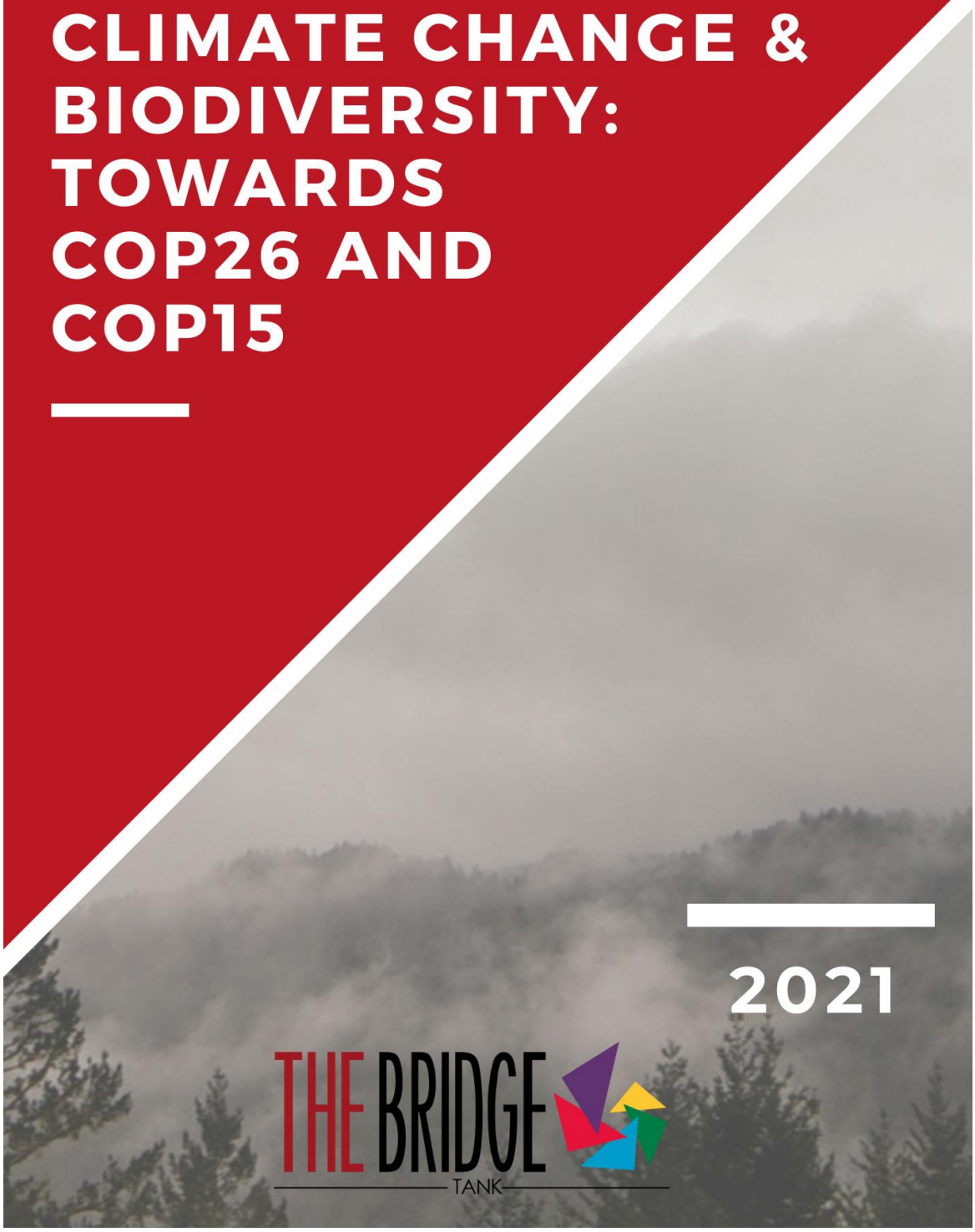
CLIMATE CHANGE & BIODIVERSITY: TOWARDS COP26 AND COP15



2021

THE BRIDGE TANK

The Bridge Tank
Palais Brongniart
28 Place de la Bourse
75002 Paris
https://thebridgetank.org/

CONTEXT

In the context of international negotiations on climate and biodiversity (COP26 and COP15), The Bridge Tank has developed analyses on global priority topics, these international conferences of which are considered as some of the most urgent.

This report aims to contribute to the global and diplomatic discussion on climate change and biodiversity challenges. Through deep academic and scientific review, we designed method, foresight, and recommended solutions, divided into 4 chapters.

The first two chapters put forward positions, structuring and global elements on adaptation, finance and governance while forcing action at different scales. The second two chapters develop scientific, industrial and technical theories on operational subjects.

The first chapter addresses the **ADAPTATION FINANCE** mechanisms with a specific focus on blended finance as an efficient tool to finance emerging economies. Our analyses allow us to identify various tools for scaling up climate action.

The second chapter deals with the innovative approach of **COALITION** into the climate change negotiations toward bottom up and regional coalition by involving non state-actors.

The third chapter focuses on the place **HYDROGEN** can take in the energy transition as an upcoming energy vector. It underlines the specific economic and political dynamics that characterize the hydrogen ecosystems and puts forward possible bottlenecks that could impede its effective scale up for industry uses in the coming years.

The last chapter explores the need to work towards a transition to a **BLUE ECONOMY** in coastal territories worldwide and more specifically in the Indo-Pacific. This chapter highlights the fact that the ocean industrialization needs to be limited and coastal ecosystem and blue economy value chain should be better integrated.

Everything you need to know about the COP26

UN CLIMATE CHANGE CONFERENCE UK 2021

IN PARTNERSHIP WITH ITALY

What is COP?

COP (Conference of the Parties), is the supreme decision-making body of the UNFCCC (United Nations Framework Convention on Climate Change) which meets annually to assess progress in dealing with climate change.

This year's COP will be its 26th edition, hence COP26.

Where:
Glasgow, Scotland

When:
31 October - 12 November 2021

Who:
Representatives from 197 states
20,000 to 25,000 attendees

All you need to know about the COP15

2020 UN BIODIVERSITY CONFERENCE
COP 15 - CP/MOP10-NP/MOP4
Ecological Civilization-Building a Shared Future for All Life on Earth
KUNMING CHINA

What is the COP15?

The COP15 biodiversity summit is dedicated to the protection and rehabilitation of nature and natural environments.

Under the guidance of the United Nations, the conference will consider the progress and results of the Strategic Plan for Biological Diversity 2011-2020 and will attempt to establish a roadmap for the post-2020 period.

Where
Kunming, China

When
11 - 15 October 2021, pre-Cop meeting (virtual) / 25 April - 8 May 2022, COP15

Who
Representatives of around 195 countries

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SUSTAINABLE DEVELOPMENT GOALS' SYNTHESIS

Sustainable development goals

	ADAPTATION FINANCE	COALITION	HYDROGEN	BLUE ECONOMY
1 NO POVERTY	X	X	X	X
2 ZERO HUNGER	X	X		X
3 GOOD HEALTH AND WELL-BEING	X	X	X	
4 QUALITY EDUCATION	X	X		
5 GENDER EQUALITY	X	X		
6 CLEAN WATER AND SANITATION	X	X		X
7 AFFORDABLE AND CLEAN ENERGY	X	X	X	
8 DECENT WORK AND ECONOMIC GROWTH	X	X	X	X
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	X	X	X	X
10 REDUCED INEQUALITIES	X	X		X
11 SUSTAINABLE CITIES AND COMMUNITIES	X	X		X
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	X	X		X
13 CLIMATE ACTION	X	X	X	X
14 LIFE BELOW WATER	X	X		X
15 LIFE ON LAND	X	X		
16 PEACE, JUSTICE AND STRONG INSTITUTIONS	X	X		
17 PARTNERSHIPS FOR THE GOALS		X		

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ACRONYMS

$: Dollar

£: Pound Sterling

€: Euro

ABT: Aichi Biodiversity Target

AFD: French Development Agency

Afhypac: Association Française pour l'Hydrogène et les Piles À Combustibles

ARAF: Acumen Resilient Agriculture Funds

C&I: Criteria and indicator

CCS: carbon capture and storage

CO2: carbon dioxide

COP: Conference of Parties

COVID-19: Corona Virus Disease 2019

CPC: Communist Party of China

DFIs: Development Financial Institutions

EC: European Commission

ECOSOC: United Nations Economic and Social Council

ECOWAS: Economic Community of West African States

EJ: Exajoul

ETS: Emission Trading Scheme

EU: European Union

EV: electric vehicle

FAO: Food and Agriculture Organization of the United Nations

FCEV: Fuel Cell Electric Vehicle

FCHEA: Fuel Cell and Hydrogen Energy Association

FDI: Foreign direct investment

FSR: Florence School of Regulation

GCF: Green Climate Fund

GDP: Gross Domestic Product

GEF: Global Environment Facility

GHG: Greenhouse gas

GPS: Geographic positioning system

Gt: Gigaton

GW: Gigawatt

H2: Hydrogen

Ha: Hectare

IDFC: International Development Finance Club

IFC: International Finance Corporation

ILO: International Labour Organization

IRENA: International Renewable Energy Agency

Kg: kilogram

Kt: kiloton

KW: Kilowatt

LCD: Long-term national low carbon development strategies

LDCs: Least Developed Countries

M&E: Monitoring and evaluation

M3: Cubic Metre

MENA: Middle East and North Africa

MIGA: Multilateral Investment Guarantee Agency

MOU: Memorandum of Understanding

MRV: Measurement, Reporting and Verification

Mt: Megaton

MW: Megawatt

NAP: National Adaptation Plans

NAZCA: Non-state Actor Zone for Climate Action

NDC: Nationally determined contribution

NGO: Non-governmental organization

ODA: Official development assistance

OECD: Organization for Economic Cooperation and Development

OPECST: Office parlementaire d'évaluation des choix scientifiques et technologiques

PV: photovoltaic

RE: Renewable Energy

RES: Renewable Energy Sources

SADC: Southern African Development Community

SDG: Sustainable Development Goals

SIDS: Small Island Developing States

SINTEF: Stiftelsen for industriell og teknisk forskning

SMR: Steam Methane Reforming

SOE: State Owned Enterprise

SUV: Sport Utility Vehicle

T: ton

TW: Terawatt

UAE: United Arab Emirates

UK HFCA: United Kingdom Hydrogen and Fuel Cell Association

UK: United Kingdom

UN: United Nations

UNCCD: United Nations Convention to Combat Desertification

UNDP: United Nations Development Programme

UNECE: United Nations Economic Commission for Europe

UNEP: United Nations Environment Programme

UNFCCC: United Nations Framework Convention on Climate Change

US: United States

VNCs Voluntary national contributions

VNRs Voluntary national reports

WRI: World Resources Institute

WWF: World Wide Fund For Nature

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Chapter 1:
Blended climate finance for long-term transition and collective action

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CHAPTER 1: BLENDED CLIMATE FINANCE FOR LONG-TERM TRANSITION AND COLLECTIVE ACTION

Introduction

Finance and adaptation are part of the top 5 priorities of the COP26. Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change.[1] However, to truly implement this strategy, there is still a gap for financing emerging economies or local capacities. This is why several mechanisms, such blended finance, should be instigated and are required in order to fulfill the SDGs (Sustainable Development Goals) and contribute to international climate change ambitions.

Both the 2020-horizon USD 100 billion mobilization for climate and 2025 renewed target remain elusive. Multilateral and G20-based Development banks cannot create massive market or scale-up without aid money, and public spending is constrained by the debt burden. Plus, to contribute to the green economic transformation of our societies and make it sustainable, the private sector needs to become a key player. A better engagement of private players for sustainability and protecting the environment is a part of the 2030 framework for the SDGs.[2]

Over the last years, several ways out of this deadlock have been attempted: syndication, sovereign bonds markets, dedicated risk-bearing funds in general limited to green finance, insurance, derisking through equity-loan bundling, or again global policy hopes of Western-Chinese coordination, institutional aid to improve ex-ante bankability. Whilst interesting, these options neither separately nor together suffice in stretching the envelope; none have really created a massive market nor proved its ability to scale up without aid money.

It is necessary to discuss the current evolutions of portfolio strategies and partnerships of several Funds, including the largest among multi-lateral climate funds, the GCF (The Green Climate Fund), which targets “greater paradigm-shifting mitigation and adaptation impact”. Especially, along with Development Banks and Funds syndicating, the role of local Southern Banks and local Funds in channelizing projects has been little explored, the GCF ‘direct access’ procedure being a -limited so far- exception, worth reflecting on.

It is high time finance more actively involves organizations from the South. Through this event, we propose to see innovative funds – like GCF, GEF (Global Environment Facility) or the newly reorganized AFD (the French Development Agency) – as vehicles for collective learning on climate resilience. Attention should be brought to both the financial de-risking and blended-finance mechanisms and to the projects themselves that could serve as models for climate resilience expertise scale-up worldwide.

[1] What do adaptation to climate change and climate resilience mean? (s. d.). UNFCCC. https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/what-do-adaptation-to-climate-change-and-climate-resilience-mean
[2] Advances in Blended Finance. (2019). The Global Environment Facility. https://www.thegef.org/sites/default/files/publications/gef_advances_blended_finance_201911.pdf

Blended finance is considered as the strategic use of development finance for the mobilization of additional finance towards sustainable development in developing countries. In this sense, it can help bridge the investment gap for the SDGs but requires a common framework[3] and go to deepen adaptation finance.

Figure 1. Blended finance for SDGs[4]

To illustrate our perspective and existing mechanisms, examples and experiences in the agriculture sector and Africa will be given throughout this chapter. To meet the SDGs, additional capital and financial means are required. Agricultural sector has a huge potential for reaching blended finance or co-financing/cooperation mechanisms, such as agribusiness and commercial banks, specialized in agriculture may contribute to a range of non-financial (i.e. equipment donation, training) and financial (grants, loans, subsidies) outcomes.[5] Moreover, the African continent is under-banked. Only 4% of the foreign direct investment (FDI) is financing by international donors, which is very low for the actual needs.

A. International Context Towards Adaptation Finance

Adaptation to climate change is now widely integrated into national policies around the world, but the levels of commitment and quality of instruments vary greatly between countries. Adaptation finance is

[3] Making Blended Finance Work for the Sustainable Development Goals. (2018). OECD. https://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/OECD_Making_Blended_Finance_Work_for_the_SDG.pdf
[4] Making Blended Finance Work for the Sustainable Development Goals. (2018). OECD. https://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/OECD_Making_Blended_Finance_Work_for_the_SDG.pdf
[5] Havemann, T. (2020). Blended finance for agriculture : exploring the constraints and possibilities of combining financial instruments for sustainable transitions. Agriculture and Human Values. https://link.springer.com/article/10.1007/s10460-020-10131-8?error=cookies_not_supported&code=48c28ca8-ff24-4254-b4c6-d051a0542397

struggling to meet the need. International public finance for adaptation is slowly increasing, but there is insufficient data to identify such a trend in national public or private financial flows. At the same time, the annual costs of adaptation in developing countries alone are currently estimated to be around USD 70 billion, and are expected to reach USD 140-300 billion in 2030 and USD 280-500 billion in 2050. Development finance providers are not sufficiently integrating adaptation into their activities. In addition, the current COVID-19 pandemic is expected to further exacerbate this trend by constraining public finance at the national and international levels.[6]

On this basis, our study will **detail the possible (co-)financing mechanisms, both public and private, that exist in relation to adaptation finance**. The aim is not to highlight the resources granted by the funders, but to identify the different types, trends and mobilizations of funding directly linked to the (co)funders and the project leaders, particularly at the local level. Starting from the most innovative and moving towards the recent evolution of more general actors, we have identified three (3) important elements in the financing mechanisms related to adaptation:

1. Today, projects **eligible for climate finance** are those that participate, by necessity (because they are highly affected) in adaptation to climate change who may also be eligible for mitigation financing. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as local, national or transnational financing—drawn from public, private and alternative sources of financing—that seeks to support mitigation and adaptation actions which will address climate change. Climate finance is equally important for adaptation, as significant financial resources are needed to adapt to the adverse effects and reduce the impacts of a changing climate.[7] The UNFCCC insists on the importance of varied sources, instruments and channels, noting the significant role of public funds, through a variety of actions, including supporting country-driven strategies, whilst taking into account the need and priorities of countries.

2. **Blended finance** can also be considered in a more financial logic. The International Finance Corporation (IFC) defines blended finance as the use of relatively small amounts of concessional donor funds to mitigate specific investment risks and help rebalance risk-reward profiles of pioneering investments that are unable to proceed on strictly commercial terms.[8] As some projects are subject to contextual and structural variables that can compromise their completion (political and economic risks), climate finance has developed de-risking tools: in order to de-risk loans, there has been a recent growth in the restructuring of financing tools towards the inclusion of a share linked to grants, which helps mitigate the lender's risks and helps donors reach their objectives. The political debate then concerns the allocation of these donation capacities: should they be directed towards projects financed by pure donations, which are deemed "unbankable"? or towards blending projects, where the donation complements a loan, the project then being deemed "quasi-bankable"?

3. Finally, whether or not the financing has a dedicated "climate" component or a grant component, in order **to share the risks and maximize the chances of success, traditional donors have decided**

[6] *Adaptation Gap 2020*. (2021). United Nations Environment Programme. https://www.unep.org/fr/resources/rapport-2020-sur-lecart-entre-les-besoins-et-les-perspectives-en-matiere-dadaptation
[7] *Introduction to Climate Finance*. (s. d.). UNFCCC. https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance
[8] Blended Concessional Finance. (s. d.). IFC. https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/bf

to work in syndication, that is, to work together: to identify projects and above all to co-finance them in order to share the risks (loan component) or increase their impact, or at least their presence (grant component).

Today, the Green Climate Fund (GCF or the Fund) is the best known and largest multilateral climate finance fund in the world in terms of committed amounts. Mobilizing private and public actors, the Fund, which aims to be transparent, nevertheless requires mastering the complexity of navigating between actors and means of financing.

Others exist and traditional donors have evolved their practices towards more green financing, including adaptation, de-risking and syndication. However, combinations of these three approaches are not strictly independent of each other. It is difficult for a new entrant to make appropriate financing choices because of the complexity of the organization and the many actors with different origins and structures. It is therefore necessary to make strategic choices in order to identify target actors and, in our case, to consider with more attention the actors who are involved in adaptation finance. Our study will not dwell on describing each entity, but will focus on typology to strategic choices to be made in identifying donors, who are interested in projects related to adaptation to climate change in line with the COP26 objectives. This will enable and accelerate long-term transition with collective action across the public and private sectors. This is why we will mainly focus on blended finance.

In our study, classic development donors will be identified. In the interests of the structural evolution of development issues towards those of adaptation, it is important to remember that the logic we are interested in is **the identification of strategies for financing mechanisms - a logic shared by financiers linked to adaptation and development banks, and not the logic of implementing solutions - which is strictly sought by development financiers.**

To a lesser extent, we need to take a step back from the subject to refine our thinking. Adaptation finance is gradually entering the international debate on the international aid system. The international aid system and its donors are structurally changing - particularly with the omnipresence of global public goods issues related to the environment. The logic of aid and climate action is evolving towards new financial and governance mechanisms by:

- the relocation of aid in South-South dynamics - and no longer North-South;
- the rise of private actors as "competitors" to traditional public actors in the value chain of the development aid system and climate action;
- And, the systematic integration of climate change issues, particularly among political, financial and industrial actors. Adaptation to climate change is thus integrated into the strategies of these actors.

Green Adaptation Finance Beyond the Green Climate Fund: a Growing but Unstabilized Ecosystem

The international community, beyond the traditional donors, is considering financing the fight against climate change through dedicated funds. They are numerous, their mandates partially overlap, and their

strategies differ - financing pure mitigation, pure adaptation, or mixed objectives. Following the example of the World Resources Institute (WRI), we can situate them along an axis of the size of their interventions:

Note: LDCF, Least Developed Countries Fund; SCCF, Special Climate Change Fund; AF, Adaptation Fund; GEF, Global Environment Facility; SREP, Scaling-Up Renewable Energy Program; FIP, Forest Investment Program; PPCR, Pilot Program for Climate Resilience; GCF, Green Climate Fund; CTF, Clean Technology Fund.

Figure 2. Financing strategies from donors

The Green Climate Fund is the most important, with a commitment in 2020 of 19.4 billion dollars, of which 5.6 billion is provided by the GCF, and the rest is completed by partners from the world of traditional bilateral and multilateral institutions.

While our report analytically treats the actors separately, in practice it is important to consider the dedicated climate actors - the funds - and the traditional donors in parallel as they shift their strategy towards climate finance.

Among the major actors in adaptation finance, we have identified the partnership of development banks, the International Development Finance Club (IDFC), which has taken a major part in the growth of climate finance. It will therefore be interesting to mobilize this group in our strategy to find new financiers and to identify which of its members would be inclined to syndicate in adaptation finance.

Below, the complex architecture of climate finance actors, classified by origin and position in international climate finance.

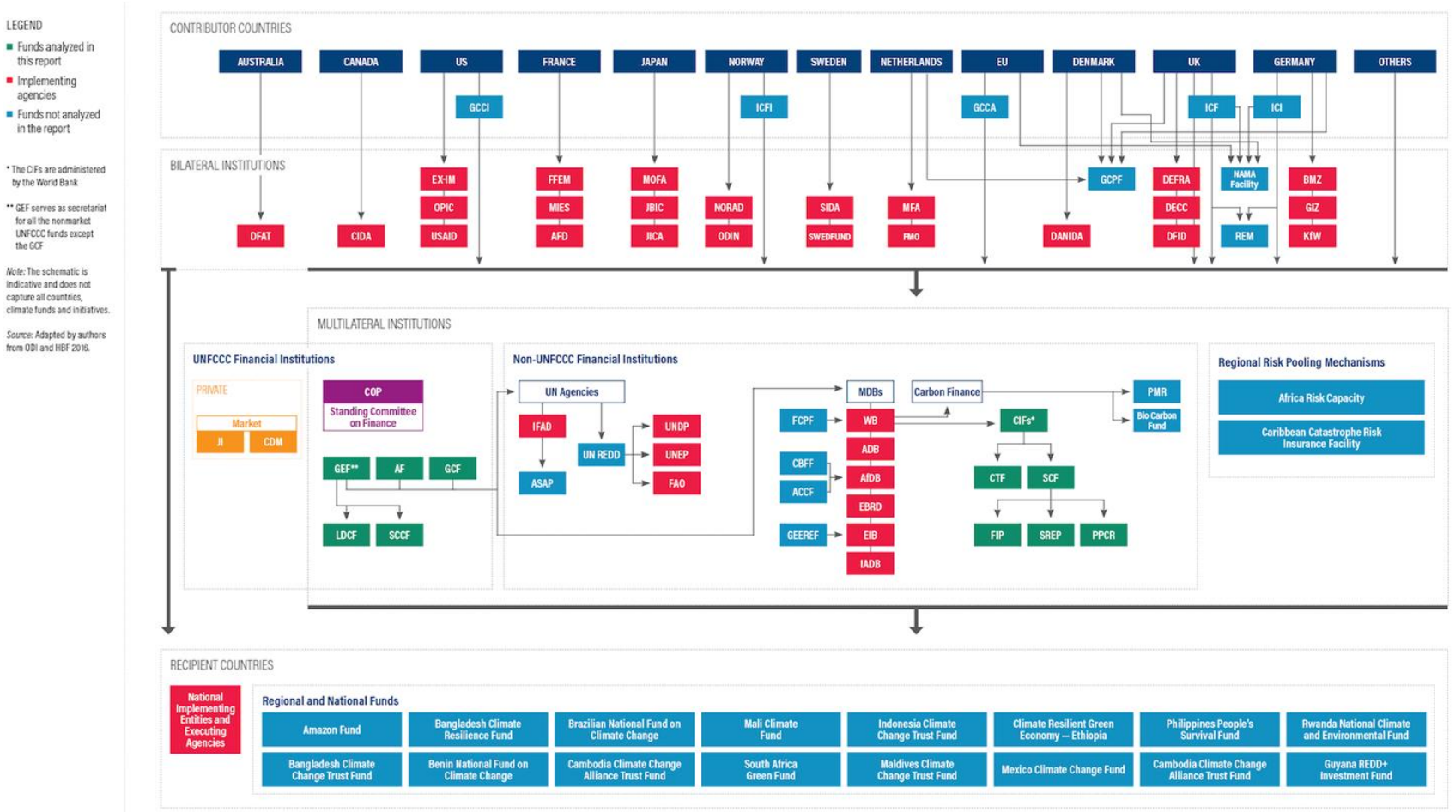


Figure 3.. Global architecture of climate finance– From WRI

As for the GCF, projects validated by its Board of Directors must be submitted by "accredited entities" that sponsor (and often co-finance) the beneficiaries' projects. These are categorized by the GCF as international, regional or national entities. Projects sponsored by international accredited entities are much more numerous (101 projects) than projects sponsored by the other two types of accredited entities, i.e., direct regional entities (10 projects) and direct national entities (17 projects).

