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Opportunity and challenges of Carbon neutrality actions in developing countries to tackle climate change

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Abstract

Climate change is acknowledged as the greatest threat to the environmental and societies. Today, carbon neutrality has become a global strategic measure to coup with climate change in the context of GHGs emission reduction. Carbon neutrality can be defined as the balance between emitting carbon and absorbing carbon emissions from carbon sinks. It can be used as net zero carbon and/or zero carbon footprint as well. Major carbon sinks include forests, soils, and oceans. The European Union Commission reported that natural carbon sinks including forests, soils, and oceans remove 9.5-11 GtCO2 per year. IPCC AR6 reported that Carbon neutrality mechanisms knock on the world economic doors of new world economy frameworks since more than two decades ago. There would be achievement of the Paris Agreement goal, especially if every country, city, financial institution, and company adopts realistic plans for transitioning to net zero emissions by 2050. This study is an outcome of review on a number of research papers, articles, and documents in the context of climate change. In accordance with Article 4, paragraph 12 of the Paris Agreement, Nationally Determined Contributions – NDCs communicated by Parties including developing countries shall be recorded in a public registry maintained by the UNFCCC secretariat. The NDC synthesis report synthesizes information from the 168 latest available NDCs, representing 195 Parties to the Paris Agreement, including the 153 new or updated NDCs communicated by 180 Parties, recorded in the NDC registry as of 25 September 2023. The NDCs are composed of the parties' individual targets, and policies and measures for reducing their national emissions and adapting to climate change impacts. And the parties expressed information either the needs for, or the provision of, finance, technologies, and capacity building for these actions. Even though Parties of the UNFCCC and Paris Agreement are trying to reach the 1.5℃ Paris goal by means of different measures including strategy and principle of a Just Transition, the developing countries including small island states are facing challenges to apply not only technology and financial challenges but also job quality, natural person migration or brain draining, natural resource-based market strategies and unsystematic land use management are mostly challenging in developing countries. Capacity building, practically relevant mechanism development, strengthening cooperation and coordination among national, regional, and international institutions, financial and technical accessibility, transparency, and MRV are recommended to overcome the difficulties and challenges of developing countries.

Keywords: GHGs, carbon sink, carbon market, net carbon neutrality

ရာသီဥတုပြောင်းလဲမှုတိုက်ဖျက်ရေးတွင် ဖွံ့ဖြိုးဆဲနိုင်ငံများ၌ ကာဗွန်မျှခြေဖြစ်စေရေး လုပ်ငန်းများနှင့်စပ်လျဉ်းသည့် အခွင့်အလမ်းနှင့် စိန်ခေါ်မှုများ

ဒေါက်တာဆန်းဝင်း၊ ညွှန်ကြားရေးမှူး
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

