Self-governance in global climate policy: An essay

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Preface

On December 12, 2015, COP21 in Paris adopted the Paris Agreement. The unanimous adoption prompted praise and high expectations. The agreement, however, is a grey text, opaque or silent about how the global atmosphere and climate commons may be governed. Scientific and societal media burst from many ideas and proposals about proper global policy regimes. This essay distills a consistent architecture from the diverse propositions, with Elinor Ostrom's studies and recommendations playing the leading role. Elinor Ostrom (1933-2012) is the first and only female Economics Nobel price (2009) winner.

When the entitled appropriators of a commons resource pool are sovereign, self-governance is unavoidable. Sovereignty is real in case of the global atmosphere and climate commons. There is no world authority imposing mandatory rules. Privatization of the atmosphere and climate commons is neither desirable, nor feasible. The global community governs the global climate commons with a framework convention (UNFCCC 1992) and by follow-up COP agreements. Since 1995 yearly COP meetings delivered the Kyoto Protocol (COP03, 1997), the Copenhagen Accord (COP15, 2009), and the Paris Agreement (COP21, 2015). Notwithstanding the massive mobilization of participants and audience at the yearly December COP events, the approaches tried year after year book little success: Timely and effective greenhouse gas emissions reductions are not occurring on the required scale.

This essay extends the findings by long-time experts in governing local commons (Ostrom 1990, Bromley ed. 1992) to governance of the global atmosphere and climate commons. Ostrom (1992) has given the hint: "*The general principles involved in solving large-scale commons problems are similar, however far more difficult and costly. Institutional designs relying on nested structures of smaller organizations within larger organizations are most likely needed*". The essay's focus is on the UNFCCC, as being the top of a nested, multi-leveled governance structure. This structure is largely existent. Highlight its strong hubs, clarify the interconnections among the many centers, and complete a few links are sufficient for a workable global climate policy regime. The UNFCCC is the top of the multilevel construction, and should limit its actions to top executive tasks.

The results and principles described by Ostrom and her colleagues are applicable by incorporating the abundant literature on climate policy architectures or regimes (e.g., Aldy and Stavins eds. 2007, Hahn and Ulph eds. 2012, Cramton et al. eds 2015, Barrett et al. eds. 2015). The outcome of combining the many sources is thwarting the approach of traditional economics, official policies of market-based economies (for example the European Union), and the course followed by the COPs.

The analysis tries a rational approach for speeding up global climate policy to a pace effective in certainly staying below risky +2°C atmospheric warming. UNFCCC's global climate policy is the pinnacle of extended, multi-leveled and nested constructions. Below UNFCCC level, all mitigation and adaptation activities occur in national and local contexts. UNFCCC's core task is safeguarding and managing the climate commons, by preventing GHG emissions' continuation and growth. Successful prevention is difficult to visualize and enforce, but crucial for respecting the 2°C limit. A rational approach recognizes the specificity of issues like mitigation, adaptation, finance, technology, capacity building. This essay focuses only one issue, albeit the principal one, mitigation of energy-related carbon dioxide (CO_2) or in other language: preventing the continuation and

growth of energy-related emissions until the full elimination of energy-related CO_2 emissions is achieved. It requires quitting fossil fuels as an energy source, fully and as soon as possible.

Why an essay?

How to keep overview when thousands of people debate climate policies, which were tried, prepared, or proposed? Publications and propositions on climate policy differ by various aspects: discipline and affiliation of the authors, explicit or implicit assumptions, values, goals, limits in scope and information, and more. Some authors ventilate dissatisfaction about the ongoing global policy-making process, but their criticisms and alternatives are mostly overruled by mainstream beliefs and practices, prolonging the usual policies. The slow and fragile progress by customary climate policy however reveals the urgent need for drastically different pathways. In first order, the supply and use of energy present practices need reframing and rebounding in a sustainable development perspective. Again a contentious topic of endless study and debate.

Covering a minor part of the debates already leads to tomes of text. Yet, my ambition is to review the important topics in an essay of limited length, and in a language accessible to an audience interested in climate policy. This essay provides information, recipes, tips, and a few warnings. The formal mindset of QED (Quod Erat Demonstrandum) is avoided. Proofing works via testing practical recipes and their results. This stimulates the readers' creativity in associating own experiences with the presented information and suggestions. Feedback by readers is appreciated.

This essay is modular. Most parts can be consulted independently. This applies to the glossary (chapter1), legends (chapter 2), COP21 agreement and decision (chapter 3), challenges and alternatives (chapter 4). Having considered the four chapters is helpful in absorbing the grand menu (chapter 5), proposing a comprehensive and consistent composition of essential ingredients of workable global climate policy. The menu applies Elinor Ostrom's concepts about self-governance on the global climate commons. All modules (in chapter 6 called 'boxes') are open for criticism and improvement, with a focus on practice, reality and diversity. With an open mind, the available and new contributions can be converted into improved propositions.

Finally, this essay is less formal in referencing. Including all the references that informed and inspired me on climate policy issues over the last twenty-five years, would swell the text, and deteriorate its practicality. Hence the bibliography section holds an extensive (still incomplete) list of publications consulted, not all of them referenced in the text. Comments and suggestions of readers about completing the essay and about improved referencing are solicited. Co-authorship is welcomed.

Principles subscribed

A set of principles guide the analysis and propositions:

1) The drastic and urgent changes in energy supplies and use request exploration of non-conventional approaches and solutions (think out of the box). It is unlikely for people and organizations rooted in the fossil fuel era and with major interests in the continuation of present lifestyles to find the disruptive pathways needed.

2) Endowed nations realize first the renewable energy transitions, opening roads for the developing nations (if not this way, forget about a sustainable future)

3) Propositions respect five overarching principles (Verbruggen 2011):

- Universality: global issues are assessed and solved from a universal vision
- Sovereignty: sovereign nations request balanced and fair approaches
- Diversity: only specific solutions are effective, efficient, and fair
- Transparency: for real and persistent commitment in common resolve
- Realism: change asks resources, time and organization; inaction brings catastrophe

4) Sustainable development as mission. The principal dimensions of sustainable development are governance and equity. The commonplace 'present generations bring offers for future generations' when they address climate change, conflicts with the polluter pays principle. Present generations do not own rights of littering the atmosphere, but duties to urgently stop littering and clean the mess.

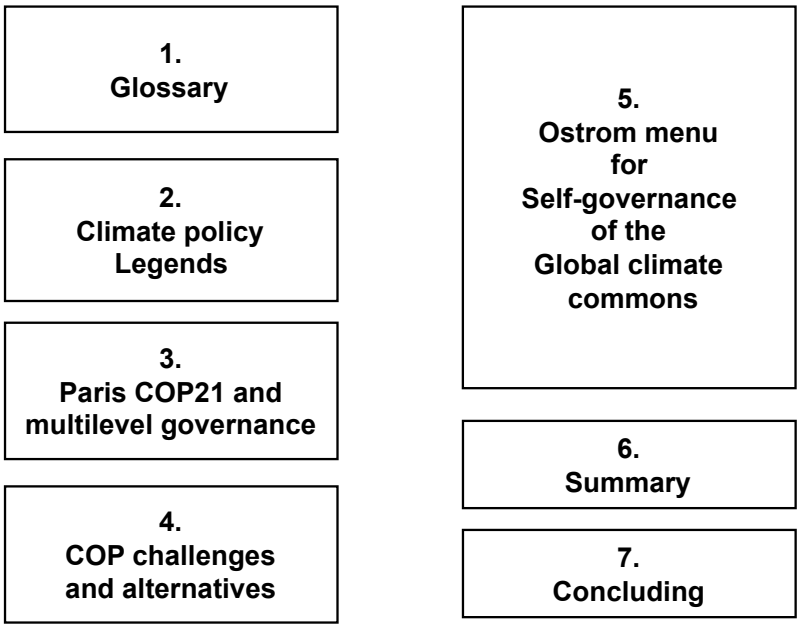
Practical things

When referring to another chapter, section or figure of the text, vertical brackets [.] are used.

Referencing in the text is limited; the bibliography at the end holds more sources consulted.

The essay is structured by providing four introductory chapters (left side of following scheme). The main chapter 5 outlines the self-governance architecture. Figure 6 is a flowchart of the architecture's constituent components. Chapter 6 is a Summary of the major properties of the self-governance propositions of chapter 5. A brief Concluding (chapter 7) ends the essay.

The structure of the essay



Acronyms

BRI: Budget Reform Index
CDM: Clean Development Mechanism (adopted at COP03)
CO_2: carbon dioxide (long-living greenhouse gas; the emissions are mainly due to fossil fuel combustion and explosions (internal combustion engines); land use and deforesting are the second source)
COP: Conference of Parties (of the UNFCCC), since 1997 convening yearly in another place of the globe
Cpp: average energy-related CO_2 annual emissions per person in a country (summary indicator to monitor a country's emissions intensity)
DPSI@R: Driving Forces – Pressures – State – Impacts @ Responses (analysis of major environmental issues in their causal sequence, and after evaluation addressed by policy responses)
ETS: Emissions Trading Scheme (EU's CO2/ GHG emissions trading system, started in 2005 in follow up of COP03 in Kyoto, 1997)
GCF: Green Climate Fund (agreed in the Copenhagen Accord of 2009 to transfer a yearly $100 billion from 2020 onwards)
GDP: Gross Domestic Product (indicator of total wealth produced by a country during one year); conversion in US$ currency may use Market Exchange Rates or Purchasing Power Parities. The latter method assesses better wealth of developing countries.
GHG: Greenhouse Gases (long-living gases in the atmosphere with warming potential covered by the Convention: CO_2, CH_4, N_2O, and three F-gases)
IAEA: International Atomic Energy Agency (UN organization, functioning as well as promoter as controller of nuclear activities. At the moment very active for the acceptance of nuclear power as low-carbon electricity source)
INDC: Intended Nationally Decided Contribution (by every Party)
IPCC: Intergovernmental Panel on Climate Change
IPECS: Individual Parties' Emissions Contraction Scenarios (indicative patterns for contracting and converging of the Cpp of countries)
MRV: Monitoring-Reporting-Verification (of commitments by Parties)
P&R: Pledge and Review (of commitments by Parties)
PPP: Polluter Pays Principle. Recommended by the OECD in 1972, evolving into a spectrum of interpretations: polluters pay only the own abatement expenses (light PPP), or also damage and adaptation expenses (strong PPP), or the extended producer liability (strong version applied on impacts producers may cause without human error)
PWR: Pressurized Water Reactor (most common nuclear power supply station)
RE: Renewable Energy / Electricity
SD: Sustainable Development (as defined in Our Common Future, chapter 2)
SE4All: Sustainable Energy for All. Initiative of the UN General Assembly to half the energy intensity and double the use of renewable energy in developing countries
TINA: There Is No Alternative (belief paralyzing creativity and progress)
UNFCCC: United Nations Framework Convention on Climate Change (also: the Convention)
WCED: (UN) World Commission on Environment and Development (published in 1987 Our Common Future, stipulating the concept of Sustainable Development)

1 Glossary

No exhaustive glossary is provided, only a few terms, important in the global climate policy discussion.

1. **Commons** (common-pool resource; public goods): natural or man-made resources sufficiently large that it is costly to exclude users. Two main aspects of commons are: 1) access to use, related to the cost of achieving physical exclusion; 2) rivalry in use, related to congestion and depletion. *Freeriding* erodes commons, eventually to full loss. To avoid this tragedy Hardin (1968) proposes 'mutual coercion mutually agreed upon'. The usual shorthand solutions (privatization or enforcement imposed by outside force) are not feasible in case of the global commons atmosphere and climate, accessible by sovereign nations and their inhabitants. Ostrom (1990) argues that stable institutions of *self-government* can be created (this creation being again a collective dilemma). Three puzzles are to be solved: 1) supply a new set of rules; 2) credible commitments (based on reciprocity, trust and fairness); 3) mutual monitoring. Without monitoring, there can be no credible commitment; without commitment, there is no reason to propose new rules. The global atmosphere and climate commons require nested polycentric organizations within a globally comprehensive multi-level architecture. The diversity of the global actors and organizations at the nested levels asks for differentiated approaches and solutions.

2. **Complexity** (term generally used with imprecise meaning). A complex system is characterized by interwoven relationships to a degree that analytical decomposition is impossible and the dynamics are unpredictable (Homer-Dixon 2011). If global climate policy would be complex and own both characteristics, they would impede the design of rational multi-level governance structures. Already, social scientists propose 'clumsy solutions for a wicked world to improve global governance' (Verwey 2011). Climate change itself is complex, and indeed, COPs made global climate policy complicated. Nevertheless, climate governance is apt for decomposition and time-sequential ordering. Multi-level and polycentric distribution of responsibilities solves the sterile stalemate between top-down and bottom-up approaches. Mitigation and adaptation tasks can be decomposed. The policy process can be structured in yearly time-sequential rounds. It means, *climate policy is **not** under the spell of complexity*.

3. **Conference of the Parties**: supreme body of the UNFCCC, comprising countries with right to vote that have ratified or acceded to the convention. Since 1995, the COP convenes yearly in searching proper implementation of the UNFCCC.
   COP03-1997 Kyoto Protocol: A panel of Annex1 countries including the EU pledged to reduce their volume of GHG emissions by 2008-2012 compared to 1990. Higher efficiency in emissions reduction was pursued by global trading in emission permits and by a Clean Development Mechanism. The latter also would transfer finance and technology to the non-Annex1 Parties.