The average share of GCF in the financing of these three types of accredited entities differs greatly depending on the origin of the project's contribution: projects of direct national entities obtain on average more funds from the GCF (93%), projects of international entities also obtain on average more funds from the GCF (73%), while projects of direct regional entities obtain on average 46% of funds from public national resources and only 32% from the GCF.

Figure4: Origins of funds from GCF accredited entities

A Pragmatic Approach by Donors in Climate Finance: The IDFC

Even if the COP-25 did not reach a consensus on climate finance, the amounts available are very significant. The development banks gathered within the IDFC invested $134 billion in 2018 in green finance, 93% of which was dedicated to the fight against climate change. The share dedicated to adaptation, although still a minority, is growing; with regards to the AFD, for example, 24% of this share is dedicated to sustainable agriculture. Similarly, carbon fixation in soils by agriculture is a growing concern for donors.

The IDFC is a group of 26 national and regional development banks from around the world, the majority of which are active in emerging markets. Combined, IDFC members are the largest provider of public development finance in the world, with $4 trillion in combined assets and average annual commitments of more than $600 billion over the past five years. Since 2011, the IDFC has been conducting periodic mapping of institutional contributions to green finance. At the 2019 UN Climate Action Summit, the IDFC confirmed a series of commitments to improve not just the quantity of green finance flows, but also the quality of investments, including valuing efforts to align financial flows with the Paris Agreement and the UN Sustainable Development Goals. The development community needs to address gaps on blended finance in order to increase fragmentation of the governance and development of blended finance, lack of data and information on blended finance flows and market and gaps in the monitoring and evaluation (M&E) of blended finance facilities and projects.[9]

[9] Making Blended Finance Work for the Sustainable Development Goals. (2018). OECD. https://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/OECD_Making_Blended_Finance_Work_for_the_SDG.pdf

Figure 5. Lessons learned from Blending in practice[10]

In 2019, IDFC members committed $197 billion in green finance. This represents a 47% increase over 2018, but is still below the peak reached in 2017. In total, cumulative green finance commitments by IDFC members have reached $867 billion since 2015.

Green finance commitments accounted for about 25% of total new commitments signed by IDFC members in 2019. Climate finance, which includes activities related to greenhouse gas (GHG) emissions mitigation (mitigation) and climate change adaptation, accounted for 93% of total green finance in 2019. 87% of financial commitments in climate finance are for renewable energy financing and GHG mitigation. Climate change adaptation accounts for 10% of climate finance, with a 26% increase in 2019 compared to 2018.

In terms of funding sources, IDFC members based in non-Organization for Economic Cooperation and Development (OECD) countries committed $146 billion (74%) in 2019. IDFC institutions based in OECD countries committed $51 billion (26%), which is lower than in previous years. On the destination of these flows, the East Asia and Pacific region received 60% of total green finance commitments and assets, and is thus the main region of destination. Commitments reaching Eastern Europe and Central Asia increased significantly, from $2.1 billion (2%) to $10 billion (5%), and increased slightly in Sub-Saharan Africa, from $3 billion to $4.5 billion (2%). Commitments to the remaining regions declined from 2018.

[10] Making Blended Finance Work for the Sustainable Development Goals. (2018). OECD. https://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/OECD_Making_Blended_Finance_Work_for_the_SDG.pdf

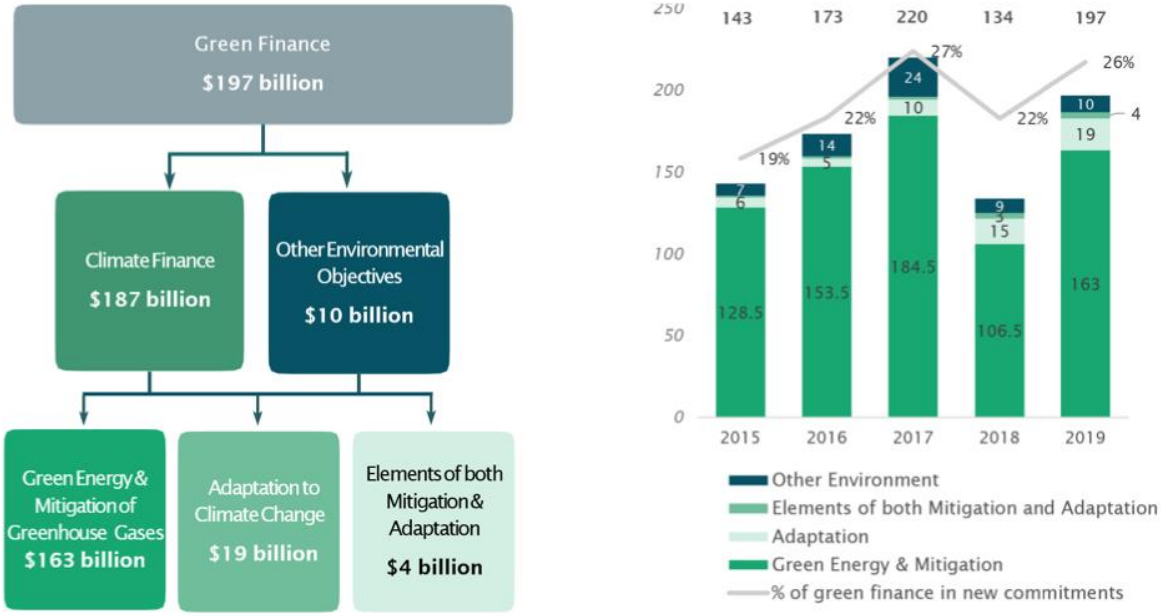


Figure 5. Breakdown of IDFC's Green Finance commitments in 2019 (left) and 2015-2019 (right) – in billion USD

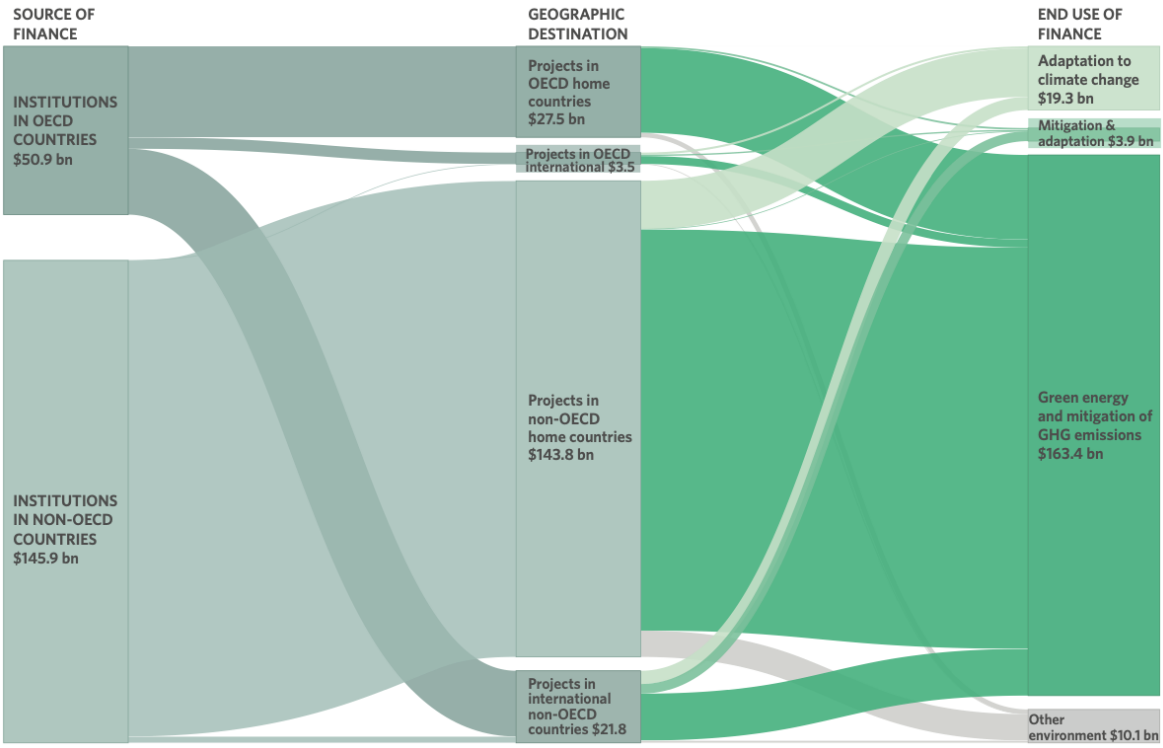


Figure 6. Green finance commitments in 2019, by origin, destination (OECD/OECD) & final use

Most of the commitments were provided in the form of loans for $190 billion, or 97% of total green finance, which is consistent with previous years. 4 billion was provided in the form of grants, continuing the upward trend since 2016.[11]

The 26 IDFC members:

Countries	Members
Italy	Cassa depositi e prestiti (CDP)
Greece	Black Sea Trade and Development Bank (BSTDB)
France	Agence Française de Développement (AFD)
Croatia	Croatian Bank for Reconstruction and Development (HBOR)
Germany	KfW Bankengruppe
Turkey	Industrial Development Bank of Turkey (TSKB)
Russia	Vnesheconombank (VEB)
Morocco	Caisse de Dépôt et de Gestion (CDG)
South Africa	Development Bank of Southern Africa (DBSA)
West Africa	Banque Ouest Africaine de Développement (BOAD)
South and East Africa	The Eastern and Southern African Trade and Development Bank (TDB)
India	Small Industries Development Bank of India (SIDBI)
China	China Development Bank (CDB)
Japon	Japan International Cooperation Agency (JICA)
Indonesia	PT Sarana Multi Infrastruktur (Persero) (PT SMI)
Central America	Central American Bank for Economic Integration (BCIE/CABEI)
Mexico	Nacional Financiera (NAFIN)
Central & South America	Development Bank of Latin America (CAF)
Peru	Corporación Financiera de Desarrollo S.A. (COFIDE)
Colombia	Bancoldex S.A.
Brazil	Banco Nacional de Desenvolvimento Econômico e Social (BNDES)
Chile	Banco Estado (BE)
Argentina	Banco de Inversion y Comercio Exterior S.A (BICE)

[11] IDFC Green Finance Mapping Report 2020, https://www.idfc.org/wp-content/uploads/2020/11/idfc-2020-gfm-full-report_final-1.pdf

Inter-regional institutions	Islamic Corporation for the Development of the Private Sector (ICD)
	International Investment Bank (IIB)

Complementary Mapping Of Asian Donors Present On The African Continent: Japan, India, China

Our study will also aim to map some traditional Japanese, Indian and Chinese donors that are not members of the IDFC and that are present on the African continent, thus filling a gap in the global mapping of climate finance, with the aim of identifying their involvement in adaptation and mitigation finance. From a de-risking perspective, we will also identify which financing methods they offer, and whether they are mainly loans or grants.

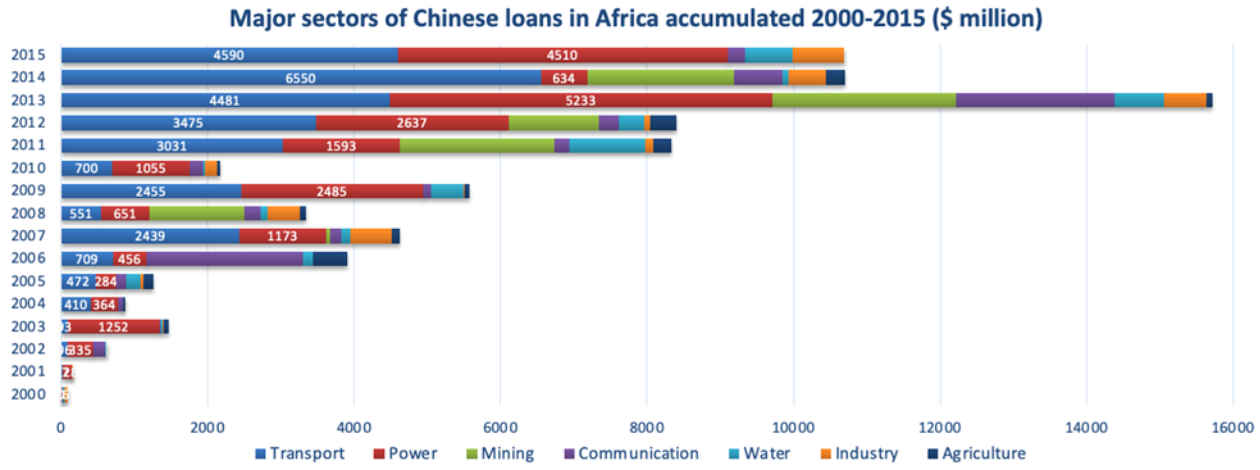


Figure 7.. China's lending by sector in Africa

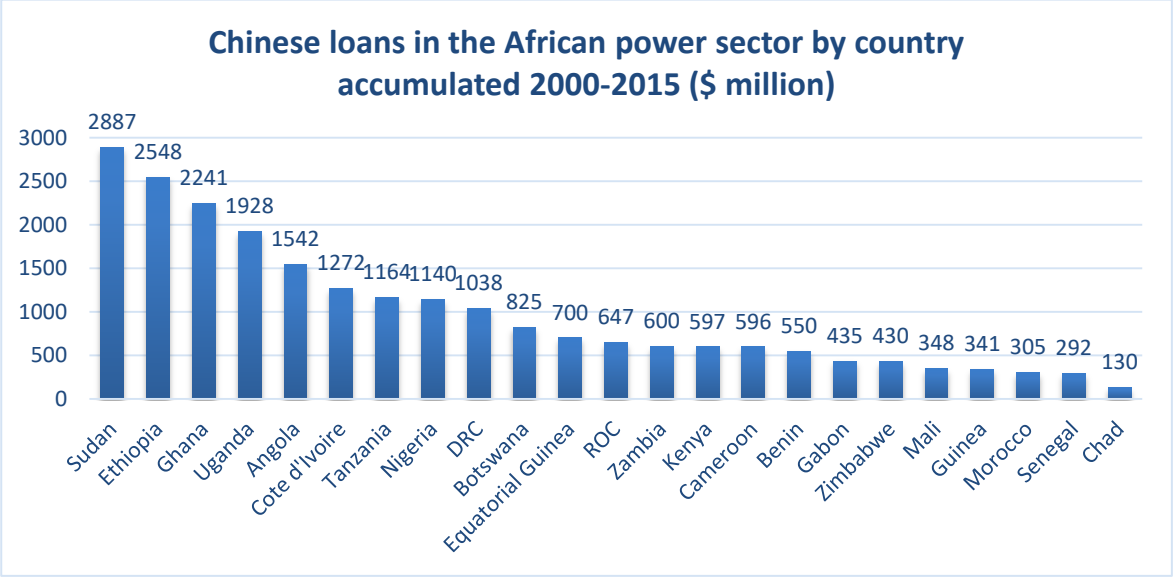


Figure 8. China's energy loans to Africa

Traditional Chinese donors:

- China Exim Bank in Africa
- Industrial and Commercial Bank of China

The bank's financing is tied to a contract with a Chinese company: the cost of capital is loaned to the developer on the condition that the developers hire a Chinese contractor. These funds are generally lent on a government-to-government basis rather than directly to private developers. The detailed terms of the agreements are generally unknown. According to some convergent sources, the bank typically finances 85-90% of the total project cost, while the remaining 15-10% is paid directly from the host government's budget. The government-funded portion may be substituted by multilateral climate finance.

Indian traditional donors:

- Exim India
- State Bank of India
- Kukuza Project Development Company
- IL&FS Group

In May 2017, India accounted for an estimated $7.4 billion in investments in Africa, primarily through lines of credit channeled through Exim Bank India, for the implementation of projects across Africa. Indian companies are also increasingly bidding on projects funded by multilateral development banks. In fact, of the contracts India has won on projects funded by the African Development Bank, the Asian Development Bank, and the World Bank, the power sector accounts for the largest share by value. Because of their technical expertise and relevant experience in these sectors, Indian companies are often well placed to win contracts for projects funded by the global development banks.

Below are the countries that have invested the most in agriculture in Africa between 2003 and 2017, among which is India, in first position with USD 2101 million invested over the period.

Top 10 countries investing in agriculture in Africa during Jan 2003-Feb 2017 (Cumulative) Total Investments: US$ 9391 mn		Top 10 countries receiving investment in agriculture during Jan 2003-Feb 2017 in Africa (Cumulative) Total Investments: US$ 9391 mn	
India	2101	Cameroon	2297
Kuwait	1500	Mozambique	1927
The UK	1370	Ghana	954
The United States	1271	Liberia	640
Malaysia	782	Nigeria	619
Switzerland	482	Ethiopia	482
Singapore	186	South Africa	439
Canada	180	Egypt	222
France	171	Angola	185
Italy	150	Uganda	184

Source: Data derived from FDI Markets; Exim Bank Research

Japanese Traditional donors:

- Japan Bank for International Cooperation (JBIC)
- Sumitomo Mitsui Banking Corporation

These donors are very active in the financing of infrastructure and energy facilities and also support certain agricultural projects. With regard to agricultural adaptation or climate mitigation projects, the de-risking tools mentioned in this report could allow the integration of these actors in the financing of such projects.

B. De-risking Mechanisms and Blended Finance

The modalities of bilateral and multilateral support for adaptation finance are evolving, so that grants are increasingly accompanied by a broader range of instruments, actors, and approaches. For example, the Green Climate Fund has allocated 40% of its total portfolio to adaptation and is increasingly using its catalytic power to attract private investment, which is an important development, particularly in support of the growing momentum for a sustainable financial system. There is greater recognition that physical risks and risks associated with the transition to a climate-resilient economy impact corporate returns, asset values, and ultimately financial stability. The introduction of new tools, such as sustainable investment criteria, climate-related disclosure principles, and the integration of risk into investment decisions can help control financial flows that contribute to adaptation, in addition to the potential to spur increased investment in climate resilience and divert funding from investments that increase vulnerability.[12]

[12] Adaptation Gap 2020. (2021). United Nations Environment Programme. https://www.unep.org/fr/resources/rapport-2020-sur-lecart-entre-les-besoins-et-les-perspectives-en-matiere-dadaptation

Beyond the usual practices of donors already involved in financing agriculture, new financial partnerships are developing, with the support of classic de-risking donors such as the Green Climate Fund, to which in October 2019, donor countries pledged an additional USD 9.8 billion over the next four years.

In addition, the GCF Board should endorse a new strategy balancing adaptation and mitigation financing; agricultural projects are very good candidates for this. In addition to reviewing the main donors, it is therefore proposed to explore with them a project financing package endorsed by climate finance.

The role of GCF in supporting partners to catalyze innovation and leverage blended finance mechanisms to accelerate the transition to low emissions climate resilient pathways. Blended finance aims to use public funds to share risk and crowd in private investment through co-financing pioneer investments in new markets, technologies and practices. The roundtable notably demonstrated the catalytic role that public finance can play in mobilizing both public and private resources to finance the net-zero transition in developing countries while building resilience to avoid the catastrophic impacts of climate change.[13]

De-risking, a financial term, is an unstabilized concept that aims to promote foreign direct investment in developing countries and support their economic growth. Investments are subject to guarantees to protect them from political risks, wars, expropriation, etc. and are supervised by the World Bank's Multilateral Investment Guarantee Agency (MIGA).

In climate finance, syndication is also a form of de-risking, because by working together, traditional lenders share the risks of operation, feasibility and good use of funds, also making it easier to find projects to finance.

Another means of de-risking used by the Green Climate Fund is blending or loan/grant combinations, which allows donors to bear some of the risk and thus reduce the risk from the lender's perspective. Moreover, de-risking is not simply about limiting risk. It is about spreading risk by partnering with other actors or using various financial instruments.