စာတမ်းအကျဉ်း

ရာသီဥတုပြောင်းလဲမှုကို ပတ်ဝန်းကျင်နှင့် လူမှုအသိုက်အဝန်းအပေါ် အကြီးမားဆုံး ခြိမ်းခြောက်မှုအဖြစ် အသိမှတ်ပြုလျက်ရှိပါသည်။ ယနေ့အခါ ကာဗွန်မျှခြေဖြစ်စေရေးသည် မှန်လုံအိမ်ခါတ်ငွေ့လျှော့ချခြင်းဆိုသည့် ရာသီဥတုပြောင်းလဲမှုကို ဖြေရှင်းရေးအတွက် နည်းလမ်းတစ်ခုအဖြစ်သို့ရောက်ရှိလာနေပါသည်။ ကာဗွန်မျှခြေဖြစ်စေခြင်းဆိုသည်မှာ ကာဗွန်ထုတ်လွှတ်ခြင်းနှင့် ကာဗွန်စုပ်ယူ ဖယ်ရှားခြင်းနှစ်ခုအကြား ဟန်ချက်ညီမှုကိုဆိုလိုပါသည်။ ၎င်းကိုအသားတင် ကာဗွန်သုညနှင့်/သို့မဟုတ် ကာဗွန်ခြေရာ ကျန်ရှိမှုသုညဖြစ်သည်ဟုလည်း ခေါ်ဝေါ်သုံးနှုန်းကြပါသည်။ သဘာဝအလျောက် ကာဗွန်သိုလှောင်ထားနိုင်သည့် အဓိကကျသော အရာများတွင် သစ်တောများ၊ မြေဆီလွှာများနှင့် ပင်လယ်သမုဒ္ဒရာများ ပါဝင်ပါသည်။ ဥရောပသမဂ္ဂကော်မရှင်၏အစီရင်ခံစာအရ သဘာဝကာဗွန်သိုလှောင်သည့်အရာများမှ တစ်နှစ်လျှင် ကာဗွန်ဒိုင်အောက်ဆိုဒ် ၉.၅ မှ ၁၁ ဂစ်ဂါတန် နှုန်းဖြင့် စုပ်ယူဖယ်ရှားပေးနေကြောင်း တင်ပြထားပါသည်။ ကာဗွန်မျှခြေလုပ်ငန်းစဉ်များသည် လွန်ခဲ့သောဆယ်စုနှစ်နှစ်စုခန့်မှစ၍ ကမ္ဘာ့စီးပွားရေးမူဘောင် တံခါးများကို ခေါက်လျက်ရှိကြောင်း IPCC AR6 အစီရင်ခံစာတွင် တင်ပြထားပါသည်။ အထူးသဖြင့် နိုင်ငံတိုင်း၊ မြို့ကြီးများ၊ ဘဏ္ဍာရေး အဖွဲ့အစည်းများနှင့်ကုမ္ပဏီများအားလုံးက လက်တွေ့ဆန်သော ကာဗွန်ထုတ်လွှတ်မှု အသားတင် သုညဖြစ်စေရေး အသွင်ကူးပြောင်းမှု စီမံချက်များကို လက်ခံကျင့်သုံးနိုင်မှသာ ပါရီသဘောတူညီချက် အောင်မြင်နိုင်မည်ဖြစ်ပါသည်။ ယခုလေ့လာတွေ့ရှိချက်မှာ ရာသီဥတုပြောင်းလဲမှုဆိုင်ရာ သုတေသန စာတမ်းများ၊ ဆောင်းပါးများနှင့် မှတ်တမ်းများကို လေ့လာဆန်းစစ်ခြင်းမှ ထွက်ပေါ်လာသော ရလဒ် တစ်ခုဖြစ်ပါသည်။ ပါရီသဘောတူညီချက်အပိုဒ်(၄)စာပိုဒ် (၁၂)နှင့်အညီ ဖွံ့ဖြိုးဆဲနိုင်ငံများ အပါအဝင် အဖွဲ့ဝင်နိုင်ငံများက တင်ပြလာသောNDC အစီရင်ခံစာပါ လုပ်ငန်းအစီအစဉ်များကို UNFCCC အတွင်း ရေးမှူးရုံးမှ ထိန်းသိမ်းထားသည့် အများပြည်သူ ကြည့်ရှုလေ့လာနိုင်သည့် မှတ်တမ်းစာရင်းတွင် မှတ်တမ်းတင်ထားရှိပါသည်။ NDC စုစည်းသုံးသပ်ချက်အစီရင်ခံစာက အဖွဲ့ဝင်နိုင်ငံ ၁၅၈ နိုင်ငံမှ တင်သွင်း

