

This annex includes the complementary projects reviewed in addition to the Senegal and Tanzania case studies:

- FPS Environment support to NDC Partnership in Burkina Faso
- FPS Environment support to NDC Partnership in Niger
- KivuWatt Rwanda
- WATER MANAGEMENT and urban DEVELOPMENT in Ha Tinh in relation to climate change (WAMADE) in Vietnam

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1. Introduction

1.1. Subject

This annex presents the reviews of four projects as part of the set of 14 projects reviewed for this evaluation. They cover projects in Burkina Faso, Niger, Rwanda, and Vietnam. They aim at complementing the 10 projects reviewed in the two country case studies on Senegal and Tanzania. They enable to better cover the diversity of Belgian climate action at a geographic but also thematical and institutional level.

The four additional projects are the following:

- National Determined Contributions (NDC) support by the Federal Public Service (FPS) Environment in Burkina Faso
- NDC support by the Federal Public Service (FPS) Environment in Niger
- The KivuWatt project, a methane gas capture project funded by BIO, in Rwanda
- A University cooperation project in Vietnam: WAter MAnagement and urban Development (WAMADE) in Ha Tinh in relation to climate change.

The NDC support interventions by the Federal Public Service (FPS) Environment in Burkina Faso and Niger were selected as representative of the diversity of FPS Environment's international climate action, as the FPS Environment is not active in Senegal and Tanzania where the two country studies were undertaken but it is necessary for the evaluation to have an insight into the FPS Environment's international climate action.

The KivuWatt project was selected to expand the analysis conducted on BIO's activities during the country case studies. It was further identified as a showcase for investments in innovative technologies within BIO's thematic portfolio. Lastly, representatives from Non-Governmental Organisations (NGO) interviewed during the study phase challenged the climate relevance of this project and could therefore benefit from an in-depth analysis during the case study phase.

The WAMADE project was selected as an example of University cooperation and urban climate action. Initially, there was also the perception that it was an example of a collaboration between two Belgian climate action operators (VLIR UOS and Enabel) but this dimension unfortunately proved to be limited.

1.2. Methodological approach

The complementary project reviews were conducted from March until May 2021. A desk-based research was undertaken based on general documentation and evaluation reports provided by the various operators (BIO, FPS Environment, VLIR UOS) and their partners. Additionally, interviews were conducted with key informants (representative of operators, partner institutions and country governmental authorities).

A complete list of interviewees and documents used may be found in Annex B and C.

As the complementary case studies were not undertaken as part of a country case study, as was the case in Senegal and Tanzania, triangulation of results concerning the 4 complementary projects relied mainly on documents and interviews with the Belgian operators (BIO, FPS Environment, VLIR UOS, KU Leuven) and the main local or international partners (government institutions : Centre National de Développement

Durable (CNDD), Permanent Secretariat of the National Council for Sustainable Development; or other implementation partners : NDC facilitator, Contour Global, CITEPA, NDC Partnership Support Unit). It was not desirable to obtain access to the final beneficiaries. Indeed, the latter are quite removed from the 4 interventions in question and largely unaware of their existence whether it be NDC implementation support, research on water management and urban development or energy production from methane gas harvested from the bottom of Lake Kivu. In the case of the KivuWatt project, it was not possible for BIO to grant the evaluation team access to the government of Rwanda; and in the case of the WAMABE project, need for translation was a further constraint to discussions with local partners. In the case of KivuWatt, as far as possible, constraints in terms of variety of interviews and perspectives were compensated by the use of external documents, on the topic of methane extraction from Lake Kivu. Such sources were provided by Belgian NGOs and provided a more critical view of the intervention, recognising potential benefits but also pointing out the risks involved.

2. Project reviews

This section presents the main findings of the project review for each complementary project. After a rapid presentation of the intervention, it is structured around the eight items for project analysis presented in Annex A of the Country Case Studies for Senegal and Tanzania: climate relevance (EQ1), alignment with local objectives (EQ2), partnerships (EQ3), efficiency (EQ4), effectiveness and impact (EQ5), climate-related monitoring (EQ5) and expected sustainability (EQ6).

2.1. Support to NDC partnership in Burkina Faso

2.1.1. Presentation of the project

The project is undertaken by the FPS Environment in support of the implementation of the NDC of Burkina Faso through the NDC Partnership. In practice, it covers the wage of an NDC in country facilitator, an independent consultant, based within the Permanent Secretariat of the National Council for Sustainable Development / Conseil National du Développement Durable (CNDD) at the Ministry of Environment. The CNDD has authority to oversee NDC engagements in the country.

Since the beginning of 2020, and for 2 years, the facilitator has assisted the Burkina Faso climate change focal point within the CNDD in the implementation of the Partnership plan for NDC implementation and the mobilisation of resources in support of its implementation. He also acts as an intermediary between Burkinan authorities and development partners active in support of the NDC partnership.

2.1.2. Key findings

Climate relevance

Parties to the Paris Agreement signal their commitments through Nationally Determined Contributions (or NDCs) - each country's strategy to cut its own greenhouse gas emissions and build resiliency against the negative effects of a changing climate. The NDC partnership leverages resources and expertise to provide countries with the tools they need to implement their NDCs and combat climate change.

The NDC partnerships support to Burkina is provided by 17 donors, amongst them the Belgian FPS Environment¹, who covers the wage of the facilitator embedded in the CNDD at the Ministry of Environment. Belgium is therefore one of the important NDC partnership support providers at the level of the country.

Moreover, the facilitator's work corresponds to the priorities suggested by the NDC partnership at the level of the Sahel region:

- Facilitation of support to countries.
- Taking the lead on NDC implementation plan development.
- Support to the identification of areas of support at respective country level.

¹ <https://ndcpartnership.org/countries-map/country?iso=BFA>

In addition, Burkina still lacks capacity in terms of climate change. They are presently elaborating a strategy in terms of climate action capacity building needs with ICRAF and the National authority for the GCF. The facilitator provides knowledge and skills related to climate change which burkinan climate actors only partly master and for which they need capacity building.

Internationally, there is a bigger focus on mitigation and more interest from donors but the NDC partnership builds plans with governments in the countries they work with, as is the case in Burkina Faso, an equal share of attention and support is provided to mitigation and adaptation projects. In Burkina Faso, as in many other LDCs, adaptation is a major issue, with resilient livelihoods, food safety and desertification being major climate change related challenges. Beyond the facilitator's direct support to the NDC partnership, the focus Belgium's portfolio puts on Agriculture and livelihoods, in Burkina Faso and beyond, reflects these preoccupations.

Alignment with local objectives

Burkina Faso produced an NDC in 2015. In February 2018, they joined the NDC partnership. An NDC partnership team visited Burkina Faso and identified a certain number of needs, particularly the need to revise the NDC. Burkina Faso, through its CNDD, then submitted a project for the revision of its NDC. Belgium's FPS environment was quick to respond to this request and recruited a facilitator to support the revision process for 24 months from the beginning of 2020 to the end of 2021.