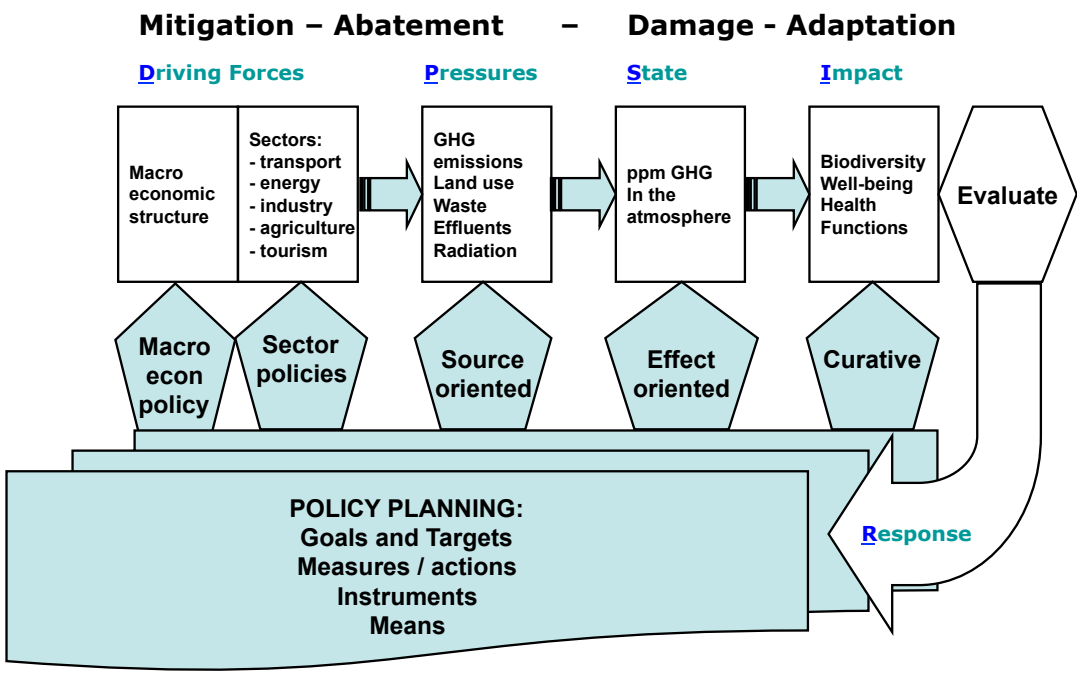
COP15-2009 Copenhagen Accord: Political leaders of the major world nations have set out some major policy lines for the future. They adopt 2°C as ceiling on global temperature increase (Art.1). Art.12 announces consideration in 2015 of a 1.5°C ceiling. "*Deep cuts* in global emissions are required"; for developing countries "a low-emission development strategy is indispensable" (Art.2) and "low emitting economies should be provided incentives to continue to develop on a low emission pathway" (Art.7). Next to mitigation is stressed "the need to establish a comprehensive adaptation program" (Art.1). The Accord emphasizes cooperation on adaptation and mitigation: "developed countries shall provide adequate, predictable and sustainable financial resources, technology and capacity-building" (Art.3), reiterated in Art.8 as "scaled-up, new and additional, predictable and adequate funding" where also the USD 30 billion 'fast-start' financing by 2012 and the "goal of mobilizing jointly USD 100 billion dollars a year by 2020" are mentioned. For managing the financial transfers, the Green Climate Fund (GCF) is founded. The clear, univocal text of the Accord is two A4 pages. The Accord is evaluated as "*maybe the best occurrence for climate policy since the UNFCCC (1992)*" (Verbruggen, 2011). However, default talk about the Copenhagen COP covers a long and very negative vocabulary.
COP21-2015 Paris Agreement: see Chapter 3

4. **Contraction & Convergence**: Greenhouse gas, or energy-related CO_2 emissions per person (Cpp) diminish towards a common low or zero level. In the 1990s the idea was highly promoted, for example by the Global Commons Institute (Meyer 1998). In the strongest version Cpp is a uniform quota, given to all citizens on the globe, and tradable. In a more realistic version, Cpp is the average value by country, contracting over a period of decades, and via a tightening maximum allowable Cpp emissions level applied on all Parties, converging towards very low quota near zero. Agreeing on contracting and converging Cpp numbers is a translation of the maximum +2°C constraint in clear targets for all the Parties, with respect for the principle of 'common but differentiated responsibilities and respective capabilities'.

5. **Diversity** (concept used by many sciences). UNFCCC's Art. 3.1 '*common but differentiated responsibilities and respective capabilities*' refer to diversity of the Parties, also stretching to their goals, expectations, interests, and more. Aristotle aims to avoid discrimination by the rule '*treating equal cases equally and unequal cases unequally*'. In every continuum from minor to significant diversification, identification of divides distinguishes variety (cases submitted to equal treatment) from disparity (cases for separate treatment). Attention for diversity is almost absent in economic theory. As a corollary uniform policy prescriptions are considered as superior [*Legend n°1*]. Institutional economics, law and social sciences, propose specificity for addressing diversity in an effective, efficient, and equitable way. Also practical business is keen to diversify in technology, product designs, consumer services, etc. In climate policy, the conundrum of uniformity is unrealistic and harmful.

6. **DPSI@R** (Driving forces – Pressures – State – Impacts @ Response). The kernel of this logic suggested by the OECD (1993) has been extended by several environmental administrations. Upfront driving forces were added, with macroeconomic and economic sectorial detail (agriculture, industry, buildings, transportation, tourism, etc.). The causal sequence DPSI is concluded by evaluation, preceding an extensive response design, named Policy Planning in figure 1. The DPSI@R framework has proven to be of practical use in conceiving and deploying environmental policies. It helped to shift the emphasis in policy-making from curative towards preventive approaches. In climate policy, mitigation comes prior to adaptation.

Figure 1: DPSI@R analysis as scientific basis for designing comprehensive environmental, in particular climate, policies



7. **Flexible Mechanisms**: COP03 (Kyoto 1997) decided to launch a global trade system in emissions permits. On the one hand, a Cap & Trade mechanism allows trade among Annex1 Parties to reduce emissions 'at least cost'. On the other hand, Annex1 Parties could offset part of their committed reduction by obtaining certified emission rights via the Clean Development Mechanism. Due to their dubious effectiveness, efficiency, fairness, and administrative feasibility, the support for the flexible mechanisms faded. Major energy suppliers and industrial companies care about the life extension of EU's Emissions Trading Scheme (ETS). Economic policy instruments are little visible in the Paris decisions and agreement. Flexible mechanisms are covered in art.6 of the agreement.

8. **Graduation**: In 1992 UNFCCC classified Parties as Annex1 versus non-Annex1. A binary classification is rudimentary; over decades nations do develop and change. Graduation is the evolvement in belonging of Parties to particular classes, depending on changes in attributes and performance (for example GDP/capita). Suggestions to substitute more *refined and adaptive classifications* for the 1992 binary, face high resistance of many non-Annex1 countries. This resistance is harmful for reaching equitable agreements in common resolve dynamics in the spirit of 'common but differentiated responsibilities'. Binary is not the same as differentiated. Another type of graduation is the *progressive participation of nations in a global agreement*. A global agreement could start with 20 percent of the world's nations emitting more than 80 percent of the greenhouse gases, with the option for all other nations to join the agreement. Deliberate joining will occur when the agreement is transparent and respecting the rights of all countries in a balanced way.

9. **(Ir)reversibility**: *Reversibility is the ability to restore or to maintain the functional performance of a system*. Irreversibility occurs when no substitutes exist for a system which functioning is destroyed. Hence, destruction is fatal and to prevent destruction, drastic and urgent interventions are warranted. Accumulation of long-living GHG in the atmosphere and destabilizing the global climate are irreversible function losses *justifying drastic and urgent measures*.

2 Climate Policy legends

Legends spread unfounded stories and increase the believing by others. Although fake, legends' impacts may be huge and damaging, inter alia by paralyzing valid solutions and necessary progress. Also climate policy design is infected by legends, of which two with high impact are discussed.

The grand climate coalition (officials, academics, captains of industry, green campaigners) may dislike the unveiling of the legends. The coalition did invest huge amounts of time and money in making the legends widely adopted. But this did not lead to the announced successes. The policies and plans to continue 'throwing good money after bad' are criticized. The coalition attitude is rooted in the belief 'there is no alternative' (TINA), a closure of the faith 'the only feasible way is the on-going business'. TINA is little helpful in addressing climate change, requiring thorough transitions of energy systems, with deep disruptions and reversals in theories, technologies and practices.

Legend n°1: A globally uniform carbon price is necessary and (almost) sufficient to manage the climate commons.

Economists are the authors and active propagators of this legend. The pursued uniform carbon price should be installed by preference via a global emissions permits cap & trade system covering all emission sources on earth (Gollier and Tirole 2015). Some economists argue that the second-best option of applying a globally harmonized uniform carbon price or tax is a more realistic approach (Cooper 2007, Nordhaus 2007, Stiglitz 2015, Weitzman 2015, Cramton et al. 2015). Some economists and social scientists are more cautious about the uniformity rule and focus more on the real diversity (Metcalf 2009, Parry and Williams 2012, Sartor 2015)

The legend of the globally uniform carbon price sounds good: with a single scythe, the "trillions of emissions daily caused by billions of people" (Nordhaus 2007) can be trimmed to the right length. However, practically it is impossible setting-up and applying the globally uniform carbon price. It does not match the reality of human life, being immensely diverse. Just try to answer the question: What does a uniform carbon price of say US$20 per ton CO_2-eq emitted mean for respectively the Bahamas, Bangladesh, Belarus, Belgium, Benin, Bhutan, Bosnia, Botswana, Brazil, Bolivia, Bulgaria, Burkina Faso, to name just a few countries? Adding a uniform carbon tax to very different pricing, taxing and subsidizing systems in nations is similar to covering the skyline of a city with a blanket for obtaining a flat field. Because it is practically impossible to ever install a uniform carbon price, the 'eating of the pudding proof' never will happen. As a corollary, advocating the superiority of the global uniform price solution can continue forever.

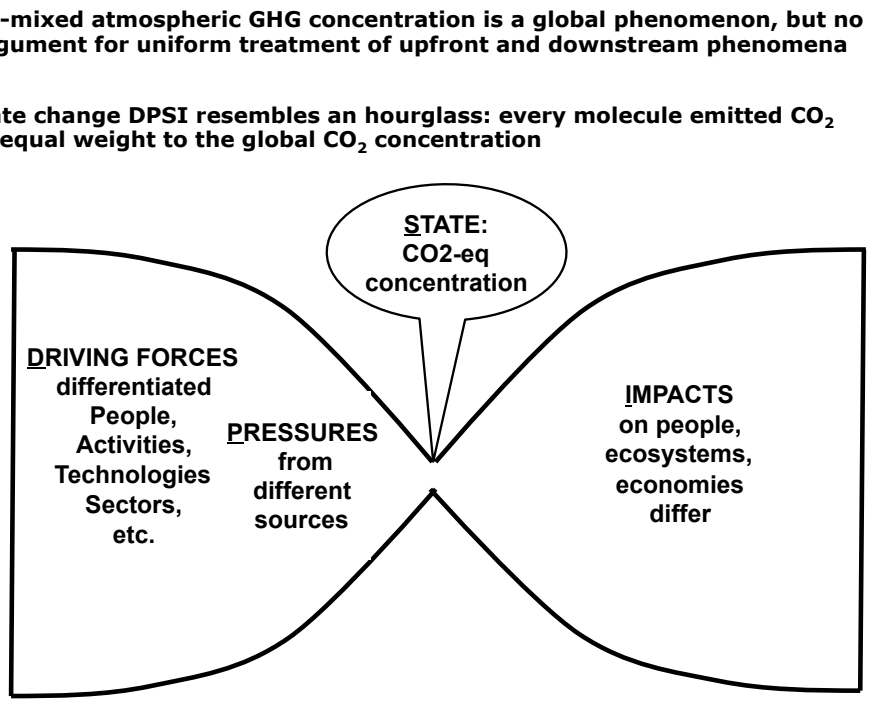
Abuse of non-refutable truths

The legend is proposed as valid wisdom with the help of two non-refutable truths.

• First, emitting a quantity of CO_2-eq GHG wherever on earth causes a similar increase of CO_2-eq ppm concentration in the atmosphere. This concentration is the main State (S) variable in the climate change DPSI [*Glossary*] causal sequence to indicate the global accumulation of non-assimilated GHG emissions. From a ton emitted causing a similar increase in concentration is derived the flawed conclusion that all emission sources should be treated equally. Absent remains the theoretical or practical foundation for transmitting the global

coverage attribute of one particular State (S) variable (in case: GHG concentration) onto the differentiated Driving forces (D), Pressures from different sources (P) and different types of Impacts (I) on different places and populations. Actually, the DPSI model is a tool to chart and study the broad scope and diversity of variables and relationships constituting environmental themes or issues, like climate change being now the most predominant one. A detailed analysis is the basis for specifically designed policy responses in the completed DPSI@R model [*Glossary, figure 1*].

Figure 2: Well-mixed atmospheric GHG concentration is a global phenomenon, but no argument for uniform treatment of upfront and downstream phenomena



• A second truth used to argue in favor of uniform pricing of emissions is the formal mathematical method of mitigation costs minimization. By equalizing the marginal costs of emission reductions at various emission sources, the total cost of reducing a volume of emissions by the sources is minimized. Hence, economists favor the inclusion of *all* emission sources in *one* global basket, to obtain the *single uniform price* of maximum efficiency.
Formal mathematics is correct. Only, a correct formula does not deliver meaningful results in all circumstances. When separate treatment of sources is due because of a high degree of differences across activities, technologies, sectors, conditions, functioning policies, etc. it is necessary to investigate and specify the scope and the set of cases includable for a valid application of the formula. Treatment of diversity is related to economics textbook assumptions about unlimited substitutability; by assuming everything is substitutable, trimming diversity into uniformity is seen as a major source of economic benefits.

However, the real world is and wants to stay utmost diverse because diversity is natural, desired and often necessary. The crucial role of diversity is also observed in practical economics. For example, successful entrepreneurs segment markets to high refinement for meeting the demands of differentiated customers. Production systems are organized in sectors and subsectors for several reasons, one being differentiation of the applied technologies, diverse skills, etc. One major strategy of managerial success is differentiation (Porter 1980).

Stubborn failures

It is puzzling why economists favor a single global approach (market) in climate policy. It is also puzzling why they maintain that favor after experiencing failure in repetitive trials to impose the uniformity straitjacket.

The economics legend has paralyzed climate policy since 1997 (COP03, Kyoto), when the USA (via vice-president Al Gore) imposed emissions trading. The EU, in 1997 freshman in emissions trading, embraced the new instrument. December 2015, eighteen years are lost in trying to make the EU Emissions Trading Scheme (ETS) effective. The ETS carbon price is merely symbolic. In energy transition pioneer countries (the Netherlands, Germany) the ETS was not effective in barring the substitution of coal for gas in power generation (supercritical coal plants emit more than the double CO_2 per kWh than combined cycle gas plants). The ETS is neither efficient: many participating companies get the emission permits for free, and technological innovation triggered by the ETS is absent. Significant windfall profits (and even fraud) question the fairness of the ETS. Notwithstanding the evidence, the emissions trading legend prolongs its life, with warm support of the regulated companies and sectors. In particular the major energy companies love the ETS (Magritte Group Press Conference of March 19, 2014 www.gdfsuez.com). When regulated companies are strongly in favor of a regulatory system, the latter is mostly captured and toothless.

Epilogue: Don't throw out the baby with the bathwater

Prices and bills play a significant role in guiding economic decisions. Economic calculus by producers-appropriators of common goods is also the central piece of Ostrom's governance analysis. Energy use, with its various harmful emissions, is essentially an economic decision. However, a 'global uniform carbon price' cannot streamline the economic calculus of trillions of decisions by billions of people. For changing decisions, the monetary pressures (= bills) need adjustment to the minimum forces necessary to obtain intended changes. The bills must also be compatible with the carrying capacity of the actual decision-makers. A tremendously differentiated real world asks for fine-tuning of the pressurizing machineries, not for the mirage of a simple scythe zooming over a global leveled playing field.

Carbon taxes need also tuning with other economic instruments (such as subsidies) and with legal, social, and structural instruments (the so-called menu of instruments [*Glossary DPSI@R, figure 1*]). Every nation's policy field is a patchwork of particularities due to particularities of the nations themselves, historical decisions, etc. Improving the policies for addressing climate change is necessary and possible by redesigning the many patchworks. This is work to deliver at the national, state and local levels. General names of this work are budget reform, tax shift, green tax reform, etc. (www.foes.de).

Budget Reform Index (BRI)

Efforts in redesigning can be measured appropriately by an annual budget reform (tax shift) index, as the ratio of two numbers. The numerator of the ratio is the sum of four numbers yearly known in nations that have developed adequate national accounts = {(taxes raised on bads + subsidies given to goods) – (taxes raised on goods + subsidies given to bads)}. 'Bads' are climate and environmental harmful activities, for example: emissions of GHG, use of fossil fuels and of nuclear power, meat consumption, airborne traffic, etc. Goods are climate and environmental beneficial activities, for example: use of sustainable renewable energy, construction of efficient buildings, cycling and walking, etc. National accounts, and so the four numbers and their addition, are expressed in the currency of a country. The denominator of the BRI is the total state budget. BRI reflects the importance of the budget or tax shift, and monitors the yearly progress of a nation in redirecting financial incentives. EUROSTAT (2015) publishes similar indices about the share of environmental taxes in the budgets of EU member states.

