# Research report

**COMMITTEE :** UN Oceans **ISSUE :** How to develop renewable energies while limiting their impacts on marine biodiversity. **CHAIRS:** Camille LEVEQUE, Timothée POULARD

# How to develop renewable energies while limiting their impacts on marine biodiversity

# **CHAIR INTRODUCTION**



Hello everyone ! I am Camille Lévêque, I am 17 years old and I live in the Pays de Gex, near the Swiss borders.

After two years as a delegate in ferMUN, I decided to become a chair for this new conference of ferMUN 2023.

As soon as the issues were announced, I was immediately interested by the Ocean committee. This first issue intrigued me because it deals with subjects that I am really interested in : the protection of the environment, innovation and the development of technologies to accelerate ecological transition.

Whereas the said transition sets the pace of innovations, it appears that a lot has yet to be done, especially regarding renewable energies.

Indeed, these new types of energies, while of perfect appearance, introduce, in fact, new issues. If fossil energies were relatively localized in specific areas so far, renewable energies are by nature collected through the whole Earth's surface and in the heart of ecosystems. Therefore, it is paramount to measure and control their impacts to prevent them from damaging the environment, which would go against the desired outcomeI hope that this report will serve as a rich source of information to facilitate your research and, above all, that this issue will inspire you for the debates to come. Have a nice read !

# **KEY WORDS**

**Green renewable Energies :** energies coming from inexhaustible natural sources whose exploitation only produce negligible quantities of pollutants compared to other sources used and declared as pollutants.

**Ecosystem :** functional assembly of organisms, which has the appropriate characteristics to ensure the wellbeing of living life, to ensure the conditions necessary for biological evolution in the long term. (definition by géoconfluences)

**Marine biodiversity :** biological diversity specific to oceans or directly depending on them.

**IPCC :** Intergovernmental Panel on Climate Change, founded in 1988 by two United Nations' institutions, The World Meteorological Organization(WMO) and the United Nations Environment Programme (UNEP). This group aims to collect the already existing climate knowledge in reports published every six years. It represents 195 countries, thus covering almost all the world.

IPCC is composed of three groups : group 1 brings out the scientific datas, group 2 analizes consequences of climate change on earth, and group 3 proposes solutions to reduce gas emissions. They all published an independent report, then followed by a global report gathering conclusions from the 3 groups.

**Greenhouse gas** : gas from natural (water vapor) or human sources (human activities) absorbing and emitting a part of the sun rays (infra-red radiations). This phenomenon is the root cause of the greenhouse effect. ( definition from INSEE)

The main greenhouse gas from human sources is carbon dioxide (CO<sub>2</sub>) which represents almost 75% of the total emissions, followed by methane (CH<sub>4</sub>) which represents 18% of the said emissions, then followed by other minor gasses.

Carbon dioxide has a lifespan in the atmosphere of 100 years, however methane has a lifespan of 10 years but has a warming potential 20 to 25 bigger than CO2.

# **GLOBAL OVERVIEW**

## I. Climat assessment



## 1. The context of climate change

Thanks to the last IPCC group 1 report, we now know with certainty that human activities are responsible for global warming and more globally, for climate disruption.

Indeed, various industry sectors result in the production or the release of greenhouse gas in the atmosphere. The latter shape a layer increasingly dense which keeps solar rays in the atmosphere and, as a consequence, warms the Earth.

The graph shows the increase of temperatures (black curve) is linked to human activity and natural variation (brown curve)

Source : IPCC report, climate change 2021 the physical science basis summary for policymakers, page 6

## 2. Environmental impacts

First of all, polluting emissions of these gasses have a considerable impact, which is becoming irreversible for our planet. These emissions are partially absorbed by our lands and oceans.

The absorption by these natural wells increases as the emission increases too. However, to date, these emissions are so much increasing that natural wells are saturating and therforeaborb a increasingly smaller portion of the greenhouse gas emissions.



The graph presents the absorption capacity of oceans and lands depending on the emissions amount.

This amount varies under the considered scenarios being in light blue the most optimistic and in red the most pessimistic one.

The bigger the emissions, the bigger the absorption capacity.

However, the skyrocking increase of these emissions does not allow an optimal adaptation.