As is the case with all cooperation in the context of the NDC Partnership, the request emanated from the government. On the basis of this request, the NDC Partnership Support Unit coordinated with development partners to respond to it. The support is therefore totally aligned to local objectives. More generally, the NDC Partnership shares governmental requests with all member development partners (Embassies and development institutions) in a transparent way. They discuss with the NDC Partnership stakeholders how best to respond to the request and identify who is capable of providing support. The national focal point then coordinates with willing members the support offered. But demands always emanate from local authorities and correspond to local objectives.

In Burkina Faso, the NDC focal point is the CNDD which encompasses Burkinan authorities beyond the Ministry of Environment as it has entries in a set of other ministries (Agriculture, Animal resources, Energy, Environment, Habitat, Health, Infrastructure). All such authorities are therefore implicated in identifying priorities of NDC support. Indeed, the NDC revision process implicates a wide set of Ministries: Agriculture, Animal resources, Energy, Environment, Habitat, Health, Infrastructure. They also consult with civil society, the private sector and local authorities.

Alignment is further ensured by the fact that the NDC Partnership undertakes an exercise of on-going project mapping to see how far the various interventions undertaken by its members are aligned. In the case of Belgium, the NDC partnership has a clear vision of work undertaken by the FPS Environment and Enabel but a limited one on BIO or Non-Governmental Actors (NGA); it would be good if they could integrate all Belgian activity.

Partnerships

The facilitator is based at the Permanent secretariat of the National Council for Sustainable Development / Secretariat Permanent du Conseil National pour le Développement Durable in the Ministry of Environment. This is the organ which coordinates the action of all actors in their support to NDC. The facilitator oversees the revision and implementation of the Partnership plan and climate related objectives. He also plays a role of interface between the government and other climate actors and takes part in all dialogue concerning climate change at a national level. This also involves finding resources for NDC plan implementation. A large part of his role consists in building further partnerships between

local authorities and the 40 development partners members of the NDC partnership in Burkina Faso.

In particular, there are clear synergies between the NDC plan and activities of other partners in the country such as the United Nations Development Programme (UNDP) or the United Nations Food and Agriculture Organisation (FAO), or Development partners involved in the Great Green Wall. Further major actors active in Climate action are the World Bank (WB), the West African Development Bank (BDAO), the African Development Bank (AfDB), and the Swedish, Japanese, Danish, German and French development cooperation.

In addition, the facilitator provides regular reports on NDC plan progress to all development partners and climate actors. This supports further coordination and partnership building.

In terms of partnerships specific to Belgian cooperation, the facilitator's Belgian counterpart is the chargé d'affaire at the Embassy. In Belgium, he is in contact with FPS Environment which manages his contract. At times, the NDC facilitator may therefore be called upon for support. Demands have emanated from the Embassy itself as well as from Enabel to support the formulation of its Joint Strategic Framework and the formulation of the regional programme for Sahel (in terms of fixing the main priorities). Though it is not one of his official responsibilities, the NDC Partnership appreciates such demands for support.

In practice, the NDC facilitator has also been in contact with Belgian NGOs to mainstream climate change within their action. Broederlijk Delen (BD) was responsible for mobilising all the Belgian NGO. Various meetings led to a capacity building session at the Belgian Embassy. The session revolved around a state of play of the implementation of climate commitments at the level of Burkina Faso. A consortium of national NGO's was also present.

Efficiency

The NDC Partnership Support Unit and Burkinan authorities consider the facilitator provides the required climate expertise. He is considered as very well qualified as well as efficient in proactively reaching out, coordinating and distributing the NDC plan components between partners and Ministries through regular meetings. His role in supporting the NDC revision process through monthly meetings with representatives of all partners is also valued.

However, there is also the feeling that Belgium is not necessarily getting the visibility they deserve through this work. Though it is not a lead donor in terms of financial engagement, Belgium has led the process for other partners and significantly contributed to NDC support.

One should also note that there is no duplication of efforts with other climate actors.

Partners met consider that Belgian added value beyond the fact that the burden of climate action needs to be shared by all is that Belgian climate actors are easy going, and develop an open minded, flexible and accommodating approach. They are pro-active and pick up on unsupported requests which is very helpful. Moreover, they understand needs of their various partners, the countries as well as the NDC Support Unit, very well. As a result, Belgian cooperation actors cooperate well with other stakeholders. Belgian cooperation provides a lot of embedded advisory services; others do also but it is a Belgian characteristic and Belgium does it very well. The NDC partnership support unit also appreciates that Belgium operates in some of the most difficult countries.

However, in addition to the current supporting facilitator role for NDC implementation plans, active involvement in climate action within the donor community by Belgium authorities (as is the case in Mali), associated to improved coordination of Belgian operators with the NDC partnership in terms of programmatic planning would be particularly appreciated. Furthermore, although the FPS Environment and Enabel are

already working together on climate action in the context of the formulation of the regional thematic portfolio in the Sahel region, stronger coordination of the FPS Environment and Enabel's action respectively for their thematic expertise and their field connections would be interesting. More globally, the NDC partnership would like development partners to work programmatically with them on the basis of a common climate related plan of action based on the NDC and concerted with local authorities.

Finally, it should be noted that FPS Environment monitored and took part in the management of the study but did not provide technical support itself.

Effectiveness & Impact

Both Burkinan authorities and the facilitator consider that objectives of the intervention should be reached. However, they admit that the support being geared at a process, objectives are not clearly set. Moreover, everything is interrelated and objectives also depend on the action of other partners. Indeed, the facilitator catalyses dialogue and action by climate actors, provides monthly reports and prepares monthly programs, but he doesn't implement himself.

None the less, beyond the revision of the NDC, the facilitator is also in charge of mobilising climate finance. He advocates for resources and project implementation through conceptual notes. This latter work is considered as one of his main contributions. He is recognised as possessing a good network.

The facilitator also builds capacity and has put in place a number of specific tools for climate action (elaborated by the Intergovernmental Panel on Climate Change (IPCC) or FAO).

More generally, an SNV report (to be validated) considers that, NDC commitments have been fulfilled. However, interestingly, the report considers that these commitments have not been fulfilled thanks to the activities of the NDC plan but thanks to projects distinct from NDC plan activities.

Finally, one should note that to improve this type of cooperation, Burkinan authorities consider that such technical assistance should be associated to an engagement to implement the NDC plan.

Climate-related monitoring

The facilitator has an "objective contract" (contrat d'objectif) with quite specific tasks. Any evaluation of his work would be undertaken in relation to these tasks rather than climate mitigation and adaptation results themselves which only indirectly depend on him. He provides monthly reports and programs which enable such a monitoring. The Burkinan government and the NDC Partnership approve the report before it is sent to the Belgian authorities (FPS Environment). However, the level of monitoring of the intervention remains very general.