Financial incentives cannot be organized at the UNFCCC level; they are the full responsibility of nations and of states within nations. Nations may cooperate to create transnational instruments for transnational activities (international aviation, shipping, and global industrial sectors). Sectorial emissions trading systems at a global scale may be one of the instruments selected.

Concluding, all type of instruments can play a role for cutting the annual tens of billions tons emissions of GHG. The diversity of policy instruments to cut emissions is similar to the diversity of cutting instruments used for physical cutting in the versatile human activities observed. Just do the exercise of enumerating the tens to hundreds of useful cutting instruments you know. You will find out that the several instruments are suited for some applications but totally unpractical and dangerous in other applications.

Legend n°2: The world is well advancing towards Sustainable Development

The SD discourse at the international level evolved after the publication of the seminal report Our Common Future (WCED 1987). The WCED discourse links and interlaces two major post-World War II challenges – the worldwide unequal economic and social development (UNCTAD 1974) and the impact of economic development on the environment (Meadows 1972). The WCED report points out the need for economic growth to counteract poverty, especially in developing countries. This created room for business-as-usual interpretations such as sustained economic growth and sustained profits in ongoing businesses (Grober 2014). Gradually, the further articulation of sustainable development concepts and challenges was colonized by neoliberal governance principles (Pestre 2011), culminating in the reduced form of People-Planet-Profit (3P or triple bottom line). Adoption of 3P newspeak in governance for sustainability is pernicious and vulnerable to manipulation (Norman and MacDonald 2004).

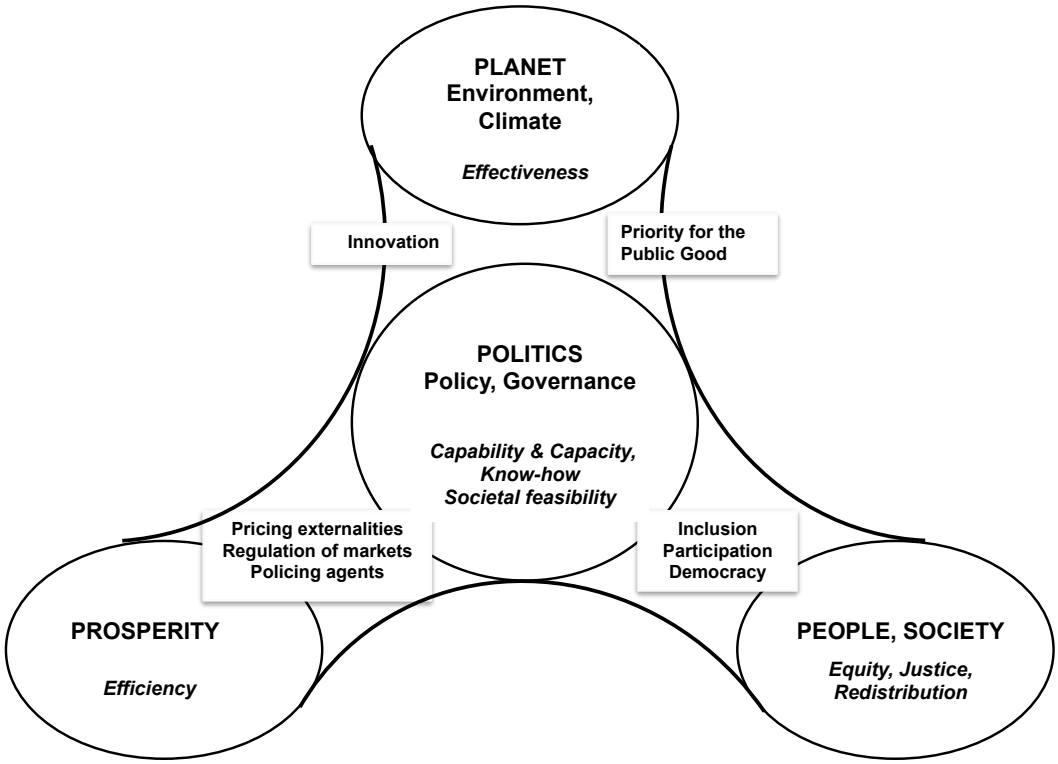
Reducing the SD message to 3P speak has contributed to the spreading and success of the term SD. Over the past two decades, SD has been included in the discourse of political, social and business actors at international, national,

regional, and local levels. Apart from this discursive success, achievements in actual sustainability since 1987 are quite sobering (Zaccaï 2012). The 'sustainable growth' interpretation has become too far removed from the initial WCED (1987) and Agenda 21 (UNCED 1992) propositions.

Revisiting Our Common Future

The conceptual Chapter 2 of Our Common Future (WCED 1987, p. 43-65) concludes at p.65 with the requirement of rebuilding seven societal systems, three of them directly referring to politics, policy-making, and governance (i.e.: "*a political system that secures effective citizen participation in decision making*", *"an international system that fosters sustainable patterns of trade and finance",* and "*an administrative system that is flexible and has the capacity for self-correction*"). All reference to the political dimension is omitted by the 3P reductionist approach. When Sustainability is taken seriously, Politics stays central in governing and integrating Planet, People, and Prosperity [*figure 3*].

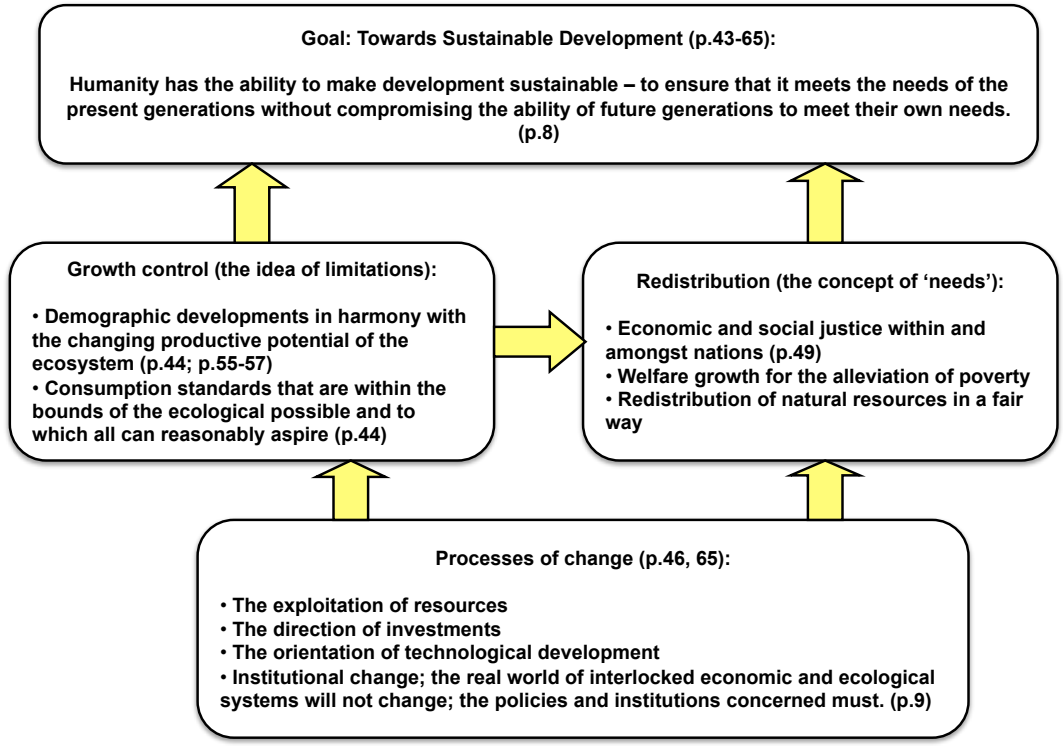
Figure 3: Four dimensions and their interactions house the change processes needed for progress in Sustainable Development (based on WCED 1987).



The WCED definition of SD is inclusive yet broad and general, and contributes to diverging interpretations in terms of worldviews and interests of the beholders. Some said that SD is a vague concept; others proposed to dispose of the term. Yet like democracy, SD holds a goal for humankind and contains sets of criteria to

assess whether developments advance the goal or set it back. It is helpful to complete the widely cited and recited SD goal, and to link it with substantiated elements considered necessary for its advancement [*figure 4*].
The standard mantra is better completed with the preceding WCED text "*Humanity has the ability to make*", emphasizing the responsibility of humans, i.e. the ability and necessity to act. SD is advanced in three main action fields: growth control, redistribution, and societal change underpinning the foregoing actions.

Figure 4: Substantiated definition of Sustainable Development (based on WCED 1987)



The Mask of Sustainable Development
The clarity of the contents as provided by chapter 2 of Our Common Future and the implied actual U-turns required, make SD an intimidating, concrete and challenging duty for societies, politicians and their constituencies.

In practice, the essential substance of the SD concept and paradigm remains covered. It seems unknown as if Our Common Future has never been written and published. The term sustainability is depreciated to an obligated stamp for passing any exploitation of resources, any investment, any technology, or any policy, program, law or institutional structure. Missing are diligent sustainability assessments of all the above undertakings, which humans should fundamentally change as Our Common Future argues.
Sustainability assessment missing is obvious for policies, programs, and projects embedding nuclear power technologies. The new approval nuclear power is patching together is based on a flawed substitution of the narrow attribute 'low-

carbon' for the full range of sustainability criteria. The poor assessment of nuclear power is masterminded by UN's IAEA (International Atomic Energy Agency). Also IPCC (2014) Working Group 3, chapter 7 is struck in IAEA's pitfall at the enormous cost of denying the own IPCC mission of comprehensive and balanced assessment of the scientific literature (Verbruggen and Laes 2015).
In the latest EU policy documents on energy and climate policy, sustainability figures as a lip-serving term without any impact (EC 2014, 2015). The inevitable consequence is that non-sustainable business-as-usual is continuing to prevail, moreover hided under the mask of sustainable development.

Epilogue: Don't throw out the baby with the bathwater

Frustration by the capture and abuse of the crucial concept SD makes people reject further use of SD and suggest a search for a new concept. This is not the road to take because SD in the original version of Our Common Future provides robust roots for applying practical sustainability assessments. Prick the balloons of 3P packed in glossy publications, happenings and self-awarded certificates. They create a false, wooly image of SD.
The advancement of real sustainability is to be fought in every practical decision about exploiting resources, investments, technological development, and institutional change [*figure 4*]. Contributing to sustainability is leaving the forums of wooly generalities. There is lots of work to do in the machine rooms of our societies, where the handles directing the flows are hold, or turned to reroute development. Every handle is occupied, most by interests of the past with little concern about SD. Rerouting is not easy: it requires good understanding of the machinery, of the strategies and tactics of vested interests, of the alternatives and the stimuli they need. Being alert, thinking ahead, and resist misfortunes and defeats, help in taking over the handles one by one.
The UNFCCC and IPCC agenda's have shown a mix of addressing climate change and SD, without clarity what comes first. Mostly SD is set aside in obligated phrases, sections, or separate chapters. More effective is to submit important resource exploitations, investments, technologies, institutional reforms, programs and projects to a comprehensive and thorough sustainability assessment rooted in the essence of Our Common Future. For example, the low-carbon nuclear technology has to be submitted to thorough sustainability assessment by independent experts.

3 Paris COP21 and multilevel governance

The 'ad hoc working group on the Durban platform for enhanced action' prepared the COP21 negotiations during years of many meetings with tomes of paper. Over 2015, the extensive preparation went crescendo towards COP21 (Nov.30-Dec.12, 2025). Ten thousands attendants and observers, with hundred thousands refused access due to the terrorist attacks on the evening of Nov.13, 2015. The push to reach a deal to overcome the 'failure of Copenhagen' was persistently strong. The COP club received broad goodwill from most media and societal groups: the many people and organizations concerned about derailing climate change, involved scientists, active governments, social organizations, banks, industrial companies, up to corporates with significant activities and assets related to fossil fuels.
The goal was consensus approval of a binding agreement. By default of a clear program, the results of the Kyoto Protocol (1997) and of the Copenhagen Accord (2009) functioned as presumed content. On the evening of Dec.12th, French minister L. Fabius forged the unanimous approval of the Paris Agreement after days and nights of tedious negotiations. Quoting Al Jazeera (Dec.2015): "*The deal, which brought the climate change issue back to top the news agenda, was hailed as a success by the mainstream media and self-congratulatory political leaders - who made it sound like a major milestone. However, climate scientists and activists have since said the agreement has little cause for cheer, falling well short of what is needed to forestall a climate change catastrophe. They say the deal lacks any legally binding mechanism to hold governments or corporations to emission quotas, while other key issues in the accord are not binding at all.*"

The 31 pages text of the Paris Decision & Agreement holds boundless opportunity for differentiated interpretation and protracting quarrels. PwC director J. Grant talks of "*constructive ambiguity, or even woolly wording in some areas*", but as COP21 President L. Fabius said "*this allows all countries the ability to take the deal home and declare success."* Ambiguity, woolly wording, every Party can read the text as her success, announces a shaky contract. Without mastering COP history and language, the Paris text is difficult to understand. Many preparatory meetings and the tedious negotiations at COP21 have ironed out almost all of substantive content. What substantively rests is the program of the Copenhagen Accord [*Glossary*], and a few spurious things, like Art.16 §8 of the Paris Agreement nominating explicitly IAEA as COP observer organization [*Legend n°2*]. The words fossil fuel, coal, oil, nuclear power, international aviation or shipping, … are not mentioned. Renewable energy is mentioned once and specifically related to Africa, covering the overall responsibility of wealthy industrialized nations to develop and deploy sustainable renewable energy supplies.
In striving for consensus, the French diplomacy has stripped the text from content, leaving voluntary efforts, voluntary contributions, and voluntary transfers, as fillings for patchworks of later projects. Who undertakes which projects, how and with whom, is under the discretion of "*all Parties and non-Party stakeholders, including civil society, the private sector, financial institutions, cities and other subnational authorities, local communities and indigenous peoples*".
It is factual that mitigation and adaptation activities occur in the nation-states at all levels of societal action, involving almost all citizens and organizations. It is also recommended for the UN COP not to muddle in the factual intricacies of

nation-states, but to concentrate on the own responsibility of governing the atmosphere and climate commons. Some preliminary comments on COP21 follow.

Unanimity is not sanctifying

Unanimity is the acclaimed attribute for calling the Paris Agreement an historic landmark. '*Finally all countries of the world agreeing to address the climate change problem'*, is heralded as novel and crucial. Both pretending is false.

Unanimity is not novel: In 1992 at the Rio summit, humanity agreed to address climate change and enacted this in the UNFCCC. Since 1995, the COPs search for workable implementation of the convention, with limited results notwithstanding the agreed Kyoto Protocol (1997) and Copenhagen Accord (2009).

Unanimity is not crucial: The quest for momentary unanimity is not beneficial in constructing global climate policy architecture. When sovereign Parties with divergent visions and interests cling together, a watered down compromise results. Because the deep change program must run urgent and be drastic, setting out the beacons and starting the task is due by a dedicated panel of pioneer countries. For example the full turnover of electricity generation to sustainable renewable energy supplies is the responsibility of financially, technologically and organizationally endowed countries. In Europe, Germany has taken the lead with a few other member states (Denmark, Austria, Sweden). Instead of supporting and extending the sustainable energy transition, it has been obstructed by lobbyism of big industry and by the European Commission (Verbruggen et al. 2015; EC 2014b).