[13] The Climate Finance Opportunity in Developing Countries : How the. (s. d.). Green Climate Fund. https://www.greenclimate.fund/event/climate-finance-opportunity-developing-countries-how-green-climate-fund-delivers-climate

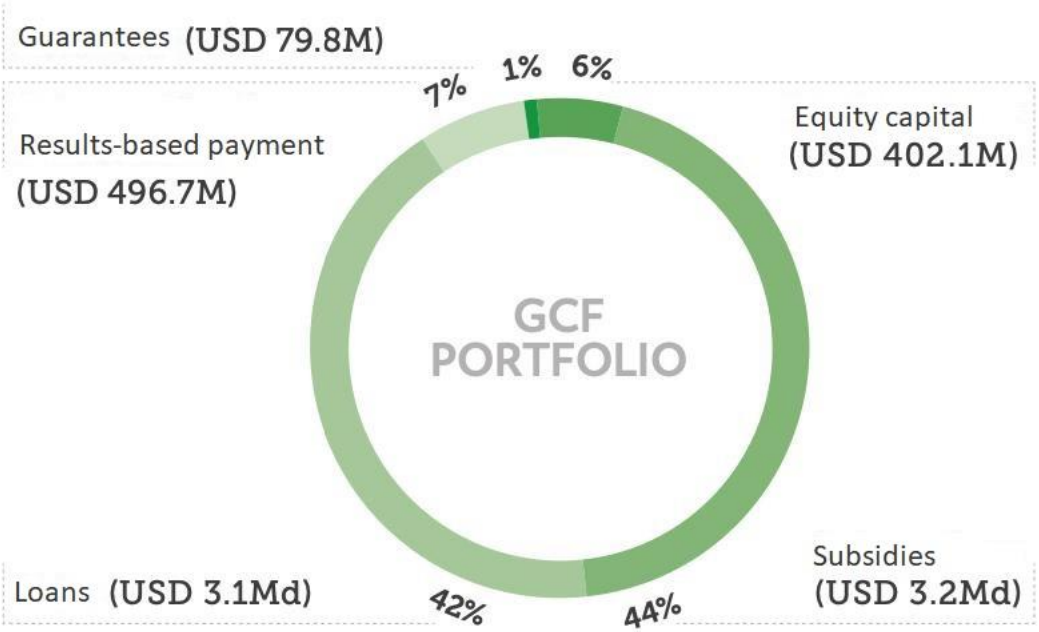
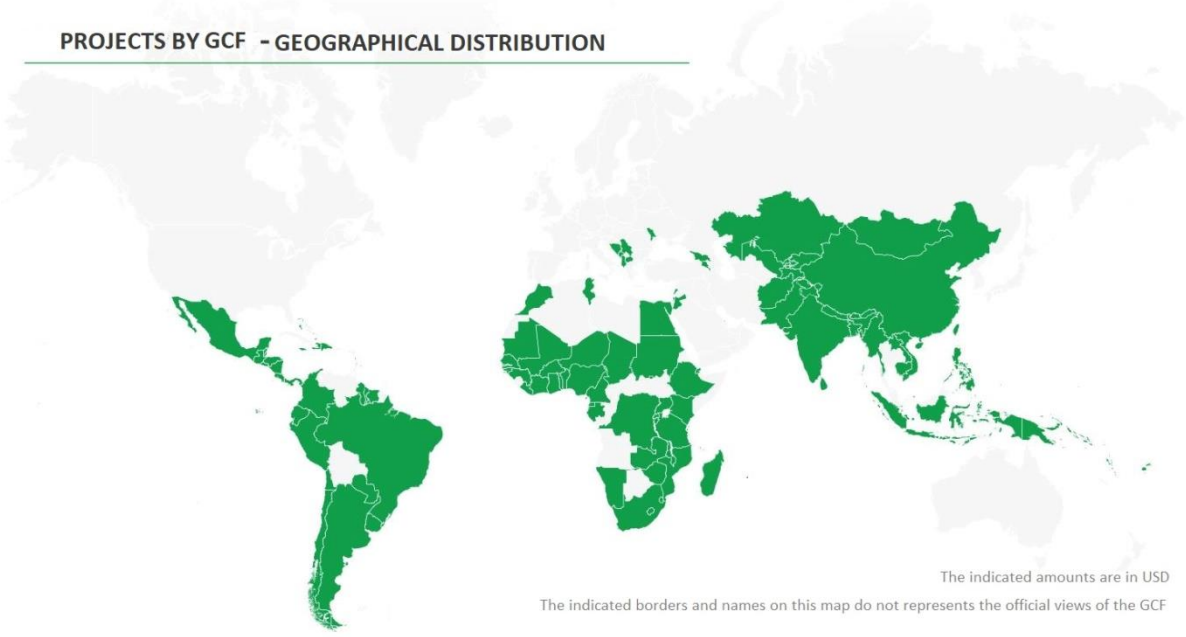


Figure 8. Amount of financing by financial instruments

Out of the USD 7.2 billion in approved GCF funding, 38% was funded by private entities and 62% by public entities. Also, out of the $7.2 billion, $1.7 billion was for adaptation projects (23%), $3.2 billion for mitigation projects (45%) and $2.3 billion (32%) for cross-cutting projects. Africa is the priority region where the most projects have been funded to date (47%) and represents 38% ($2.7 billion) of the overall VCF portfolio.



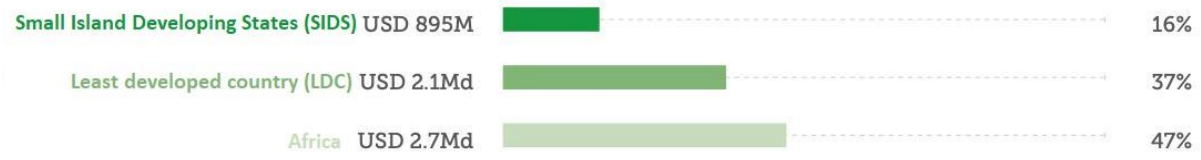


Figure 9. Geographical distribution of GC funded projects

Among the "direct access" accredited entities (national accredited entities in the language of the GCF), those present in Africa are: Acumen (ARAF), FNEC, ADA Morocco, MOE_Rwanda, AWB, MoFEC, BOAD, MWE_UGA, CDG_Capital, NEMA, CRDB, OSS, CSE, SANBI, DBSA, LBA, Ecobank, KCB, EIF.

The GCF collaborates with private entities to increase funding sources and capacities. As the private sector plays an increasingly important role in the renewable energy markets, its support for climate adaptation is still insufficient, especially for smallholder farmers who are most affected by climate change. The GCF is therefore partnering with private entities to increase its financing capacity by limiting the risks of these actors, and to go beyond limited grant support to strengthen agricultural adaptation.[14]

For example, Acumen Resilient Agriculture Funds (ARAF) will shift investments in adaptation projects from grants to long-term capital to enable farmers to respond effectively to climate change. The GCF $23 million investment in ARAF's first loss pool is catalytic in reducing investment risk for more risk-averse private sector investors and provides a strong incentive for them to partner with Acumen and the GCF.[15]

C. Alternative Mechanisms Typology: the Case of Agriculture in Africa

Below, the main donors are developed. The selected entities are also accredited by the Green Climate Fund, which will allow them to provide financing mechanisms in favor of agriculture and present in Africa, according to the two categories of traditional donors, multilateral and bilateral. To make relevant strategic choices, we singled out these actors in terms of their expertise in syndication and their willingness to share risk.

MULTILATERAL PUBLIC FUNDINGS (SELECTION)		
Entities	**Description**	**Main types of financing[16]**
World Bank	The World Bank is a leading source of financing and knowledge for developing countries. It is committed to fighting poverty increasing shared prosperity and promoting sustainable development. [17]	Loans

[14] GCF, Acumen Resilient Agriculture Fund at a glance, https://www.greenclimate.fund/sites/default/files/document/case-study-fp078.pdf
[15] GCF Spotlight Africa, https://www.greenclimate.fund/sites/default/files/document/gcf-spotlight-africa_0.pdf
[16] After a brief analysis of funding mechanisms for similar projects or on similar themes
[17] Mission du Groupe de la Banque mondiale. (s. d.). World Bank. https://www.banquemondiale.org/fr/what-we-do

European Investment Bank (EIB)	The European Investment Bank is the European Union's financing institution. It is the world's leading multilateral lender, particularly for climate action financing.[18]	Loans Cofinancing (Blended finance + syndication)
European Bank for Reconstruction and Development (EBRD)	The European Bank for Reconstruction and Development invests for better lives.[19]	Grants Loans Cofinancing (Blended finance + syndication)
Food and Agriculture Organization (FAO)	The Food and Agriculture Organization is a specialized UN agency that works to eliminate hunger.[20]	Grants Loans Cofinancing (Blended finance + syndication)
International Fund for Agricultural Development (IFAD)	The International Fund for Agricultural Development is a UN agency that works to improve food security for rural people[21]	Grants/Subsidies Loans Cofinancing (Blended finance + syndication)
United Nations Development Programme (UNDP)	The United Nations Programme is one of the leading multilateral development agencies working to eradicate poverty and reduce inequality and exclusion[22]	Grants Loans Cofinancing (Blended finance + syndication)
United Nations Environment Programme (UNEP)	The United Nations Environment Programme is the highest authority on environmental matters within the UN. Its mission is to encourage cooperation to protect the environment.[23]	Grants Loans Cofinancing (Blended finance + syndication)

BILATERAL PUBLIC FUNDINGS (SELECTION)		
Entities	**Description**	**Main types of financing [24]**
French Development Agency (AFD)	The French Development Agency is a public institution that implements France's development and international solidarity policies. More than 4 000 projects with a strong social and environmental	Grants Loans Cofinancing (Blended

[18] Qui nous sommes. (s. d.). BEI. https://www.eib.org/fr/about/index.htm
[19] Notre mission. (s. d.). EBRD. https://www.ebrd.com/fr/what-we-do.html
[20] À propos. (s. d.). Food and Agriculture Organization of the United Nations. http://www.fao.org/about/fr/
[21] A propos du FIDA. (s. d.). IFAD. https://www.ifad.org/fr/about
[22] À propos du PNUD | PNUD. (s. d.). UNDP. https://www1.undp.org/content/undp/fr/home/about-us.html
[23] Sundholm, M. (s. d.). PNUE : Programme des Nations Unies pour l'Environnement – Bureau de L'Envoyé du Secrétaire général pour la Jeunesse. UNEP. https://www.un.org/youthenvoy/fr/2013/08/pnue-programme-nations-unies-lenvironnement/
[24] After a brief analysis of funding mechanisms for similar projects or on similar themes

	impact in the areas of climate biodiversity, peace, education, urban planning, health and governance have been carried out by AFD.[25]	finance + syndication)
German Agency for International Cooperation (GIZ)	The German Agency for International Cooperation is committed to sustainable development and works flexibly and efficiently to provide better living conditions for the population[26]	Grants Subsidised loans Cofinancing (Blended finance + syndication)
Belgian Development Agency (ENABEL)	The Belgian Development Agency implements international projects to improve the delivery of public services to citizens and the living conditions of populations, mainly on the African continent[27]	Subsidies Cofinancing (Blended finance + syndication)
Austrian Development Agency (ADA)	The Austrian Development Agency is active in three areas : fighting poverty, securing peace and preserving the environment[28]	Subsidies Cofinancing (Blended finance + syndication)
Foreign Economic Cooperation Office (FECO)	The Foreign Economic Cooperation Office of the Ministry of Environmental Protection of China has as its main mission the management of external cooperation funding[29]	Cofinancing (Blended finance + syndication)
Japan International Cooperation Agency (JICA)	The Japan International Cooperation Agency works primarily for human security and quality growth. Its work is based on engagement, proximity to the field, strategy, co-creation and innovation[30]	Official development assistance loans Grants that are part of the diplomatic policy or directly managed by the Ministry of Foreign Affairs
Swiss Agency for Development and Cooperation (SDC)	The Swiss Agency for Development and Cooperation is the body of the Federal Department of Foreign Affairs responsible for international cooperation activities whose objectives are to fight poverty, improve respect for human rights, promote democracy and protect the environment[31]	Subsidies Cofinancing (Blended finance + syndication)

On this basis, we have established the following typology:

- **Regional public financing on the African continent**

[25] L'Agence française de développement. (s. d.). AFD. https://www.afd.fr/fr/agence-francaise-de-developpement
[26] G. (s. d.). Profile. GIZ. https://www.giz.de/en/aboutgiz/profile.html
[27] Projets. (s. d.). Enabel. https://www.enabel.be/fr/content/projets
[28] Austrian Development Agency. (s. d.). ADA. https://www.entwicklung.at/en/ada
[29] About FECO. (s. d.). FECO. http://en.mepfeco.org.cn/About_FECO/201006/t20100610_563481.htm
[30] About JICA | JICA. (s. d.). JICA. https://www.jica.go.jp/english/about/index.html
[31] Portrait. (s. d.). SDC. https://www.eda.admin.ch/deza/fr/home/ddc/portrait.html

On the African continent, there is a plethora of financial initiatives and regional funds, which are intended to address agricultural development and ensure better water management in an efficient and inclusive manner. To date, agriculture has been under-financed by continental bodies. These regional mechanisms tend to be better integrated with the support of public authorities.

- **Private financing**

Within the framework of this project, there is also private financing, both international, regional and national, which can be mobilized. These financing mechanisms may be possible if they are associated with the Green Climate Fund and local commercial banks.

- **Financing syndication: from yield to risk pooling**

Financial syndication is a grouping of several banking and financial entities, whose main objective is to pool financial operations and risk capital. This method makes it possible to raise the large amounts of capital needed to finance major projects, both public and private, but also to respond to a crisis situation. Syndication also seeks to improve the quantity and quality of investment. The purpose of this financial and risk sharing is to maintain the expectations and returns of the projects in which the entities have joined forces.

Summary Table Of Alternative Financing

Types	**Objectives**	**Integration process**
Regional public financing on the African territory	Agricultural development ; Improved water management; Efficiency and inclusion;	Support from public authorities
Private financing	Participate in the financing of agricultural projects	GCF/commercial finance
Syndication of funding	Pooling of financial operations and venture capital; Raising larger amounts of funds; Investment quality	Syndication

Conclusion: diversification of tools for scaling up climate finance action

A multitude of players and financial mechanisms are entering the adaptation finance market as climate change is everyone's problem. Throughout this chapter, we have shown that co-financing mechanisms, coming from various countries, both from public and private entities are accelerating in relation to adaptation finance.

We have developed in this work that whilst the traditional actors of finance, notably public actors such as development banks or international governmental organizations, largely contribute to financing projects relevant for adaptation to climate change and contributing to financing lower economies, their contributions will not be sufficient to reach USD 100 billion mobilization for climate.

We identified three trends in adaptation finance:

- **A transformation in the source of funds**, thanks to the diversity of the type of private or public actors. Regional, national or local commercial banks are gaining in importance, devoting a larger share to financing projects related to climate change adaptation.
- **A geographical redistribution of funds**, where private and/or public organizations that did not traditionally intervene in certain areas of the world. This is notably the case for Asian organizations in West Africa.
- **Blended-finance is becoming more important as a financial mechanism** for (re)financing lower economies and attracting private investors.

Chapter 2 :
Redefining coalition approach toward bottom-up and regional coalition

The Bridge Tank
Palais Brongniart
28 Place de la Bourse
75002 Paris
https://thebridgetank.org/

CHAPTER 2: REDEFINING COALITION APPROACH TOWARD BOTTOM-UP AND REGIONAL COALITION

Introduction

The annual Conference of the Parties (COP) have imposed themselves as the most important gathering for climate related discussions and negotiations since they began taking place following the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. The UNFCCC integrates an international environment treaty where parties commit to combat "dangerous human interference with the climate system". In the following years, under the UNFCCC, important treaties were agreed upon, namely the Kyoto Protocol in 1997 and the Paris Agreement in 2016.

Climate negotiations have seen the emergence of two specific trends over the last few years. Firstly, concerning climate political negotiations specifically, the development of platforms of actors has been observed, especially in the case of "non-annex 1 countries" (by opposition to the Annex 1 countries, which, at the time of the signing of the UNFCCC in 1992, were the high-income, industrialized, OECD countries). These non-annex 1 countries have been constituting coalitions of actors in order to leverage political influence and weigh on negotiations.

Secondly, since the Paris Agreement, Nationally Determined Contributions (NDCs) have imposed themselves as the preferred tool to organize and conduct ecological transitions at a national level. The use of NDCs stems from the idea that defining a small number of uniformized energy and ecological trajectories at a multilateral level, which parties would be expected to follow, is not a well-suited approach to the transition. Rather, it appeared that the national level was most-pertinent to integrate territorial specificities, particularly socio-economical inertias. Governments are therefore free to establish their own trajectory of transition to reach climate targets defined at the multilateral level.

We will analyze and characterize how these groups operate and clarify their motivations in constituting such coalitions during climate negotiations. Moreover, we will argue that for emerging and less developed countries, constituting regional "climate blocks" could appear coherent to continue conducting climate negotiations at the multilateral level and counter-balancing the political and economic influence of G20 countries.

Additionally, if we welcome the change of philosophy that has led to the use of NDCs as the privileged climate transitioning tool, following a growing sense that bottom-up initiatives are to complement –and up to an extent realize- national commitments, nonetheless, we argue that this approach remains too state-centered and top-down (at the national level). We believe that non-state actors are still insufficiently included in the definition of ecological trajectories and objectives, when, at the end of the day, it is their actions and investments that will for the most part effectively materialize the transition. We will therefore underline in which manner non-state stakeholders could and should be included in climate negotiations, notably through platforms of actors, such as the Non-state Actor Zone for Climate Action (NAZCA), launched at the COP20.

A. Climate change negotiations: alliances and coalitions in action

How do climate change negotiations work?

Climate change negotiations at the multilateral level, mostly around the Conference of Parties (COPs) annual meetings, have seen a gradual increase in coalition making since around 2005.[32] If it can't be considered a breakthrough phenomenon, like any multilateral negotiation, climate negotiation is based on alliances and coalitions. It is the scale of the practice that breaks with previous habits. Most developing countries started participating in several coalitions at one, trying to leverage political influence and to be able to weigh on negotiations that are usually led by high-income, OECD, countries.

We define coalition as any group that adopts common proposals and an agreed upon stance during the negotiations. Coalitions can be public or private, formal or informal entities. There are three trends to say to what extent coalitions:

- The first one focuses on harder to find compromises and reaching a common agreement as it allows more actors to speak up and influence the negotiation;
- The second one insists that coalitions serve to reduce complexity and improve the bargaining power of the coalition members. This explanation is the most shared by the literature and stakeholders who decide to group themselves to invest their voice to recommend climate justice for all.[33]

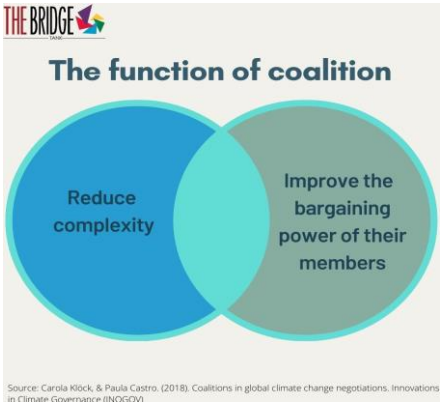


Figure 1. The main function of coalition

- The third trend justifies logically why smaller and less developed countries (usually non-annex 1 countries) join more coalitions so the governments have sufficient bargaining power by themselves. However, it is to be noted that multiplying participations might come at a cost, what Ronald Coase

[32] Klöck, & Castro. (2018). Coalitions in global climate change negotiations. Innovations in Climate Governance (INOGOV)

[33] Réseau Climat Développement. (2017). Non-state actors towards a leading role in the implementation of the Paris agreement. http://climatdeveloppement.org/wp-content/uploads/2017/11/RCD-BROCHURE-2017-Anglais.pdf

calls “transaction costs”[34], which increase concomitantly with the complexity of the structure. In a very practical dimension, countries that have multiplied participation in coalitions struggle to coordinate with multiple groups and to attend all coordination meetings.[35] But, despite such a cost, multiplying meetings also gives the chance to multiply interventions and to defend one’s position repeatedly. We see that coalition membership for negotiations purposes have ambiguous consequences for the stakeholders.

More broadly within the context of the fight against climate change, some key points will be essential to pursue the ecological transition and conduct effective and successful climate negotiations in the future. If the goal of limiting global warming between, +1.5° to 2°C is to be achieved, these will have to be taken into account and implemented:

1. If coalitions have allowed emerging, non-annex 1, countries to gain a voice in climate negotiations, taking their interests better considered, these countries still lack the necessary support from developed countries and international institutions to carry through their transition. Upcoming climate negotiations should be the place for OECD countries to renew their commitment to provide 100 billion dollars in climate finance annually to poorer nations. This commitment needs to be honored this time around, as it has not been until now.
2. Platforms such as the G7 and G20 are indispensable multilateralism gatherings to pursue the advancement of global issues and counteract free riding. If inclusiveness remains the priority, it cannot be denied that these countries are the major emitters and also the ones with the most bargaining power. Therefore, such reunions, where developed economies have the chance to begin converging on agreements and common terms, are useful, not the least in the sight of COP meetings. The recent agreement on a global minimal corporate tax of 15% underlines these platforms’ capacity to achieve important advancements.
3. Climate-policy should expand beyond its “niche” and become integrated in the broader international development agenda, especially within the framework of the Agenda 2030. It is well understood that climate cannot be approached as a specific public policy sector anymore but as an all-encompassing issue that must be integrated all around, first and foremost in development policies and planification. We must “push an approach that makes NDCs, National Adaptation Plans (NAPs) and long-term national low carbon development strategies (LCDSs) a permanent component of national development planning, including a coherent economic, regional and finance policy.”[36]

[34] Coase, R. H. (1960). The Problem of Social Cost. Classic Papers in Natural Resource Economics, 87- 137. https://doi.org/10.1057/9780230523210_6

[35] International Climate Negotiations : Issues at stake in view of the COP25 UN Climate Change Conference in Madrid. (s. d.). European Parliament. https://www.europarl.europa.eu/RegData/etudes/STUD/2019/642344/IPOL_STU(2019)642344_EN.pd

[36] Hirsch. (2016). The Role of Alliances in International Climate Policy after Paris. Friedrich-Ebert-Stiftung.

We call for a better bottom-up approach, defended by the concept of "hybrid multilateralism". In this sense, coalitions may play a leading role for transforming the climate governance and leadership:[37] vulnerable countries progressively increase their visibility in climate change negotiation thanks to coalition actions advocating their ambitions. For instance, recent evidence has revealed that coalitions such as Small Island Developing States (SIDS) and Least Developed Countries (LDCs) have developed ambitious NDCs. Their efforts prove that fighting global warming to 1.5C is a shared duty of all.[38] There is still a lot to do for climate justice and equality, more particularly during negotiations. A great deal of internal work needs to be done within the coalitions to ensure their proper functioning, and then to increase their effectiveness and credibility in the climate negotiations.

Strengths & limits

A number of factors can have decisive importance in deciding whether a coalition, a group, will be successful in achieving the purpose it has set itself. But as Hirsch has highlighted in a 2016 article[39], it is first and foremost coherent policy demands that bind the coalition together and enables successful bargaining. Policy demands should strive to reflect the main interests of the parties to the alliance and provide operationalizable targets to implement. In the case of the Paris Agreement, which was a major milestone in climate negotiations, Hirsch identifies several key policy dimensions that allowed the agreement to be ratified and illustrates that it is the coherence, realism and inclusiveness of the policy demands that made the COP a success.

It is to be noted that conducting coalitions to levy influence during multilateral negotiations is no panacea and that it has inherent limits, the first being that the process ultimately requires unanimity, no matter the coalitions in place. Moreover, political positions, even in one negotiation, are prone to evolutions and to re-arrangements and therefore coalitions might need to find the flexibility to follow such changes, to "reforge in changing formations".[40]

Coalitions and alliances during climate change negotiations can be formal or informal. However, the formalization of a group is key for long term collaboration and success. Partial or non-participation of coalitions is a structural problem in climate negotiations. But in order to improve their better integration, it is crucial to strengthen their structure, both in terms of substance and form. Hirsch[41] has identified several factors which guarantee conditions for successful grouping, both alliances and coalitions.