Globally, not enough is done in terms of Monitoring and Evaluation (M&E) climate change linked results, particularly in LDCs where a sectorial approach is still followed. In fact, the NDC Partnership is still unclear about what action contributes to what effect. This was recently discussed during the NDC Partnership annual retreat. They don't have adequate Key Performance Indicators (KPI) and they are not in a position to assess impact well enough, particularly in terms of adaptation.

Indeed, it's harder to demonstrate adaptation results and obtain a return on adaptation investments. Moreover, objectives are not set in stone for adaptation as they are for mitigation. Countries find it harder to elaborate, detailed and concrete adaptation plans. This explains why donors and the private sector tend to prefer financing mitigation which is more straight forward, and provides clearer returns and communication opportunities.

None the less, one should note that an evaluation framework is planned for the revised NDC plan (whereas the first one did not have any indicators associated to it) and, with FAO support, a consultant has been hired to support the identification of indicators for the revised NDC in the course of the month of April 2021. In addition, the facilitator has provided (or organised?) training of climate stakeholders in evaluation tools. However, this does not constitute an evaluation system. For this Burkina Faso intends to call on another institution.

Expected sustainability

Initially, the NDC Partnership Support Unit thought 2 years would be enough to institutionalise results/support but in practice, just to ensure the appropriation of climate challenges by local actors takes years. 2 years support is not sustainable. In their new working programme, they have extended the support from 2 to 5 years.

In general, it is recognized by the NDC Support Unit and the CNDD that more technical assistance is required, particularly for the implementation of NDC actions. In addition, it is considered that no one in Burkina could take the relay of the current Belgium supported facilitator once his contract ends at the end of the year. This raises some doubts concerning the action's sustainability, although there might be a possibility to extend the contract as part of the Sahel climate portfolio.

Furthermore, one should note that it will still be necessary to find resources to implement the NDC plan after the current facilitator's contract comes to an end. The NDC plan only has an indicative budget associated to the investment plan and this is in no way guaranteed. In practice, the budget will be shared with all donors to see who can contribute to what. Burkina Faso is also thinking about the possible mobilisation of a National Fund.

2.2. Support to NDC partnership in Niger

2.2.1. Presentation of the project

From the end of 2018, the FPS Environment has provided technical assistance to the government of Niger and its National Center for Sustainable Development (CNDD) through the CITEPA in order to set up a national system of Green House Gas (GHG) inventory. This was undertaken through three distinct components:

- Setting up a Monitoring, Reporting and Verification (MRV) system to Support data collection mostly on energy, centralised electricity or self-produced by industrial actors.
- Write up Memorandums of Understanding (MoU) to establish sustainable agreements between stakeholders, particularly with data providers, and clarify the rights and obligations in terms of data transmission and data confidentiality.
- Support data collection on fluoride gases to integrate Hydrofluorocarbon (HFC) gases in the NDC.

In addition to the CITEPA (a non-profit private association and State operator for the French Environment Ministry which contributes to the fight against atmospheric pollution and climate change by calculating, interpreting and disseminating information on reliable emission data for decision-makers and specialists in France and abroad), 3 national consultants were contracted to support each of these 3 components.

2.2.2. Key findings

NB: A certain number of more general findings valid for both Niger and Burkina Faso have been left out in this section to avoid undue repetition.

Climate relevance

The work is particularly relevant to climate action as a good quality inventory significantly facilitates the work on NDC implementation. The inventory system is an essential piece of NDC implementation. It enables to see which sectors consume most energy and produced most emissions. This in turn helps calculate the impact of mitigation measures in terms of emission reductions and provides a good idea of where impact can be obtained and which sectors are most likely to yield it. The inventory methods in Niger give particular attention to energy consumption and industrial processes.

Hydrofluorocarbons (HFCs) are important GHGs. HFCs were adopted to replace the more potent chlorofluorocarbons (CFCs) in industry. They do not harm the ozone layer as much as the compounds they replace, but they do contribute to global warming, with trifluoro methane having 11,700 times the warming potential of carbon dioxide for instance. Their atmospheric concentrations and contribution to anthropogenic greenhouse gas emissions are rapidly increasing, causing international concern.

Alignment with local objectives

As is the case with all actions in the context of the NDC Partnership, the request emanated from the government and the NDC Support Unit coordinated with development partners to respond to it. The support is therefore totally aligned to local objectives. Almost 20 ministries were involved and agreed on the needs.

As a result, following a request by the Niger NDC focal point, the FPS Environment contacted CITEPA with 3 objectives in mind corresponding to 3 local demands. The 3 components were selected on the basis of an initial support also provided by CITEPA.

Beyond the inventory, the CNDD is particularly interested in building capacity with respect to mitigation as well as to cost benefit analysis linked to adaptation action. All actors need capacity building: Ministries of Energy, Agriculture, Animal husbandry, Industry, Petrol and Environment, as well as the United Nations Framework Convention on Climate Change (UNFCCC) focal point which is attached to the Prime Ministers cabinet. The Belgium supported technical assistance has contributed to satisfying this wide-ranging need.

Partnerships

The support took place in the framework of the NDC Partnership and was undertaken by CITEPA and the National coordinator. The Memorandum of Understanding was proposed by CITEPA.

The UNDP also supported the data collection financially. However, apart from the collaboration with UNDP, it is a standalone project. Moreover, the COVID 19 crisis prevented the CITEPA team from travelling to Niger so they undertook the assignment at a distance (although they hope to be able to take part in a closing mission). Their main interlocutor has been the Ministry of Environment but there are also contacts with the Ministries of Agriculture, Energy, Industry, Forests and the Waste Management agency. Such exchanges depend a lot on the way the effect monitoring system is structured.

Aside from FPS Environment, the UNFCCC focal point (and CNDD) consider they don't have much contact with other Belgian cooperation actors at a national level. Enabel develops varied actions related to adaptation and resilience but they have no MoU. The UNFCCC focal point would wish to be more implicated in the identification of Enabel's actions, possibly through an MoU.

At the level of the Belgian technical assistance, contacts with the main development partners active in climate action in Niger (UNDP, UNEP, FAO, Oxfam and IFAD) have not been developed. Also, despite the CILSS's presence in Niger, the intervention has not interacted with Agrhymet in any way.

None the less, Belgium has financed a dialogue workshop with all climate change actors whether they manage data or are implicated in the NDC revision process. Besides, there have been interactions with the so called "francophone cluster" of the Partnership for Transparency in the Paris Agreement, which is supported by Belgium. The cluster works as a network of African francophone countries which organises a workshop (sometimes 2) every year.

More generally, the UNFCCC focal point coordinates dialogue at the level of at least two climate related exchange platforms.

Efficiency

The work has involved establishing a method for data collection (particularly for HFC as they had never been the object of data collection in the past), touring energy sites in the country and setting up a system for archiving GHG data over the period 1997 to 2017. According to actors met, the inventory system is not a big investment but it is essential and represents money well spent.