Moreover, the momentary unanimity is fragile. It may be dissolved by exit of one major Party or consortium of Parties. For example the USA when the Republican Party conquers the White House in Washington. The Paris agreement has built in a time elapse of four years before a Party can formally leave, but non-living up the voluntary pledges and engagements is similar to a formal absence. When voluntary financial contributions fall short of the announced annual US$100 billion, developing countries may be inclined to leave or drag the feet.

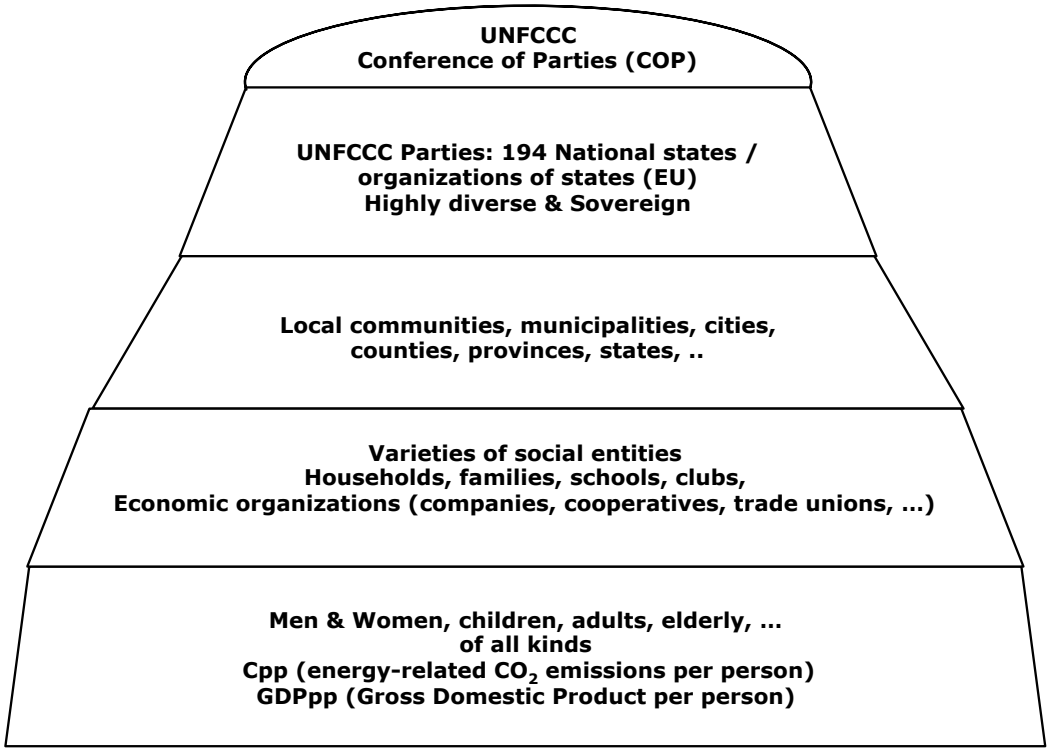
A 'binding' climate agreement is difficult

The INDCs are voluntary intentions; they are formulated as planned efforts and targets focused on the 2020-2030 decade with 2030 as final delivery date. COP21 converted intentions in pledges, and foresees five-year periods for review and strengthen the ambitions. The first overall review is planned for 2023 (still eight years after Paris). Monitoring INDCs is cumbersome (Aldy and Pizer 2015). The voluntary character of Parties' engagement and the absence of practical mutual monitoring solutions are interlinked. Both show that essential aspects of governing the climate commons are not addressed by COP21. Stiglitz (2015) repeats the undeniable experience with public commons: "*voluntary contributions simply will not work. Agreements have to be enforceable*." This explains the many calls for a '(legally) binding agreement', but binding sovereign nations is very contentious and precarious. When they refuse to install some enforcement authority, precision of the agreement is the major second best to obtain some binding power (Bodanksy 2015). However, the Paris agreement is little precise as being built on voluntary actions, contributions, payments, coalitions, and more. Hence, COP21 is unlikely to advance UNFCCC's principal mission: guard and safeguard the climate commons.

Multilevel governance

Tensions between top-down and bottom-up policy regimes were epidemic in the history of the COPs (Jacoby 2007, Hare et al. 2010, Rayner 2010). The COP03 top-down, failing rulings became more and more challenged by bottom-up initiatives and arguments (Keohane and Victor 2011, 2015). The faulty, top-down uniformity cannot bring an effective global climate policy. By COP21 putting all cards on INDCs, the pendulum swung to merely intended bottom-up actions by the Parties. Illusory globally uniform economic instruments are overruled by INDC patchworks, also bewildering people's fantasy about self-emerging effectiveness, efficiency and equity. The mistaken remedy of full voluntarism by all, equals free roads and dominance for the mightiest Parties and actors, being the multinational corporates.

Figure 5: The dome of multilevel climate policies



In building the multilevel pyramid of the world's climate policies, the artificial top-down versus bottom-up conflict is sterile. The tensions naturally fade by bringing the multilevel, nested character of the architecture to the foreground. Social scientists identify sub-national, national, transnational, international and global levels in climate policy, interconnected by polycentric governance structures (Ostrom 2010, Jordan et al. 2015). Global climate policy is the top of the dome of policies [*figure 5*].

This essay is not exploring the many versions and proposals about multilevel governance. Figure 5 imprints the reality of the 'trillions daily decisions by billions of people', and emphasizes the pinnacle position of the UNFCCC –COP structure. On the one hand, the leaner the top, the better. On the other hand, some strains

on Parties' policies are necessary for governing the global climate commons issues. The UNFCCC is the top of the multi-level structure and only in charge of managing and preserving the global atmosphere and climate commons. All practical climate policy is to be designed, set-up, performed, and evaluated under the Parties' direct authority without COP muddling. The Parties' discretion includes policy programs (like INDCs) and policy instruments (like emissions permits trading and carbon taxing). The UN is not suited to delve into the specific matters of national specificity and intricacy.

4 COP challenges and alternatives

Several challenges complicate the global policy-making process. The major internal challenges, i.e. properties and functioning of the UNFCCC and COP system, are discussed and followed by alternatives as recipes for solutions. The challenges are described in normal script, the alternatives in italic.

1. Zero-sum versus common resolve

The logic of 'zero-sum game' (what some Parties gain other Parties lose) dominates crucial nodes in COP negotiation phases. It creates suspicion and animosity among the participants, and results in conflicting coalitions for defending group interests. It paralyzes creativity and transparency, and may end in sterile stalemating. These effects are lethal for constructing a self-governing management (Ostrom 1990, 1992, 2010) of the global atmosphere and climate commons. COP21 avoided zero-sum stalemating by stripping the agreement from all contentious matter. This momentary relief delays requested solutions and contradicts the high urgency of effective climate policies.

Zero-sum logic is promoted by defining GHG emissions as occupying room in a strictly limited remaining emissions space. The constraint is tightened by defining emissions mitigation as an expensive duty, and not as an innovative business providing extra benefits for all engaged actors, yet most to first-movers.

***Alternative**: 'common resolve' is the natural mood of self-governing sovereign partners. Common resolve among a group of people can grow by sharing in the design, development and construction of a positive, concrete project. For this, the project evolvement obeys the five smart fundamentals by being specific, measurable, attainable, realistic, and timed. In mitigation, such a project is at hand: the full transformations of present fossil fuel economies into 100% sustainable, renewable energy supplies. There will be resistance of fossil fuel depending interests and Parties, but no single effective measure can be realized without overcoming this resistance. Moreover, success on the energy transitions project is solving the preponderant part of the whole mitigation task.*

2. Attributes of the COP processes

Unwieldy COP agenda and processes are due to historical factors (preceding the 1992 Rio Summit and the UNFCCC) and to the crowding of initiatives after 1992. The management of the COPs are mainly complicated by:

- ***Merging the climate change agenda with the economic developing agenda***. After 1992 climate change rose as a global threat attracting wide media coverage and politicians' attention, together with growing fear and awareness in the wealthy industrialized countries of irreversible losses. Developing countries hooked their economic growth aspirations (UNCTAD 1974) at the climate locomotive, helped by the Sustainable Development hype. This conflation, often called 'mainstreaming' gets approval of most observers, expecting to solve all the major world problems in a single global turnover. However, it seems that the climate locomotive cannot deliver the appropriate and required power for getting on track.
  ***Alternative**: substitute streamlining for mainstreaming, with UNFCCC (exclusively) focusing on the own responsibilities in governing the global atmosphere and climate commons. For being successful UNFCCC will need to respect the full scale of SD imperatives in the original meaning of Our Common Future [Chapter 2, Legend n°2]. Finance, technology, and*

governance capability transfers from wealthy to developing Parties fulfill central roles in equilibrated climate policies. For global climate policy's effectiveness and efficiency the transfers should be climate action dependent. These transfers are not sufficient to address the major development issues. UNDP (2007) assigns priority to addressing climate change because of its devastating impacts on all other development efforts. Organizing this priority is a condition for progress on all fronts.

- ***Amalgamation of issues that require a specific approach***. Today it is customary to label systems and problems with 'complex' or 'wicked'. Complex [*Glossary*] is often the excuse for bypassing the effort of meticulous analysis, and wicked seems a voucher for clumsy solutions (Verweij 2011). Progress in understanding is promoted by unraveling large problems in parts suited to systematic analysis with testing hypotheses and results; detailed analysis is alternated with synthesis of results in comprehensive frames.
  Alternative*: While climate policy is certainly complicated, it is not complex because separable in manageable parts and sliceable in consecutive phases over time. One can disentangle complicated problems. Climate policy may be advanced by clearer identification of the various issues, for example mitigation (Driving forces and Pressures phases upstream of State in the DPSI cycle [Glossary, figure 1]) and adaptation (downstream phase Impacts). Mitigation can be specified by sources of GHG (energy-related, land-use, industrial gases), by socio-economic sectors, by region, by emitting activities (power generation, steel, cement, aviation, shipping, etc.), by related actors. Adaptation can be specified by hazard, by sector, by region, by exposed people, etc. Temporally, mitigation can be sliced in* ***yearly stages*** *because of its intimate links to human activities. Adaptation, linked to hazards and risks, is improved by shifting attention from curative to preventive and precautionary initiatives, bringing the needs for investments and measures forward in time, and putting a higher weight on mitigation. Proper dissection and analysis of the mitigation and adaptation issues, inspires the selection of policy spearheads for overcoming barriers and piercing walls of resistance.*

- ***Unstructured authority and responsibility over the various components of the ubiquitous climate policy task***. Weak structure may result from the newness of the problems, from merging different agendas, from amalgamation of issues, from lack of formal authority caused by the sovereignty of Parties [*Challenge 3*]. The COPs establish a precarious balance between the decisive power of Parties' political heads (presidents, prime ministers) representing sovereign nations, and assiduous efforts of settled COP-related officials and large supporting staffs. In Copenhagen political heads substituted a readable 3-pages accord for the opaque administrative tomes (Stern and Rydge 2012). Another symptom of weak structure is the lasting conflict between top-down and bottom-up approaches, and the zigzag switch from top-down dominance at COP03 to full reliance on bottom-up INDCs at COP21. The step into INDCs is creating chaos by national items and intricacies blurring the UN level, turning MRV into an invincible dragon.

***Alternative**: climate policy holds a multitude of ubiquitous aspects and facets spanning the globe. A workable policy cannot but be organized in multi-level polycentric structures (Ostrom 2010) with varieties of regime complexes everywhere (Keohane and Victor 2011). The UNFCCC is the top of the multi-level structure [Chapter 3, figure 5].*

- ***The loose timing in climate policy conflicts with the high urgency to act.*** The history of UNFCCC since 1992 and of COP operations since 1995 is not glorious. Notwithstanding the growing awareness about the urgency to act, supported by vocal grassroots, scientists and NGO initiatives, the COP inertia remains provocative. The heads of state of the mightiest economies prefer a pace according their domestic agenda. Progress in COP negotiations is blocked by catch-22 priorities for addressing climate change or for enhancing development opportunities. The irresponsible attitude on urgency is also reflected in the actual time framing of the UNFCCC and COP activity. The base-line year for calibrating mitigation actions and results is still the (prehistoric) 1990, which is maintained because perverse effects in the adopted awkward policies emerge when it is tried to update or install rolling baseline years (for example: 'present year – 2'). The use of timetables with delivery dates five or more years in the future (now horizons 2020 to 2030) preempts responsibility of present decision-makers. They engage their followers, while politicians mostly negate the plans and commitments of their predecessors. Only legally enacted commitments are eventually taken serious and enforced.
  ***Alternative**: the time loops in global climate policy are double. On the one hand, (strategic) long-range pathways show constraints and funnels to be respected by selected indicators for guaranteeing that warming remains below 2°C, viz. 1.5°C. At the moment the preferred indicator is the yearly volume of global GHG emissions (IPCC representative pathways). More detailed indicators enhance clarity, for example by including the Ehrlich-Holdren-Kaya identity[1] specified by regions and countries. On the other hand, (operational) formatting of the commitments and delivery by Parties, need the shortest feasible time loop of 3 to maximum 5 years. The baseline reference should be no more than two years behind the year of expressing commitment, and delivery of results should be within two years in the future. It means the set-up of a time-sequential procedure, functioning robustly on yearly rolling baselines. This alternative approach mimics the planning and operational management of successful corporations.*

3. Self-governance by sovereign nations

The management and preservation of the global commons atmosphere and climate are dependent on the creation of self-governing rules by more than 190 sovereign and differentiated Parties (Barrett 2012). The global commons cannot be managed by an exogenous authority (an authoritarian UNFCCC secretariat

[1] The identity is mostly applied on energy-related CO_2 emissions, i.e.: Total CO_2 emissions = (number of people) x (GDP per person) x (energy use per unit of GDP) x (CO_2 emissions per unit of energy). Extensive analysis and reporting of statistical studies are available (for example: IPCC 2014, WG3, Ch6)

neither can deliver lasting authority) or by applying private property rights (the atmosphere and the climate are not divisible). E. Ostrom (1990, 1992, 2005) is famous in studying self-governing solutions for common-pool resources. Most of her studies focus on local communities with involved resource producers and appropriators being personally interlinked. Nevertheless, Ostrom's lessons are relevant for constructing self-governing structures and rules for managing the global commons atmosphere and climate by the sovereign and differentiated Parties. Credible commitments and mutual monitoring are requested. Credibility of commitments is enhanced by reciprocity, trust and fairness, and grows step by step. Common resolve among the Parties in pursuing shared goals in a shared project creates the appropriate mood for cooperation. Legal binding via an international treaty may become relevant after Parties have proven their engagements are robust. Binding options are illusory when zero sum gaming and suspicion prevail. Credible commitments are imperfect, but the most reliable guarantees that Parties will deliver results (Barrett 2012).

Pledge & Review is the (presumably only) workable mechanism to engage sovereign parties. It is adopted by UNFCCC, but heavily criticized by academics (Gollier and Tirole 2015). Within Pledge & Review, there are several variants. At COP03 a panel of Annex1 Parties pledged emissions reduction targets with a timetable. COP21 builds on INDCs by all (willing) Parties. The credibility of both versions of Pledge & Review is weak, reliable monitoring of real progress is tough and contentious, and enforcing incentives are not built in. Developing and applying more credible types of Pledge & Review are urgent.

Monitoring-Reporting-Verification (MRV) is regularly high on COP agendas. They are indispensable activities in any agreement. Because of the particular types of pledges used in the COPs (now being INDCs) MRV of INDCs will require excessive administrative staff and outlays, several times more than implied by the unfortunate CDM experience.