[37] Réseau Climat Développement. (2017). Non-state actors towards a leading role in the implementation of the Paris agreement. http://climatdeveloppement.org/wp-content/uploads/2017/11/RCD-BROCHURE-2017-Anglais.pdf

[38] Cabinet Office. (2021, 26 juillet). Ministers have renewed common mission for climate action, but more work to do says COP26 President [Press release] https://www.gov.uk/government/news/ministers-have-renewed-common-mission-for-climate-action-but-more-work-to-do-says-cop26-president

[39] Hirsch. (2016). The Role of Alliances in International Climate Policy after Paris. Friedrich-Ebert-Stiftung.

[40] Hirsch. (2016). The Role of Alliances in International Climate Policy after Paris. Friedrich-Ebert-Stiftung.

[41] Hirsch. (2016). The Role of Alliances in International Climate Policy after Paris. Friedrich-Ebert-Stiftung.

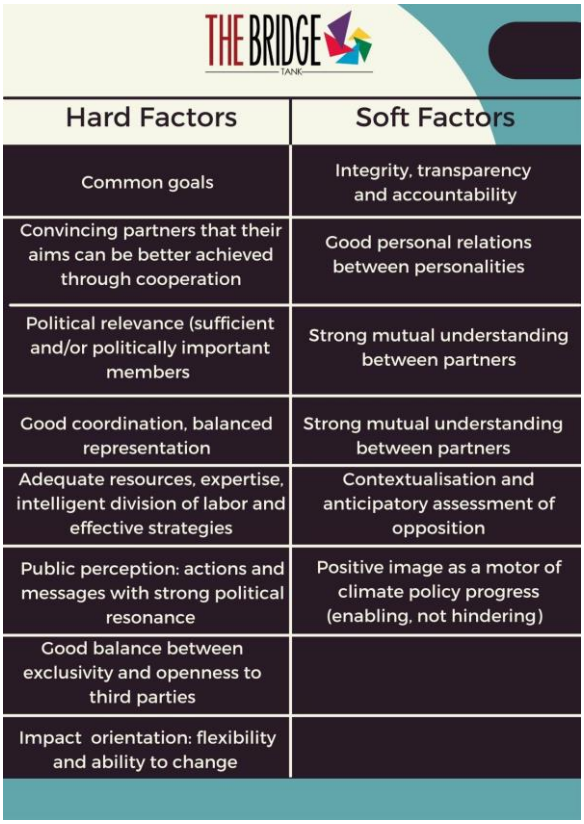


Figure 2. Conditions for successful coalitions[42]

The elements developed above are almost exclusively tailored to government coalitions. In order to improve climate governance, negotiations and action by all to fight climate disruption, the mobilization of a multitude of actors is necessary and beyond borders.

Beyond common tools, towards a regional integration of objectives

Constituting coalitions is without a doubt the privileged way for less influential countries to have a more outspoken voice and to levy as much influence as possible. Inequalities in bargaining power have been identified during the climate negotiation with vulnerable countries usually finding themselves in smaller delegation sizes with a consequently lesser influence.[43] But at the COP21, lower income countries, notably sub-saharan, have been participating in increasing delegation size that has rebalanced power

[42] Hirsch. (2016). The Role of Alliances in International Climate Policy after Paris. Friedrich-Ebert-Stiftung.

[43] Martinez, G. S., Hansen, J. I., Olsen, K. H., Ackom, E. K., Haselip, J. A., Bois Von Kursk, O., & Bekker-Nielsen Dunbar, M. (2019). Delegation size and equity in climate negotiations : An exploration of key issues. Carbon Management.

relations. These higher delegation sizes and coalitions have allowed for a more inclusive, equitable process during the previous COPs meeting and as a consequence induced better crafted agreements.

We would like to argue that furthering this process by favoring convergence between neighboring countries through regional integration, or "regional blocks", would allow for better inclusiveness during climate negotiations. As the environment and climate does not limit itself to national borders but has regional specificities that encompass a number of countries, convergence between those states appears appropriate and is a process that is slowly gaining traction. It can be seen in specific issues like accessing Green Climate Funds, where Caribbean countries often adopt a regional approach, in the rising role of regional development banks (in Asia, Africa, Americas), or even in the EU where an increasing number of member countries adopt the commonly prescribed European objectives. Current attempts by ECOWAS (Economic Community of West African States), with GCCA+ support, to adopt common climate policies in a pan-african context can also be quoted. The GCCA+ West Africa initiative targets the capacity building and MRV (Measurement, Reporting and Verification), as it already exists on national level, of regional institutions, and the emergence of innovative field solutions to strengthen the climate resilience with inclusive activities for local communities.

Such a re-composition of groups of countries also derives from an outdated classification from the UNFCCC that distinguishes between annex 1 / non-annex 1 distinction. As it is no longer relevant, we see new groups of countries forming that are more representative of current political, economic, and environmental realities. On a purely economic stance, the World Bank distinguishes between low, lower-middle, upper-middle- and high-income countries. To some extent, the many negotiation coalitions in the UNFCCC reflect these categories, while others instead reflect more geographical characteristics or common preconditions. Overall, it appears it is regional integration of countries with similar economic and environmental characteristics that are most representative and therefore most efficient and coherent for climate negotiations. Moreover, it is easier for, say, high-income industrialized countries with important financial capacities, to negotiate with a group of assembled countries that present an individualized interlocutor with whom to carry negotiations, or at least a set of conditions, policies and needs that have been established commonly and that can serve as a basis of discussions.[44]

Already thought by many analyses, regional integration, based on common issues, seems to be essential to weigh in negotiations, avoid duplication of actions and mobilize resources, both financial, economic, technical and social to fight against these issues.

Build On Existing Initiatives And Tools To Make Coalitions Work

Various top-down mechanisms have been promoted at the national level through the work of previous COPs. In our study, we will focus on the NAP mechanism (National Adaptation Plan). This process emerged from the 16th COP to the UNFCCC in Cancun in 2010, where Parties affirmed that "adaptation must be

[44] Jernnäs, M., & Linnér, B.-O. (2019). A discursive cartography of nationally determined contributions to the Paris climate agreement. Global Environmental Change.. https://doi.org/10.1016/j.gloenvcha.2019.01.006

addressed with the same priority as mitigation".[45] For our analysis, what matters is the recent methodology used for implementing the NAP into national policy. The NAP must be designed with a vertical integration, or a bottom-up approach, as we call for climate negotiations. A vertical integration is "the process of creating intentional and strategic linkages between national and sub-national planning, implementation and monitoring and evaluation" (in the NAP's case in particular with adaptation issues).[46]

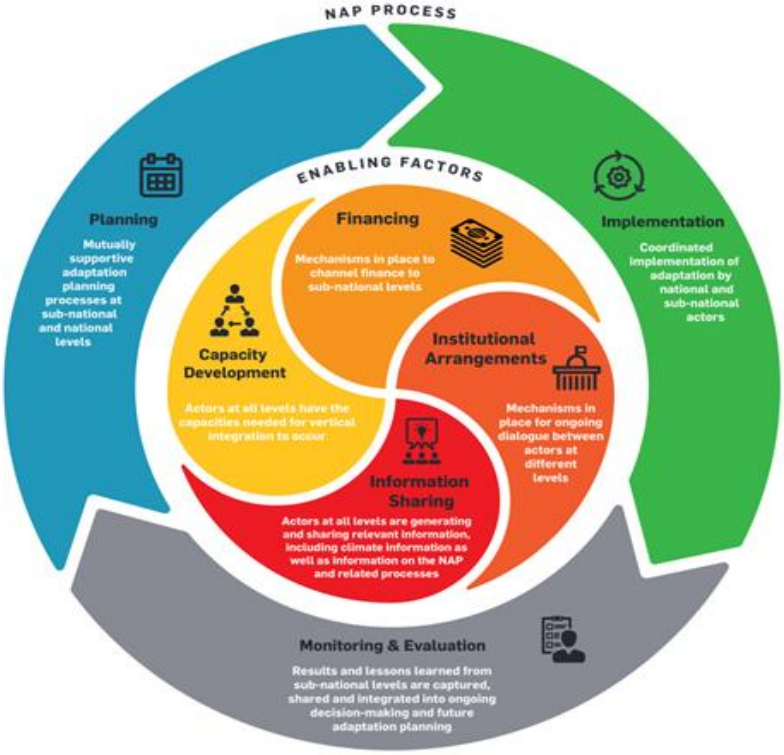


Figure 3. NAP process[47]

The vertical integration in the NAP process addresses fundamental elements, such as:[48]

- Participatory governance with all kinds of stakeholders;
- Transparent by enabling sharing of information between all levels;
- Gender sensitivity;

[45] NAP Global Network. (2016). Vertical Integration in National Adaptation Plan (NAP). Processeshttps://www4.unfccc.int/sites/NAPC/Documents%20NAP/Supplements/Vertical-Integration-in-NAP-Processes-Guidance-Note.pdf

[46] NAP Global Network. (2016). Vertical Integration in National Adaptation Plan (NAP). Processeshttps://www4.unfccc.int/sites/NAPC/Documents%20NAP/Supplements/Vertical-Integration-in-NAP-Processes-Guidance-Note.pdf

[47] NAP Global Network. (2016). Vertical Integration in National Adaptation Plan (NAP). Processeshttps://www4.unfccc.int/sites/NAPC/Documents%20NAP/Supplements/Vertical-Integration-in-NAP-Processes-Guidance-Note.pdf

[48] NAP Global Network. (2016). Vertical Integration in National Adaptation Plan (NAP) Processes. https://www4.unfccc.int/sites/NAPC/Documents%20NAP/Supplements/Vertical-Integration-in-NAP-Processes-Guidance-Note.pdf

- Consideration of vulnerable groups, communities and ecosystems.

To ensure the good implementation and efficiency of the NAP process, the involvement of all kinds of stakeholders and at all levels are required. Three key factors for vertical integration have been identified:[49]

- Institutional arrangements;
- Information Sharing;
- Capacity Development.

Figure 4. Key factors for efficient implementation of the NAP[50]

Based on this brief presentation of the NAP process and our previous statement and analysis, we believe that a similar mechanism at the regional level is quite feasible to accompany the coalitions, which could be called RAP process (Regional Adaptation Plan). The COP26 agenda calls for a deepening of adaptation actions. We also think that the issues and status of coalitions will be developed during the COP26 in Glasgow. Having a regional mechanism would help to push bottom-up initiatives, build capacity, give power and visibility to alliances and coalitions, both state and sectoral, but especially non-state sectoral.

[49] NAP Global Network. (2016). Vertical Integration in National Adaptation Plan (NAP) Processes. https://www4.unfccc.int/sites/NAPC/Documents%20NAP/Supplements/Vertical-Integration-in-NAP-Processes-Guidance-Note.pdf

[50] NAP Global Network. (2016). Vertical Integration in National Adaptation Plan (NAP). Processeshttps://www4.unfccc.int/sites/NAPC/Documents%20NAP/Supplements/Vertical-Integration-in-NAP-Processes-Guidance-Note.pdf

B. On linking platforms and coalitions: the role of non-State stakeholders

The Paris Agreement and the establishment of Nationally Determined Contributions (NDCs) have, as we highlighted, shown a willingness to include actors, here public actors, in the shaping up and steering of transitions rather than adopting a top-down approach that negates specificities of particular socio-economic systems. This approach was a welcomed rupture with the OECD' and IEA's usual top-down, standardized approach. The belief that each public actor is best suited to determine its socio-economic inertias, to identify them and to correct them towards a sustainable path is a stance we agree upon. However, we believe that this change in perspective does not go far enough, and that a significant and essential part of the equation was left out of the discussion, i.e., the private sector, non-state actors and their specific needs, constraints and considerations. Negotiations that forget to include them are ones that lack an essential dimension of what will enable the successful implementation of climate agreements. Indeed, "Non-state actors are often perceived to spur implementation as well as monitoring and evaluating compliance. But they also stimulate ambition and participation by defining problems, setting agendas, shaping rules, principles, and norms provide information and capacity building, mobilize public engagement, evaluating and monitoring compliance"[51].

Figure 5. Inclusion of non-state actors into the governance levels[52]

[51] Bäckstrand, K., Kuyper, J. W., Linnér, B.-O., & Lövbrand, E. (2017). Non-state actors in global climate governance : from Copenhagen to Paris and beyond. Environmental Politics. https://doi.org/10.1080/09644016.2017.1327485

[52] Réseau Climat Développement. (2017). Non-state actors towards a leading role in the implementation of the Paris agreement. http://climatdeveloppement.org/wp-content/uploads/2017/11/RCD-BROCHURE-2017-Anglais.pdf

While the COP delegations meet annually, gathering public entities and governmental representatives, there additionally needs to be a place for permanent dialogue between industrialists and financiers, between innovators and territories, between legislative negotiators and entrepreneurs, anchored into civil society. An ongoing dialogue between stakeholders, both public as well as private, is necessary.

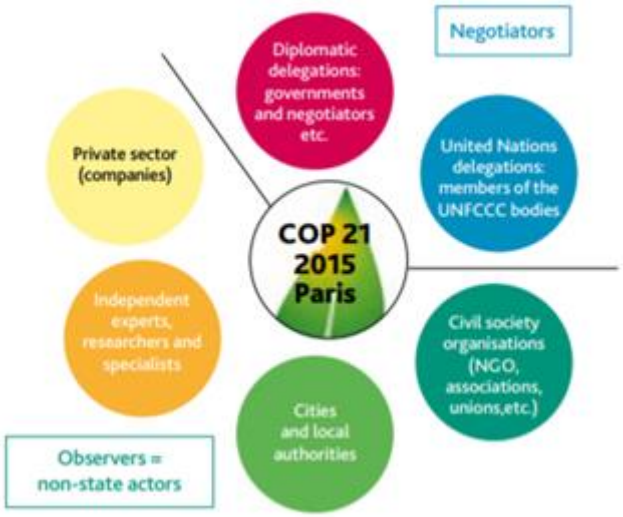


Figure 6. Climate change negotiations' stakeholders[53]

Platforms such as NAZCA gather an ecosystem that is useful and acts as a first step in that direction, however, continuity is found more in sector-specific or issue-specific coalitions such as IDFC (International Development Finance Club) for finance (with a growing focus on climate finance, which represents 95% of the total green finance), or dedicated funds ecosystems (GEF (Global Environment Facility), GCF (Green Climate Fund) etc. through their syndications with several DFIs (Development Financial Institutions)), NDC Partnership, etc. The list is long, but, while they work on a more recurring basis, integrating the myriad of actors into this permanent exercise and ensuring inter-sectoral, inter-issues coupling may be necessary. What may not be –but could resemble- a sort of consultative Parliament of actors with bottom-up picking of topics or a 'coalition of coalitions' might fill a gap.

The crucial role of non-state actors in climate negotiations is gradually recognized and they are consequently given room in climate talks. For instance, the former Moroccan Minister of Environment, Hakima El Haité, when in office, asked all civil society parties, non-state actors (business, regions, cities, industries and non-governmental organizations) to become partners to the public authorities to organize and conduct the transition. This trend is taking up in global climate politics and truly took its first step

[53] Réseau Climat Développement. (2017). Non-state actors towards a leading role in the implementation of the Paris agreement. http://climatdeveloppement.org/wp-content/uploads/2017/11/RCD-BROCHURE-2017-Anglais.pdf

during the COP 20 in Peru with the launch of both the Lima-Paris Action Agenda (LPAA) and the non-State Actor Zone for Climate Action (NAZCA).[54]

This new dynamic in climate negotiations has led some to talk about a widened frame for climate diplomacy (Christoff 2016) underlying the growing importance of non-state actors all around in our societies. Bäckstrand et al.[55] talk about "hybrid multilateralism" to describe this new state of affairs with "intensified interplay between state and non-state actors in the new landscape of international climate cooperation". This hybrid multilateralism also gives a greater place to cities that, as non-state public actors, have imposed themselves as an avoidable participant of the ecological transition. Following Pr. Donald Trump's withdrawal from the Paris Agreement for instance, many cities declared they would nonetheless stick to the accord and conduct the transition. Similarly, it is during the COP in Denmark's capital Copenhagen that cities, corporations, industries, NGOs truly began to participate in climate change negotiations and to the steering of the transition. As Bäckstrand et al. highlight, it is not a drift of power from the state to non-state actors that are witnessing but rather a complexification of global climate governance.

With the growing importance of non-state actors in climate actions, that we welcome, it has to be noted that enhanced and more inclusive participation will not miraculously induce perfect solutions and agreements if as a consequence of the multiplication of actors, negotiations are rendered arduous and objectives are watered down. That is why, concomitantly to the inclusion of non-state stakeholders, coalitions play such a crucial role, not only for less influential states but also as to make sure that negotiations while becoming more inclusive can remain effective, or even gain in effectiveness. Overall, to make sure non-state actors' role in climate change negotiations is effective, authority, legitimacy and effectiveness will be needed. Moreover, non-state actors might not only be highly important for climate negotiations and policy design but they may also play a leading role for technological innovation and economic transformation and push public bodies to deepen climate change objectives towards "clean sectors of the national economy".[56]

Figure 7. Non State actors goals during climate change negotiations[57]

[54] Bäckstrand, K., Kuyper, J. W., Linnér, B.-O., & Lövbrand, E. (2017). Non-state actors in global climate governance : from Copenhagen to Paris and beyond. Environmental Politics. https://doi.org/10.1080/09644016.2017.1327485

[55] Bäckstrand, K., Kuyper, J. W., Linnér, B.-O., & Lövbrand, E. (2017). Non-state actors in global climate governance : from Copenhagen to Paris and beyond. Environmental Politics. https://doi.org/10.1080/09644016.2017.1327485

[56] Hale. (2018). The Role of Sub-state and Nonstate Actors in International Climate Processes. Chatham House.. https://www.chathamhouse.org/sites/default/files/publications/research/2018-11-28-non-state-sctors-climate-synthesis-hale-final.pdf

[57] Hale. (2018). The Role of Sub-state and Nonstate Actors in International Climate Processes. Chatham House.. https://www.chathamhouse.org/sites/default/files/publications/research/2018-11-28-non-state-sctors-climate-synthesis-hale-final.pdf

Conclusion: involving non state-actors for innovative coalitions

We have seen specificities that characterize multilateral climate negotiations, among which notably two relatively recent trends: the slow adoption of a bottom-up approach, with NDCs, as well as the increasing importance of coalitions during climate meetings especially. Less influential countries, especially those which have usually been labeled as non-annex 1 countries, have seen alliances and political groups as a way to gain bargaining power.

We identified what could be qualified as two "bottlenecks" currently in climate negotiations that are however inclined to evolve favorably in the years to come. First, **non-state actors, despite the bottom-up approach adopted during the COP 21, are still insufficiently included in climate negotiations** even though positive trends, among which the launch of NAZCA is an illustration, have emerged. Second, **coalitions need to gain even further influence so that multilateral climate negotiations can become more inclusive and equitable,** and that every country can have the opportunity to express their position.

We consider those two evolutions as complementary. In fact, as non-state actors are going to gain more and more importance, the number of participating actors in climate negotiations will only increase which might induce an excessive complexity. In that sense, the strengthening of the practice of coalitions will prove to be indispensable and to allow both the inclusiveness of all actors as well as the efficiency of negotiations.

We believe that the establishment of a **consultative assembly** that would gather relevant and influential non-state actors would be an important and positive evolution for multilateral climate negotiations. Integrating the vision and the understanding of the problems faced by non-state actors because of the transition necessities would be particularly useful.

Overall, **we call for a long-term process** that would integrate coalitions in order to strengthen governance, mechanism, transparency, equality between all Parties during climate change negotiations. Moreover, we trust regional coalitions would be a privileged process to fight against climate change in order to mobilize institutional, economic, technological, industrial, scientific and social means.

Annex: Traditional State coalitions[58]

GROUPS' NAMES	GROUPS' FUNCTION	DEVELOPING /DEVELOPED COUNTRIES	COUNTRIES	GLOBAL/REGIONAL GROUPS
Umbrella Group	Most of its members have high per-capita greenhouse gas emissions. Hence, some of the members of this group are cautious about ambitious mitigation actions and the group generally calls for developing countries to contribute to mitigation action. In the negotiations, members of the Umbrella Group aim at overcoming the differentiation between developed and developing countries which was introduced in the Convention. In general, the group calls for high standards of transparency in reporting, both for developed and developing country Parties.	Developed countries	Australia, Belarus, Canada, Iceland, Israel, Japan, New Zealand, Kazakhstan, Norway, Russia, Ukraine, United States	Global group
Environmental Integrity Group (EIG)	Members of the EIG call for ambitious mitigation action, including from developing coun-tries, and they are proponents of transparent reporting.	Developed countries	Georgia, Mexico, Republic of Korea, Liechtenstein, Monaco, Switzerland	Global Group
Independant Alliance of Latin America and the Caribbean	AILAC aims at bridging divides between developing and developed countries. Its members call for ambitious mitigation action, not only from developed, but also from developing countries. AILAC also supports an effective transparency framework for all countries. Like other groups of developing coun-tries, AILAC	Developing countries	Chile, Colombia, Costa Rica, Guatemala, Honduras, Panama, Paraguay, Peru	Regional Group

[58] International Climate Negotiations : Issues at stake in view of the COP25 UN Climate Change Conference in Madrid. (s. d.). European Parliament. https://www.europarl.europa.eu/RegData/etudes/STUD/2019/642344/IPOL_STU(2019)642344_EN.pdf (updated)

(AILAC)	also points out the importance of adaptation action and of financial, technological and capacity building support			
Alliance of Small Island States (AOSIS)	As these countries will be affected disproportionately by rising sea levels and by extreme weather events, AOSIS is a proponent of ambitious mitigation action. In the negotiations on the Paris Agreement, the introduction of the 1.5 °C goal constituted one of the achievements of AOSIS. In current negotiations, the group calls for high levels of transparency and environmental integrity, while being mindful about the limited capacities available to developing countries. Consisting of mostly low-income and small countries, the group calls for support, e.g. for financial support and ca-pacity building in the area of adaptation. However, as the possibilities to adapt to effects such as global sea level rise is limited for low-lying islands and coastal areas, members of AOSIS also show high interest in the topic of loss and damage due to climate change in climate negotiations.	Developing countries	Bahamas, Barbados, Belize, Dominican Republic, Fiji, Guyana, Haiti, Jamaica, Cuba, Kiribati, Maldives, Marshall Islands, Micronesia, Nauru, Papua New Guinea, Samoa, Singapore, Antigua and Barbuda, Dominica, Grenanda, St Kitts and Nevis, St Lucia, St Vincent and Grenadines, Solomon Islands, Suriname, Timor-Leste, Tonga, Trinidad and Tobago, Tonga, Vanuatu	Global Group
Least Developed Countries (LDC)	The LDCs have limited capacity to respond to the impact of climate change. In the negotiations, the group stresses the importance of adaptation action and of addressing loss and damage. LDC is also vocal in the negotiations on support for developing countries.	Developing countries	Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Centra African Republic, Chad, Comoros, Democratic Rpublic of Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sudan, Timor-Leste, Togo, Tuvalu, Uganda, Tanzania, Yemen, Zambia[59]	Global Group
African Group	Like other groups of developing countries, the AGN points out the challenges	Developing	Comores, Djibouti, Libya Mauritania, Morocco, Algeria, Egypt, Sudan, Somalia, Tunisia, Angola,	Regional Group