Thus, the more we emit, the smaller the proportion absorbed by lands and oceans will be.

source : IPCCresearch report, climate change 2021 the physical science basis summary for policymakers, page 20

As a consequence, a bigger part of these gasses are released in the atmosphere which amplifies the greenhouse effect. The average temperature has increased by 1,1 degree since the industrial revolution in 1850 and is constantly progressing.

According to IPCC, an increase of 2 degrees would endanger 30% of the species on a global scale.



This graph shows the possible evolutions for global temperatures under the previously seen socio-economic scenarios.

source : IPCC research report, climate change 2021 the physical science basis summary for policymakers, page 22

Moreover, the absorption of these gasses by the ocean has significant impacts as it triggers water acidification, which thus destroys the entire marine food chain, preventing life of microorganisms. This acidification also complexifies the absorption of carbon dioxide by the ocean. These accumulated consequences amplify the atmosphere's warming.

Concurrently, this temperature increase generates the melting of terrestrial ices and the dilatation of water which result in the rise of the oceans' level. The said warmth also triggers an hydrologic cycle imbalance which provokes very violent meteorological events.

Facing these deep changes in the environment, humans are attempting to adapt ,but the rapidity and the violence of these changes, sometimes irreversible, lead to uncontrollable situations. According to the last research report of IPCC, around 3,3 to 3,6 billions of people live in highly vulnerable conditions to climate change.

# II. Renewable energies : an ideal solution ?

Conscious of the necessity to act, multiple actors across the world are tempting to think about sustainable solutions. One of the considered approaches would be to change our source of energy using renewable energies thus limiting a run out due to the excessive exploitation of resources but also using green energies to prevent our carbon emissions. Nowadays, different forms of renewable energies have been developed to thereby exploit various natural sources.

# 1. Different types of renewable energies

There exists diverse types of green renewable energies : solar power, wind power, water power, bioenergy, geothermal energy and marine energies. Only a few of these impact marine biodiversity, as presented below :

- **Wind power** : energy obtained thanks to kinetic energy of wind though wind turbines. It is used to produce electricity. The wind turbines can be placed on land or on water. They will be more optimal on water as the absence of obstacles and therefore presence of stronger winds will be ideal for their use. However, the maintenance on water is more complex and more expensive.
- **Hydraulic energy**: Hydraulic energy uses kinetic energy from water by using watercourses and waterfalls to produce electricity. The exploitation of this energy is possible thanks to diverse types of infrastructures, including some exploiting oceans' movements to produce marine energy.
- **Renewable marine energies** : set of technologies allowing the production of electricity based on various forces or resources of the marine environment : the swell, the marine currents, tides, the gradient of temperature between warm waters on the surface



and cold waters in the depths. Renewable marine energies include, amongst others, hydrokinetic power, tidal energy, waves energy and water-thermal energy. The ones with the most potential are the two first ones amongst the ones presented previously.

This plan shows the various renewable marine energies

source : Eyman fakhri from researchgate, novembre 2020

- **bioenergy :** energy from the combustion of natural resources, including organic waste (biomass). It backs up on the life cycle of the organic matter. It allows the production of electricity or gas.

# 2. A threat for marine biodiversity ?

Considering the importance of these energies in the fight against global warming, we could be brought to think that their impact on the environment is just beneficial. Yet, negative externalities directly impact biodiversity and as a consequence, marine life.

Firstly, some installations may have, by their physical presence, a direct impact on marine biodiversity. Even though specific cases are concentrated on water courses, every change on these ecosystems will influence, afterward, the marine ecosystems.

Amongst others, the construction of hydroelectric dams or turbines, underwater or not, directly disrupts ecosystems implanted there. Species have to displace themselves because they are threatened by infrastructures which harm the protection and food chains of these living beings. This phenomenon also directly affects marine species such as benthic fishes due to the ocean floor anchoring of foundations.

Hydric fluxes can also be disrupted by infrastructures on the rivers. This implies several modifications on water composition. Amongst these, a modification of the river-bed sediments portion, namely the proportion of the organic matter or organic waste in the water. This phenomenon brings a surplus of matter or of minerals in some places, which disrupt the water turbidity, namely its capacity to absorb sun rays. This surplus of matter reinforces the phenomenon of eutrophication, that is a phenomenon of vegetal spreading that alters the ecosystem equilibrium.