Niger has a good system to select sites and businesses for inquests. Supporting data collection on fluoride gases was the most complicated component because the national consultant was less implicated.

More globally, Belgian work on the data inventory and data archiving system is particularly appreciated as it is considered a delicate question in the subregion, and Belgium appears to be the only development partner providing such support.

As in Burkina Faso, FPS Environment monitored and took part in the management of the study but did not provide technical support itself.

Effectiveness & Impact

CITEPA support is technical support aimed at building capacity. It has set up the data archiving system and contributed to training 20 experts in the 2006 IPCC guidelines with the support of Belgium.

More concretely, the following results can be underlined:

- Data on Niger's GHG emissions from 1997 to 2017 have now been archived.
- HFC can now be taken into account by Niger which was not the case in its first NDC.
- The Memorandums of understanding enable data on GHG emissions to be collected annually, not only when an inventory is undertaken (generally every 4 years).
- Local experts now master IPCC 2006 guidelines.

Results have been obtained for all three components. Only the work on fluoride gases may need additional capacity building. Niger authorities are satisfied by the results.

In Niger, the inventory system has helped understand how far agriculture, deforestation and energy are key sectors in terms of climate change mitigation (and to a lesser extent, climate change adaptation). Water management is key to adaptation. Deforestation is very much linked to energy and agriculture. Examples of findings indicated by national authorities are the fact that the Agriculture, Forestry, Animal husbandry and other land uses sector represents over 88% of Niger's emissions. In this sector, it is possible for Niger to reduce its emissions by 30% as it has committed to. In terms of hydrocarbon use, they also indicated that data points to the fact that subsidising gas to limit deforestation can in some instances be a relevant transition measure because it will not be possible to replace wood at very short term in some areas. Moreover, gas can provide co benefits because it lessens the need for women to collect wood and reduces emissions as gas stoves are more efficient than wooden ones.

Future impact may be further foreseen as setting up an MRV system is an essential condition to access international climate finance, particularly that aimed at GHG mitigation projects.

Climate-related monitoring

A GHG inventory is a basic requirement at the heart of monitoring climate mitigation. The support provided by the FPS Environment is not however directly aimed at reducing GHG emissions themselves but at supporting the monitoring of such emissions which constitute clear climate related indicators. In order to monitor the work of the technical assistance it provides, the FPS Environment is in contact with the coordinator at a national level. The setting up of the inventory system (including that specific to HFC) and the existence of MoU with data providers are thus the object of review and evaluation. Beyond this work, , however, no system for monitoring the quality of the GHG inventory and its effectiveness in evaluating climate mitigation efforts is yet established.

More widely, climate impact and NDC implementation indicators are still waiting to be set up. It is necessary to build a system to collect information on NDC progress and centralise it, focalising on NDC plan activities. This responds to the guidelines established in the COP 24 in Katowice, to be implemented by 2024.

With the initial NDC, no effort was made to establish indicators of progress because these NDC were established at the last moment by international experts, and too focused on urgently setting up NDC plans and implementing them. After 5 years they are incapable of properly measuring effects obtained by the initial NDC plan although they do follow emissions.

Presently, there is a big demand from countries concerning NDC tracking in relation to adaptation and mitigation. To follow emissions, it is possible to follow the LEAP model which modelises future increases in emissions with respect to various sectors: transport, deforestation. One looks at where emissions will increase most and tries to act. Training on the LEAP model is provided in the context of the French cluster of the Partnership for Transparency in the Paris Agreement.

Expected sustainability

It is considered that the inventory system has enabled to set up a sustainable tool appropriated by Niger. However, Niger has already launched a call for offer to continue in the line of what Belgium has done. They wish to strengthen the institutionalisation of a database for an information system. They hope to continue working with Belgium and the CITEPA. After 2024, they will have an Enhanced Transparency Framework / cadre de transparence renforcé (CTR) and wish for Belgium to continue to support within this framework.

Authorities also consider that after the inventory, there is a need to strengthen capacity in terms of mitigation and intensify actions which will have an impact.

More generally, concerning sustainability of the intervention, it is pointed out that, future data collection could be jeopardised by a lack of resources to collect data. The MRV mission has already been confronted to such problems; indeed, it is expensive to travel the country, inspect sites and collect data: Niger's petrol production site, for instance, is 1300km away.

In addition, as in other countries, Niger suffers from a brain drain problem due to the fact that trained personnel tend to abandon local service to be employed by international organisations This however has not (yet?) been the case of personnel trained by CITEPA.

2.3. KivuWatt Rwanda

2.3.1. Presentation of the project

The KivuWatt project was initiated in 2011 and resulted in the commissioning of a power plant in 2015, straddling the city of Kibuye and the Kivu lake. The power plant is an innovative solution to the threatening reserve of methane and carbon dioxide (CO₂) dissolved in the Kivu lake². **The main objectives for BIO to invest in KivuWatt were to provide broad access to affordable energy to Rwandans, to support private sector development, and to avoid new gas eruptions in the region** (interviews, representatives from BIO and Contour Global). The project is formally classified by BIO as an 'Energy efficiency electricity generation' undertaking, 'alternative to other form of thermal generation emissive source of CO₂ and contribution to diminution of methane emanation from the lake'³. During the project development stage, the 'fight against climate change' was not yet part of BIO's development assessment, which was only formalised in 2015⁴. In 2017, a back tracking exercise was conducted by BIO, whereby the 2015 assessment system was applied to older investments. Then, the KivuWatt project was identified as a climate-relevant investment qualifying for a Rio Marker 2 (primary objective).⁵

Acknowledging that methane is released regularly and may erupt when waters are saturated or when earthquakes occur⁶, threatening the health of the two million inhabitants living nearby⁷ and jeopardizing Rwandan mitigation efforts, the project extracts the gas to produce electricity⁸ (interview, representative from Contour Global). The KivuWatt project represents the first instance of gas extraction from water in the world⁹, which makes it a complex engineering operation and requires constant and costly monitoring (interview, representatives from Contour Global).

The facility offers a 26.2 MegaWatt (MW) generation capacity¹⁰, and delivers a third of Rwandan energy production¹¹. The plant will be transferred to the government property at the end of the 25 years concession period. Added to the low costs of the electricity produced, the project thus offers a strong social impact and has been generally welcomed by the local community¹². The plant commissioner, ContourGlobal, conducted additional trainings for local fishers and farmers along with school refurbishments as corporate social responsibility projects¹³.

From a geopolitical perspective, the project further represents an opportunity for cooperation between Rwanda and the DRC¹⁴. As the Kivu lake and its methane are a shared resource between the two neighbouring countries, the project had to garner DRC support prior to its development. A permanent Bilateral Regulatory Authority is now under consideration¹⁵. Congolese authorities also indicated their willingness to share knowledge and experience for developing equivalent methane extraction facilities.