လာသော အစီရင်ခံစာ (၁၆၈)ခု (အသစ်(သို့) မွမ်းမံအစီရင်ခံစာ ၁၅၃ စောင် အပါအဝင်)ကို အခြေခံ၍ တွေ့ရှိချက်များကို ဖော်ပြထားပါသည်။ အဆိုပါ NDC အစီရင်ခံစာများကို အဖွဲ့ဝင်နိုင်ငံများအလိုက် ရာသီဥတုပြောင်းလဲမှုသက်ရောက်မှုများနှင့် လိုက်လျောညီထွေ ဖြစ်စေရေးနှင့် အမျိုးသားအဆင့်ထုတ်လွှတ်မှု လျော့ချရေးရည်မှန်းချက်များ၊ မူဝါဒများနှင့်နည်းလမ်းများ ထည့်သွင်းရေးဆွဲ ထားခြင်းဖြစ်ပါသည်။ ထို့အပြင် အဖွဲ့ဝင်နိုင်ငံများက အဆိုပါလုပ်ငန်းများ ဆောင်ရွက်ရန်အတွက် ရန်ပုံငွေ၊ နည်းပညာများနှင့် စွမ်းဆောင်ရည်မြှင့်တင်ရေး လိုအပ်ချက်(သို့)ထောက်ပံ့ရန်အချက်အလက် များကိုထည့်သွင်းဖော်ပြထားကြပါသည်။ UNFCCC နှင့် Paris Agreement အဖွဲ့ဝင်နိုင်ငံများက ပါရီ ပန်းတိုင် ၁.၅°C သို့ရောက်ရှိရေးအတွက် သီးသန့် အသွင်းကူးပြောင်းရေးဆိုင်ရာ မဟာဗျူဟာအပါအဝင် နည်းလမ်းအမျိုးမျိုးဖြင့်ကြိုးစား ဆောင်ရွက်လျက်ရှိသော်လည်း ကျွန်းနိုင်ငံငယ်များ အပါအဝင် ဖွံ့ဖြိုးဆဲနိုင်ငံများတွင် နည်းပညာနှင့် ရန်ပုံငွေတို့ကို အသုံးပြုနိုင်ရန်သာမက အလုပ်အကိုင်အရည် အသွေး၊ အသိပညာရှင် အတတ်ပညာရှင်များ ပြောင်းရွှေ့လုပ်ကိုင်မှု (သို့) ဦးနှောက်ယိုစီးမှု၊ သဘာဝ သယံဇာတ အခြေခံစျေးကွက် ဗျူဟာများနှင့် စနစ်မကျသောမြေအသုံးချမှုများစသည့် စိန်ခေါ်မှုများကို ကိုင်တွယ်ဖြေရှင်းရန် စိန်ခေါ်မှုများနှင့်ကြုံတွေ့နေကြရပါသည်။ ဖွံ့ဖြိုးဆဲနိုင်ငံများ၏ စိန်ခေါ်မှုနှင့် အခက်အခဲများ ကျော်လွှားနိုင်ရန် အထူးသဖြင့်သင့်လျော်သော လုပ်ငန်းစဉ်ရေးဆွဲဖော်ဆောင်ရေး စွမ်းဆောင်ရည်မြှင့်တင်ခြင်း၊ အမျိုးသားအဆင့်၊ ဒေသဆိုင်ရာနှင့် နိုင်ငံတကာအဖွဲ့အစည်းများအကြား ပူးပေါင်းပါဝင်မှုနှင့် စုစည်းဆောင်ရွက်မှုမြှင့်တင်ရေးနှင့် စောင့်ကြည့်လေ့လာခြင်း၊ အစီရင်ခံ ခြင်း၊ စိစစ်ဆောင်ရွက်ခြင်းများ ဆောင်ရွက်သင့်ပါကြောင်းသုံးသပ်တင်ပြအပ်ပါသည်။

အဓိကစကားရပ်များ။ မှန်လုံအိမ်ခေါင်ငွေ့များ၊ ကာဗွန်စုပ်ယူသိုလှောင်နေရာ၊ ကာဗွန်စျေးကွက်၊ ကာဗွန်စျေးကွက်၊ ကာဗွန်မျှခြေ

Opportunity and challenges of Carbon neutrality actions in developing countries to tackle climate change

1. Introduction

Fauna and Flora, humans, soil, water, air, and a number of ecosystems among them, and climate system are naturally existing on the earth which is the unique home for us in the planets of the solar system. According to the carbon dating technology results from fossil evidence of animal, stone, and ice block, real human was assumed to be born since 315,000 years ago while the life of our earth is 3.7 billion to 3.5 billion years ago (Britannica, 2023)and (Britannica, 2024). Civilization of the human were believed to started for 4500 years ago during bronze age (WorldAtlas, 2023). Until the 17th century fossil fuels were not extracted by the human as they did not know the power of the fossil fuels. The nature especially internal intellectual properties of the human which is much higher than other animal is raising up the human being to be sustainable existence and adaptable living system against the challenges from all aspect from their surrounding natural environment and different societies. Modern civilization was initiated sine 4500 by the mid bronze age (GoogleArt&Culture, 2023). Then, different development levels among the countries in the world has been driven by the many drivers including social system, culture, believes, topography, climate, natural resources, and administrative systems. Since the beginning of the first industry revolution has made a significant difference in the world society. The latest IPCC Report estimates that there's a 50% probability that we can limit global warming to 1.5°C (or 2°C) starting in 2020 with a carbon budget of about 500 gigatons (Gt) (or 1,350 Gt) of CO2 (Dwortzan, 2022).

2. Methodology

2.1 Study area

Exploration was conducted among research works directly and indirectly link with climate change mitigation inclusive of different methodology particularly low carbon and carbon emissions mitigation techniques.

2.2 Method

This paper is an outcome of review on a number of research papers, articles, and documents.