We can also notice contributions of more salted water or more oxygenated waters. All of this contributes to the pollution of ecosystems and water currents and so, the imbalance of ecosystems.

Secondly, installations trigger, by their operations, nefast effects on marine biodiversity. Noise disturbance caused by the operations or the metallic infrastructures disrupt the proper development and the sense of direction of certain species. The presence of toxic substances, especially pesticides within biomass, or toxic painting and material used on infrastructures beget mortality of species and so a perturbation of the whole food chain. The use of waves' energy or even the differences of important temperatures inside the same area can also increase mortality. This concerns tropical fishes in particular.

# TRAITÉS DE L'ONU ET GRANDS ÉVÉNEMENTS

#### 10/12/1982 - United Nation Convention on the law of the sea

Ratified in 1994, this convention has the objective to codify the law of the sea and to define in a clearer way the rights and the liberties of each state.

Notably, it settles the right of each state to develop renewable energies only in the "territorial sea area" or in the "exclusive economic zone". States also ought to protect the biodiversity in this particular zone.

#### 2014-2016 - Ocean energy Forum

Orchestrated by the European Commission, this forum aims to gather a large number of actors thus to share researches that have been led up to now. At the outcome of this, an "strategic roadmap" has been published in order to guide future decisions of the European commission in this field.

**Octobre 2022 - International conference on ocean energy & energy Europe** This event aims to gather the international conference on marine energies and the European conference on energies. The objective is thus to put together various actors in the same place to pool and to introduce future projects in this field.

## **POTENTIAL SOLUTIONS**

First of all, one potential solution would be to redesign energy exploitation sites by updating facilities and materials in order to limit their impacts on ecosystems' development. For instance, the selection of the turbine park location is a crucial element to consider asit can have a strong ecological impact. Some regulations could limit the said impact by banning some places like bays or narrow passages to not hinder the animals movement. Typically, a minimum distance imposed between offshore wind turbines within parks could facilitate animal mouvement.

Moreover the use of non-toxic paints or of noiseless materials would reduce the death rate of young fish. For intance, composite fiber can be an alternative to steel. Some countries have also defined "sensitive periods" during which activities are banned in the more exposed zones. This could, correspond to breeding seasons or migration periods. In addition, the use of sound frequency or duration less likely to be perceived by animals or the use of a progressive increase in sound technologies like *soft start* or *ramp-up* could enable the reduction of human-made noise pollution for species.

Secondly, research is of paramount importance. Indeed, it is necessary to develop and support analysis around this subject because the more accurate the research and the derived results , the more efficient, the methods and developed technologies will be and so the concrete impacts on living beings.

For instance, the project named "Floating wind turbines of Gulf of Lion" proposes the installation of a wind farm in a marine protected area. The goal of that project is to enable people to have a better understanding of the impact of offshore wind turbines on marine biodiversity. Moreover, it also tests the efficiency of man-made habitats of the Biohut ® 's technologie (detailed in the next section). The implementation of that project, planned for 2023, would provide the first results for the development of these technologies.

In addition, encouraging the development of meeting places/events between different public and private stakeholders would allow for discussion and exchanges favoring the setup of projects better adapted to everyone.

Finally, it is also important to add that renewable energies can have a positive impact on marine biodiversity. For example, the creation of dedicated areas in sea brings the prohibition of fishing and the prohibition of maritime transport that support the growing of certain species and thus their preservation. However, it is crucial to monitor the development of that species to avoid another ecosystem imbalance.

For instance, the startup named Ecocean and the Perpignan's university developed an artificial nursery : Biohut <sup>®</sup>. Composed of cages or sticks, this technology is rolled around

pipelines of the renewable installations to enable young fish to develop with more ease. This creation allowed a concentration of young fish 5 times higher than in the areas which are not equipped with that technology. This increase in fish concentration also allows sustainable fishing in the vicinity of these project areas.

#### <u>Few clues for your delegation :</u>

- 1. Should we prioritize the development of renewable energies which have a meaningless impact on the environment or should we adapt the already existing technologies ?
- 2. Should we promote the positive aspect of renewable energies on marine ecosystems ? If so, how should/could we promote them ?
- 3. Should we restrict the negative impacts of energy production on ecosystems ? If so, how ?
- 4. Should we regulate the construction of machines and infrastructures related to energy production ?
- 5. Should we regulate the use of machines for energy' production ? If so, how/where/when should they be regulated?