² Lake Kivu's Great Gas Gamble, MIT Technology Review, 2015, Retrieved from: <https://www.technologyreview.com/2015/04/16/248915/lake-kivus-great-gas-gamble/>

³ Energy-Climate finance investments table (Shared by BIO)

⁴ BIO (2015). Annual report. Impact Investing From Belgium for Africa, Asia and Latin America. Retrieved from: <http://docplayer.net/48460382-Impact-investing-from-belgium-for-africa-asia-and-latin-america.html>

⁵ Based on e-mail correspondence with representative BIO, 6 May 2021.

⁶ Lake Kivu Gas Extraction, Report on Lake Stability, Kling et al., 2006, Retrieved from: <https://www.wits.ac.za/media/wits-university/conferences/misgsa/documents/2019/Lake%20Kivu%20Gas%20Extraction%20Report.pdf>

⁷ MIT Technology Review, Ibid

⁸ KivuWatt Investment Analysis, 2011 (Shared by BIO)

⁹ <https://www.contourglobal.com/asset/kivu watt>

¹⁰ KivuWatt Annual ESMR, 2020 (Shared by BIO)

¹¹ Project Review Report, 2019 (Shared by BIO)

¹² KivuWatt Investment Analysis, 2011 (Shared by BIO)

¹³ Project Review Report, 2019 (Shared by BIO); KivuWatt Annual ESMR, 2020 (Shared by BIO)

¹⁴ MIT Technology Review, Ibid

¹⁵ KivuWatt Annual ESMR 2019 (Shared by BIO)

The intervention was approved under the BIO-FMO Risk Sharing Agreement and represents a 10€ million investment for Belgian cooperation¹⁶. BIO will not finance the next investment round of the KivuWatt project (interview, representative from BIO). A reason for this, amongst others, is that the project will be financed as part of a larger country portfolio, including projects that do not meet the International Finance Corporation's (IFC) environmental and social performance standards to which BIO is compliant.

2.3.2. Key findings

Climate relevance

As explained in the introduction, the initial purpose of the project was *not* to mitigate climate change, but to reduce the risk of a natural disaster in Lake Kivu in combination with the increased access to affordable energy for Rwanda (Interviews, representatives BIO and Contour Global). Due to the unique¹⁷ chemical characteristics of the lake, the project climate relevance is not clear-cut.

Methane radiative forcing is estimated to be 20-25 times stronger than carbon emissions. For this reason, the CO₂ emissions associated with electricity generation are less detrimental to the environment comparatively to the natural release of methane. This rationale is central within the intervention logic of the KivuWatt project¹⁸ (interview, representatives from Contour Global), which de facto does not rely on traditional criteria for establishing climate relevance. In this regard, the KivuWatt must be considered in the broader debate surrounding methane extraction: climate relevance must be questioned in terms of avoided emissions, other available technologies¹⁹ and monitoring (see section 3.6.).

Due to this complexity, the climate relevance of the project highly depends on the baseline used for assessment. BIO's investment strategy relied on a broad baseline, which included the inevitable methane leaks from the lake and the use of expensive and polluting diesel generators by locals (interviews, representatives from BIO). From this perspective, the KivuWatt project's GHG emissions associated with methane burning were deemed acceptable by BIO at the time of project appraisal. Interviewees also flag that the project was selected prior to the development of BIO's sustainability strategy. For this reason, the climate relevance of the KivuWatt project was examined specifically from the perspective of the Rwandan context, rather than against systematic climate criteria. In 2017, a backtracking exercise was conducted by BIO, whereby the 2015 assessment system was applied to older investments. Then, the KivuWatt project was identified as a climate-relevant investment qualifying for a Rio Marker 2, due to the efficiency of its technology and the avoided emissions associated with local diesel generators and methane leaks (communication with a representative from BIO). The recent pledges by European development banks related to climate-neutrality²⁰ are likely to act as push for reviewing methodologies, which might affect the conclusions from this backtracking exercise (communication with a representative from BIO).

Following European guidelines to measure the impact of gas projects²¹, three additional considerations may complement the rationale for qualifying the KivuWatt project as the best available technology available in the region. Added to the avoided use of diesel generators, and impossibility to use turbines on the instable surface of the lake (interview,

¹⁶ KivuWatt Investment Analysis, 2011 (Shared by BIO)

¹⁷ MIT Technology Review, Ibid

¹⁸ Lake Kivu Gas Extraction, Report on Lake Stability, Kling et al., 2006, Retrieved from: <https://www.wits.ac.za/media/wits-university/conferences/misgsa/documents/2019/Lake%20Kivu%20Gas%20Extraction%20Report.pdf>

¹⁹ Measuring the contribution of gas infrastructure projects to sustainability as defined in the TEN-E regulation, European Commission, 2020, retrieved from <https://op.europa.eu/en/publication-detail/-/publication/364d69a4-1744-11eb-b57e-01aa75ed71a1/language-en>

²⁰ EDFI Statement on Climate and Energy Finance, EDFI, 2020, Retrieved from: <https://www.edfi.eu/wp/wp-content/uploads/2020/11/1.-EDFI-Statement-on-Climate-and-Energy-Finance-Final.pdf>

²¹ European Commission, Ibid

representatives from Contour Global), local environmentalists mention that the electricity production leads to a decrease of illicit charcoal use and associated deforestation²². Furthermore, it is important to measure actual rather than potential emissions. The fact that the KivuWatt project approaches but does not reach its full capacity (interview, representative of BIO) implies that emissions are lower than initial estimations. Finally, the impossibility to retrofit the powerplant for switching towards less radiative fuels may not be analysed as a detrimental lock-in, since methane is constantly produced and emitted by the lake.

Alignment with local objectives

The project is fully in line with Rwandan objectives for electrification and private sector development.

Rwanda's energy generation capacity remains one of the lowest of the continent, such that the project provides direct benefits to locals and national objectives. The KivuWatt project increased the national electrification rate from 6% to 10%²³. Similarly, the project backs the national diversification of the energy mix and the focus on renewables.

The private sector is also indirectly supported by the project. The government-owned Rwanda Energy Group faces inefficiencies and elevated costs. The cost-effectiveness and management of the KivuWatt project directly led to decreased operational generation costs in the country²⁴. This decreased yielded benefits for the government, with important savings in subsidies for electricity purchase. BIO also identifies this gain as a major advantage for businesses, offering opportunities for strengthened competitiveness²⁵.

Partnerships

Due to the high complexity and up-front costs (141.66USD million initially estimated²⁶), BIO partnered with FMO, the Emerging Africa Infrastructure Fund (EAIF) and the AfDB. As mentioned above, BIO's participation took place under the BIO-FMO Risk Sharing Agreement, which suggests a coherent approach between Belgian action and international climate action of other donor countries. FMO initiated due-diligence and introduced the project to BIO²⁷. The intervention is now identified as a global technological showcase and as a highly relevant investment for Rwandan communities, suggesting the efficiency of the partnership between BIO and its Dutch counterpart.