Carbon neutrality = Net Zero Carbon (N_0)

$C_{sr} - C_{em} = N_0$

Global warming is becoming more significant and forcing changes in the global climate system. In addition to helping to mitigate "dire weather changes" which is moving towards carbon neutrality offers co-benefits such as reduced air pollution and increased resiliency of buildings, not to mention reduced energy bills (Gillingham, et al., 2020).

3. Results and discussion

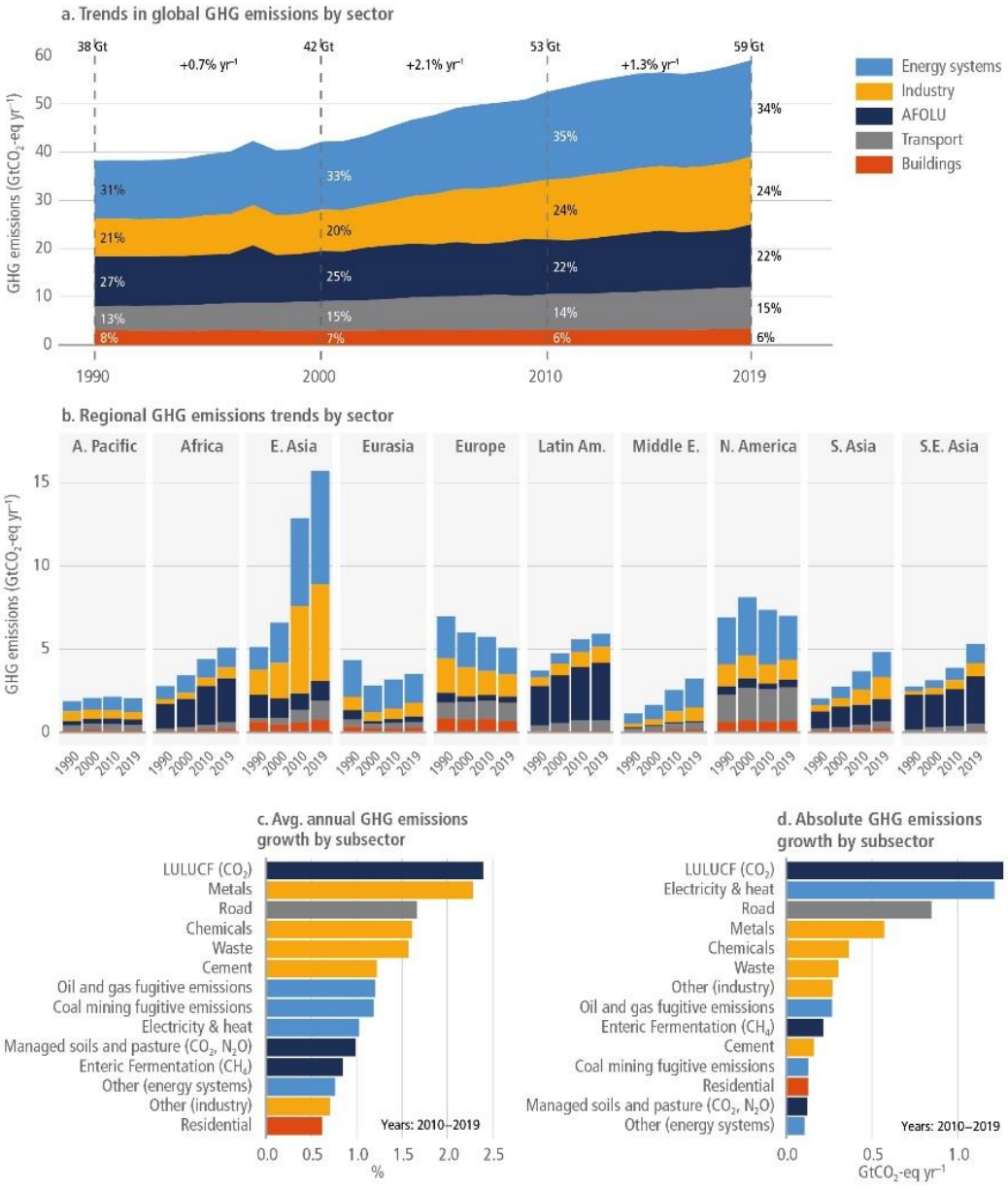

Figure 1: Global GHG emission in five main sectors: Energy systems, industry, AFOLU, Transport, Building and 14 subsectors during 1990-2019.

