvard.edu/faculty/Weitzman/papers/JELSternReport.pdf>
- William Nordhaus, “The *Stern Review* on the Economics of Climate Change,” November 17, 2006, p.6. Available at <http://nordhaus.econ.yale.edu/SternReviewD2.pdf>
- Williams, M. (1997): The Group of 77 and global environmental politics. *Global Environmental Change* 7: 295-298
- Wissenschaftlicher Beirat der Bundesregierung – globale Umweltveränderungen (2009): *Kassensturz für den Weltklimavertrag – der Budgetansatz*. Berlin
- Xiaosu Dai, Michel den Elzen, Höhne N. (2004) [Ad hoc group for the modelling and assessment of contributions of climate change \(MATCH\)](#)
- Yanagi, M., Munesue, Y., Kawashima, Y. (2001): Equity rules for burden sharing in the mitigation process of climate change. *Environ Engg and Policy* 2 (2001) 105 – 111
- Ybema J.R., J.J. Battjes, J.C.Jansen, F.T.Ormel (2000): Burden differentiation: GHG emissions, undercurrents and mitigation costs. Report ECN-C--00-012/CICERO WP 1999: 14, Petten/Oslo.