***Alternative**: in a multi-level policy structure with UNFCCC at the top and with very diverse Parties, INDCs are intended contributions to deploy at levels below the UNFCCC top. Instead of submitting INDCs over periods of five years or longer, Parties better agree on submitting yearly pledges and review progress on a limited number of performance indicators. The latter indicators are available as SD indicators or goals, and yearly elaborated for nearly all nations of the world by established institutions (IMF, World Bank, International Energy Agency, IPCC, and others) in collaboration with the nations' administrations. Under such conditions the MRV tasks are diligently executed and certified. In this way, the third component in Ostrom's scheme of self-governance can be supplied. It will support the common resolve with credible commitments, because transparent mutual monitoring works.*

4. Transfers

Three main transfers are subject of COP discussions: money (earmarked funds, project finance), technology, and governance capability. In the UNFCCC, transfers flow from Annex1 to non-Annex1 Parties. Transfers take a central position in a global agreement (for example: CDM in the Kyoto Protocol; the GCF with pledged $100 billion yearly funding in the Copenhagen Accord; in the COP21 negotiations transfers stay high on the agenda). Developing nations want significant transfers as compensations for the historical responsibility of industrialized nations in

causing the high CO_2 concentration in the atmosphere, and for long-standing injustices now to be resolved by Sustainable Development.

Reference is also made to the Polluter Pays Principle (PPP), launched by the OECD in 1972 for harmonizing environmental policies of its member states. Light PPP implies that polluters pay their own mitigation expenses only. Strong PPP adds payment for damage costs and adaptation outlays. The debate about transfers is linked to political and ethical positions of Parties on GHG emissions. When emitting is considered to be a right, present generations 'bring offers' when reducing the emissions [*Principles, Glossary*].

***Alternative**: When emitting is defined as littering the atmosphere with GHG, the PPP principle entails the duty to stop emitting 'drastically and urgently' and to clean the mess at the expense of the polluter. This principle anchors the responsibility of historic large emitters for mitigation and adaptation wherever most needed. Historic large emitters are generally today's members of the wealthy nations club. Correlating GDP/person to the duty of donating to the GCF may help escape protracting and paralyzing quarrels about historic responsibility. Fine-tuned and yearly graduation [Glossary] of all nations on the GDP/person indicator is more helpful to control flows from developed to developing nations, than the present Annex1 / non-Annex1 divide.*

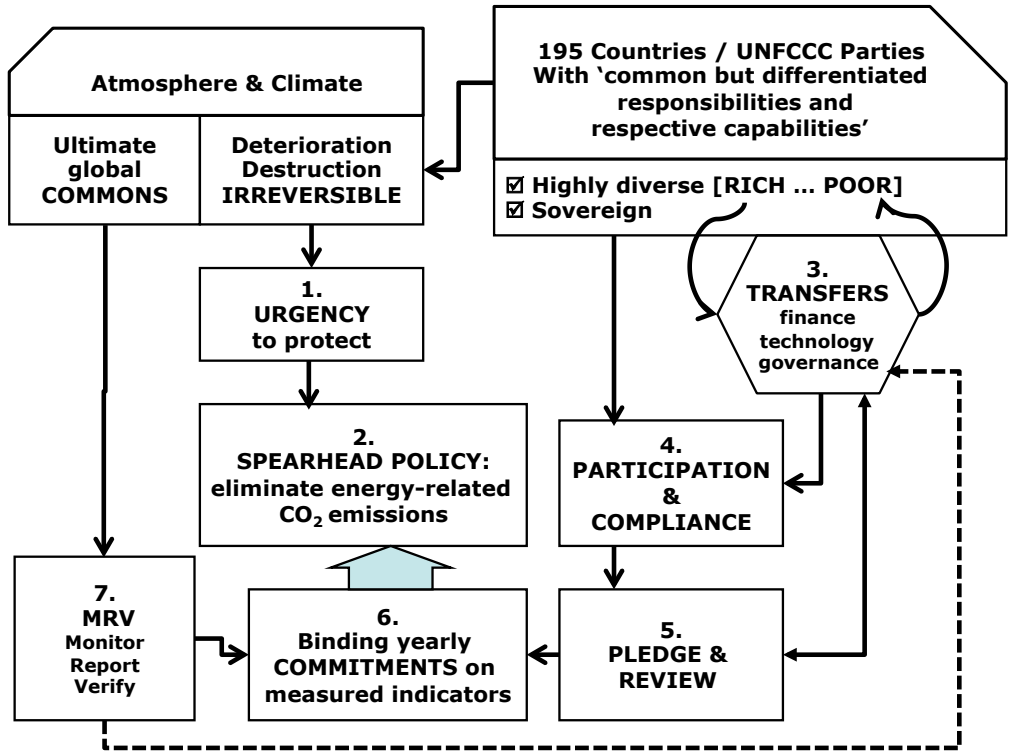
Transfers in technology are most guaranteed when the industrialized, wealthy nations urgently transform all their energy supplies and uses into sustainable renewable energy options. Many developing regions (in particular Africa) own vaster and more intense renewable sources than most industrialized countries; with improved harvesting and conversion technologies they will finally have access to sufficient energy supplies for supporting robust economic development. Better governance may emerge when all COP Parties are embedded in common frameworks with differentiated duties and rights depending on their GDP/person. The duties as donor and the rights as beneficiary of transfers are partly dependent on their performance in mitigation and adaptation activities. The frameworks should be specialized per major issue and related tasks, for example a framework for energy-related CO_2 emissions, another framework for emissions from LULUCF (where REDD+ is already making headway), specialized adaptation frameworks for drought problems, for natural disasters, etc. The financial flows through the GCF would become well structured, with accounts classified by framework, GDP and performance dependent, yearly calculated and transparently monitored.

5. Ostrom menu for Self-governance of the Global climate commons

With the elements developed in chapters 1 to 4, a comprehensive architecture of global climate policy for mitigating energy-related CO_2 emissions is set up. The design of the construction is inspired by the work of Elinor Ostrom.
Managing and conserving the global climate commons is the inalienable, heavy task of the UNFCCC, letting all other policy tasks with the Parties [*figure 5*]. The Parties are best placed to obtain practical results. An organic division of responsibility and authority is imperative for a better performing UNFCCC.

Figure 6 shows the architecture's layout. At the top of figure 6 are mentioned the major physical (left side) and political (right side) issues. This essay does not aim at an extensive analysis of the issues. The priority task of global climate policy is safeguarding and governing the ultimate global atmosphere and climate commons [*Glossary*]. Ultimate because atmosphere and climate are primary life-support systems, substrate for other crucial life-support systems, like water and food supplies (UNDP 2007).

Figure 6: Comprehensive architecture to prevent energy-related CO_2 emissions continuation and growth



By human activities (arrow arriving from the box top right in figure 6) the atmosphere and climate deteriorate, and their balanced functioning is more and more destroyed. This function loss is irreversible [*Glossary*] in an absolute sense because atmosphere and climate are unique, in no way substitutable and not repairable when tipping points have been trespassed. Climate change is not

"*potentially* irreversible" as stated on page 1 of the unanimously approved Paris text; it is irreversible in absolute sense.
Human activities are undertaken by inhabitants of countries, here also called Parties to the UNFCCC by their signature of the convention. Article 3.1 of the convention stipulates their *common but differentiated responsibilities* in the deterioration and destruction of the unique global atmosphere and climate. This signals that the duties to protect also differentiate, further complicated by the differentiation in capabilities (and capacities) to set up actions and to deliver results. The link to desirable, possible, and necessary transfers [*Chapter 4*] is short [*shown by the two curved arrows, interacting with box 3 in figure 6*].
The various countries or Parties own many more attributes, but only two essential ones for global climate policy are discussed. First, there are the highly diverse wealth positions of countries, ranging from RICH to POOR. Although wealth is a multivariate attribute, international policy generally limits the metrics of wealth to GDP [*Acronyms*] and GDP/person. The imperfect GDP statistics are used because verified numbers are annually available. The second attribute is totally different from the wealth metric. Sovereignty is binary (yes/no sovereign), and is of equal weight for all recognized nations. This is why only negotiated agreements among sovereign nations work at the UN level. Although often implicit in COP relations, the agreements do not have to involve all nations, nor have negotiations to end in consensual decisions. [*figure 6, box 4 further down*].

The seven boxes hold the titles of building blocks to construct workable institutions of *self-government* by solving Ostrom's three puzzles: 1) supply a new set of rules [*Boxes 1 to 5*]; 2) credible commitments [*Box 6*]; 3) mutual monitoring [*Box 7*]. The contents of the boxes and their relationships are discussed one by one, also building on the previous chapters of this essay.

Box 1. Urgency to protect

The annual ca.50 billion tons of greenhouse gas (GHG) emissions due to human activities add yearly a few ppm CO_2-eq to the global atmospheric concentration. It takes decades to centuries before the emitted GHG disintegrate. The higher concentration causes global warming with irreversible deterioration of unique, for human survival essential, ecosystems, such as a healthy atmosphere and long-term climate stability (IPCC 2014). Addressing the emissions deserves first priority because climate change causes or aggravates the other daunting global problems (UNDP 1997). The Copenhagen Accord (COP15 2009) stipulates that "*Deep cuts in global emissions are required with a view to reduce global emissions so as to hold the increase in global temperature below 2 degrees Celsius*", and "*take action to meet this objective consistent with science and on the basis of equity*". For supporting climate policy in the follow-up of Copenhagen, an international consortium of research centers investigates 'deep decarbonization pathways' for a set of countries, together emitting three quarters of the global energy-related CO_2 tonnage (http://deepdecarbonization.org).

Today's tendency is to convert the +2°C limit into a spendable carbon emissions budget, considered and handled as 'rights to emit'. This practice raises the likelihood of transgressing the +2°C limit to almost certainty. The +2°C limit, called a 'guardrail' in 1995 (COP01 Berlin Mandate), is a risky extreme to be avoided by all means. Facing the huge uncertainties and lurking irreversibility,

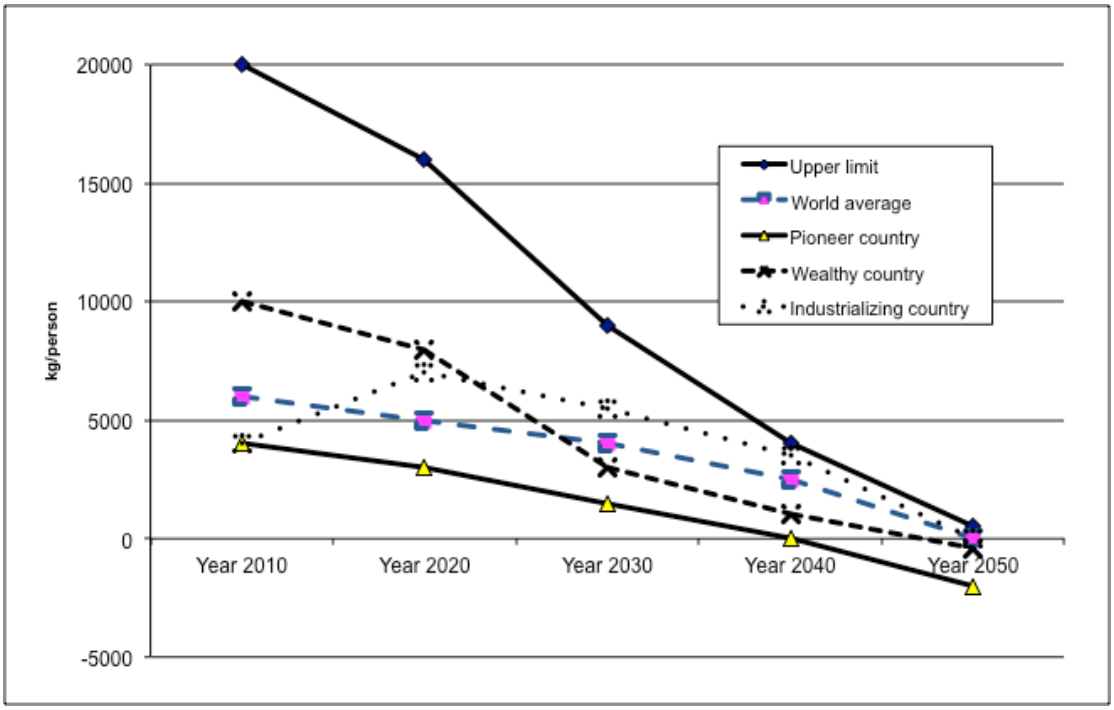
responsible practice preserves maximally the remaining space and feasible degrees of freedom.

The dangerous practice of spendable rights is rooted in a particular perception of rights, spread without questioning by economists and most media, like: '*by mitigating emissions, present generations deliver efforts and make expenses for the benefit of future generations*'. This means: rights to pollute the atmosphere are assigned to present generations. This assignment delays the uptake of measures and degrades the necessity of prevention and precaution.

The unwarranted rights position conflicts with a civilized status of environmental policy. Emitting CO_2 in the atmosphere is an activity of dumping without any further concern, what equals 'gaseous littering'. In developed societies litterers face two obligations: immediately stop further littering and be responsible for the mess occasioned. The civilized vision is embedded in the UNFCCC. Due to the global atmosphere being a public commons, it is difficult to enforce the vision on civilized societies and people.

Let us assume all Parties are serious about the +2°C as dangerous extreme, not to trespass in no way. This corresponds with adhering to the RCP2.6 emissions pathway as studied by IPCC (2014). This remains a global target on a common emissions budget, exciting the individual Parties to zero-sum gaming rather than to effective action.

Figure 7: Individual Parties' Emissions Contraction Scenarios, materializing respect for the maximum +2°C average temperature increase



The first rule of global climate self-governance consists in designing and agreeing on Individual Parties' Emissions Contraction Scenarios (IPECS). For this, the focus is on Cpp = the average energy-related CO_2 annual emissions per person in every nation. The Cpp indicator is yearly assessed for all UN members, and ranges now from less than 100 kg to more than 20,000 kg. The choice for Cpp (emissions per

person) reflects a search for more equity as part of sustainable development. The custom and push for using as indicator 'emissions per $ GDP' (carbon intensity of GDP) obscures the high wealth inequality among countries [*see further: box 6*]. The indicator 'carbon intensity of GDP' is popular with consultants and preferred by rich Parties.
Within the nations the spread of citizens' Cpp around the average may be highly skewed, but the issues of national equity are a sovereign responsibility of the Parties. More fine-tuned Cpp indicators taking into account skewed income and emission distributions in the various countries, is beyond the mandate and the capability of UNFCCC.
Fairness does not require equal emissions per person (Wiener 2007), although "equity in itself suggests moving in this direction" (Frankel 2007). Several factors (for example weather conditions, geographical structure, natural resources endowment, age structure of the population) are a source of variation of Cpp among Parties and within countries.

Figure 7 presents a stylized view of Cpp 'contraction & convergence' [*Glossary*] scenarios for a few typical Parties, with also an agreed upon upper limit of Cpp, which contracts to a low Cpp value in 2050 (e.g., a maximum of 500 kg Cpp). For every Party its scenario starts at its recently verified Cpp value. Every Party designs its Cpp path, respecting the constraint of staying below the commonly agreed upper limit. In its 2015 report the Deep Decarbonization Pathways Project documents actual Cpp contraction scenarios for sixteen major CO_2 emitting nations.