The Government of Rwanda has been a key partner since the inception of the project, as indirect buyer of the produced electricity and future owner of the facility. Nonetheless, tensions emerged in 2017 between national authorities and developers surrounding a tariff increase and monitoring. Lenders intensified visits to authorities and attempted to pacify relations, including through their embassies (interview, representative from BIO), yet relations have not sufficiently improved to consider the expansion of the project²⁸. An arbitration is currently under way between the state-owned energy company and KivuWatt Ltd for damages associated with the delayed operation of the KivuWatt project²⁹.

Efficiency

The start of the implementation phase was delayed by 4 years, following difficulties with the initial contractor Civicon. Based on the interview with BIO's representative, as well as evaluation reports and further desk-review, the project appears to score well on efficiency during the implementation phase. This may be linked to regular compliance visits and monitoring activities. Due to the highly complex nature of the project, monitoring programs are in place for the physical state of the lake, additional quality and

²² MIT Technology Review, Ibid

²³ Project Review Report, 2019 (Shared by BIO)

²⁴ BIO, Ibid

²⁵ BIO, Ibid

²⁶ BIO, Ibid

²⁷ KivuWatt Investment Analysis, 2011 (Shared by BIO)

²⁸ Project Review Report, 2019 (Shared by BIO)

²⁹ Operating Report to Lenders, 2020 (Shared by BIO)

environmental impacts (air quality, noise emissions, waste management) and social aspects (health and safety, social actions)³⁰. As compliance is regularly and systematically ensured, and assessed against international standards, opportunities and challenges are identified early on. This generally supports the efficient conduction of the project.

Box 1. COVID-19 management

The management of the sanitary crisis supports the positive assessment of KivuWatt's efficiency. BIO's representative indicated that the COVID-19 risk was satisfactorily mitigated by pre-existing plans: the project adapted swiftly to the situation and only 2 cases of contamination were detected on-site.

The plan prevented major impacts on the facility, such that the operations were maintained. Likewise, the measurement of the environmental performance was conducted internally in March-July 2020 due to travel restrictions³¹.

Despite this internal management, COVID-19 affected Contour Global. Administrative difficulties related to the crisis complicated the obtention of the subsidies owed by the Rwandan authorities. A decrease in electricity demand in 2020 due to the lockdown was also noted by the interviewee. Although caught-up since, this transitional change is not excluded in the future.

Effectiveness & Impact

The project can be considered as effective with regards to its key objective of electricity generation. Although the construction of the facility was delayed due to engineering challenges and a defaulting contractor³², the operation is now running without major problems³³. The extraction efficiency for methane revolves around 83%, which corresponds to minimized losses³⁴. The overall operation approaches full plant capacity³⁵ and the grid availability³⁶ is increasing (currently reaching 93%; interview, representatives of Contour Global).

The project has an overall positive impact on local communities. BIO representatives' flag that certain families were re-located. They estimate that the extent of re-locations was acceptable compared to other infrastructure projects and to the social positive impacts of the KivuWatt project (e.g., creation of jobs, productivity of local companies). All actions planned under ContourGlobal corporate social responsibility have been launched, and a series of trainings have been conducted to build a pool of local staff members (interview, representative from Contour Global). The COVID-19 crisis reoriented a portion of the activities towards health objectives and the support to vulnerable families. The involvement of the commissioner in a Joint Action Development Forum, whereby 125 institutions coordinate social actions in the Kibuye district³⁷, suggests that the actions conducted are subject to synergies and maximized. Substantial projects such as the construction of water storage tanks are still under development and may therefore not be evaluated.

The effect of the KivuWatt project on the lake stability and biodiversity are the two major environmental risks^{38,39}, leading Contour Global to appoint a dedicated expert for environmental monitoring (interview, representatives from Contour Global; see 3.6.).

³⁰ KivuWatt Annual ESMR, 2019 (Shared by BIO); KivuWatt Annual ESMR, 2020 (Shared by BIO)

³¹ KivuWatt Annual ESMR, 2020 (Shared by BIO)

³² Project Review Report, 2019 (Shared by BIO)

³³ BIO, Ibid; KivuWatt Annual ESMR, 2019 (Shared by BIO)

³⁴ KivuWatt Annual ESMR, 2019 (Shared by BIO)

³⁵ Project Review Report, 2019 (Shared by BIO)

³⁶ The grid availability indicates the percentage of the total electricity produced by the KivuWatt which feeds-in the electric grid, thus accounting for inevitable losses of energy.

³⁷ KivuWatt Annual ESMR, 2019 (Shared by BIO)

³⁸ Management prescriptions for the development of Lake Kivu gas resources, Eawag, 2009, Retrieved from: <https://www.dora.lib4ri.ch/eawag/islandora/object/eawag%3A19124>

³⁹ MIT Technology Review, ibid

Concerns have been raised that the reinjection of water in the Lake after the methane extraction might affect the balance between the density layers of the lake⁴⁰. Evaluations and BIO representatives indicate that the regular assessments of the lake stability have not revealed issues⁴¹. By contrast, a representative from BIO indicates that the removal of methane would have the potential to stabilize the lake if the plant was used at full capacity.

Impacts on the lake biodiversity remain difficult to assess. Initial feasibility studies had suggested that the project would affect the repartition of nutrients in the lake in such a manner that it would balance adverse impacts from climate change, and increase fish yields⁴². However, during the pilot stage of the project, fishermen noticed that their catches decreased. The cause of this trend may be attributable to the introduction of predator species in the lake, to the unregulated circulation of boats, or to the KivuWatt project⁴³. BIO representatives do not signal impacts on fish yields.

From the perspective of BIO's mandate of private sector development, the KivuWatt project has an overall positive impact. BIO representatives attribute this success to the reliability of the electricity produced and to the lowered power prices. Local companies are not constrained by intermittent access to electricity, and Rwandan authorities realize important savings of subsidies due to the electricity costs decrease from 50 \$ cents to 12 \$ cents⁴⁴ (interviews, representatives from BIO and Contour Global). Nonetheless, a portion of the lake is not accessible anymore to fishers⁴⁵, which may have caused a decrease in their revenues. At the investment level, the KivuWatt project may be re-financed if sufficient interest from investors emerges. A teaser for the next investment round was issued in winter 2021 (interview, representative from BIO). Moreover, the experience of the KivuWatt led the company Symbion Power to undertake a similar project 50 kilometers further on the Kivu lake⁴⁶, suggesting that BIO has fulfilled its general objective of catalyzing private finance.

Climate-related monitoring

Amongst all projects under review, the KivuWatt project provides the strongest example of monitoring, although the monitoring is not motivated by climate mitigation objectives. Monitoring is characterized by regular visits, quarterly environmental and social monitoring reports⁴⁷. It combines standard on-shore and tailor-made off-shore monitoring procedures.