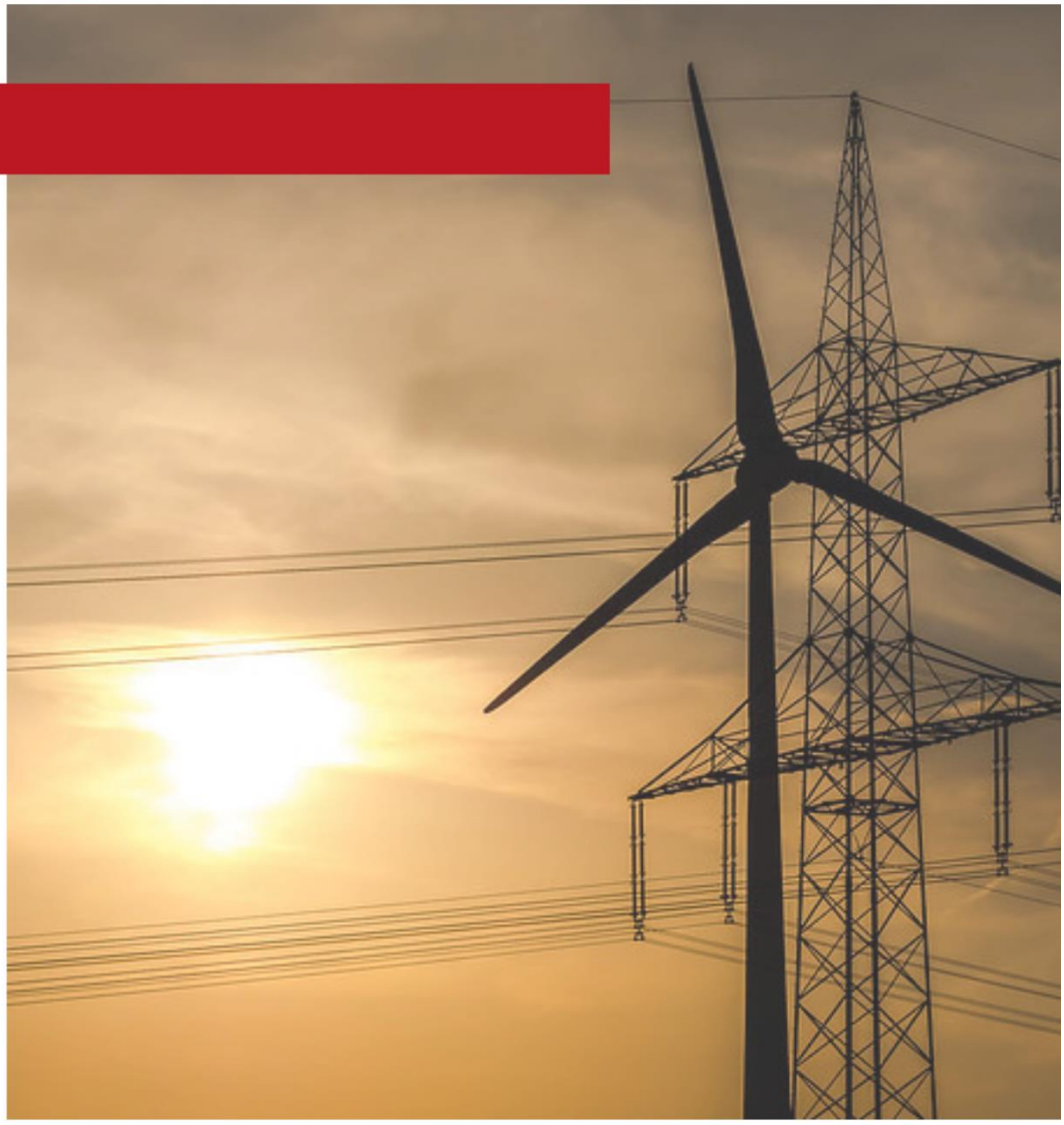
[59] https://unctad.org/fr/node/2972

of Negotiators (AGN)	faced by their members in adapting to the adverse impacts of climate change. Hence, the AGN calls for giving the same level of importance in the negotiations to adaptation as to mitigation. In addition, the AGN points out the limited capacities available in African countries and calls for financial, technological and capacity building support. Within the AGN, South Africa is an important country that supports high transparency standards.	& Developed countries	Benin, Mali, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Republic of the Congo, Equatorial, Guinea, Eritrea, Ethiopia, Eswatini, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, South, Sudan, Togo, Uganda, Tanzania, Zambia, Cabo Verde, Mauritius, Seyschelles	
Group of Argentina, Brazil and Uruguay (ABU)	For these countries, it is important to recognize the specific role of agriculture in mitigation and adaptation. As agricultural activities lead to the emissions of specific greenhouse gases (methane and nitrous oxides) besides carbon dioxide, ABU is active in the discussion on global warming potentials of various greenhouse gases. Another area in which ABU (mostly Brazil) is vocal is the discussion on Article 6 of the Paris Agreement. Brazil has been very active in the Clean Development Mechanism under the Kyoto Protocol and aims at establishing a mechanism with similar rules and avoiding restrictions under the Paris Agreement.	Developing countries	Argentina, Brazil, Uruguay	Regional group
Bolivarian Alliance for the People of Our America (ALBA)	Although the group is less active at present, it has played a prominent role in supporting the interests of indigenous peoples in the climate change negotiations. The group was also a proponent of introducing concepts such as 'climate justice' in the Paris Agreement and it supports the development of non-market approaches to cooperation between Parties.	Developing countries	Cuba, Bolivia, Nicaragua, Venezuela, Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, St Lucia, St Vincent and Grenadines	Regional group
Like-Minded Developing	This group often refers to the principle of common but differentiated responsibilities and calls for ambitious action and support from the part of	Developing countries	Cuba, Bolivia, Nicaragua, Venezuela, Mali, Alergia, Egypt, Sudan, Bangladesh, China, Ecuador, El Salvador, India, Indonesia, Iran,	Global group

countries (LMDC)	developed countries. The group stresses the historical responsibility of developed countries, as they have been responsible for the majority of greenhouse gas emissions over the past decades. The LMDCs point out the importance of taking into account sustainable development and poverty eradication when addressing climate change. The topic of loss and damage is also on the group's agenda.		Malaysia, Pakistan, Sri Lanka, Viet Nam	
Arab Group	As some of them are important oil and gas producers, the Arab Group pays particular attention to possible impacts of mitigation measures (such as a shift away from fossil fuels) on their economies. The topic of 'impacts of the implementation of response measures' is a regular item on the agenda at climate change negotiations (cf. chapter 4.5.5). The Arab Group and other oil producing countries point out the challenges of diversifying their economies in response to mitigation actions; Saudi Arabia is the most vocal member of the group.	Developing countries	Bahrain, Lebanon, Oman, Palestine, Qatar, Unites Arab, Emirates, Yemen, Comores, Djibuti, Libya, Mauritania, Mrococco, Iraq, Jordan, Kuwait, Saudi Arabia, Syria, Algeria, Egypt, Sudan, Mali, Somalia, Tunisia	Regional group
G77 and China	Representatives of the group point out that developed countries are responsible for a large share of historical emissions and should take the lead in climate change mitigation. Another focus of G-77 and China is the call for support from the part of developing countries. On specific technical topics, however, diverse views exist across the members of G-77 and China. On such topics, G-77 and China holds a general position, while other groups of developing countries bring forward more nuanced positions.	Developing countries	AOSIS, LMDC, Arab, ALBA, AILAC, ABU, AGN (without Cabo Verde, Mauritius, Seychelles) groups, Afghanistan, Azerbaidjan, Buhtan, Bosnia and Herzgovina, Brunei, Darussalam, Cambodia, DPR Korea, Lao, Mongolia, Myanmar, Nepal, Philippines, Thailand, Turkmenistan	Global group
European Union (EU)	For each agenda item negotiated at a climate change conference, a representative (from a Member State or from the European Commission) is selected who negotiates on behalf of the EU and its Member States. Member	Developed countries	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania,	Regional group

	States do not speak for themselves in the negotiations. The focus of the EU in the negotiations is on increasing mitigation actions. The EU also acknowledges the importance of support to developing countries and points out the related efforts by the EU and its Member States. It calls for transparent reporting on both action and support.		Slovakia, Slovenia, Spain, Sweden	
Parties without group affiliation	-	Developed/ing countries	Albania, Andorra, Armenia, Kyrgyzstan, Moldova, Montenegro, North Macedonia, San Marino, Serbia, Turkey, Uzbekistan	-
Observers	Civil society, local and regional governements, internationales organizations, think tanks, researchers, individual experts	-	-	-

Chapter 3 :
Integrating hydrogen into sustainable energy transitions



The Bridge Tank
Palais Brongniart
28 Place de la Bourse
75002 Paris
https://thebridgetank.org/

CHAPTER 3: INTEGRATING HYDROGEN INTO SUSTAINABLE ENERGY TRANSITIONS

Introduction

Most of the seventeen United Nations Sustainable Development Goals (SDG) are concerned by the energy transition. The energy transition concerns, on one hand, the restructuring of our energy systems, therefore of our economies whose development has been structured around fossil fuels, and, on the other hand, the ecological transition which intends to mitigate climate change and limit global warming to 1.5°C compared to pre-industrial levels. Currently 75% of greenhouse gases (GHG) are carbon dioxide emissions and 80% of those emissions come from the combustion of fossil fuels. Consequently, talking about the energy transition has economic growth and ecological implications, involving several SDG, the most obvious being the 7th, "Affordable and Clean Energy", and the 13th, "Climate Action". However, most of them are related to the energy transition such as the 8th, "Decent Work and Economic Growth", or the 9th, "Industry Innovation and Infrastructure", as we have highlighted the link between energy consumption and our economies. Even the first goal, "No Poverty", is highly linked to the energy transition and to the access to energy, especially electricity, as it was highlighted by a 2017 report published by Oxfam France, "Renewables to Fight Against Poverty"[60].

Figure 1. The UN SGDs relevant for hydrogen

Without electricity, it is impossible to study or work in good conditions by night, or to use computers. The health effects are also worth noting; if hospitals do not have access to a reliable energy source, it would be impossible, for instance, to stock refrigerated vaccines or conduct chirurgical operations by night. This demonstrates the impact the energy transition and ability to access electricity has on the third goal, "good health and well-being". Yet 840 million people or 11% percent of the population worldwide is still unable to

[60] *Des énergies renouvelables pour lutter contre la pauvreté*. Oxfam France, 2017.

access electricity, of which 573 million are living in Africa (South Sudan, Guinea-Bissau and the Central African Republic especially).

These examples illustrate that energy transition is at the core of the UN sustainable development goals and must receive important attention, at the core of which are two energy vectors. First, electricity, which can be used to replace most fossil fuels applications. For example, gas used for heat production or oil for combustion engines can be produced in a completely decarbonized manner using renewables (hydroelectricity, wind, solar) or nuclear. It is therefore an important tool in the advancement of the ecological agenda and the decarbonization of energy sectors. In the case of non-industrialized countries such as those found in Africa, the problem of global warming requires a direct transition to renewables without going through a "fossil fuel" phase as have done OECD economies. Second is hydrogen, which is more and more often evoked as the key, or rather, one of the keys, to the energy transition. We will see that to grasp an acute picture of the place of hydrogen in our future economies it is more accurate to talk about "hydrogens" in the plural form and that it will be indispensable as a "complementary vector" besides electrification but will not be the central tool of carbon neutral economies.

A. Hydrogen: a characterization of the molecule

What Is Hydrogen?

Hydrogen is the first chemical element of the periodic table of Mendeleïev. It is the smallest and most abundant atom in the universe and represents 75% of its mass. When talking about hydrogen in the context of the energy transition, it refers to, in fact, the molecule of dihydrogen (which is composed of two atoms hydrogen). This molecule is very rarely present in a natural state in our environment and is most of the time associated with other elements, for example with oxygen in water (H2O) or carbon in methane (CH4). To be produced, hydrogen (dihydrogen, H2) needs to be separated from other molecules. Additionally, Hydrogen is an energy vector[61], which means that it needs to be produced originally from a source of energy that is naturally available in the environment (such as fossil fuels, or renewables).

How Is Hydrogen Produced?

There exist different ways to produce hydrogen resulting in different "colors" of hydrogen (blue, brown, green, yellow…). Nowadays, almost all pure hydrogen (that is not mixed with other gases) consumed in the world is produced using fossil fuels (71% using natural gas and 27% using coal[62]).

[61] An energy vector is an energy vehicle, which allows to carry energy that is then used for final energy consumption. For example, electricity is an energy vector, produced in electric plant using coal, gas, or uranium and then used in a number of different applications in our economies.

[62] IEA, 2019.

Hydrogen produced using natural gas (methane steam reforming) is called “grey” hydrogen and is categorized as “brown” hydrogen when produced from coal (coal gasification), which is the most carbon intensive. This fossil fuels dependency means that hydrogen production is responsible for 840Mt of carbon dioxide emission annually, equivalent to the CO2 emissions of the UK and Indonesia combined[63]. However, hydrogen production using fossil fuels could be decarbonized using carbon capture and storages (CCS) which consists in capturing the CO2 at the end of the production chain and storing it in deep geological formations. In these cases, we talk about “blue” hydrogen.

THE COLORS OF HYDROGEN	
Brown hydrogen	- Hydrogen produced from coal using gasification - releases both CO2 and carbon monoxide into the atmosphere - Also known as ‘black hydrogen’
Grey hydrogen	- Hydrogen produced from gas through steam methane reforming (SMR) - Releases CO2 in the atmosphere - Currently the most common form of hydrogen production
Blue hydrogen	- Hydrogen produced using fossil fuels (gas or coal) but associated with CCS (carbon capture and sequestration) - Recognized as ‘carbon neutral’
Green hydrogen	- Hydrogen produced from renewable electricity using water electrolysis - Decarbonized hydrogen
Yellow hydrogen	- Hydrogen produced via water electrolysis using electricity coming from the power grid - The “carbon content” of yellow hydrogen depends on the level of carbonization of the grid: if the grid’s electricity is produced solely from fossil fuel plants, the hydrogen will be as carbonized as grey or brown hydrogen; if it a mix of renewables and fossil fuels, it will be less carbonized; etc.
Turquoise hydrogen	- Hydrogen produced from gas through methane pyrolysis

[63] Ibid

	- Produces hydrogen and solid carbon (consequently no carbon dioxide emissions)
Pink hydrogen	- Hydrogen produced via water electrolysis using nuclear produced electricity - Decarbonized hydrogen
White hydrogen	- Hydrogen that is naturally present in the environment

Figure 2. The colors of hydrogen

It is necessary therefore to find alternative ways of producing hydrogen for it to become a tool in the ecological transition. The most important one currently considered and invested in is water electrolysis, which consists in separating hydrogen from oxygen in the water molecules (H2O) using electricity. In 2019, hydrogen produced from water electrolysis represented less than 1% of total production[64]. But using water electrolysis does not induce that hydrogen is decarbonized, as this depends on the source of the electricity's production (as an energy vector, it needs to be produced). Electricity can be produced either from fossil fuels, nuclear (which is referred to as pink hydrogen), or renewables (green hydrogen). Only the latter two are decarbonized. In the first case we talk about yellow hydrogen, which means hydrogen produced with electricity coming from the power grid that can be a mix of fossil fuels-based electricity, renewables based-electricity, or nuclear based-electricity.

A final way of producing hydrogen in a decarbonized manner is methane pyrolysis which "cracks" methane (CH4) to separate hydrogen on one side and solid carbon on the other, therefore avoiding carbon dioxide emissions. The technology is working, and prototypes have been constructed but it remains unsure whether it will experience considerable scale up in the years to come and so far, water electrolysis remains the privileged method for decarbonized hydrogen production. Methane pyrolysis produces "turquoise" hydrogen.

[64] IEA, 2019.

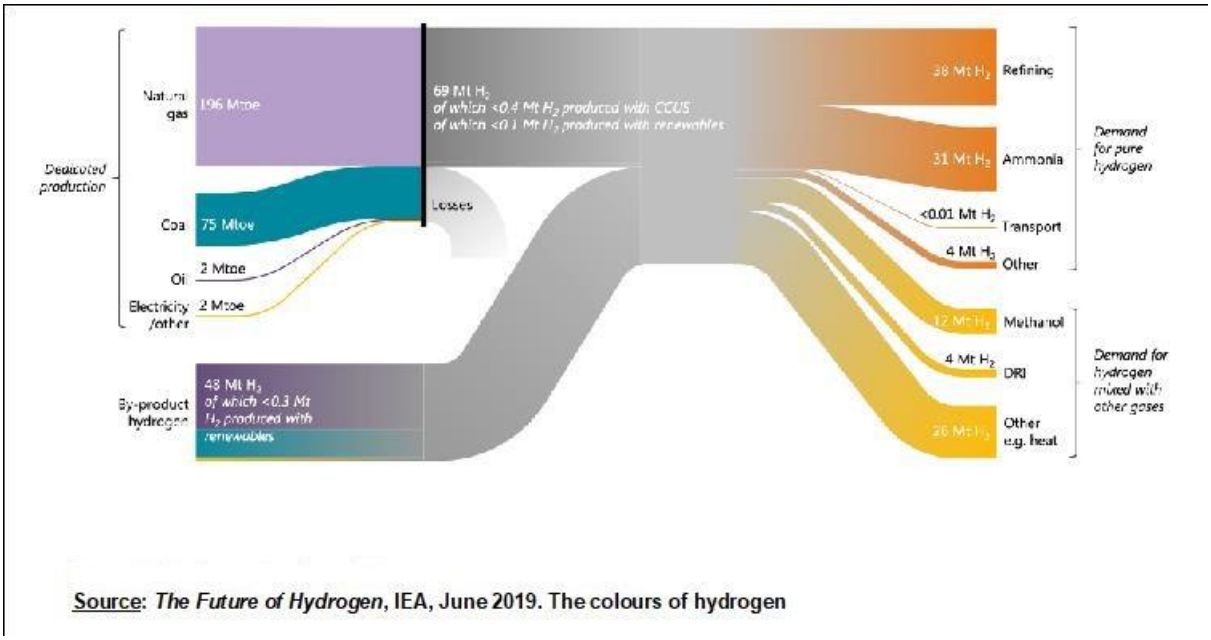


Figure 3. Hydrogen' value chain: production and final use

What Is Hydrogen Used For?

Hydrogen as an energy vector overlaps with electricity on many possible uses that we will elaborate upon. However, hydrogen is currently used most commonly as a reactive for industrial processes, necessary for the production of cement, of ammonia (as fertilizer) and for oil refining. In 2018, global demand of hydrogen amounted to 73,9Mt, 52% of which was used for refining purposes and 43% for ammonia production[65].

However, if hydrogen has become "fashionable" in recent years it is because of its possible uses (even though still marginal for the moment) as an energy vector in the context of the energy transition. In that sense, it has possible concurring uses with electricity. Firstly, as a fuel, hydrogen can be used for many purposes including domestic combustion. Secondly, it can also be used as an electrical fuel for mobility. In addition to battery electric cars, hydrogen can also be considered as a green fuel for mobility. These fuel cell electric vehicles (FCEVs) that convert hydrogen into electricity using a fuel cell have the advantage of a wider range and the capacity to recharge twice as fast compared to a battery-powered vehicle. Thirdly, and perhaps most importantly, hydrogen facilitates power grid integration as it allows to store the surplus of intermittent renewables, thus optimizing and improving the stability of the power grid. To do so, it converts the surpluses of electricity to hydrogen by electrolyzing. Moreover, hydrogen allows sector coupling, meaning the interconnection and integration of energy sectors.

We see that hydrogen could appear as a concurrent to electricity in most sectors. In reality, transitioning through direct electrification will remain the priority whenever possible because of the

[65] IEA.

efficiency limitations of hydrogen (following the principle of additionality which states that electrification should always be conducted first, if possible, because of the great conversion energy losses of hydrogen under the laws of thermodynamics). In fact, the second law of thermodynamics establishes the concept of entropy, which states that every time an energy conversion occurs, losses will occur. As hydrogen requires much more conversions than electricity, its efficiency is logically less important.

That is why hydrogen should rather be considered as a "complementary vector" that perfectly accompanies the intermittence of renewable electricity and provides stability and resilience to the energy sector.

However, hydrogen is also highly relevant and necessary to what we call "hard-to-abate sectors" (meaning sectors where it is difficult to find a way to cut down emissions), or more transparently, "hard-to-electrify" sectors. The 2020 EU Strategy on "Energy System Integration policy" declared that hydrogen should be considered "for end-use applications where direct heating or electrification are not feasible, nor efficient or have higher costs" and the Florence School of Regulation highlights that hydrogen will be a complementary vector where "electrification is either (currently) not technically feasible or not cost-competitive"[66]. It is in those sectors (such as long-distance transport or industrial uses: steelmaking; refineries, ammonia production) that hydrogen will likely prove to be the more "ecologically-fitted" response[67] [68].

A Quantitative Characterization Of Hydrogen: The Current Situation And Future Prospects

As a quantitative recap of the current state of affairs, 120 Mt of hydrogen are produced each year globally with an installed electrolyser capacity of around 200MW in 2021, while fossil fuels account for 95% of production[69]. 75% of hydrogen consumption is used for oil refining, ammonia, and methane synthesis. IRENA estimates in its World Energy Transition Outlook that green hydrogen will have reached about 400 Mt of production annually (49 exajouls) by 2050, which would require a 5TW installed electrolyses capacity (IRENA 2021). To achieve such a number, the agency estimates that by then, the global manufacturing capacity will need to be around 130 to 160GW a year. On the other hand, the Hydrogen council in its 'scaling up' report envisioned 79 EJ of hydrogen production (for a 10 TW renewable capacity).

The hydrogen council, in a report titled: "Hydrogen Decarbonization Pathways: Potential Supply Scenarios", elaborated three theoretical pathways towards a ten-fold build-out of H2 supply by 2050 with decarbonized sources. It established a green only scenario (only using green H2 by 2050), a blue H2 scenario (only using blue H2) and a hybrid scenario (using both). It also established that from 2020 to 2050, achieving the green only scenario would induce the emission of approximately 10 Gt of CO2, 8 of which would come from the progressive phase out from grey H2, while the blue only scenario would induce 20 to 25 Gt of CO2 over the same time period.

[66] *Hydrogen in the energy transition.* Florence School of Regulation, November 18th, 2020.
[67] *No-regret Hydrogen. Charting early steps for hydrogen infrastructure in Europe*. Agora Energiewende, January 2021.
[68] *Hydrogen insights. A perspective on hydrogen investment, market development and cost competitiveness*. Hydrogen Council, February 2021.
[69] IRENA, May 2021

A couple of reports defend a hybrid pathway at the beginning with blue hydrogen being regarded as a medium-term transition tool towards a mature hydrogen economy (Oxford Institute of Energy Studies, March 2021; UK HFCA, February 2021; OPECST, April 2021).