The approach respects 'common but differentiated responsibilities and respective capabilities' in emission reductions. 'Common responsibility' is: all countries respect the upper limit scenario. 'Differentiated' means: high value Cpp countries must contract first and at a fast rate ('deep cuts'); low value Cpp countries (mostly developing and least developed countries) can grow in Cpp value with the obligation to respect the contracting upper limit values in future years. Practically, the engagements are: First, the Cpp intense (wealthy) countries develop and deploy renewable energy supply and use technologies that fully substitute for the present non-sustainable energy systems, and are suitable for implementation by low Cpp (poorer) countries. Second, the poorer countries emulate the sustainable renewable energy solutions.

Box 2. Spearhead policy: eliminate energy-related CO_2 emissions

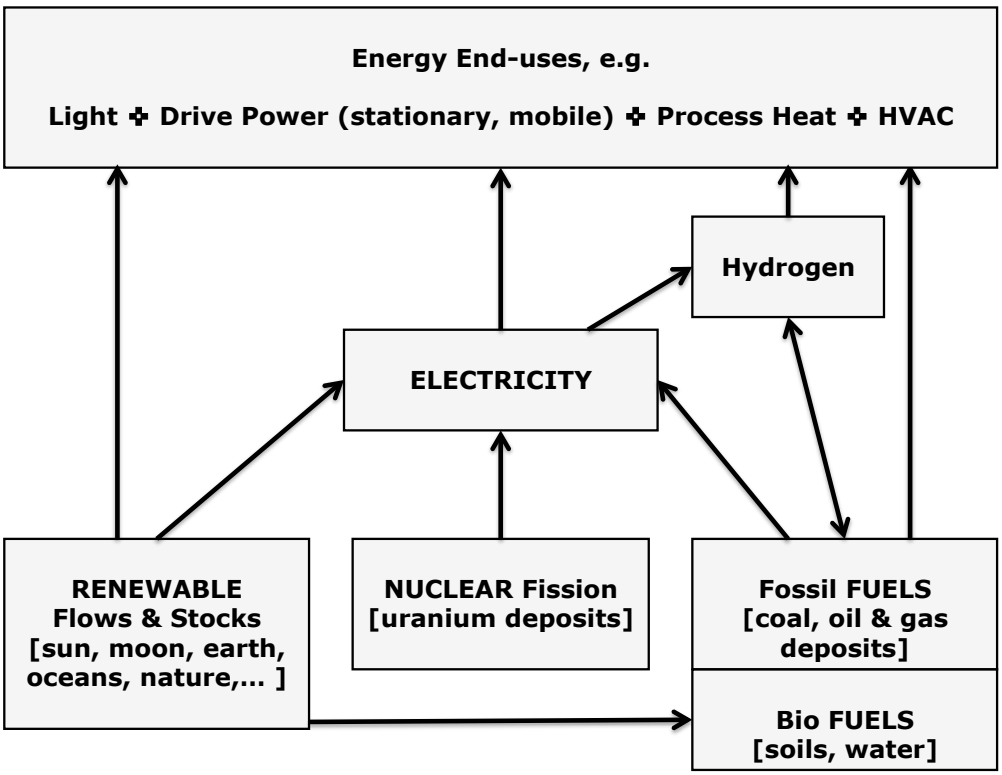
Since the UN Framework Convention (1992), over the Kyoto Protocol (1997) and the Copenhagen Accord (2009), yearly global GHG emissions continued to grow, as did the yearly use of commercial energy (IEA's yearly Outlook; BP's yearly Statistics). About $4/5^{th}$ of GHG emissions are due to present energy supply and use practices. Presumably more than $4/5^{th}$ of the climate policy studies focus on energy-related CO_2 emissions and their mitigation. Climate policy involves more (e.g., other GHG than fossil fuel related CO_2, land-use, adaptation), also influenced by fossil fuels use (for example methane emissions, changing land-uses affected by low-priced supplies of fossil fuels).
Ongoing climate policy is little effective, partly because many goals on several aspects are prioritized. Contrary to the widespread opinion that UNFCCC must mainstream and simultaneously solve many major problems in the world, rational

climate policy detects spearhead issues functioning as locomotive in accelerating mitigation or adaptation. Strategic advance needs spearheading with a selected issue that will break the locks on needed technological, industrial and societal transitions. Thorough transformation of energy supply and use is widely recognized as the predominant change to perform (IPCC, 2012).

Energy supply options

For performing activities, people want energy of the right type and quantity, supplied at the right place and time. Energy supplies combine energy *sources* with *technologies* for winning, converting and transmitting energy. In sequence of importance, available sources are: renewable flows and stocks in the natural environment, fossil fuel deposits in mines and wells, and uranium deposits (figure 8). The environment supplies for free most energy, useful with little technology, e.g., daylight, heat, ventilation, drying. Natural processes concentrate diffuse renewable flows (photosynthesis, the water cycle). Over the last decade, the costs of man-made technologies harvesting renewable flows dropped significantly (IPCC 2012). Technological capability announces further cost cuts, for example levelized kWh prices of PV to €ct. 4 to 6 by 2025 and €ct. 2 to 4 by 2050, although dependent on financial and regulatory conditions (Fraunhofer 2015).

Figure 8: Overview of energy supply categories, with sources in [.]



Nuclear fuel is fabricated from refined and enriched uranium, whose dense deposits are limited (American Nuclear Society 2001). Uranium shortage may be overcome by breakthroughs in breeder or fusion technology. Commercial new

breeder and fusion plants are not expected before 2050, the year wherein carbon free electricity systems should be operational.
Fossil fuels cover a market share of above 85% of commercially traded energy supplies (BP 2015). Their success is the result of being versatile, dense, for all scales divisible, abundant, storable, and performing on command. However, fossil fuel combustions cause various environmental harms, and inevitably fetch CO_2. In a low carbon future their use will be stifled (IEA 2014), but 'carbon lock-in' and related interests are exceptionally strong. A smooth phasing-out of fossil fuels is rather unlikely to happen.
Hydrogen is a carbon free fuel, not naturally available on earth. New industrial infrastructure may fabricate hydrogen from low carbon electricity. This is a costly, long-range undertaking.

Energy transitions of a different kind

The mitigation spearhead is the fast reduction of energy-related CO_2 emissions (ca. $4/5^{th}$ of GHG emissions) by richer countries fast developing and deploying renewable energy supplies of the kind and size also applicable and affordable by developing countries. Suitability of pathways for emulation by developing countries is highly relevant for global CO_2 emissions reductions in the coming decades. The attribute of readiness for emulation is essential, because it bars the way for transitions to low-carbon energy systems mainly composed of non-sustainable nuclear power and centralized large-scale renewable plants. However, in 2014 the EU promoted the non-sustainable centralized low-carbon pathways while blocking the successful innovation financing of the German Energiewende (EC 2014b, Verbruggen et al. 2015).

The EU is an interesting example of how different 'low-carbon energy' systems are conceived and prepared. Notwithstanding promotion of the single energy market by the European Commission (EC 2014a, 2015), every EU Member State plans its own energy future, leading to widely divergent pathways, most apparent in electricity supplies.
Germany embarked for a drastic reversal, aiming at an entire power supply from PV, wind and biogas (Agora, 2015). In the high diversity of projects a significant role is plaid by small-scale installations of end-users producing electricity. Five salient characteristics of the German approach are:

1) The transition is interwoven with a nuclear phase-out, politically decided after advice by a representatively composed ethics council (Töpfer et al. 2011). Public initiatives, politicians, academics, innovative industries, and local energy companies are motivated for change.
2) Technological innovation is crucial in increasing efficiency and decreasing costs of RE collection and conversion equipment. PV and wind turbines continue to show fast decreasing costs per kWh generated (Fraunhofer 2015).
3) National tariffs per RE category pay specific levelized cost prices for a period of mostly 20 years. With technological progress, tariffs by category decrease to the level sufficient for proofing and launching the transition. After some years RE supply prices cut the line of grid parity, phasing in the full transition.
4) The German transition reveals how superior RE technology can competitively harvest mediocre (low capacity factor) RE sources. Expected

decreases of PV and wind technology costs make redundancy in electricity capacities affordable (Fraunhofer 2015). Redundancy in generation capacities is a luxury but also challenging for power systems' technical integrity. Regulatory solutions are decisive, showing the influential role of independent public regulators, not captured by major corporates.

5) Every country may emulate the RE pathway. Some countries and regions with excellent RE sources (for example Africa) are now missing affordable harvesting technology. Cheap distributed RE technologies are a crucial factor of energy supply in developing countries, and hence for prosperity and sustainable development.

The UK HM's Government (2009) plans for new pressurized water reactors (PWR), carbon capture and storage (CCS), and large-scale RE projects (off-shore wind; tidal). In contrast to Germany, the UK approach is characterized by:

1) Large-scale projects fit to the business model of major incumbent energy (power) companies, and override local initiatives.
2) Innovation is difficult. PWR standard costs increase; waste and risks stay. CCS faces high costs and delays in starting a demo project. Large-scale tidal projects are not welcome.
3) Price guarantee at £92.50 (about €127.50) per MWh during 35 years for technological mature PWR reactors, mainly paid by domestic electricity customers. The money is not supporting innovation, but an economic activity.
4) Power supply systems are planned as predominantly composed of capacities on command. Also from RE projects high capacity factors are requested.
5) Emulation of the pathway by developing countries is unlikely, if not impossible.

The sustainable renewable energy alternative as such is not costly when fully deployed. Evidently, the sustainable energy transition itself is challenging. Depending on the scores by progressive, viz. reactive strategies, forces, and public support, the difficulties and costs will be modest or high. For overcoming lock-in, urgent transitions bring earlier depreciation of sunk investments. The latter are more significant when incumbent energy companies reacted little or very late on the 1992 Rio summit and ensuing conventions. For example in the 1990s, incumbent electricity companies have built coal power plants in the Netherlands and in Germany (two countries of high exposure in energy transition literature and practice). Transition costs are spent for the first time development and deployment of new technologies, infrastructures and institutions. The transition will be smoother and cheaper when a clear mission is defined. One fundamental change in the logic is adopting the future sustainable goal situation as reference to measure and evaluate present states and evolutions. In the transition of the electricity sectors, the incumbent reactive viewpoint is: 'intermittent and stochastic renewable energy supplies disturb the reliable delivery of power; power on command is the reference'. This must be replaced by: 'intermittent and stochastic renewable energy deliver the most sustainable supplies, and merit priority over the non-sustainable supplies; given this priority, the reliability of power is organized'.

Spearheading in mitigation by eliminating energy-related CO_2 emissions can be accompanied by spearheading policy tracks in land-use, land-use change and forestry (LULUCF) via REDD+. Also in adaptation, spearheading policies are feasible. Every spearhead is most served by a separate Ostrom menu for self-governance of the related commons issues. Without such a menu, progress will be slow and precarious.

Box 3. Transfers

UN member states diverge in size, ownership of natural resources, population, industrial development, material wealth distribution, available capital, governance institutions, access to education, medical care and other public goods. Deep inequality is a main impediment to practical mutuality in negotiation processes about a future agreement and the accompanying enforcement regulations. To bring the member states to more balanced relationships, significant and sustainable improvement of the living conditions in poorer countries is due. Transfers [*Chapter 4*] from richer to poorer countries are an essential part of COP agreements. For example, the Copenhagen Accord (2009) qualified the necessary transfers as "*adequate, predictable and sustainable*", next to "*scaled-up, new and additional*". US$ 100bn annual financial transfers from 2020 onwards were pledged, and are to be fleshed out at COP21 in Paris (2015), but at the start of COP21 (Nov.30, 2015) details are still unclear.

In a robust cooperation, transfers among participants are linked to two groups of factors: on the one hand, some characteristics owned by the participants, and on the other hand, the performance of the participants on an agreed set of criteria. To the first group belongs the marking of UN member states as (potential) donor or recipient, or neutral as intermediate category. In 1992, Annex1 nations were labeled as donors and non-Annex1 as recipients. This dichotomy has grown obsolete. Recommended are more refined rules of classification and graduation [*Glossary*]. For the elimination of the energy-related CO_2 emissions, graduation of Parties shifting along changes in their wealth position is most workable. The average GDP/inhabitant is the metric of the wealth position of a Party.
In the second group a few measurable criteria have to be selected for monitoring the performance of all participants, and report regularly (annually is the most appropriate time scaling [*Chapter 4*]). Here the links with the boxes 4 to 7 of the Ostrom menu emerge [*figure 6*]. Transfers are adapted along the results booked by every Party on the yearly commitments made and realized. Hence, transfers will remain in the picture while discussing the following boxes.

Box 4. Participation & Compliance

A global agreement on safeguarding the global atmosphere and climate commons is served by a high degree of participation by the Parties. Without missing any of the major nations on earth, 195 countries have ratified the UNFCCC. This success has spilled over on the COPs' expectations about consensus rates of participation. When consensus is considered imperative, every participant obtains a veto right, making strong agreements unlikely, because participants can compromise for acceptance of personal agendas. Unanimity may be more adverse than beneficial [*Chapter 3*].

Although nations are the sovereign signatories, more and more coalitions among groups of nations have been formed, for example: G77+China, Umbrella Group, EU28+, and smaller (sub)coalitions like AOSIS, BASIC, Arab Group, least developed countries. By coalitions smaller countries enhance their power in talks with large countries. Coalitions also may thrive on suspicion as part of the zero-sum game negotiations [*Chapter 4*].

Scholars discussed tensions between shallow & broad versus deep & narrow agreements (Aldy and Stavins 2007). A smaller panel of countries is assumed to agree faster on stronger engagements. The Copenhagen Accord is a historical example of a narrow group of high-level political leaders agreeing in short time on a deep accord. Nevertheless Copenhagen is labeled a failure by most COP habitués, presumably because they prefer a broad compromise.
However, the sovereignty of the Parties precludes mandated participation and compliance. How then "*are nations to be induced, coerced, or persuasively invited to participate?*" is Schelling's question (2007), adding the issue of compliance when discussing about possible, but little effective options. Schelling convincingly argues enforcement is an illusion, followed by the advice "*to contemplate some kind of progress without a 'regime' – something more opportunistic, more piecemeal, more purely diplomatic.*" The COP21 set-up is in line with this advice, but not ready to meet the inalienable duty of the UNFCCC to save the global atmosphere and climate commons.
Hardin (1968) states that compliance has to be enforced by "*mutual coercion, mutually agreed upon*". Concerned here is the community of all UN member states and their peoples. Their sovereignty imposes balanced mutuality and reciprocity in global agreeing, with care for "*accuracy of information, monitoring capabilities, sanctioning reliability, and zero costs of administration*" (Ostrom, 1990). Reciprocity among Parties is advanced by higher equality and by transfers from richer to poorer nations [*Figure 6: Box 3 affects box 4*].

After the experience of the Copenhagen Accord, and the unchanged reality of a diverse and unequal world, the protracting quest for a consensus agreement is sterile. It conflicts with other climate policy imperatives like urgency to act, deep cuts in emissions, effectiveness, fairness and historical responsibility.
It is more effective to organize a two-phase participation & compliance approach, where phase two shortly follows phase one. In phase one about twenty Parties responsible for more than eighty percent of the energy-related CO_2 emissions agree on a self-governance regime. When a small group cannot agree, it is unlikely a larger group could agree.
The agreement is constructed in a way that every other Party can seamless join the agreement, via accepting the clearly defined rules. By a balanced regulation of transfers from rich to poor nations, most of the presently lower GDP/person and lower Cpp countries are stimulated to immediately join the agreement.
The participation issue is a minor problem compared to the compliance problem. Compliance is dependent on the design of the three following boxes 5, 6 and 7 [*figure 6*] of the self-governance regime. Transfers [*Box 3*] play also a decisive role in the compliance success of the regime.