Regional cooperation effort

Regional Collaboration Centres – RCCs established in six regions: 1) *Asia and Pacific*, 2) *Caribbean*, 3) *East and Southern Africa*, 4) *Latin America*, 5) *MENA and South Asia*, and 6) *West and Central Africa* support the parties of the Paris Agreement under the UNFCCC for a successful implementation of their national climate actions with capacity-building, technical assistance and strategic networking, sourcing know-how and resources to drive clean development (UNFCCC, 2021). The centres are playing a crucial role in supporting the parties with both technical and financial resources along the way to combat climate change and strengthening carbon neutrality approaches (Figure 2).

Figure 2: RCCs representing six regions equipped with task of supporting the implementation of Nationally Determined Contributions, Article 6, Adaptation, Climate Finance, Stakeholder engagement and more

On 3 September 2023, the ASEAN Economic Community (AEC) Council adopted the ASEAN Strategy for Carbon Neutrality ("Strategy"), which will guide ASEAN's transformation towards a just, inclusive, and green future (AECC, 2023). Eight strategies have been identified to accelerate the region's decarbonization journey. These are:

i) accelerate green value chain integration;

ii) promote regional circular economy supply chains;

iii) connect green infrastructure and markets;

iv) enhance interoperable carbon markets;

v) foster credible and common standards;

vi) attract and deploy green capital;

vii) promote green talent development and mobility; and

viii) offer green best practice sharing.

Carbon neutrality

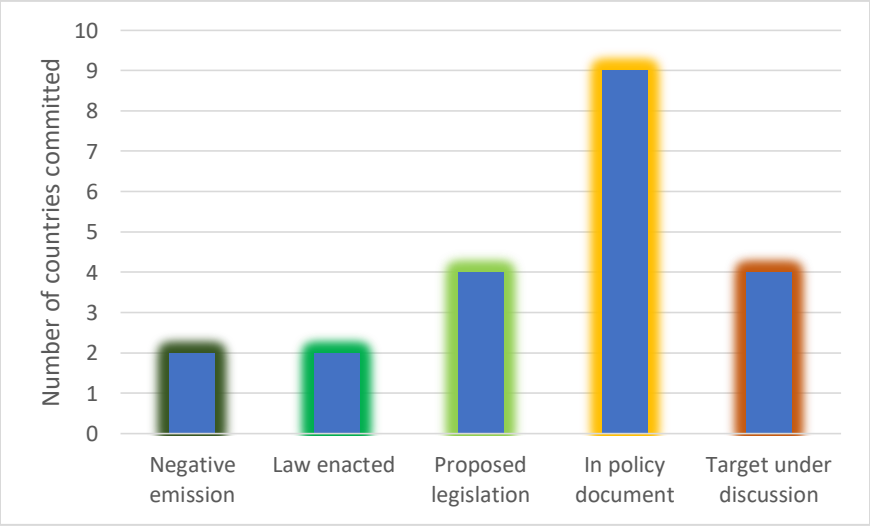

Figure 3: Countries committed (including Countries with negative emission: Bhutan and Suriname) to reach carbon neutrality.

What are to be readiness along the carbon neutrality path?

(1) **Policy and strategy**

(2) **Framework**

(a) Just transition: Jus transition means embedded within short- and long-term climate plans like NDCs and LTS, will help leaders stay focused on the urgent task at hand of rapid decarbonization, while also striving for fair and inclusive outcomes (UNDP, 2022). The just transition strategy which has been developed and applied by the US trade unions to protect workers affected by new water and air pollution regulations in USA since around 1980s (UNDP, 2022). Healy and Barry (2017) made a clarification of a just transition at the local level as "avoiding the creation of new sources of carbon lock-in (avoid investing in or subsidizing fossil fuel activities), or increasing the dependence of small- and medium-sized enterprises (SMEs) or public revenue on carbon intensive industries (SEI, 2020). The strategy and principle of a Just Transition is playing an important role to achieve a low-carbon, environmentally sustainable economy that is essential to the wellbeing of future generations.