B. Hydrogen economic dynamics

Hydrogen Cost Expectations And The Importance Of Carbon Pricing

A number of reports from NGOs in the past few months have provided prospects on costs expectations for hydrogen in the years to come (Florence School of Regulation, April 2021; The Oxford Institute of Energy Studies, March 2021; UK HFCA, February 2021). The Florence School of Regulation provides the most detailed work with its paper: "A snapshot of Clean hydrogen Costs in 2030 and 2050". It recognizes that 2050's prices are mostly speculative but 2030's prices provide stronger information. By 2030, low carbon hydrogen cost is expected to range from €0.9/kg (for the cheapest solar PVs and electrolysis combination) to €2.8/kg (for the most expansive steam methane reforming using natural gas). As a comparison, conventional hydrogen prices in October 2020 averaged $1.25/kg in the US Gulf Coast versus $2/kg in California (refer to table 2 below).

According to most prospects, blue hydrogen (fossil-based hydrogen using carbon capture) will remain a viable investment up to 2030. Afterwards, green hydrogen will outcompete blue hydrogen almost everywhere, even without carbon pricing (however it is to be noted that without carbon pricing, companies have no incentive to use carbon capture, and therefore no reason to produce blue hydrogen rather than grey or brown). Between renewables, solar-based green hydrogen plants will be the most competitive compared to the slightly more expensive wind-based electrolysis infrastructures. Italy and Spain will have the cheapest solar-based renewable energy in Europe thanks to important solar radiation that provides them with a comparative advantage.

Interestingly, the Hydrogen Council[70] highlights that without carbon pricing, hydrogen will still be competitive in four sectors: buses, trains, trucks, and SUVs. In one-word, long-distance and heavy-duty transport. However, in order to make green hydrogen competitive for ammonia and steel production as well as refinery use, a 100$ carbon price would be required.

The tariffication of carbon is being given more and more importance regarding future hydrogen development prospects in many reports[71]. Research conducted by BNP Paribas Asset Management suggests that for the EU to credibly meet its 2050 Net Zero goal it must impose a carbon tax of between €79 - €103 per ton by 2030. The OPECST (France's Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques). They state however that a price of €250 per ton would be necessary for green and yellow hydrogen (nuclear-based hydrogen) to compete with grey hydrogen, while a price of

[70] *Hydrogen insights.* Hydrogen Council, February 2021.
[71] Hydrogen Council, February 2021 ; Hydrogen Europe, April 2021 ; Energy transitions commissions, April 2021 ; UK HFCA, February 2021 ; OPECST, April 2021

between €100 and €200 would be required to at least incentivize the use of Carbon Capture and Storage (CCS).

Hydrogen: The New Oil?

We hear a lot of about hydrogen as "the new oil", the future global commodity of a decarbonized world, that has the capacity to even reconfigure geopolitical dynamics. Indeed, in the years to come, hydrogen will most probably become an object of trade between countries with abundant RES and those with scarcer ones. Hydrogen can be transported and exported through a backbone of pipelines at regional level, or, at an international level, stored and transported in the form of ammonia (for instance)[72]. Such initiatives are already arising Germany is multiplying memorandum of understandings with countries such as Morocco (in January 2021) or Portugal (in February) for future hydrogen imports. Japan has signed cooperation agreements with Australia or the United Arab Emirates in January. Both Japan and Germany lack sufficient renewables capacity to answer their future domestic needs. Consequently, at first sight, hydrogen can appear as the easy way to replace oil as the new commodity that will ensure every country can match its renewable needs, even without sufficient domestic capacities.

However, careful consideration and observation leads us to believe that for a long time to come, hydrogen exports will not take the magnitude nor the forms of standardized transactions, such as oil or natural gas. Rather than the emergence of a hydrogen market fitting the archetypical economic understanding, long term industry and trade agreements will prevail. The amount of hydrogen that will be traded in a "commodity way" will in the end remain limited[73].

Just as the hydrogen industry does not exist in a unified way, neither does the hydrogen economy, at least not in the sense of the oil or raw materials economy i.e. the so-called commodity economy handled by markets and traders. In the case of hydrogen, there are no global price markets (the cost price but also the use depends on specific and local projects), no physical supply-demand markets (hydrogen at this stage does not travel well on a global scale, except for transforming it into ammonia). On the contrary, productions in silos are developing at the local level, where hydrogen can be a by-product or the subject of a dedicated production. In the latter case, it is often a captive use or pre-empted by certain industries. Overall, there is no foreseeable open market on the 10 to 15 years horizon.

There is no unified technology, not only because the technology is premature (for example, the hydrolysis of water using renewable electricity will not be profitable in comparison to petrochemical hydrogen until 2030, as previously underlined), but because hydrogen is based on several technologies and there are various ways of producing it.

Just as electricity is produced by various processes, from coal, gas or hydroelectricity via wind, solar, nuclear, etc., which constitute many electrical sectors, there are also several hydrogen sectors, and several hydrogen colors.

[72] *Hydrogen insights*. Hydrogen Council, February 2021
[73] Antoine Goutaland and Joël Ruet. *L 'hydrogène, nouvelle commodité, vecteur énergétique 'magique', ou prescripteur de politiques publiques exigeantes ?*. The Bridge Tank, 2021.

Finally, the technology is not unified in the sense that, in each area of the world, hydrogen use depends on pre-existing energy and industrial situations of various types.

The mix of grey, blue or green hydrogen produced by different, sometimes rival players, varies according to past trajectories and the legacy of existing industrial systems. Above all, their uses vary. What is important to clarify here is that the diverse uses of hydrogen are not the same as that of electricity or oil which is supplied to a market. Often, the production and consumption of a form of hydrogen are integrated into the same industrial structure, the same project, without ever passing through a 'market' where different producers and uses would meet!

These situations will remain specific to each area of the world for a long time to come... and to each actor implementing it for his own purposes.

The great adaptability of hydrogen is therefore what makes it impossible to think of a hydrogen economy as a standardized product or 'commodity' in the sense of oil, gas, minerals, or metals.

The absence of a “market” that brings together all the producers and buyers, which is the basis of the concept, can be explained by the various production methods and the multiplicity of its current and potential uses, which are still mainly internal and specific to industrial cycles (steel industry, fertilisers, storage of renewable electricity in the form of hydrogen for future re-injection into the electrical networks such as batteries). This kind of hydrogen is largely produced internally on industrial sites, as a by-product of other processes or dedicated to a customer.

Hydrogen cannot be considered as a singular, standardized commodity but must be comprehended as *hydrogens*, in the plural.

C. Political stakes and public policies around hydrogen

Hydrogen’s Recent Notoriety Isn’t Foreign To Lobbying From *Industrial* Actors

The emergence of hydrogen on the media and public policy scene has been facilitated and enabled by a few major reports orchestrated and commissioned by various groups since 2017.

First, by reports from hydrogen interest associations. In particular, The Hydrogen Council is an international association promoting the development of hydrogen interests. The association is formed by many industrialists and organizes training courses on the subject. It has published six reports so far.

The reports have moved progressively from promoting the potential uses of hydrogen, to reporting on the state of play of world production and cost projections. These projections should be seen as signals to stimulate interest in the hydrogen industries. The multiplication of these signals must be seen as the crystallization of the interests of certain financial curators, public decision-makers and industrialists for the molecule. On the other hand, there is no visible and organized sectoral coordination around common instruments.

The Hydrogen Council's reports are therefore particularly well documented lobbying tools.

Regional associations have also emerged to bring together the industry. H2 Europe is the European association that relays the Hydrogen Council reports. It has also produced reports dedicated to the European industry. H2 Europe has been instrumental in putting the hydrogen plan on the EU agenda in the context of the establishment of the German Presidency of the European Council in the summer of 2020. Prior to this, the association had lobbied the European Commission to prepare the EU strategy.

National hydrogen associations play a similar role. In France, Afhypac brings together major industrialists and mid-sized companies. It publishes a monthly newsletter on hydrogen developments in France. Other historical examples exist (SINTEF in Finland), and new associations are being created to federate roadmaps proposed to governments (e.g. the UK).

All in all, Europe is in a balanced position between areas where the development of hydrogen is driven by the state (Asia) and countries where the industry has long had an ineffective lobbying practice (FCHEA in the US, which was not listened to by either Trump or Obama).

Ultimately, hydrogen seems to have finally gained real traction and to have imposed itself as a necessary tool for the energy and ecological transition. After several failed waves of optimism over the last few decades, the multiplication of national hydrogen strategies by governments in Europe and around the world, as well as the amount of funding granted to it (a €1.8 billion envelope in France for the period 2020-2023, €8 billion in investments in 62 projects by Germany announced in May) demonstrate that hydrogen should finally impose itself within our energy ecosystems.

Hydrogen National Strategies Are Multiplying

For most countries, hydrogen has now become a decisive part of their national strategy to carry through the decarbonization of their economy.

In July 2020, the EU officially recognized the importance of hydrogen by publishing its hydrogen strategy: “A hydrogen strategy for a climate-neutral Europe”[74]. Since then, NGOs’ hydrogen reports and national hydrogen strategies have multiplied. For instance, since summer 2020, France, Norway, Spain, Canada, Chile and Germany have each published their own national hydrogen strategy, while others had already been published earlier in the year and many remain in preparation (Colombia announced it will present its roadmap in the first half of 2021).

[74] Antoine Goutaland and Joël Ruet. *Analysis of the EU H2 strategy, of the EU energy integration strategy and of the clean hydrogen alliance launch*. The Bridge Tank, July 2020.

In the EU's footsteps, many member States governments followed suit and published their own national hydrogen strategy shortly before or after, and others are preparing to do so. In 2020 alone six strategies were published: those of the Netherlands, Portugal, Germany, Norway, France, and Spain.

Among the common traits of the different national strategies is an installed electrolysis capacity objective for 2030. Such a target has been inscribed in almost all national strategies, European's as well as non-European ones. These targets range from 2GW for Portugal in 2030 to as much as 25 GW for Chile, whose national strategy positions as a future world leader in green hydrogen production thanks to a considerable renewable energy generation potential.

In the long term (with a deadline between 2030 and 2050), green hydrogen (hydrogen produced from a renewable source of energy) is the main, if not the only, mode of hydrogen production considered by the different governments. However, some countries (the UK, Scotland, the Netherlands, Canada) include blue hydrogen (hydrogen production from fossil fuels with carbon sequestration) as an intermediary medium-term solution to transition to a hydrogen economy and scale-up production. France is in a unique position with the importance of nuclear production in its electricity mix (70% of the country's electricity production in 2019) which might prove to be a real comparative advantage in the race to low-carbon hydrogen production leadership. If nuclear is not explicitly mentioned in the French strategy, the "hydrogen opportunity", if we can call it so, might actually relaunch the nuclear industry in France which seemed to slowly direct itself towards its dismantling.

Finally, in the short term, hydrogen production is mostly considered for industrial use (refineries, steel, ammonia) and long-distance transport by the governments 'national strategies; in one word, in hard-to-abate sectors.

European investment in green hydrogen appears logical considering both its environmental commitments (reaching net zero by 2050, which is now a juridical constraint following the adoption of the European climate law in June 2021) as well as its historical use of hydrogen, notably in ammonia production and in the steel industry. Since 2020, investments have ramped up. The Netherlands, Spain and Portugal have been pioneers with investments in electrolysis capacity coupled with new renewable energy generation. Alongside its hydrogen strategy, the EU launched a European Hydrogen Alliance, on the model of the European Battery Alliance, as well as a European strategy for energy system integrations, which plans for a convergence of the electrical and gas sectors, notably of their backbone, which will experience increasing integration thanks to hydrogen.

These strategies are accompanied by visions for the design of "hydrogen valleys", a concept based on projects of gas pipelines dedicated to hydrogen transport, linking the Netherlands to Northern Italy on the one hand, and Spain through France on the other. For the moment, these valleys are mainly concepts that give coherence to research and development investments carried out on a territorial scale.

If China hasn't published an official hydrogen strategy per say so far, the leading Asian economy is still investing heavily into hydrogen and perceives it as an essential part of its energy transition, as it aims to reach carbon neutrality by 2060 following President Xi Jinping's engagement. Hydrogen is seen as one of the six industries of the future in the CPC's 14th Five-Year Plan (2021-2025) while 16 provinces and cities have launched their own five-year plans involving hydrogen development. If China mostly puts forward hydrogen for light mobility uses, it is, in reality, investing in all possible usages of the hydrogen economy

and notably hopes to valorize its enormous renewable (wind and solar) capacities using hydrogen conversion.

The United States, who seemed to be lagging behind under the Trump and Obama administrations finally seems willing to catch up and is investing massively in hydrogen ecosystems. If their approach is hardly integrated so far (with different vision for hydrogen development between federal states), President Biden has undeniably shown willingness to promote the molecule and recently disclosed the Hydrogen Energy Earthshot.

Japan and Australia are also building a partnership based on hydrogen. On December 26, 2017, Japan was one of the first governments to publish its National Hydrogen Strategy (Basic Hydrogen Strategy), which was updated in 2019. Japan also plans to import hydrogen for its economy on a massive scale through maritime transport. Australia is a privileged partner in this regard. In 2019, Australia announced significant investments in hydrogen production and commercial partnerships with Japan. Numerous demonstrator projects are being conducted by the national research agency. Through its liquefaction strategy (to export hydrogen), Australia is supporting its coal sector by finding an outlet for it. Coupled with CO2 storage using various tools, Australia hopes to develop a low-carbon blue hydrogen industry that it can use as part of its climate ambitions.

Finally, it is to be noted that emerging powers and especially Middle Eastern North African (MENA) countries are not ready to be left behind in this emerging economy and are pushing investments to establish and strengthen their position in the future hydrogen ecosystems. Saudi Arabia hopes to become a green hydrogen exporter and is developing FCEVs manufacturing lines and GW electrolyzers plants in the country. Morocco which detains considerable renewable resources is also emerging as a potential major player and has signed bilateral cooperation agreements regarding hydrogen with Germany and Portugal (in February). The United Arab Emirates (UAE) has also made progress in this area: since the beginning of the year, it has inaugurated the first solar-based hydrogen facility in the region, signed a MOU with Japan for the development of an international hydrogen supply chain and three major state-owned enterprises (SOEs) signed an MOU eager to turn the emirate into a substantial green hydrogen economy and an exporter of blue and green hydrogen[75].

We see that governments' implication is gradually taking importance and great amounts of investments have been made in the development of hydrogen ecosystems all over the world. Governmentally driven national hydrogen strategies are indispensable since they communicate clear messages to private players that hydrogen will have long-term importance and they give clarity to the phases of its scale up. Nevertheless, it will be the response of industrial players to those public policies and investments that shape the future of hydrogen ecosystems. Government commitments are therefore insufficient and industrial player's own interests, perspective and needs must be apprehended.

Hydrogen: A Diplomatic Tool

[75] For more details, turn to the Bridge Tank's monthlies hydrogen highlights.

Hydrogen's main contribution to greenhouse gas reduction is likely to be diplomatic for the time being. In the summer of 2020, hydrogen has become an effective tool for rallying around climate goals.

It has been a positive element in the dialogue between the German Presidency and various EU blocs. In fact, the German Presidency was able to rally Eastern European countries, in particular Poland and the Czech Republic, to negotiation the reform of the ETS market (European Trading Scheme, the European carbon market) by obtaining their support for the Commission's strategy. This enabled them to break out of the tug-of-war with Brussels between climate commitments and the defense of the public expression of sexual minorities and reproductive rights of the other.

The German government was able to get itself out of a conflictual situation with southern European countries, irritated by the lack of European solidarity when the COVID crisis erupted in Italy.

In the spring, a confrontation occurred between the southern countries and France on one side, and the Netherlands and the Scandinavians on the other, concerning the mutualization of debts linked to health expenditure. It was through the European Commission's hydrogen strategy that Brussels and Berlin have managed to reopen positive dialogues around substantial and promising industrial investments. Portugal and Italy have a particular need for renewable gases such as hydrogen to ensure their decarbonization and Spain has also shown enthusiasm for investment.

Conclusion: Public polices to match hydrogen ecosystems for industry uses

Will We Have Sufficient Renewable Energy?

As we have seen, the production of green hydrogen through water electrolysis represents less than 1% of total current hydrogen production. Hence a massive scale up will be required in order to first, fully decarbonize current hydrogen production, and second, expand hydrogen to new uses and sectors (mobility, hard to abate sectors). Such a scale up will be a challenge as it requires both a considerable increase of electrolyzers manufacturing capacities globally as well as an even more important increase of renewable (or nuclear) production capacities in order to match the rising demand for electricity (stemming from the further electrification of our economies and from water electrolysis requirements to produce hydrogen).

It is to be noted however that it remains far from obvious whether countries will have sufficient renewable capacities to match this massive increase in electricity demand. Serious analysis and well documented research will have to be carried out in order to ensure that electricity demand will not exceed renewable production capacity, which is not, contrarily to some beliefs, unlimited. For example, the Florence School of Regulation tried to determine in a recent publication if the EU has (or more accurately will have) sufficient renewable production capacities to meet all the EU's decarbonizations objectives[76]. It concludes that renewable electricity will be a scarce and precious resource in the EU by 2050 (compared to the demand

[76] Ronnie Belmans & al. *Electrification and sustainable fuels: Competing for wind and sun*. Florence School of Regulation, May 2021.

for it) that needs to be used with care. In the case of hydrogen, it states that if "there is strong GHG value in substituting grey hydrogen demand used as feedstock by 2030", nonetheless, "using precious renewable electricity over the next decade to do so when the hydrogen can be very largely decarbonized using SMR/CCS appears illogical". The FSR therefore takes a strong stance against using renewable electricity for hydrogen production (through water electrolysis) on the basis of renewable electricity's scarcity in the years to come.

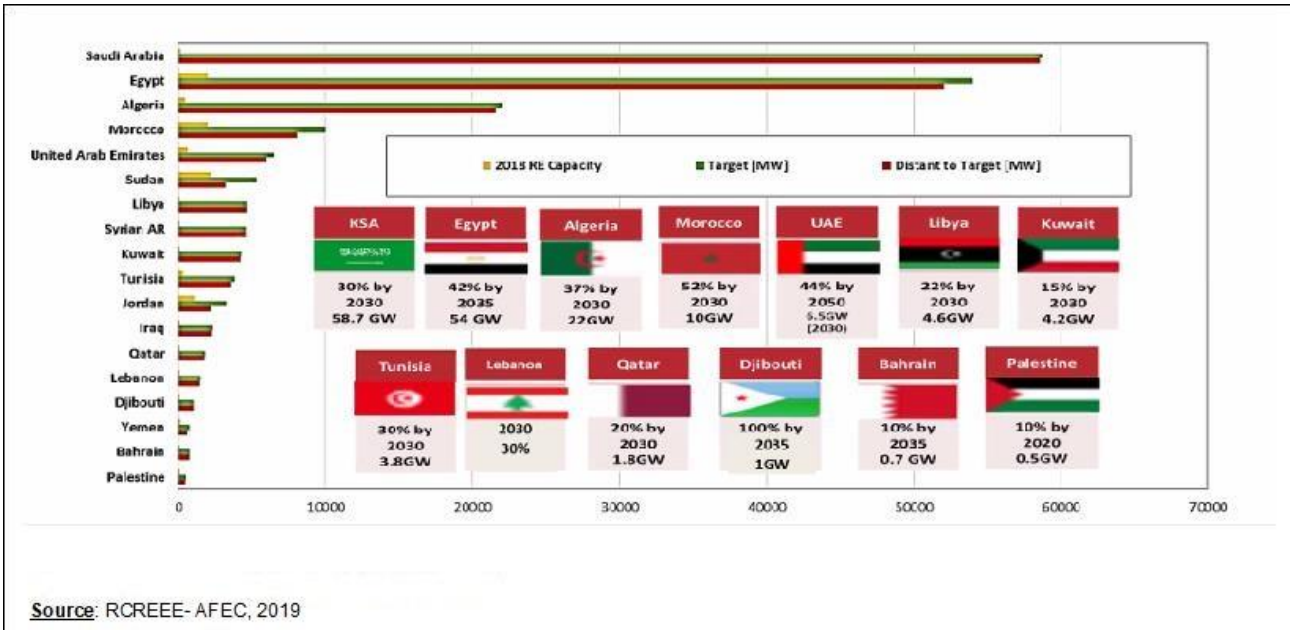
Such a strong challenge to the current political narrative, which has almost only been focusing on water electrolysis and multiplying electrolyzers capacity objectives announcements, probably needs to be well understood and taken into account. The results of the FSR might encourage a reconsideration of the place of blue hydrogen in the transition, which has so far been considered at the most as a medium-term transitioning tool by EU countries and parliament. The place of nuclear (pink hydrogen), which has considerable, pilotable, decarbonized electricity production capacities, might also require reconsideration.

The Problematic Of Clean Water Supply For Hydrogen Production In Water Stressed Countries

In MENA countries especially, there is a need for adaptation and mitigation. In these cases, hydrogen, as we have shown, would be very useful. However, these countries also face a scarcity of water resources, the MENA region being one of the most water stressed of the world. At least 13 of the region countries suffer 'absolute' water scarcity and it is predicted that amongst the top 33 water-stressed countries in the world by 2040, 16 of them will be MENA countries. Hydrogen however requires considerable amounts of water to be produce in a decarbonized manner through water electrolysis. Therefore, while these countries often have considerable renewable potential, the counterpart for hydrogen production, water, might be insufficient. Every kilogram of hydrogen produced requires 9 kilograms of very high-quality water, that cannot be salinized. In some countries like Saudi Arabia, the government therefore plans to desalinize water beforehand, which will require an even higher amount of energy.

It is however telling to compare the water needs of different imported goods in order to grasp an idea of scale. For potatoes, 240 to 400 liter of water per kg are required, for rice it is 2600 to 3400, for beef 15000, and for hydrogen electrolysis, only 9 to 10 liter of water per kg of hydrogen produced. Here we see that despite concerns in water stressed countries. Moreover, water desalination might not prove to be a bad idea, indeed its cost represents less than 2% of total hydrogen production costs (it will cost between 0.6 to 1.6€m3 in 2030[77]). It is however very energy intensive, but desalinization can also profit to local communities for irrigation purposes for instance. In the end, MENA countries will have access if they dispose sufficient available water resources to carry out the development of a hydrogen ecosystem and of large-scale production (to achieve exports long term).

[77] International Ptx hub Berlin, 2021.



Source: RCREEE- AFEC, 2019

Figure 4. Renewable energy targets in the Arab region

Chapter 4 :
Sustainable Blue Economy in coastal territories

The Bridge Tank
Palais Brongniart
28 Place de la Bourse
75002 Paris
https://thebridgetank.org/

CHAPTER 4: SUSTAINABLE BLUE ECONOMY IN COASTAL TERRITORIES

Introduction

As the green economy concept gained prominence before Rio+20, UNEP proposed to apply this concept to the ocean economy. This 2012 Rio+20 conference was the first to raise the notion of a 'Blue Economy', a concept that has emerged as a new paradigm for the sustainable development of oceans and seas (Sustainable Development Goal 14) and particularly for the economic growth of coastal countries, including Small Island Developing States (SIDS).