## **BIBLIOGRAPHY**

I. Definitions

<u>Qu'est-ce qu'une énergie renouvelable ? | EDF FR</u> <u>Énergies renouvelables : définition, exemples, avantages et limites (youmatter.world)</u> <u>Les énergies renouvelables : qu'est-ce que c'est ? | Nations Unies</u> definitions of renewable energies and complementary explanations

<u>Biodiversité marine — Wikipédia (wikipedia.org)</u> definition of marine biodiversity

<u>Énergies marines renouvelables | Ministères Écologie Énergie Territoires (ecologie.gouv.fr)</u> definition of renewable marine energies

<u>Définition - Gaz à effet de serre (émissions) | Insee</u> <u>GES : effet de serre et gaz à effet de serre (apc-paris.com)</u> definition of greenhouse gasses and their compositions https://www.edfenr.com/lexique/energie-verte/#:~:text=Une%20%C3%A9nergie%20propr e%2C%20ou%20%C3%A9nergie,et%20consid%C3%A9r%C3%A9es%20comme%20plus%20 polluantes. definition of a green energy

<u>Qu'est-ce que la biomasse ? | EDF FR</u> definition of biomass

<u>Energie hydraulique : sa définition, ses avantages et inconvénients (selectra.info)</u> definition of hydraulic energy

<u>Comprendre le GIEC | Ministères Écologie Énergie Territoires (ecologie.gouv.fr)</u> definition and explanations about IPCC

## II. Research reports and studies

<u>IPCC AR6 WGI SPM final.pdf</u> summary of the search report of IPCC group 1 (2) Le Rapport du GIEC Résumé Simplement ! - YouTube explanatory video about this report

<u>IPCC AR6 WGII SummaryForPolicymakers.pdf</u> summary of the search report of IPCC group 2 (2) Le Nouveau Rapport du GIEC Résumé avec Jean Jouzel ! - YouTube explanatory video about this report

<u>IPCC\_AR6\_WGIII\_SummaryForPolicymakers.pdf</u> summary of the search report of IPCC group 3 (2) <u>GIEC 3 : Le Nouveau Rapport Résumé Simplement ! - YouTube</u> explanatory video about this report

<u>OEF-final-strategic-roadmap.pdf (oceanenergy-europe.eu)</u> The strategic roadmap of the ocean energy forum ?

doc\_num.php (wmo.int) Report of WMO - "state of global climate 2021" État du climat en 2021: des phénomènes météorologiques extrêmes et de lourdes conséquences | Organisation météorologique mondiale (wmo.int summary of this report

lecaillon-g\_seb2017\_.pdf (eolien-biodiversite.com)

report about more adapted technologies for marine life - " Enrichissement et valorisation de la biodiversité marine sur les parcs d'éoliennes offshore au travers de l'éco-ingénierie marine"

<u>Guide préconisations pour limiter l impact des bruits sous-marins sur la faune marine.pdf</u> (ecologie.gouv.fr)

Report of french government about limiting the impact of underwater noises -"Préconisations pour limiter les impacts des émissions acoustiques en mer d'origine anthropique sur la faune marine"

## III. Complementary resources

<u>Les sédiments - L'eau dans le bassin Artois-Picardie (eaufrance.fr)</u> explanation of marine sediments

<u>Énergie renouvelable et biodiversité : les implications pour parvenir à une économie verte -</u> <u>Fondation pour la recherche sur la biodiversité (fondationbiodiversite.fr)</u> Article about problems that triggers renewable energies on biodiversity

<u>Projet Ferme Eolienne flottante marine au Golfe du Lion (info-efgl.fr)</u> Article about the project of Floating wind turbines of Gulf of Lion (<u>4) [FORMAT COURT] Conjuguer énergie renouvelable et biodiversité marine : le projet pilote EFGL - YouTube</u> explicative video

International Conference on Ocean Energy & Ocean Energy Europe (ICOE-OEE 2022) | Tethys (pnnl.gov) icoe2022donostia.com – The leading global ocean energy event will take place in DONOSTIA – SAN SEBASTIAN (icoe0ee2022donostia.org)

information about the conference Ocean energy & ocean energy europe in october 2022