(3) Mitigation actions

a. **Carbon sequestration**

b. **Low carbon technologies**

c. **CCS and CCUS technologies:** Among the carbon reduction and removal measures, different facilities and technologies were observed. Carbon capture, utilisation and storage, or CCUS, is an important emissions reduction technology that can be applied across the energy system. It refers to a suite of technologies that can play an important and diverse role in meeting global energy and climate goals. CCS involves three major steps: Capture: The separation of CO2 from other gases produced at large industrial process facilities such as coal and natural-gas-fired power plants, steel mills, cement plants and refineries. The CO2 can also be captured directly from the atmosphere via Direct Air Capture (DAC) technology. Transport: If not being used on-site, the captured CO2 is compressed and transported via pipelines, trucks, ships or other methods by pipeline, ship, rail or truck to a suitable site for geological storage or utilization. Storage/Utilization: CO2 is injected into deep underground rock formations, usually at depths of one kilometer or more. Alternatively, the CO2 is used as a resource to create valuable products or services. CCUS technologies also provide the foundation for carbon removal or "negative emissions" when the CO2 comes from bio-based processes or directly from the atmosphere. The captured CO2 is used primarily to produce fertilizers and for enhanced oil recovery. Other commercial uses of CO2 include food and beverage production, cooling, water treatment and greenhouses. New CO2 use pathways include fuels (using carbon in CO2 to convert hydrogen into a synthetic hydrocarbon fuel); chemicals (using carbon in CO2 as an alternative to fossil fuels in the production of some chemicals); and building materials (using CO2 in the production of building materials to replace water in concrete or as a raw material in its constituents.)

d. **Carbon offset mechanisms**

i. *Kyoto protocol mechanisms*: Kyoto Protocol – KP, an international treaty, has been adopted by – countries on 11th Dec 1997 to operationalize the United Nations Framework Convention on Climate Change – UNFCCC by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets.

In the context of reduction GHG emission and the presence of GHGs in the atmosphere by means of carbon offset, the KP adopted three main market mechanisms based on trade of permit and . international credits are generated through two mechanisms set up under the Kyoto Protocol. These are:

ii. Clean Development Mechanism (CDM) – allowing industrialized countries with a greenhouse gas reduction commitment (called Annex 1 countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emissions reductions in their own countries

iii. Joint Implementation (JI) – allowing industrialised countries to meet part of their required cuts in greenhouse gas emissions by paying for projects that reduce emissions in other industrialised countries. Joint Implementation provides for the creation of emission reduction units (ERUs), whereas the Clean Development Mechanism provides for the creation of certified emission reductions (CERs).

iv. Article 6.4 mechanisms: Article 6 of the Paris Agreement provides for a mitigation mechanism to replace existing mechanisms (such as CDM and JI) and provide for certification of emission reductions for use towards nationally determined contributions (EU, 2021).

e. k

(4) Mitigation co-benefitting actions

f. Nature based solutions:Nature based solutions can be defined as measures to enhance both climate change mitigation and adaptation by means of the conservation and restoration of soil, forests, and wetlands. The measures include protection, sustainable management, or restoration of natural ecosystems to address societal challenges such as climate change, human health, food and water security, and disaster risk reduction effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (WorldBank, 2022). Parties of the Paris Agreement are encouraged to include nature-based solutions in actions to meet their NDC targets as it can contribute 37% of climate mitigation efforts required by the Paris Agreement by 2030 (WorldBank, 2022).

g.Energy efficiency

(5)Financial mechanism

(6)Awareness and ethic

Challenges for the developing countries

1) Challenges to follow the just transition strategy due to transparency and agreement; lack of data on the benefits of a green transition; complexity among different sectoral policies; inadequate technical capacity and finance
2) Natural person migration or brain draining from developing countries is much more than it from the developed and economic transition countries
3) Job creation, job quality, and ethic
4) Carbon pricing (MRV implementation, taxation, etc.)

Climate terminology impacts

Development of diverse taxonomy make developing countries and their citizens. The role of developing countries in climate negotiations has been changing over time, evolving from spectators to main actors (Sforna, 2019).

Ethic in claiming CO2 neutrality

There are increasing reports of companies using false claims of CO2 neutrality (Denkstatt, 2023). This can make carbon offset mechanisms weak due to actual GHG emission unethically made by a false or fake calculation. In this context, proper MRV system are critically required.

4. Conclusion

Carbon neutrality is one of major strategy in moving forward to achieve the Paris goal 1.5℃. To apply the carbon neutrality in developing countries, not only technology and financial challenges but also job quality, natural person migration or brain draining, natural resource-based market strategies and unsystematic land use management are mostly challenging in developing countries. Capacity building on both personal and institution, practically relevant mechanism development, strengthening cooperation and coordination among national, regional, and international level institution, financial and technical accessibility, transparency, and MRV are recommended to overcome the difficulties and challenges of developing countries. Even though the strategy and principle of a Just Transition is playing an important role to achieve a low-carbon, environmentally sustainable economy, developing countries may face some difficulties and challenges to follow it.

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