Blue economy can be defined as a sustainable ocean economy, where economic development is in balance with the long-term capacity of ocean ecosystems to support this activity whilst remaining resilient and healthy.[78] However, the definition of this recent term is still under discussion, hence the vague understanding of blue economy today. For example, the definition from UNFCC describes blue economy as pertaining to "all economic activity relating to oceans, seas and coasts, from fishing to renewable marine energy to coastal tourism". These activities place the ocean at the heart of our global economy, providing a livelihood for over 820 million people around the world. The value of ocean-related assets is estimated at more than 2,5 trillion dollars, making the blue economy the seventh economic power in the world by GDP, behind France and the UK, but ahead of Italy and Brazil.

For the purpose of this report, Blue Economy encompasses all sectoral and cross-sectoral economic activities based on or related to the oceans, seas and coasts:

- Marine-based activities: this includes activities undertaken in the ocean, sea and coastal areas, such as marine living resources (capture fisheries and aquaculture), marine minerals, marine renewable energy, desalination, maritime transport and coastal tourism.
- Marine-related activities: activities which use products and/or produce products and services from the ocean or marine-based activities like seafood processing, biotechnology, shipbuilding and repair, port activities, technology and equipment, digital services, etc.

Sustainably developing ocean spaces for economic growth while maintaining ocean health could define a new era of economic opportunity for ocean-facing countries. According to OECD (2016), many ocean-based industries have the potential to outperform the growth of the global economy as a whole, thereby boosting employment. Over the next fifteen years through 2030, the ocean economy could more than double its economic contribution to GDP equivalent. But at what cost, and to whom?

Blue economy from A COP26 Perspective

[78] Economist Intelligence Unit - World Ocean Summit 2015. (2015). The blue economy Growth, opportunity and a sustainable ocean economy. https://perspectives.eiu.com/sites/default/files/images/Blue%20Economy_briefing%20paper_WOS2015.pdf

Blue economy is at the heart of the current global issues in the perspective of the COP26, as expressed in the Goal 14 of the United Nations SDG: “conserving and sustainably using the oceans, seas and marine resources for sustainable development”. This SDG points out several challenges linked to Blue Economy, from marine pollution to ocean acidification, overfishing or sea level rise.

The Sustainable Development Goal 14 can be summarized in five guidelines:

- To prevent and significantly reduce marine pollution of all kinds by 2025;
- To sustainably manage and protect marine and coastal ecosystems by 2020, including restoration, to achieve healthy and productive oceans;
- To effectively regulate harvesting of fish stocks and end overfishing, illegal, unreported and unregulated fishing by 2020 (including prohibiting subsidies that contribute to overfishing), to restore fish stocks in the shortest time feasible to levels that can produce the maximum sustainable yield;
- To conserve at least 10% of coastal and marine areas by 2020;
- To increase to economic benefits to SIDS from sustainable use of ocean resources by 2030.

These objectives provide different milestones, but the COP26 could be the opportunity to set new concrete measures and to make real progress on these subjects. In the context of preparations for COP26 in Glasgow this year, the UNFCCC summarized as follows some of the concerns and challenges faced by the global community to reverse the ongoing decline in the ocean’s health:

- Due to excess CO2 emissions, the ocean is acidifying at the fastest rate in the history of the planet.
- The ocean is increasingly experiencing deoxygenation, changes to circulation of currents, dramatic melting of sea ice, marine life moving away from the tropics, and through warming of sea surface temperatures, increased frequency and intensity of tropical cyclones, and rising sea levels.
- Many human activities on and in the ocean have a direct effect on Climate Change, for example bunker-fueled propulsion of global shipping fleets, the use of destructive fishing gear, as well as emerging seabed mining techniques.
- Better safeguarding of the ocean’s health calls for greater efforts to minimize the negative effects of land-based human activities, in particular through “source-to-sea” discharges and emissions.
- The window of opportunity to limit global warming to 1.5°C will not be open for much longer and adequate finance will be required to keep it open.
- Nature-based solutions are a critical element in building the resilience of ecosystems, societies, and economies to respond to Climate Change, estimated as having the capacity to provide a third of our mitigation needs. Since financing for Nature-based solutions remains comparatively low, it’s urgent to change the paradigm by accounting the value of blue natural assets, identifying investment needs, and providing the necessary incentives, investment mechanisms and finance.

Bringing ocean issues to the center of COP26 deliberations would create much greater impetus for countries to include ocean-related measures in their climate strategies, including in their Nationally Determined Contributions (NDC), National Adaptation Plans, Adaptation Communications and National Policy Frameworks. While ocean and coastal ecosystems (mangroves, seagrasses and salt marshes) are serving as the planet's largest carbon sink, they have been too infrequently mentioned in NDC targets. There are many opportunities for countries to upgrade their NDCs, such as by protection and restoration of blue carbon ecosystems through "Climate-smart" marine protected areas, greening of shipping, decarbonizing fisheries, and committing to offshore renewable energy. An outcome of COP26 should include clear encouragement to Parties to include ocean-based Climate action in their Climate strategies, and the global stock take taking place after COP26 as part of the second ambition cycle of the Paris Agreement, could very usefully serve to identify ocean-related gaps and opportunities.

Framing The Indo-Pacific Region

Blue Economy is a global concern which doesn't have frontiers. However, it does have a particular interest for the Indo-pacific region. The Indo-pacific is a multi-polar region that contributes more than half of the world's GDP and population and includes countries falling in the direct catchment of the vast Indian and Pacific oceans. The ocean is the common thread that connects this vast Indo-pacific region. The prime focus of the Indo-pacific is, therefore, centered around the ocean. The Indo-pacific ecosystems and natural resources form a unique asset for the region's countries and territories, so understanding and measuring the economic activity tied to this asset is essential for sustainably growing its affected economies. To unlock the economic potential of Indo-pacific region, a number of countries are investing enormous financial, technological and human capital to develop maritime economies and are striving to leverage their unique strength. That's why this region is a perfect example illustrating the needed transition toward Blue Economy.

A. Reconciling an Intensifying Ocean Economy and Human-Driven Changes in Ecological Systems

With the growing population in the Indo-pacific and the rest of the world, demand for seafood and therefore aquaculture production will increase, shipping traffic and tourism will continue to grow, and new ocean industries will emerge. Even though their potential for economic advancement is significant, at the same time, the ecological processes of the sea are changing significantly due to human activities (overfishing, climate-change included ocean acidification, poorly planned coastal development, land-based sources of pollution such as plastic entering the sea and untreated effluent). How to reconcile then these two tendencies?

Our global ocean covers more than 72% of the earth's surface and is responsible for providing food, jobs, and recreation for a large portion of the world's population. The ocean also connects cities and countries around the world, driving economic activity and trade for the 38% growing of the global population that lives within 100 kilometers of the sea, which is also expected to grow in the future decades. The ocean may also be a new economic frontier, driven by a growing population in search of new sources of growth and rapid technological advances that make new resources accessible.[7980]

The ocean has become a significant driver of global GDP: it represents 8% of global trade, provides 32% of hydrocarbons extracted for energy needs, enables tourism for almost 200 countries and overseas territories, and contributes to 3% of global added value. Submarine cables cross the ocean's floor carry 90% of the electronic traffic on which communications rely. Seaborne trade is expected to continue to grow at annual rates of at least 3% uup to 2030, and global tourism at a rate of almost 4% annually to 2025 (OECD, 2016). For example, China's ocean economy alone contributed 962 billion dollars, or 10% of GDP, in 2014, employing 9 million people. Estimates for Indonesia are a sizeable 20% of GDP, a similar ratio to other low-middle-income countries with large ocean territories.

The contribution of the ocean economy to global GDP has rarely been measured, though a number of recent estimates have been made, generally on the order of some 1.5 to 3 trillion dollars annually, or roughly 3 to 5% (Global Ocean Commission 2014a; Hoegh-Guldberg et al. 2015.[81] For small island developing states (SIDS) in particular, the ocean economy and national economy are often indistinguishable. The share of the maritime economy in coastal territories is difficult to calculate and probably undervalued, because of non-market activities that contribute to development, such as carbon sequestration, coastal protection, waste disposal, and the existence of biodiversity. Measures of the ocean economy without such natural stocks and their flows of services will always be incomplete (OECD 2016).

The outbreak of the COVID-19 pandemic represented a major shock for the global economy, with severe socio-economic consequences. However, it is expected that different sectors in the Blue Economy will be differently impacted, with unequal paths to recovery. For example, the impact of the crisis on marine living resources or port activities was significant, but the recovery path is expected to be prompter than in other established sectors such as coastal tourism, which was heavily impacted. Concerning emerging sectors such as ocean energy, desalinization or maritime defense, the impact of COVID-19 has been generally small, with few long-term consequences expected.

[79] OECD. (2016). Development Co-operation Report 2016 : The Sustainable Development Goals as Business Opportunities. https://www.oecd.org/dac/DCR%202016%20Highlights%20booklet%20FINAL.pdf
[80] Economist Intelligence Unit - World Ocean Summit 2015. (2015). The blue economy Growth, opportunity and a sustainable ocean economy. https://perspectives.eiu.com/sites/default/files/images/Blue%20Economy_briefing%20paper_WOS2015.pdf
[81] WWF. (2015). Reviving the ocean economy. https://wwfintcampaigns.s3.amazonaws.com/ocean/media/RevivingOceanEconomy-REPORT-lowres.pdf

Table 2.1 Assessment of the impact of the COVID-19 economic crisis on the Blue Economy

Sector	Size	Impact 2020	Recovery path
Established sectors			
Marine living resources	Medium	Strong	Prompt
Marine non-living resources	Small	Strong	Prompt
Marine renewable energy	Nascent	Medium	Prompt
Port activities	Medium	Strong	Prompt
Shipbuilding and repair	Small	Strong	Lagged
Maritime transport	Medium	Strong	Prompt
Coastal tourism	Very large	Strong	Very lagged
Emerging sectors			
Blue bioeconomy	Small	Strong	Prompt
Ocean energy	Nascent	Small	Prompt
Desalination	Nascent	Small	Prompt
Maritime defence	Small	Small	Prompt
Cables	Nascent	Small	Prompt
Research and Education	Nascent	Small	Prompt
Marine observation	Nascent	Small	Prompt

Source: Commission Services.

Figure 1.Assessment of the impact of COVID-19 economic crisis on the Blue Economy

A New Industrialization of the Ocean

Ocean-related economic activity, traditionally focused on shipping, tourism, fishing, and off-shore oil and gas, is set to shift dramatically in the coming decades, according to the Organisation for Economic Co-operation and Development (OECD). Emerging industries will include off-shore wind, tidal and wave energy; oil and gas exploration and production from previously inaccessible waters; off-shore aquaculture; seabed mining; cruise tourism; and marine biotechnology, among others. The potential benefits from the development of these activities are considerable. They could help address many of the key challenges facing the population in coming decades, from food insecurity to the search for new sources of energy and jobs (OECD 2016).

A new wave of “industrialization” of the ocean and coasts is under way, the scale of which is only now becoming apparent. Trends point to accelerating economic activity in and around the ocean, against the backdrop of a soaring global population, growing affluence and consumption, and the need for new sources of food, energy and minerals. By 2030 two out of every three fish on our plates will have been farmed, much of it at sea. Offshore wind capacity is forecast to rise almost tenfold by 2030, and seaborne trade is expected to quadruple by 2050. On land, the ocean-related economy will experience a surge in investment in coastal infrastructure, industry and tourism as the global migration to cities and coasts deepens.

Globally in the coming decades, every sector of the ocean economy is likely to be affected by technological advances such as innovations in advanced materials, subsea engineering and technology, sensors and imaging, satellite technologies, computerization and big data analytics, autonomous systems, biotechnology, and nanotechnology. The OECD modeled the development of the ocean economy to 2030, projecting many ocean-based industries to outperform the growth of the global economy—indeed doubling its contribution to global value added from 2010. In particular, the OECD projects strong growth

rates in shipping and transport, port services, marine aquaculture, off-shore wind, and ocean-based tourism, among others. Marine renewable energy, marine biotechnology, and carbon capture and storage are also considered to have significant potential, though unlikely to be realized by 2030 (OECD 2016).

Ocean Economy in the Indo-Pacific Region

The Indo-Pacific region shares 44% of world surface area and 65% of world population, contributes 62% of world GDP and 46% of world merchandise trade. The Indian Ocean is almost 20% of the world's ocean area, touching the shores of 36 countries and connecting three continents (Africa, Asia and Australia), with a total coastline area of 66,526 km, or 40% of the global coastline.

The fishing weigh is important in the Indo-pacific, especially in the Bay of Bengal (10% of the world production / 6.5 million tons). It started with a significant growth in the mid-1980s in Indonesia, Myanmar and Indian, and continues to increase. Moreover, marine aquaculture remains insignificant compared to continental aquaculture. Overall, capture fisheries are an estimated five times larger than aquaculture production.

Taxonomy of Blue Economic Sectors and Activities

Sector	Activity
Fishing	Catches, aquaculture, and seafood processing
Marine Biotechnology	Pharmaceutical products, chemicals, algae harvesting, algae products, bio-products by the sea.
Minerals	Oil & gas, deep water mining (rare earth metal exploration, hydrocarbons.
Marine Renewable Energy	Offshore wind energy production, wave energy production, tidal energy production.
Marine manufactures	Boat Manufacturing, Sail Manufacturing, net Manufacturing, Ship & Ship Repair, Marine Instrumentation, Aquaculture Technology, Water Construction, Marine Industrial Engineering.
Shipping, Port & Maritime Logistic	Shipbuilding and repairing, ship owners and operators, shipping agents and brokers, ship management, liner and port agents, port companies, ship suppliers, container transportation services, stevedores, roll-on roll-off operators, custom clearance, cargo forwarders, safety and grooming.
Marine Tourism & Leisure	Sea fishing from boats, see angling from the shore, sailing at sea, boating at sea, water skiing, jet skiing, surfing, sail boarding, sea kayaking, scuba diving, swimming in the sea, bird watching in coastal areas, whale/dolphin watching, visiting coastal natural reserves, trips to the beach, seaside and islands.
Marine Construction	Shipbuilding and maritime engineering.
Marine Commerce	Marine Financial Services, Marine Legal Services, Marine Insurance, Marine Finance and Related Services, Charters, Media and Publication.
Marine ICT	Marine engineering consultancy, meteorological consultancy, environmental consultancy, hydro-survey consultancy, project management consultancy, ICT solutions, Geo-informatics services, yacht design, submarine telecom.
Education & Research	Education and training, R&D

Figure 3. Resources from the Indo-pacific Ocean Economy

The extraordinary burst of economic and industrial activity that began in the second half of the 20th century has led to unprecedented changes in ocean ecosystems, and to a shocking plunge in ocean health.

With the expected growth of the ocean economy in the coming decades, the potential change to its natural capital asset base may be significant and affect human well-being. In 2016 the UN Secretary General wrote: "the oceans' carrying capacity is near or at its limit" and that "urgent action on a global scale is needed to protect the world's oceans from the many pressures they face". (United Nations, 2016). 4 anthropogenic drivers of change in the natural capital: overfishing (29% of species), coastal development (filling wetlands or hardening coast- lines for construction, alter ecosystems), pollution (excess nutrient from agriculture, volume of plastic in the ocean exceed the volume of fish by 2050), climate change and ocean acidification.

Lately, these worrying trends have led to increased efforts and investments in policy reforms. World Bank has increased its active investment portfolio in projects directly or indirectly aiming to increase the ocean's natural capital to some 6,4 billion dollars by 2015 with support for sustainable fisheries and aquaculture increasing from zero in 2004 to almost 1 billion dollars by 2015.

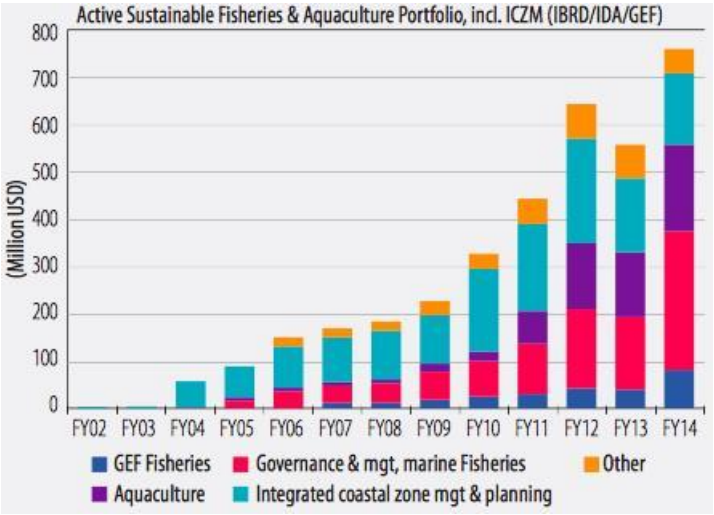


Figure 4. Growth in the World Bank's Portfolio of Investments in the Ocean

The ocean – covering 71% of the Earth's surface – plays a fundamental role in regulating global temperatures. Not only does the ocean absorb 93% of the additional heat from rising anthropogenic carbon dioxide (CO2) emissions, but it also absorbs approximately 25 to 30% of anthropogenic CO2 emissions that would otherwise remain in the atmosphere and increase global warming. The ocean also produces around 50% of the oxygen on the planet through the photosynthetic activity of marine plants and algae. However, the ocean and its organisms, habitats, ecosystems, resources, and the key services it provides are under heightened pressure from multiple threats. First on the list are climate change-driven stressors, which are

exacerbated by other human-induced pressure such as pollution, eutrophication, habitat destruction and unsustainable use of aquatic living resources.

The most recent Intergovernmental Panel on Climate Change (IPCC) report, the Special Report on the Ocean and Cryosphere in a Changing Climate[82], highlights the dire impacts on the ocean that are already underway (including ocean warming, acidification and deoxygenation) and provides a sense of even greater urgency to reduce greenhouse gas (GHG) emissions. A 100–150% rise in ocean acidity is projected by 2100, affecting half of all marine life.

The impacts of climate change on the ocean are also putting at risk 40% of the world's population who live in coastal areas and/or rely on the ocean for their livelihood and food security. These communities are already bearing the consequences of rising sea levels, eroding coastlines, more frequent and more severe extreme weather events, increased salinization of inland areas, as well as changing environmental conditions that affect the fishery resources. This is particularly true in developing countries where coastal communities are the most vulnerable to climate change.

Ocean-based mitigation and adaptation options do not feature as prominently as they could in NDCs or long-term low-GHG emission development strategies under the Paris Agreement. The growing scientific understanding from ocean research, observations and modeling needs to play a central role in the formulation of global emission reduction targets.

Recommended Actions

At the same time, commercial and technological developments are drawing more attention to the ocean and its resources as solutions to combat climate change. The ocean is increasingly vital to securing sustainable and reliable access to climate-resilient, low-carbon food, energy and transportation for a growing world population.

There is a series of key enablers for scaling up ocean-based climate solutions including:

- Wide-ranging political and societal recognition of the vital role the ocean plays in both climate
- Regulation, adaptation and mitigation;
- A subsequently sustainable and equitable well-managed ocean, aligned with climate goals and biodiversity targets, to provide the necessary space, regulatory frameworks and predictability for sustainable ocean activities;
- Increased public and private investments, including blended finance mechanisms in particular, to support developing countries to build strong sustainable blue economy strategies and adapt to climate change.
- At the same time, adaptation measures need to be identified and implemented urgently in coastal areas, as they are at the forefront of changing ocean conditions.

[82] Special Report on the Ocean and Cryosphere in a Changing Climate. (s. d.). Special Report on the Ocean and Cryosphere in a Changing Climate. https://www.ipcc.ch/srocc/

In order to achieve this system transformation for the ocean and coastal zones, the following change levers must be activated:

1) Nature-Based Solutions (NBS)

Nature-Based Solutions provided by coastal ecosystems (such as mangroves, tidal marshes, coral reefs, sand dunes, seagrass beds and seaweed) hold great potential for mitigation and adaptation to climate change. According to a 2019 High Level Panel for a Sustainable Ocean Economy report[83] protecting and restoring three coastal blue carbon ecosystems (seagrass, tidal marshes and mangroves) globally, alongside seaweed farming, could reduce emissions by as much as 1.4 billion tons of carbon dioxide equivalent annually by 2050. Coastal ecosystems in their entirety are also critical "natural infrastructure" for climate change adaptation and resilience. Restored ocean and riparian ecosystems can help mitigate the impact of storms and sea-level rise, thus saving lives and livelihoods, and would reduce the economic costs of damage and recovery.

National governments should aim to include more NBS and especially coastal blue carbon ecosystems in NDCs for both their mitigation and adaptation components in order to achieve policy recognition, and most importantly, pave the way for action and broad-scale finance mobilization. Governments can contribute to the restoration of marine ecosystems by effectively implementing climate-smart MPAs and conducting processes such as MSP and integrated coastal zone management.

As shown in the IPCC Special Report on the Ocean and the Cryosphere in a Changing Climate, concrete evidence-based targets are needed, particularly in nations holding a large percentage of the world's coastal blue carbon ecosystems. International initiatives such as the United Nations Decade on Ecosystem Restoration (2021–2030) and the United Nations Decade on Ocean Science for Sustainable Development (2021–2030) can help to provide data and information on required actions by each type of actor and how they can be implemented. The inclusion of local communities, the equal participation of all genders, as well as the incorporation of indigenous and traditional knowledge are essential to achieve the effective implementation of sustainable nature-based approaches to conservation, protection and restoration of coastal and marine ecosystems.

2) Aquatic Food production

Changes in ocean temperature, acidification, oxygenation and ocean circulation cause significant, geographically differential, favorable, unfavorable and neutral impacts on the distribution and abundance of fish stocks. Sea level rise and increasing storm events threaten coastal ecosystems and aquatic food infrastructure. These impacts of climate change on aquatic food systems will affect individuals and communities that depend on the sector for their livelihoods: an estimated 10% of the world's population, primarily located in developing countries.

Fast-growing aquacultures represent an opportunity to increase the production of sea-based proteins and can provide alternative livelihoods for fishers and fish workers. At the same time, mismanagement of aquaculture might pose additional stress on marine environments through pollution and habitat destruction, affecting marine biodiversity and marine ecosystems.

[83] Ocean Panel. (2021). Ocean Solutions That Benefit People, Nature and the Economy. https://www.oceanpanel.org/ocean-action/files/full-report-ocean-solutions-eng.pdf

Adaptation and mitigation actions taken throughout aquatic food systems will need to be scaled up to increase the climate resilience of both the production and consumption streams, reduce food loss and waste, and transform all supply chains, making them transparent and sustainable.

3) Zero-emission shipping

In shipping, the lack of regulation and growing demand as well as a fragmented industry, excess capacity and short investment horizons have led to the industry showing limited progress in decarbonization so far. There is growing evidence that green ammonia produced from green hydrogen is the most feasible candidate for deep-sea shipping. However, the industry has yet to reach consensus on the decarbonization pathway, and zero-carbon vessel technology is still in early stages of development.

By 2030, the industry aims to achieve 5% of propulsion energy from zero-carbon fuels for international shipping through a combination of container routes, niche vessel types (for example, green ammonia and liquefied petroleum gas tankers) and niche routes (for example, to Australia and Japan, which both plan for significant green ammonia production). Further to transitioning to zero-emission energy, the shipping sector must assess, reduce and avoid its negative impacts on marine biodiversity.