Box 5. Pledge & review (P&R)

In the reality of sovereign nations, pledge and review is the only practical way to start and consolidate commitment by the Parties. It is criticized heavily by some academics (e.g. Gollier and Tirole 2015). The principle itself is simple, but its effectiveness and administrative feasibility depend on the specific application and design of the pledges and possibilities to review the actual fulfillment of pledged commitments. The present P&R implementations in global climate policy are unwieldy, with dubious results.

COP practices in pledge & review

From COP03 (Kyoto 1997) followed that a panel of Annex1 countries formulated mitigation commitments as 'targets and timetables', i.e., caps on their total emissions expressed as percent decreases (the overall average was -5.2%) in their national GHG emissions to attain in distant future years (the average of the five year period 2008-2012). The total of national GHG emissions cover too many different variables: population, wealth, energy intensity, and carbon intensity. The actual meaning of the numbers is obscure because shifting with population (e.g., immigration), economic and technology dynamics (e.g., the 2008 recession, or relocating industries), while also offsets from CDM projects or hot air are accepted for meeting the targets. Caps by tons of emissions in distant future years are difficult to understand and not precisely identified (Ward 2010). Delivery of the results (review of the pledges) stretches over time spans beyond 8 years (two US presidential terms), annihilating every sense of urgency and eroding responsibility and accountability of the pledgers. Furthermore, pledges are made with 1990 as baseline year, diluting the link with reality further with every passing year. However, updating baselines in this kind of pledges entails perverse effects, and would create additional stalemates. Limiting the pledge and review engagement to only Annex1 Parties is too rudimentary. But non-Annex1 countries are not inclined to formulate similar pledges (Bodansky 2007), because their development still depends on energy supply and use systems characterized by carbon lock-in. The lock-in is protracted by the feet-dragging development and deployment of renewable energy by Annex1 countries.

Dividing a global cap in packages for assignment to responsible parties is troubled by uncertainties, growing exponentially with the number and diversity of parties involved (Weitzman 2015). Parties readily slip into zero-sum games on sharing the global cap, raising distrust and demand for intense monitoring, reporting and verification of programs, actions and measures. Yet, target enforcement is not guaranteed, neither is the additional character of emission reductions; volatility in economic up- or downturns and offset projects continuously trouble the real meaning of emissions targets.

COP21 (2015) is based on INDC (Intended Nationally Decided Contributions) pledges, now expected from all UNFCCC Parties. It is a positive evolution that all Parties are addressed, and most of them engaged. However, compared to the 'targets & timetables' pledges, the confusion is multiplied because every country decides its preferred contributions, which remain still intended. The MRV of the contributions is very elaborate and opaque (Aldy and Pizer 2015). In practice, MRV of INDCs is not doable for attaining somewhat comparable and transparent results at a realistic spending of control resources. Control of CDM projects, a fully failed experience (Wara 2007), is easygoing compared to the MRV task on INDCs. Further, INDCs own the weaknesses of the 'targets and timetables'. There

are voices to limit the time spans of the reviews to five years, to break up the fifteen years span 2015-2030. Review results on the INDCs submitted for Paris in 2015 are announced for 2023. This is mocking the urgency concerns of all informed observers on unfolding climate change.

Properties of effective and workable pledge & review

An Ostrom self-governance construction rests on three pillars. The second pillar is made up of credible commitments [*Box 6 in figure 6*]; the third pillar is mutual monitoring delivering transparent and frequent results [*Box 7 in figure 6*]. Both pillars depend on the effectiveness and workability (administrative feasibility) of the implemented pledge & review processes. Therefore, applied pledge & review systems in global climate policy should own a set of core properties:

1. Use of numerical, reliable and transparent indicators[2] for monitoring the actions or performance of all Parties, in particular in appropriating shares of atmospheric and climate commons, and their results in deploying sustainable renewable energy supply and use systems. For governing the commons, information is pivotal (Ostrom 1990, chapter 6).
2. Pledge & review occur regular in time, i.e. yearly. The yearly COPs are the suitable platform to discuss and adopt the pledges for the few coming years and review the outcomes over the last few years. The time span for the pledges is bounded to a few (three) years forward, and reviewing looks back at the Party's path focusing on the last years before the COP meeting. Politicians, officials, company managers, citizens, can know and understand what is pledged and why particular scores turned out from the latest review.
3. Realistic: for keeping their practical meaning the pledges are made against yearly updated (rolling) baselines. The reviewed indicator numerical values of a Party of two years back are the baseline for assessing her realistic progress over the coming three years. The prehistoric 1990 baseline year is shelved. Every Party starts at the position it now holds; assuming otherwise is unhelpful imagination. Ironing out big differences in the emission positions of Parties is a matter of tuning the pledges made and of time.
4. Effectively committing every Party for progressing every year from the latest reviewed actual status the Party had attained. Performance and progress are monitored every year, providing information and a summary feedback on the policies and measures taken at the local, national and regional levels. This confirms and renews commitment, linked to and interwoven with actions undertaken at various levels of living societies [*figure 5*].
5. Stimulating common resolve among Parties via agreeing on specific pledges per category of Parties and via mutual advice and help among the Parties in realizing their pledges. Positive emulation of the best technologies and practices accelerates the development and deployment of innovative solutions, for the transition to sustainable renewable energy supplies.

In box 6 is proposed how pledges owning the above five properties can contribute to firm commitment and to irrevocable progress in preventing continuation and growth of energy-related CO_2 emissions.

[2] An indicator is a variable in a context, assigning meaning to the numbers

Box 6. Binding yearly commitments

Sovereign states can bind only themselves, individually and by mutual agreement also as a group. They respect the binding character of their commitments when they realize their pledges. Box 5 mentions which properties pledges should own for being effective and workable in a global, self-governance architecture. Box 2 [*figure 7*] presents a spearhead policy to eliminate energy-related CO_2 emissions, with scenarios on contracting and converging the Parties' average CO_2 emissions per person (Cpp). By joining both boxes emerges the first-hand proposal that Parties would submit pledges about their future Cpp values. The Cpp indicator is yearly available, accurate, and transparent.

Decomposition of Cpp in three constituent factors

Cpp is a highly aggregate indicator of the Parties energy-related CO_2 emissions intensities. Decomposing Cpp in three, still highly aggregated, factors provides insight and opens the entry to more detailed, hands-on information for the Parties. The identity's right-hand side is a multiplication of respectively wealth intensity, energy intensity of wealth, and CO_2 intensity of energy use:

$$\text{Cpp} = \{\text{GDP/person}\}*\{\text{energy/GDP}\}*\{CO_2 \text{ emissions/energy}\}^3$$

Total emissions of a nation are reduced when population growth is checked, and when the product of the three intensity factors diminishes. By referring to emissions per person, population policies are excluded from the climate policy discussion. This is a step forward. Perverse incentives like impeding migration are avoided. More practical, global population policies are no longer hidden in the plies of the COP processes. Global population policies belong to a specialized UN forum with knowledgeable experts on duty.

Intensity targets have been criticized because they do not guarantee absolute emission reductions, but Pizer (2005) offers a balanced view. The critique does not hold when the various intensities are managed in context and monitored for deep and irrevocable decline (80 to 100% emission reductions by 2050). A multiplication equals zero when one of its factors is zero; it becomes small when one of the factors is very small (assuming the other factors do not increase at a commensurate pace). A way to achieve low Cpp results is the widespread adoption of renewable energy technologies (IPCC 2012) along decreasing energy intensities of economies. This also requires economic reforms, e.g., of taxes and subsidies to increase the bills of CO_2-intensive activities and to cut the bills of low CO_2 emitting activities [*BRI in Chapter 2, Legend n°1*].

Decomposing energy-related CO_2 emissions in constituent factors is a widespread practice. IPCC reports take advantage of decomposition for explaining the evolution of energy-related CO_2 emissions (see the 2014 Assessment report, working group 3, chapter 6). The SE4All initiative of the General Assembly (UN

[3] The decomposition can go on by splitting GDP in its major composing activities, by identifying actors related to the various activities, by specifying the types of energy used, etc. At UN level the higher aggregate suffices and further detailing is the task of the Parties to design the policies for controlling the values of the aggregate indicators. Agnolucci et al. (2009), Verbruggen (2011) provide examples and suggestions of deeper decompositions.

2011) wants to half the energy intensity (factor 2 of the identity's right hand side) and double the use of renewable energy (factor 3) in developing countries. Also the INDCs of various countries (e.g. China) refer to improving on factors 2 and/or 3. Energy and climate mitigation policies recommended by IEA, the EU, and other institutes assign the predominant places to energy efficiency (factor 2) and renewable energy (factor 3). Energy and emission taxing and pricing changes are proposed to influence investment and operational decisions of economic agents, affecting the structure of GDP. GDP is embedded in the factors 1 and 2 of the identity. In summary, the composing factors are the focal points of energy and climate policy debates and activities. Therefore, it is amazing that official COP policy-making neglects the opportunities of decomposition for addressing the 'complex' and 'wicked' policy matters. A few earlier publications brought up decomposition in discussing climate policy (Hummel 2007; Verbruggen 2009, 2011; Prins et al. 2010), however with little influence on the policy regimes.

Pledges-Commitments by Parties

Transparent and verifiable pledges lead to credible commitments, especially when prepared and made by the Parties in common resolve. The pledges-commitments by the Parties consist of two interlinked parts: one, indicative scenario over the long range; two, numbered pledges on indicator values for the short-term (next years)

First, every Party sets out a Cpp contraction scenario as indicative pathway it plans to follow over the coming decades to reach a (very) low Cpp value in 2050 [*Box 2, figure 7*]. Deviations from planned scenarios may occur, and are not problematic when they are not systematic in the direction of underperforming. The latter case is a signal for increasing short-term efforts. Long-term scenarios may be reviewed and adjusted every five or ten years, always with the perspective of a very low Cpp value in 2050. The Deep Decarbonization Pathways Project (DDPP 2015) shows how to construct such scenarios.

Second, there are yearly pledges-commitments of the Parties about progress year by year for the next three years, on the three intensities composing the Cpp value. For getting transparent and verifiable pledges-commitments, the intensities are measured with indicators. One selects indicators (or their constituent variables) that are inventoried by reliable institutes (IMF, UNEP, IPCC, IEA, OLADE, etc.), and made available in a transparent and verifiable way. The proposed indicators are:

- The *Budget Reform Index (BRI) for wealth intensity (GDP/person)*. The BRI [*Chapter 2*] should irrevocably increase year after year. Budget reform is promoting sustainable low-carbon activities and charging non-sustainable activities, leading to restructuring of the GDP. The monetary total of the GDP may increase or decrease by the restructuring. The discretionary power of how to practically organize the restructuring remains fully with the Parties. The BRI only gauges the overall net monetary thrust of policies for the promotion of sustainable low-carbon technologies and practices.
- *Energy intensity (energy/GDP)* is a long-time documented indicator (Schipper et al. 1992, 2001; Geller and Attali 2006) and widely used by national and international energy administrations. Energy intensity combines the structure of an economy (how much of which activities take place) with energy efficiency (how much commercial energy is used by

one unit of activity). The first factor is affected by budget reform (BRI); the second is mainly technological. Lowering energy intensity is generally high on the list of (proposed) energy and climate policies (IEA, EU, China).

- *Carbon intensity (emitted CO_2 per unit of supplied energy)* is the keystone for controlling CO_2 emissions. Transitions to zero or almost zero carbon emitting energy uses by 2050 is the mission for all nations in the coming decades. Their transitions will be specific, due to differentiated endowment in resources, applied technologies, installed infrastructures, etc. However, all transitions are constrained by a small set of energy supply options [*Figure 8*]. In Box 2 the importance of taking the path of the sustainable low-carbon energy transition has been emphasized. This importance should be repeated here.

Which Pledges-Commitments are most practical?

Coordinating behavior among sovereign actors is promoted by focal points: "*some focal point for each person's expectation of what the other expects him to expect to be expected to do*" (Schelling, cited by Barrett 2012). For use in the COP context, substitute Party for person. "*Whether there is a focal point, and what it is, depends very much on how the bargaining problem is framed*" (Barrett 2012). The various indicators of progressing on climate policy efforts and on results are candidates as focal points. The choice is open:

- The highest aggregate indicator: Cpp
- The three constituent factors of Cpp
- One constituent factor, viz. carbon intensity, because this is the only factor apt to reflect very low emissions by 2050 pathways, meaning transitions to sustainable renewable energy systems[4].

In the multi-leveled climate policy dome [*figure 5*], working with the three factors creates more of a hinge between the UN and the nations. The three factors are interdependent[5]. For transforming the energy systems to sustainable renewable energy systems, also the other two factors need change. The decomposition of Cpp in three factors is a first step in finding policies addressing the various societal activities, the agents undertaking the activities, the energy technologies, etc. The policy problem is ubiquitous, vast and diverse. Decomposition to the first level drivers of energy-related CO_2 emissions is instructive. Emulation among Parties is stimulated by yearly reviewing past results and pledging future progress on three synthesis indicators of national climate policy.
More details on the practical organization of such a review and pledge process are provided in Verbruggen (2009). The bolds and nuts of designing and running appropriate regulations belong to the discretion of the UNFCCC secretariat.

Box 7. Monitoring – Reporting – Verification (MRV) at the UNFCCC level

In a multilevel architecture, the MRV responsibility and authority are also multi-leveled and assigned at the respective levels [*figure 5*]. Here, only MRV at the UNFCCC level are considered. MRV occasion transaction costs, which may grow

[4] Desmond Tutu's climate petition for COP21 proposes the transition to 100% renewable energy by 2050 as focal point.
[5] This interdependency makes that extrapolating simple decomposition is only appropriate for a few nearby years.

unwieldy. This is experienced in the CDM mechanism, wanting measurement of the 'additional' emissions reductions of particular projects. By spreading MRV tasks properly over the multilevel policy structure, MRV costs at the UN level are manageable. The MRV expenses and the urgency of robust climate policies, support a call on existing international institutes with experienced experts, reliable information and proofed control systems. There is no added value or meaning in the trials of UNFCCC to invent, set up, deploy, run, and fail in new systems trying to measure the non-measurable. INDCs are an example of non-measurable patchworks.

However, MRV of the commitments of Parties is essential for governing global commons. Without monitoring, none of the commitments is credible. The willingness of the Parties to cooperate is adversely affected when they consider the commitments inappropriately enforced (Ostrom 1990). Mutual monitoring is related to self- governance, but direct monitoring a colleague is almost invariably costly to the monitor (Ostrom 1990, 1992). Mutual enforcement is often costly for participants when other participants, e.g., relatives, can retaliate. In global climate policy, retaliation is less likely because nation-states are formally distant and the UNFCCC secretariat is authorized to organize MRV. A more explicit specification of the role of the UNFCCC secretariat in lean MRV is feasible when the pledges-commitments take the form as discussed in Boxes 5 and 6.

MRV must be fully transparent, and occur accurately and regularly. In the practice of global climate policy, with 195 very diverse Parties, only a system that works with reliable, numerical indicators measured by known trustworthy institutes, can meet the request of a transparent, accurate, and regular reporting. Using indicators based on variables that are monitored, verified and reported annually since decades, makes MRV easy. There will be yearly reports for every participant. One yearly updated sheet with numerical results on the few indicators is necessary and sufficient for MRV. Table 1 shows a stylized example with 2014 as baseline year and 2017 as COP-year when new pledges are made. Annual numbers are reported for a moving 10-year period: 4 verified years of the past (2011-2014), 3 pending years under verification (2015-2017), and 3 years with numbers pledged for the three years (2018-2020) following the year the COP takes place.