On-shore monitoring ensures that the KivuWatt project complies with the World Bank standards on gas emissions (interview, representatives from Contour Global). Monitoring indicators include air concentration in nitrogen dioxide, sulphur dioxide, carbon monoxide and particulate matter. Measurements of air concentrations are assessed against WHO guidelines⁴⁸, such that fully climate-relevant measures (e.g. CO₂e emitted for methane-based electricity production) are not available⁴⁹.

Off-shore, monitoring is tailored to the particular Kivu lake instability. The geological and environmental characteristics of the lake are constantly monitored to ensure that the project does not affect its surroundings (interview, representatives from Contour Global).

⁴⁰ The repartition of gases and nutrients in the water leads to the stratification of the lake in several water layers, each bearing its specific density level. The layering ensures the stability of the lake. See MIT Technology Review, *ibid*.

⁴¹ KivuWatt Annual ESMR, 2019 (Shared by BIO)

⁴² Lake Kivu Gas Extraction, Report on Lake Stability, Kling et al., 2006, Retrieved from: <https://www.wits.ac.za/media/wits-university/conferences/misgsa/documents/2019/Lake%20Kivu%20Gas%20Extraction%20Report.pdf>

⁴³ MIT Technology Review, *ibid*

⁴⁴ Comparatively with the costs of power from a diesel generator.

⁴⁵ MIT Technology Review, *ibid*; interview, representatives of BIO

⁴⁶ MIT Technology Review, *ibid*; interview, representatives of BIO

⁴⁷ KivuWatt Annual ESMR, 2019 (Shared by BIO)

⁴⁸ KivuWatt Annual ESMR, 2019 (Shared by BIO)

⁴⁹ BIO, *Ibid*; Ambient Air Quality Assessment Report, 2019 (Shared by BIO)

Along with the senior environmental lake expert mentioned above, an independent Lake Monitoring Unit is in charge of these assessments. The Unit is a Rwandan institution, fully integrated in the public Rwanda Energy Group, and is perceived as a strong safety guarantee by investors (interview, representative from BIO).

Expected sustainability

The KivuWatt project appears to deliver sustainable social, economic and climatic results. Corporate social responsibility activities are diverse and actively combined to existing local efforts⁵⁰, which paves the way to a strong buy-in and take-up of communities. Nonetheless, the communities' access to energy remains dependent on the investment strategy of the Rwanda Energy Group in electricity distribution, especially for communities located far from the powerplant (interview, BIO representative).

From an economic perspective, the project initiates efficiency gains and price decreases in the electric grid, which are solidly enshrined in national systems and thus likely to remain⁵¹. At a local level, the economy also benefits from the creation of around 45 jobs⁵².

The developer's corporate strategy also serves BIO's sustainability goals. Indeed, representatives from Contour Global indicate that the company aims at a 'best in class' position in methane extraction, and considers implementing carbon capture & storage solutions on the KivuWatt plant.

These results must be linked to BIO's investment approach. As explained in interviews by BIO representatives, the institution ultimately aims at local self-sufficiency. For this reason, sustainability is addressed from the selection and inception phases (with BIO's representative mentioning criteria as permanent employment and equivalent number of people provided with energy), thus making it a core concern during operation.

2.4. WAtEr MAnagement and urban DEvelopment in Ha Tinh in relation to climate change (WAMADE), Vietnam

2.4.1. Presentation of the project

The WAtEr MAnagement and urban DEvelopment in Ha Tinh in relation to climate change - WAMADE project is a university cooperation project implemented in Vietnam by VLIR UOS. The project studies urban development under climate change, and provides scientific support in the form of tools to develop sustainable development plans, taking into account the need for (1) flood risk mitigation, (2) the role that green in the city can play in support of such mitigation, (3) the related needs for housing (water robust and climate proof). The research is covered by different PhD researchers, but strong cooperation between them exists because of their interdependencies.

The overall academic objective of the intervention is to "Create and disseminate knowledge on flood risks and sustainable urban development in the humid tropics under climate change". The overall development objective is to "Increase the sustainability of urban development in a flood/drought prone coastal area under different scenarios of climate change and urbanization and provide policy guidelines to the Government of Vietnam".

Specific objectives are:

1. To understand the complex chain of causal links between occurrence of flood and drought in relation to climate change and urban development by applying and adapting the DPSIR framework (DPSIR – Drivers – Pressure – States – Impact – Responses)

⁵⁰ BIO, Ibid

⁵¹ Project Review Report, 2019 (Shared by BIO)

⁵² BIO, Ibid

2. To explore different scenarios of urban development with special attention for the blue and green networks and sustainable building concepts
3. To develop urban planning tools, particularly so as to mitigate flood risk.
4. To strengthen the capacity of Vietnam National University (VNU) in research and education on hydrology and sustainable urban development in relation to climate change

The research covers two main themes which are strongly interconnected with many feedback loops, and influenced by climate change:

- **Hydrology and Integrated Water Management;**
- **Sustainable urban development.**

More specifically, the intervention concerns flood hazard analysis and flood risk modelling in Ha Tinh City. In partnership with the Institute of Vietnamese studies and Development Sciences (IVIDES), a Vietnamese institution based in Hanoi. The 5 year programme began in 2016 has a total budget of 299.978 euros.

The research involved 2 Vietnamese PhD students undertaking their PhDs in Belgium in :

- **Hydrological (current and future pluvial urban flood hazard) assessment of Ha Tinh**
- **Sustainable Urban Development in Ha Tinh**

Two Vietnamese students undertook local PhD's in Vietnam in :

- **Remote Sensing for Sustainable Urban Development in Ha Tinh**
- **Simulation of outdoor thermal condition of sub-urban neighborhood typology in Ha Tinh**

In addition, 4 MSc thesis by Belgian students were undertaken in :

- **Flood risk modelling for Ha Tinh city, Vietnam, under current and future climate conditions**
- **Modeling of the urban flood hazard for Ha Tinh City, Vietnam, under current climate conditions**
- **Assessment of the impact of local climate zones on pm2.5 concentrations in Hanoi, Vietnam"**
- **Assessment of tree canopy cover and land cover with Landsat imagery in Ha Tinh, Vietnam"**

Further research and training was also undertaken by PhD students and a set of 9 Belgium Professors from KU Leuven and Université Catholique de Louvain (UCL) as well as 4 Vietnamese Professors from VNU.

2.4.2. Key findings

Climate relevance

Vietnam is one of the countries most at risk from rising sea levels and climate change. According to the World Bank, Vietnam is the most vulnerable country among the 84 coastal developing countries in terms of impact of climate change on population, gross domestic product (GDP), urban sprawl and wetland areas. Within Vietnam Ha Tinh is one of the poorest provinces.