4) Ocean Renewable Energy

Many technologies are currently being assessed for their ability to harvest renewable energy from the ocean. Bottom-fixed offshore wind represents the largest part of the renewable energy production from the ocean, with 35.3 gigawatts (GW) of installed capacity as of 2020. Floating offshore wind is expected to reach wide scale commercialization closer to 2030. In addition, technologies for extracting energy from waves and tides are progressing. Energy within the ocean can also be extracted from salinity and temperature gradients. Lastly, floating solar photovoltaic systems are beginning to emerge in marine environments. The World Bank Group reports over 71,000 GW of offshore wind potential globally using current technology, while the International Energy Agency (IEA) estimates that offshore wind could generate 18 times the world's current electricity demand.

The potential is immense, but governments must provide the enabling environment to realize the development of offshore wind. This includes actions such as developing the appropriate national vision, policy and legislation to procure and legislate ocean-based renewable energy, mapping and allocating sites for offshore wind development, and convening rigorous MSP and stakeholder consultation processes. As a broader step, governments can ensure that national targets and strategies (including NDCs) target specific increases of the share of ocean-based renewable energy in the national energy mix.

Governments should also consider various approaches for the sustainable multi-use of sea space areas and infrastructures, supported by ocean science and observation. New developments could combine two or more activities in windfarm areas such as seafood production, tourism, environmental restoration and facilitation of transit routes of smaller vessels. Multi-use infrastructures for renewable energy production and desalination combined with floating refueling stations are current pioneering technologies in the energy transition.

The new value chain of offshore renewable energy will require enhanced cooperation between governments, science and industries as well as cross-industry collaboration in the short- to medium-term on the way towards a net-zero 2050.

The Case of The Bay of Bengal

Three main areas of concern in the Indo-pacific region: [84]

- Degradation of critical habitats (mangrove, coral reefs);
- Pollution & water qualities (marine litter, heavy metals, sedimentation);
- Overexploitation of living marine resources (less resources, migration, small fishes).

In terms of climate change, a major threat caused by oxygen depletion in the Bay of Bengal can be highlighted. As for extreme weather events, they are expected to be modulated by Indo-pacific climate variability, and marine heat waves are expected to be more frequent and longer, while tropical cyclones in the area account for only 5-6% of global cyclones but account for 89-90% of deaths. Sea level rise is also a topic of growing concern in the region.

Marine resources are thus facing various pressures, as oxygen decline and temperature rise will influence tunas and food webs; causing large decreases in potential catch of Hilsa and Bombay duck (changes in phenology and seasonality of catch, reduction of average size); and extending small pelagiids distribution to the north and the east.

These drivers of change in the status of the Indo-pacific natural capital assets constitute an important constraint and significant risk to the potential growth of the region's ocean economy, similar to the risks to the global ocean economy[85]. For example, impacts of coastal development and pollution on coral reef ecosystems can directly impact the tourism sector of the region's ocean economy, and reduce the net benefits that it can generate for poverty reduction and economic growth.

Several responses and adaptations could be implemented including:[86]

- Improving national climate change policies and regional coordination,
- Encouraging traditional management systems as those may support livelihoods,
- Implementing an ecosystem-based approach to fisheries, fishery specific adaptive management plans,
- Increasing economic stability of fishers through low-cost access to credits, insurance, and minimum wages,
- Making changes in industry to increase catch values through certification - *i.e.* catch less but more expensive fish and seafood, to enable sales on international markets and to boost local industry,
- Continuing developing international research and collaboration programs.

[84] « Climate change Impacts on Biodiversity and Maritime Security in the Bay of Bengal », webinar, June 25th 2021, AFD, IRIS, DGRIS
[85] OECD. (2016). Development Co-operation Report 2016 : The Sustainable Development Goals as Business Opportunities. https://www.oecd.org/dac/DCR%202016%20Highlights%20booklet%20FINAL.pdf
[86] « Climate change Impacts on Biodiversity and Maritime Security in the Bay of Bengal », webinar, June 25th 2021, AFD, IRIS, DGRIS

- Ecosystem approach to management - which balances ecological well-being and human well-being to reach sustainable development - underlining its principles: increased participation, appropriate scale, precautionary approaches, adaptive management, cooperation and coordination, and multiple objectives.

B. Blue Economy as a New Paradigm to Align Growth And Ocean Health

Economic growth and environmental degradation have occurred concurrently in the Indo-pacific region during over recent years, illustrating the challenge of introducing policies that promote the "decoupling" of such trends, so that economic growth continues and even accelerates, while environmental degradation reverses.

This sustainable ocean economy is called Blue Economy, where economic activity is in balance with the long-term capacity of ocean ecosystems, supporting this activity whilst remaining resilient and healthy. Essentially, the blue economy concept is a lens through which to view and develop policy agendas that simultaneously enhance ocean health and economic growth, in a manner consistent with principles of social equity and inclusion.

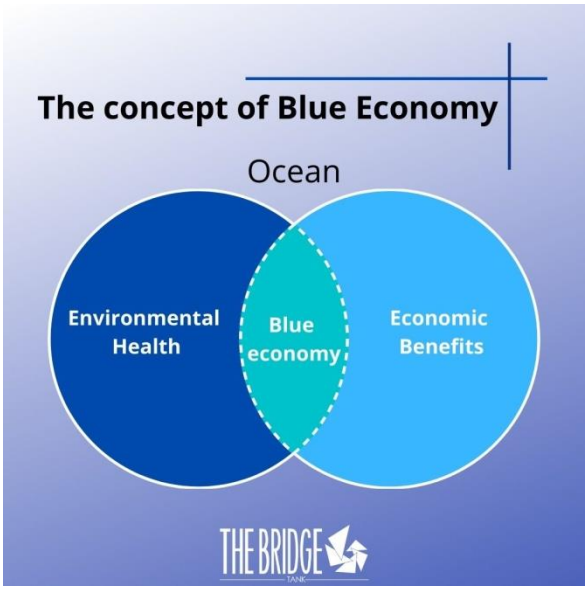


Figure 5. Blue Economy's concept

The Blue economy concept considers the ecological systems that provide so many of the services linked to the ocean economy as underlying and sometimes invisible natural capital assets. These assets include, for example, fish stocks, coral reef systems, beach and water quality, mangroves, which help support the more

visible produced capital (machinery and structures) and intangible capital (skills, expertise, and so on, with which labor is applied).[87]

Many coastal nations have already introduced a mix of sector and industry-specific policies for economic activities in the ocean. Increasingly countries have undertaken efforts to develop more integrated policies reflecting the underlying ecosystems, including coordinating the actions of various government agencies (OECD 2016).

Here are examples of a transition toward a Blue Economy within various sectors of the ocean economy:

- Sustainable fishing practices can in some instances be rewarded with an eco-label that brings a price premium;
- Shellfish aquaculture can both enhance coastal water quality and produce valuable seafood that supports employment and contributes to GDP;
- Off-shore wind and other marine renewable energy technologies can generate new jobs and significant additional energy according to some estimates;
- Green infrastructure along the coast can both create jobs and protect coastal development.

[87] World Bank. (2016). Equity and Development. https://documents1.worldbank.org/curated/en/435331468127174418/pdf/322040World0Development0Report02006.pdf

Figure 6. Established Blue Economy Sectors and Sub-sectors

In The Indo-Pacific

The future growth in the Indo-Pacific region's states and territories will be increased by transitioning to a Blue Economy in the region, with investments simultaneously in both natural and produced capital, and integrated policies that target the interrelationships between economic sectors in the water.

A potential Policy Framework for an Indo-pacific Blue Economy has to include:

- Education and Awareness
- Maritime Surveillance, Monitoring and Enforcement
- Infrastructure
- Research and Development

- Business Development and Sustainable Finance.

Here are two examples that illustrate pioneer policies in the Indo-Pacific:

Mauritius developed a “roadmap” for the ocean economy in 2013, orienting the country’s growth strategy around the development and use of its 2.3 million square kilometers of ocean space (Mauritius Prime Minister’s Office 2013). The Mauritius roadmap focuses on development of seven components of the ocean economy.

In late 2014 Indonesia’s President proposed a policy for the country as a ‘global maritime axis’, focusing on growth in the ocean economy based on four main objectives: (a) strengthening sovereignty over the country’s waters and resolving maritime border disputes; (b) sustainably managing the natural resources and protecting the marine environment (notably by stepping up efforts to combat illegal fishing, developing aquaculture, and growing public revenues from the sector exponentially by 2019); (c) increasing tourism (doubling visitors by 2019) by building marinas along yacht routes for example; and (d) building science and research capacity for a blue economy, for example through construction of three marine science technology parks by 2019.12 Similarly, the Commonwealth is supporting developing countries to pursue four interrelated objectives: (a) diversifying the existing economic base and increasing the proportion of GDP derived from ocean sectors; (b) focusing on strategies to create higher value jobs; (c) addressing the achievement of food security through marine sources of protein; and (d) supporting developing countries in sustainably managing ocean development (Roberts 2015).

Various national actions have been undertaken by eight countries in the BOBLME (Bay of Bengal Large Marine Ecosystem Project), such as institutional arrangements, legal and policy reforms. The main challenges that remains are needed improvements for governance, such as integrating climate change adaptation into decision-making, increasing political priority for management and conservation, implementing stronger coordination between fisheries and environmental organizations and strengthening regional cooperation to address transboundary issues. Another difficulty is to take into account the dissimilarities (political organization, level of economic development, degree of scientific capability, etc.) and similarities between countries to adopt strategic actions (national marine conservation and utilization of legislations are similar in characteristics and in addressing constraints). Building key partnerships and cooperation at the scientific and governance levels is essential, as well as the role of research to ensure the effectiveness of sustainable projects in the region, including the sharing of expertise between the military and practitioners to facilitate the understanding of the region's needs.

The Draft of an Indo-Pacific Blue Economy Policy

The Indo-Pacific region faces pressing challenges: declining fish stocks, illicit maritime trades, maritime mixed migration and climate risks. Indeed, the region, in addition to being increasingly vulnerable to climate change (water salinization, sea-level rise, extreme weather events) and subject to heavy coastal pollution, is a commercial destination, thus threatening both wildlife and human security (drug and human trafficking). Bangladesh is one of the most crisis-prone countries in the region: various forms of abuse (violence, forced labor and human trafficking) making it even more vulnerable to conflict. All these elements tend to impact Blue Economy and fisheries.

Blue Economy constitutes both a challenge and an opportunity in terms of international cooperation. The BIMSTEC initiative, which has notably helped the development of port infrastructures in India illustrates the relevance of building bilateral and multilateral partnerships on governance issues.

THE DRAFT OF INDIA'S BLUE ECONOMY POLICY

The draft of India's Blue economy policy is envisaged as a crucial framework towards unlocking the Indo-pacific potential for economic growth and welfare. The Ministry of Earth Sciences prepared the draft Blue Economy policy framework in line with the Government of India's Vision of New India by 2030. The document recognizes the following seven thematic areas:

National accounting framework for the blue economy and ocean governance.

Coastal marine spatial planning and tourism. Marine fisheries, aquaculture, and fish processing.

Manufacturing, emerging industries, trade, technology, services, and skill development.

Logistics, infrastructure and shipping, including trans-shipments.

Coastal and deep-sea mining and offshore energy.

Security, strategic dimensions, and international engagement.

A FOCUS OF INDONESIA'S BLUE ECONOMY POLICY

With more than 17,500 islands, 108,000 kilometers of coastline, and three-quarters of its territory at sea, oceans are central to Indonesia's prosperity through economic activities, including capture fisheries and aquaculture, coastal tourism, marine construction, and transportation. Indonesia has the world's second largest fishery sector worth around US$27 billion to GDP and providing 7 million jobs and over 50 percent of the country's animal-based protein needs. Oceans are a key asset for the country's tourism industry worth around US$21 billion to GDP in 2019 (marine and non-marine) (WTTC 2020). In 2016, 44 percent of foreign visitors undertook marine and coastal (MAC) tourism activities as part of their visit (Ministry of Tourism 2016). There are opportunities to increase this value, at the condition of healthy marine and coastal ecosystems.

However, there are challenges to the extent and integrity of Indonesia's marine and coastal ecosystems that, if not managed well, could undermine the potential of Indonesia's ocean economy : i) fisheries management is not yet optimized (in 2017, 38 percent of the nation's marine capture fisheries were

estimated to be overfished), ii) human impacts are damaging coral reefs (this is exacerbated by climate change), iii) coastal development threatens critical habitats such as mangroves, iv) marine and coastal tourism sites are threatened by inadequate infrastructure and increased visitor numbers, v) plastics litter oceans and impose costs on fisheries, tourism, and ecosystems.

Compounding these long-term challenges are more immediate pressures from the COVID-19 pandemic. The economy entered the first recession in two decades due to COVID-19, affecting especially oceans sectors. The Government has responded forcefully but its capacity faces limits.

Both long and short-term challenges can be addressed through a Blue Economy strategy; such a strategy is being pursued by the GoI through a range of initiatives. Indonesia's blue economy initiatives include:

Improved fisheries management: oceans-led development and a transition towards a blue economy is a priority for the GoI. Specific goals aligned with blue economy principles are seen in the National Medium-Term Development Plan, the 2017 Oceans Policy, and a wide range of initiatives underway. One example is seen in the strong stance taken by the GoI against foreign illegal, unregulated, and unreported (IUU) fishing.

Development and integration of spatial plans: Most provinces have developed marine spatial plans for their waters and will integrate these plans with Indonesia's broader (terrestrial and marine) spatial planning framework in the coming years.

Expansion of marine protected areas: The GoI has similarly made substantial progress in expanding marine protected areas (MPAs) to over 23 million hectares, with a further goal of reaching 30 million hectares by 2030. Improving management of these areas is now a priority. To monitor progress, MMAF has been implementing a scorecard system across MPAs to provide a rigorous and consistent means of tracking management effectiveness and has recently developed an upgraded version with increased focus on socio-economic and environmental outcomes.

A national action plan for marine debris: The GoI launched the National Action Plan on Marine Debris in June 2017, with the goal of reducing marine debris by 70 percent by 2025. Taxes and bans on single-use plastics are being enacted by provincial and city governments to discourage plastics consumption, including in Jakarta and Bali.

An integrated and sustainable tourism development program: In 2018, the GoI launched the Integrated and Sustainable Tourism Development Program to bring a more holistic and inclusive approach to tourism development. The program incorporates planning functions, support to businesses, community empowerment, and environmental and cultural asset management, along with investment in tour- ism-relevant basic infrastructure and skills.

Maritime Spatial Planning

A continuously developing policy area, Maritime Spatial Planning (MSP) is a process allocating areas for human activities, ensuring social, economic and environmental objectives are achieved in an efficient, safe and sustainable manner. The different uses of the marine space and resources include the installations for the production of energy, oil and gas exploration and exploitation, the extraction of raw materials,

maritime shipping and fishing activities, aquaculture installations, tourism, ecosystem and biodiversity conservation, and underwater cultural heritage.

This convergence of uses over the maritime space, as well as the cumulative pressures on coastal resources, requires an integrated planning and management approach. In this context, MSP is considered an important tool for the sustainable development of Blue Economy activities, and for the restoration of Europe's seas to environmental health.

MSP has a role to play in achieving the UN 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal 14 (SDG 14) "Life below water". This European Commission and UNESCO's Intergovernmental Oceanographic Commission (IOC) adopted a Joint Roadmap to accelerate MSP processes worldwide in 2017. The roadmap signals the political commitment from both institutions, includes 10 actions to advance the implementation of MSP worldwide.

Figure 6. Improvements required in governance for Indopacific Blue Economy (OECD, 2016)

Opportunities For Finance

Obtaining private sector and financial market support is comparatively easy when returns are aligned with intrinsic risks and there is a long-term government commitment to development of the sector. With commercial viability of the sustainable blue sector 10-15 years behind that of onshore renewable energy, we need to leapfrog based on the lessons learnt from green investments.

Commercially viable blue sectors are already attracting existing players. Oil majors such as Total and Shell are actively expanding and restoring mangroves funded by blue carbon credits. Some insurance companies are carving a healthy niche business by charging premiums linked to the quality of natural storm and water surge barriers, thereby giving these assets a monetary value.

The less bankable projects need special assistance. Blended or leveraged finance can play a catalytic role in lowering risk and enhancing profitability to attract private sector participation and capital for these initiatives. Other ways to create bankable project structures includes risk allocation to the most appropriate party, either public or private, or use of subordinated instruments.

Regional or sovereign funds are not only a good source of blended finance, they are also efficient vehicles for aggregating contributions from several types of investors for a specific use and term. Contributions from donors, development banks, local stakeholders, national wealth funds, and private philanthropies can be pooled in the trust fund to provide an extensive range of blended finance instruments.

More proven financial instruments can be deployed as well. These include first loss tranches, concessional capital, credit guarantees, blue credits, and purchases of blue carbon credits generated by a project. Technical assistance for innovation and certification can be funded through grants. Financial markets are fully embracing the green agenda, but they are still behind the curve when it concerns blue finance.

Increased transparency makes markets more efficient. Inclusion of climate change, environmental, social, and governance factors in risk assessments is now becoming the norm. Investors, asset managers, insurers, and banks are honing their capacity to assess, value, and price these risks. Policy departments are adjusting investment guidelines to channel funds towards sustainable investments and avoid harmful ones. Encouraging progress is under way for land-based assets.

Time has come to expand our scope beyond our terrestrial habitats and include the impact that economic activity is having on our marine ecosystems. This should be echoed by financial regulators and credit rating agencies. Globally, work is under way to define the blue universe and sustainability criteria. A detailed approach is required, since blue financing lacks the simplicity of a single metric such as carbon equivalency or a “net zero emissions” target.

One step in this direction will be taken this quarter, when the Asian Development Bank launches its ocean finance framework. This will underpin our foray into blue finance, and hopefully catalyze further investments to deliver on the healthy oceans needed for a lasting recovery from the current turmoil.

Conclusion: limiting the industrialization of ocean and integrating coastal ecosystem and blue economy value chain

Tracking metrics or indicators of growth in this economy together with the sustainability of its natural capital, with clear principles for investment, could help leverage greater investment in the Blue Economy with increased benefits for the global economy over the long term. Similarly, clear “investment principles” that essentially screen all investments in the ocean economy, could help ensure that economic and

environmental objectives are simultaneously met, consistent with internationally agreed principles on equity and social justice, and with a priority on poverty reduction.

Marine renewable energy is one example of a sector often regarded as a model for the transition to a Blue Economy, where the ocean provides increased jobs and energy without drawing down the natural capital. The aim of Blue growth is to find new sectors of the ocean economy (or promote changes to existing ones) that simultaneously enhance both economic benefits and natural capital. Green infrastructure along the coast is an example that can both create jobs and protect coastal development—enhancing the ecosystem processes.

As another example, coastal habitat restoration or engineering projects to increase defenses against storm surge and flooding showed significantly improved protection at lower costs than constructed alternatives such as breakwaters. Depending on the water depth, mangrove projects in Vietnam can be three to five times cheaper than a breakwater.

Here are some examples of successful Blue Economy initiatives:

INITIATIVE 1: RESTORING AND PROTECTING SEAGRASSES WITH THE SALE OF CARBON CREDITS IN THE COMMUNITIES OF VANGA AND JIMBO

Organized by the Wildlife Conservation Society (WCS) and Kenya Marine Fisheries Research Institute (KMFRI), the Vanga Blue Forests Initiative aims to restore and protect seagrasses with the sale of carbon credits in the communities of Vanga and Jimbo. Both these areas face illegal fishing which threatens local fisheries and damages seagrass. WCS and KMFRI will also work with government agencies and local communities to map fishing patterns and seagrass habitats, identify new sites for seagrass closures and assess seagrass carbon stocks and sequestration potential. The quantified seagrass carbon will be later traded together with mangrove carbon. The project aims to generate climate, community and biodiversity benefits, and increase fishery stocks and resilience. The conservation and restoration activities in the seagrass and mangroves will increase the capacity for these ecosystems to capture and store carbon stocks.

INITIATIVE 2: SEATECH'S SEAWEED FARMING PLATFORMS

Seatech, a Dutch company, has invented an engineering-backed seaweed farming approach with the potential to transform inefficient farming systems in developing countries around the word. With a design that allows users to adapt production to external conditions, Seatech's seaweed farming platforms can be submerged and operate in deeper water where the temperature of the water is lower and more stable. This may increase harvest sizes 20-fold and decease the prevalence of seaweed pests. The first farm, located in Takalar in South Sulawesi in Indonesia, was started in late 2019 and will eventually employ 500 locals (including 50 per cent women) on a 350 hectare site, according to Seatech's Director, Jeroen Langelaan. All of the seaweed produced will be used for cattle feed. The aim is to kick start a competitive local seaweed industry, which can provide local jobs, as well as creating protected marine areas where underwater ecosystems can thrive. Underlining a commitment to protect our oceans is addressing fragmented responsibilities for the ocean economy. This can be done by creating a central body to develop

regulatory and policy frameworks and remove well-intended but unsustainable business incentives such as subsidies or tax rebates. Encouraging progress has been made. To date, 57 countries have introduced ocean-related laws, policies or regulations. The governments of Indonesia and Bangladesh have already centralized the coordination of ocean-related issues and initiatives. The conducive Blue Economy ecosystem that will emerge from these efforts can help channel private and public investments, as well as official development assistance, towards the sustainable development and protection of our oceans. This means, we need to formulate “transfer mechanisms” to fund support for essential ocean investments that lack revenue streams. These could take the shape of allocating income from fishing licenses, redirection of harmful subsidies, tourist charges or plastic taxes.

Throughout this chapter, we identified elements that can be turned into recommendation based on successful initiatives and common issues shared by most of the countries in the Indo-Pacific.

- Improving governance; often one-sided, the policy response to the blue economy must integrate a multi-layered approach, which considers the different scales of governance processes (from local, regional, national to supranational) and involve the participation of a great variety of stakeholders.
- Promoting stakeholder coordination, thus allowing a greater involvement from public, private (enterprises), science (research institutions) and civil society (NGOs, initiatives) sectors.
- Protecting marine ecosystems; the development of the blue local economy has to come in hand with nature-based solutions that balance exploitation of ocean’s resources with their regeneration.
- Integrating climate response into policy and adaptation initiatives;
- Building capacity at the community, middle management and policy levels;
- Generating quality scientific information, optimize research and the science/policy interface;
- Increasing and strengthen the political priority given to ecosystem management and conservation;
- Strengthening coordination between fisheries and environmental organizations;
- Enforcing compliance with laws and regulations more effectively;
- Fostering the sharing of expertise between military and practitioners to facilitate understanding of the region's needs.

Edited by:
Malaurie Le Bail
Joël Ruet

Contributors:
Baudouin Becker
Clarisse Comte
Florian Dommergues
Malaurie Le Bail

Proofreading:
Jacqueline Duan

The Bridge Tank
Palais Brongniart
28 Place de la Bourse
75002 Paris
https://thebridgetank.org/