Table 1: Start MRV sheet with Predicted/Pledged and Verified values for the indicators (***2014***: rolling baseline year; **2017**: COP-year pledges for 2018-2020; X = data verified in 2017; Y = predicted or pledged numbers in year 2017; - = data filled year after year)

PARTY	GDP/person		BRI		Energy intensity		Carbon intensity		Resulting Cpp	
Year	Predict	Verif.	Pledge	Verif.	Pledge	Verif.	Pledge	Verif	PrPl	Verif
2011		X				X		X		X
2012		X				X		X		X
2013		X				X		X		X
2014		X		Test		X		X		X
2015		-		-		-		-		-
2016		-		-		-		-		-
2017		-		-		-		-		-
2018	Y	-	Y	-	Y	-	Y	-	Y	-
2019	Y	-	Y	-	Y	-	Y	-	Y	-
2020	Y	-	Y	-	Y	-	Y	-	Y	-

Many people and countries involved in climate policy are familiar with the proposed indicators [*table 1*]. The administrative burden to fill the sheets by the Parties is limited, especially when basic statistical services are in place and if cooperating with institutes such as IMF, World Bank, IEA, OLADE, and IPCC. The information is particularly helpful in realizing self-governance in global climate policy. Two aspects are highlighted: first, the leaner COP functioning with devolution of tasks to other levels of the multilevel policy dome [*figure 5*]; second, the credible structuring of financial transfers between rich and developing countries.

Leaner COP functioning

MRV is the closing keystone of Ostrom's triptych 'rules-commitments-monitoring'. Regular (continuous) MRV seal the common perception of mutual trust and reciprocity, essential in coordinated strategies by sovereign Parties. For this the MRV system has to be fully reliable and transparent. Additionally, the burden of MRV should not squander the benefits of a coordinated approach of the climate issues. In case UN coordination is too expensive, the voices for emptying the role of UNFCCC become more influential. The sheets (of table 1) and the work to compose these annually obey the criteria of a lean, reliable, transparent and timely MRV.

It is a welcome instrument to enhance mutual monitoring without witch-hunting. Related to the rulings developed in boxes 1 to 6, it helps to practically organize common resolve among the Parties. The work delivered on the INDCs for COP21 is not lost when redirected to the proper decision-making level, being the national states. Innate links strengthen both the programs, initiatives, target setting (i.e. INDCs in all their specific detail) developed by the countries and the various levels of decision-making operating in and across the countries, and the pledges-commitments indicators and MRV employed at the UNFCCC level. The latter are but the pinnacles of pyramids of domestic climate policy information systems. It encourages learning at the scale of the nation-state; the metrics provide feedback to individual countries on their own progress and, simultaneously, serve as a prod to further action (Morgenstern 2007).

By yearly reporting progress and endeavors of all nations in a convenient, accessible way, the citizenship of the world is well informed. This strengthens the democratic interaction between constituencies and politicians, and may slim the COP attendance.

Feedback from mitigation performance to financial transfers

Every global agreement (or proposal thereof) collapses without the keystone of steady and predictable transfers from rich, industrialized countries to poor, developing countries. There runs a vital feedback line from MRV [*figure 6, Box 7*, as the closing keystone of the *Boxes 4, 5 and 6*] to Transfers [*Box 3*]. In this architecture is proposed to distinguish the major components of the global climate policy challenge (elimination of energy-related CO_2 emissions, REDD+, adaptation, addressing non-CO_2 greenhouse gases), and it is recommended to click financial transfers on the separate policy processes. One large climate fund (like the GCF agreed upon in Copenhagen 2009) is divided in several accounts. Donors transfer money to the accounts, and beneficiaries obtain drawing rights on the accounts. The debits and credits per Party depend on the wealth status of the Party in the baseline year and on its performance in realizing the pledges the

Party made. The rules for donations and for drawing rights are systemic, and based on a double standard: ability to pay (measured by average GDP/person of a country) and performance on committed climate policy indicators, composing the Cpp. Commitments and performance are requested from all Parties, being they donors or beneficiaries of finances.

GDP-dependent transfers (Gupta 2007) are adjusted with performance results in meeting pledged commitments on the indicators. Making financial transfers (debits and credits) dependent on performance inserts incentives to perform better. There is more impetus to participation & compliance and making appropriate pledges [*figure 6, Box 4 and Box 5*] are driven by financial interest. Technically, the COP Parties must agree on an incentive formula common for donor countries with above world's average GDP/person and on an incentive formula for beneficiary countries with GDP/person below the world's average. Suggestions are presented in Verbruggen (2009). They provide to both sides self-enforcing incentives to perform above average of their group. The mechanism makes donors pay along their ability to pay, further adjusted for their progress on the factors determining their Cpp. A donor with little progress (too high Cpp) appropriates too much space from the limited atmosphere and climate commons, and must pay extra to the GCF account. Beneficiaries receive along their ability to invest and use the money well for controlling their energy-related CO_2 emissions. A beneficiary performing extra in controlling the factors that push up the Cpp, receive more drawing rights on the GCF account. As such the self-governance has constructed a lenient and lean, self-enforcing incentive mechanism.

Alongside this energy-related CO_2 mitigation account there will be need for additional transfers in direct technology and aid for adaptation, as well as for achieving the broader sustainable development goals.

6 Summary

This summary only covers chapter 5, presenting a workable self-governance by sovereign nation-states in eliminating their energy-related CO_2 emissions by 2050. The other four chapters have been compiled as fundaments for chapter 5. Spearheading on energy-related emissions addresses the major cause of raising greenhouse gas concentrations in the atmosphere. The energy-related emissions mitigation part of the climate change and climate policy problems illustrate how an Ostrom-like approach could advance the UNFCCC by walking step by step in the right direction. Spearhead policies are pertinent for disruptive solutions breaking through the walls of incumbent resistance. The transition to sustainable renewable energy uses and supplies is the only solution of hope. It needs changing viewpoints, for example: '*nature offers renewable energy to convert in useful supplies for society, energy systems have to adapt'* substitutes for the old '*renewable energy disturbs existing (fossil fuel and nuclear based) energy systems on command, and disturbers should be penalized'.*

Nothing in the proposals of chapter 5 is lunatic; all its components are known and have been subject of analysis and support in the global literature. The rules employ numerical indicators for transparency and precision. People are in the center of the main indicators: CO_2 emissions per person (Cpp) and wealth per person (GDP/person). There is no positive value in using the emissions/GDP indicators.

Ostrom proposes a triptych for developing self-governance of commons: a new system of specific rules – credible commitments – mutual monitoring. Each of the three constituent elements is worked out. Figure 6 provides an overview: the boxes 1 to 5 hold the system of rules; box 6 discusses credible commitments and box 7 deals with monitoring. All boxes are interconnected. As summary, the highlights are recalled.

Box 1. Urgency to protect

A civilized attitude qualifies energy-related CO_2 emissions as 'gaseous litter'. As a corollary, littering (emissions) has to stop immediately, or at least as soon as possible. The litterer is liable to clean the mess already occasioned (historical responsibility to support adaptation and compensate damages and losses). This attitude is opposite to the concept of 'rights to emit' and 'present generations bringing offers when reducing the emissions'.

Being serious about the liability and about +2°C (+1.5°C) as extreme guardrail, Parties project their average energy-related CO_2 emissions per inhabitant (Cpp) in a scenario up to 2050. The scenario renders indicative long-term mitigation goals. The Deep Decarbonization Pathways Project (DDPP 2015) provide worked out examples for the major emitting Parties.

Box 2. Spearhead policy: eliminate energy-related CO_2 emissions

By now is acquired the general agreement on the need of a transition to low-carbon energy supplies. Significant development of renewable energy occurred over the last decade. However, non-compatible visions on the future energy systems are clashing. The visions should be warranted by sustainability assessments [*Chapter 2, Legend n°2*]. Two visions are described in Box 2, one capable of bringing a sustainable energy transition, because the industrialized nations take the lead and technologies and practices are ready for emulation by developing nations. The other one is censored on the incumbent lock-in by

nuclear power and recently built fossil fuel power plants. It is a dead end, particularly risky in a time of high urgency. In 2014, the European Commission has followed the major energy and industrial companies on the risky path.

Box 3. Transfers

The financial transfers via global climate policy are split over the separate regimes, with specific accounts in the GCF by regime. The transfers related to the elimination of energy-related CO_2 emissions are dependent on the numerical indicators GDP/person and Cpp (the result of three composing intensity factors). The financial flows from donors to beneficiaries depend on the position of the Parties on the GDP/person graduation scale [*Chapter 1*]. Financial transfers accord with donors' ability to pay and beneficiaries' ability to spend. Transfers are adjusted with performance by both sides on the numerical indicators measuring progress in lowering their Cpp. The transfers are yearly cleared. Other parts and regimes of the climate problem create own transfer flows via their specific accounts.

Box 4. Participation & Compliance

COP participants adhere high value to unanimous decision-making. However, consensus among very different Parties generally brings high costs in contents of the agreement. Kick-starting the energy transition by countries having littered and littering most the atmosphere, puts the responsibility at the right place. Participation is advantageous for all other nations.

Participation means acceptance of the rules of self-governance. Compliance is respecting the rules. Compliance is enhanced by self-enforcing mechanisms, such as rewarding beyond standard performance and penalizing below standard performance. Sovereign Parties prefer modest rewards and penalties, except when one Party really endangers the commons. Appropriate transfers and common resolve stimulate compliance.

Box 5. Pledge & Review

Economists dislike this mechanism, although being the most functional one when Parties are sovereign. However, so far COPs adopted pledging rules of dubious quality, practically non-reviewable and with little credible commitment (the Kyoto percent reduction targets and the INDCs). Such pledges preclude a workable self-governance.

In conceiving P&R rules full attention is due for the next two elements of the Ostrom triptych (credible commitments and mutual monitoring). Therefore, the pledge rules should own particular properties. Pledges are made on numerical, reliable, and transparent performance indicators. Pledges are renewed yearly for enhanced performance. For staying realistic, pledges are made against yearly updated indicator value baselines; the prehistoric 1990 baseline is shelved. Yearly reviews provide feedback about the progressing pledges and performance. The system of pledges stimulates common resolve among the Parties.

Box 6. Binding yearly commitments

Credible commitments are obtained by well-founded pledges. For eliminating energy-related CO_2 emissions, the Cpp values of all Parties have to dwindle to almost zero (high emitting countries) or remain capped to low values (low emitting countries). Parties could made pledges directly on Cpp values, but the

proposal here argues in favor of pledges on the three factors composing Cpp. For every factor exist verified statistics to express pledges and progress in reliable numerical values. Wealth intensity (GDP/person) is measured by the Budget Reform Index showing how a nation is changing the incentives for moving from carbon intensive, polluting activities to carbon free, clean activities [Chapter 2]. This index is the right substitute for the economists' demand to include carbon pricing. Energy intensity (energy/GDP) is a combination of the kind of activities undertaken with the energy efficiency of the undertakings. Lowering this intensity is a commonly pursued goal by various authorities, institutes and initiatives (for example, the Chinese government, IEA, UN, SE4All initiative). Decreasing carbon intensity (CO_2 emissions/energy) depends on the growth of sustainable renewable energy supplies.

Binding cannot be imposed or enforced. The precision of pledges-commitments is most influential in enhancing the binding power of the governance. On precision the proposed indicators excel above any other system. The underlying statistics are collected and processed by respected international organizations such as UN institutes, IMF, IPCC, IEA, OLADE, Eurostat, etc.

Box 7. MRV (Monitoring, Reporting, Verifying) at the UNFCCC level

The third keystone of Ostrom's self-government structure is mutual monitoring. For many Parties, it is already quite cumbersome to conceive, specify and follow up the own INDC. It is unthinkable how the Parties could mutually monitor the performance on all the INDCs. A lean and effective MRV is necessary, but only feasible when based on transparent, accurate, numerical and yearly available indicators. The proposed governance rules and credible commitments can deliver this information. A yearly table of 10 rows by 10 columns [*table 1*] is sufficient to publish the progress and pledges for next years made by a Party. Non-intrusive verification is possible. Processing the data of all Parties delivers accessible reports for the Parties and the global community of concerned citizens. The information is enough reliable, updated and verified to function as input for assessing the performance of the Parties in controlling their Cpp pattern. Therefore it is a valid basis for deciding on the amount of donations by the rich countries, and on the amount of drawing rights from the GCF by the poor countries. The transfers respect the ability to pay by the rich, and the ability to spend by the poor, for eliminating the energy-related CO_2 emissions.

The self-governance regime

All boxes are interconnected in a grid shown by figure 6. For example: sovereign nations cooperate on pledges, transformed in credible commitments, mutually monitored, imposing strict conditions of transparency, regularity, accuracy. It asks for established knowledge and indicators, certified by trustworthy institutes. The efforts must deliver effect: the emissions go down by thorough energy transitions based on technologies and practices everywhere valid and affordable by all countries. Yet countries are diverse, and financing and capability need redistribution by transfers, taking into account ability to pay by the rich and ability to spend by the poor. Without yearly, numerical indicators on status and progress, credible MRV is not possible. Without MRV there are no credible commitments, and it makes no sense to define rules (Ostrom 1992). MRV is the keystone of a credible and workable regime in global climate policy.

7 Concluding

Global elimination of energy-related CO_2 emissions in a few decades, the latest by 2050, equals disruptive changes in energy uses and supplies, everywhere. Urgent, thorough transitions are the opposite of slow, soft bending of the easiest practices. Disruptive change follows disruptive thinking, talking, planning and handling. Disruptive proposals clash with our TINA syndrome, instigating inertia. Developed societies tremendously invest in carbon lock-in infrastructures, technologies, institutions and practices. Developing societies are copying the wealthy nations, including the carbon lock-in. It is the road to irreversible climate perdition.

Politicians and officials fully support and invest in the ongoing COP process. The forces to 'throw good money after bad money' are strong. The scientific proposals on global climate policy self-governance as developed in chapter 5 and summarized in chapter 6, ask for a detached, rational position about possibility, desirability, and necessity of their implementation.

The proposals are *possible* because, using existing and proofed operational institutes and instruments, the essential characteristics of climate change and the related common-pool resource issues are addressed. No essential parts of the proposals have to be invented or founded anew. Ongoing positive efforts and results are integrated, for example the INDCs prepared by the Parties, although too incongruent for policy at the UN level, remain useful at the nation-state level. The regime is dynamically adaptive, and matches other deep decarbonization ideas. The regime is applicable in the yearly COP meetings.

The proposals are *desirable*. They respect basic principles of global partnership: universality, sovereignty, realism, transparency, and diversity. All Parties are treated as sovereign partners in a global policy regime. Equal rules apply when common responsibilities and capabilities prevail; otherwise, rules are differentiated.

The proposals are *necessary* for the urgent and drastic changes in energy use and supply systems, which the ongoing COP process cannot deliver. Voluntary contributions, difficult to monitor and verify, fall short in governing the global atmosphere and climate commons. Ostrom's analysis and recommendations are convincing for deploying a systemic approach.

True, UNFCCC must clear the road of illusions (see the Legends in chapter 2) and from interests vested in carbon-intensive economies. However, such clearings are prerequisite for every agreement, policy and measure with a real chance to avoid the +2 °C calamity.

This essay has not the ambition to be complete. It is a search for a workable global climate policy self-governance regime. The unfinished character is an advantage: academics may propose pathways, solutions, directions, headlines, etc. Policy makers are in charge of final design, implementation, and operation. Blueprinting and realizing a workable architecture for global climate policy is still the responsibility of UNFCCC.

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