Vietnamese cities are highly vulnerable to urban flooding as a consequence of climate change and rapid urbanisation that further increases its already high vulnerability. A better urban planning is needed to respond to climate change, disaster risks-related problems and an increasing population. Water is identified among those problems, even more pronounced in coastal cities like Ha Tinh city, that suffer from more frequent and stronger storms and typhoons, a changing rainfall pattern, and more regular and extreme floods. Working on local climate zones so as to understand how you can make cities more robust and resilient to climate change by building them differently is also essential.

How does catchment behaviour change when soils become more impervious by urbanisation? What can urban and peri-urban green contribute to flood reduction and improving city life? What niches of the urban and peri-urban landscape can be used as buffer? What is the impact on floods, in house thermal comfort and the urban heat island of certain water management measures, of using different building materials and of spatial arrangements, or of methods of energy use? Where are the highest degrees of freedom and risks, regarding certain measures (e.g. dykes, flood areas, temporary storage, improved or reduced infiltration, etc.) on the quantity and quality of the water and in particular floods? What is the current status and use of urban green and how is this developing? How does urban development work to reduce greenhouse gas emissions, including green infrastructure, smart solutions for water sensitive design, preventing heat islands, energy efficiency, and establishing operational early warning systems and evacuation plans, etc.? What is the perception of flood risk, understanding of climate change and public views on flood protection? These are all key questions. There is also a need for baseline data and monitoring. Scenarios need to be developed to deal with the issues of floods, deteriorating environmental condition and an increasing population.

Moreover, Vietnam, as a MIC country, is ideal for university collaboration. The country has reached a stage that needs for state-of-the art knowledge, rather than monetary support and this is one of the strong points of universities. The knowledge gained will ultimately also benefit other lower income countries that are vulnerable to climate change.

Alignment with local objectives

Adaptation to climate change and urban development, particularly flood risk mitigation, is increasingly perceived by the Government of Vietnam and policy makers at the different levels as a crucial issue for the future.

The WAMABE project fits entirely within the priority theme 'Environment and natural resources (Climate change)' that is described in the Vietnam Strategy Document. There are links with the Health theme, by working on the prevention of flooding and its resulting damage and risks of diseases and the theme 'Technology Development' by developing a tool box for urban planners (Spatial explicit modelling, Remote Sensing, GIS) to assess risks, water balances, energy flows and energy and water balances and fluxes and develop alternative scenario's.

Moreover, Climate change and environment have been put forward in the strategy paper "The Belgian Development Cooperation in middle-income countries" and in the 2011-2015 Development Plan of Ha Tinh province.

Partnerships

VLIR's main counterpart for the intervention is IVIDES.

Initially, strong links were planned to be developed with the Enable "Water management and urban development in relation to climate change in the provinces of Ha Tinh, Ninh Thuan and Binh Thuan" development project that worked in 3 coastal cities. Enable wished to involve VLIR through Klimos in a case study. There were strong potential synergies but subsequently a change in Enabel personel led to a weakening of the collaboration.

Good relations have been developed between WAMADE and the Belgian Embassy in Hanoi. VLIR very much appreciates the collaboration of the Belgian Embassy. They used to have yearly workshops which were very much appreciated; it gave them moral support as well as a form of recognition and formal back up to their activities. The Embassy's support helps to obtain cooperation and support both from local authorities as well as other DPs. It also supports the emergence of additional projects and reaching out to a much wider audience than they would attain alone.

There were also links with a set of other on-going interventions:

- ASRO – KULeuven support to several PhD students from Can Tho University which contributed to a research project on “Water Urbanism to respond to Climate Change” (2010-2012), in collaboration with VIAP (Vietnam Institute of Architecture & Planning).
- A soil erosion project in North Vietnam implemented by Wallonie-Bruxelles International (WBI).
- Work by Institute for Soil and Environmental Transition (ISET) International, that is active in 5 more southern Provinces in Vietnam, and an IIED (International Institute for Environment and Development) project under the Asian Cities Climate Change Resilience Network (ACCCRN) on urban climate resilience planning in Quy Nhon city, Vietnam.
- An Asian Development Bank (ADB) project “Integration of Climate Technology Financing Needs into National Development Strategies, Plans and Investments Priorities” to conduct a climate change and technology assessment and evaluate the potential of incorporating various new and innovative climate technologies in the agriculture & water sector investments.
- Work by the Vietnam Green Building Council, an NGO working on the development and distribution of green building techniques and materials and works on certification.
- A Project on Climate change Induced water disaster and participatory information system for vulnerability reduction in North Central Vietnam (CPIS) funded by DANIDA (Denmark).

However, scant information is available on these interventions. Collaboration took place in various instances (soil erosion with WBI, IIED, ISET...) but the level of integration was weak and synergies appear to have been limited.

Efficiency

Despite a slight extension, the WAMADE project is considered as efficient.

Mapping the effect of hydrological infrastructure (dykes...) and the influence of man on waterflows was assisted by remote sensing methods and hydrological modelling methods. This helps see how modelled areas of flooding are different from observed areas of flooding and adjust the flood mapping models accordingly. On the whole it is a cost-effective way to achieve results and can be largely performed at a distance.

In terms of intervention method, one should note that, even though Ha Tinh remains the focal area of WAMADE, in 2019 part of the fieldwork was also carried in Hanoi. The size of Hanoi means that there is a larger contrast in local climate zones, air pollution, ... making it more interesting from a scientific point of view.

A further important point is that adapting a city to climate change and making it more resilient can only be done with the local population and policy makers. Hence, a participatory environmental monitoring and modelling approach was important to achieving results.

Moreover, Covid-19 was obviously a setback for the entire WAMADE team. Beyond travel restrictions, for Vietnamese PhD students, social isolation in Belgium was mentally demanding. However, thanks to the Vietnamese government quite strict COVID control measures, it became rapidly possible again to carry out fieldwork driven and executed 100% by the Vietnamese team.

In terms of the collaboration with Enabel, the project started a year later than the Enabel action which was a problem as ideally research should come before development itself. As a result, Enabel’s activities were already laid out before they could have any results which

lessened the interest of a collaboration with Enabel as there was no direct link with implementation. In addition, as Enabel wished to move ahead quickly, a lot of study work which could have been undertaken by VLIR was handed out to consultants. These did a good job but synergies between the two interventions were lessened.

Effectiveness & Impact

Most of the planned activities have been - or are being - carried out. Overall, most of the results will be obtained – and a bit extra with regards to the air quality work.

The study helped build a system for modelising (and predicting flooding) in urban areas. Research also helped understand how buildings can be made more climate proof. This links to the needs of housing but also to where you can build and where you shouldn't. Spatial phasing is a big issue both in Vietnam and in Belgium.

Green in the city is more related to local climate zones: they classify neighborhoods according to green spaces, the size of buildings or the height of buildings. This provides key information on how to design future cities.

More specifically, additional results can be pointed to:

- VNU benefited from the project through capacity building of staff and students. It has strengthened its experience and reputation as centre of excellence.
- Ha Tinh's city's people committee has benefited of the project's results on urban resilience planning.
- Ha Tinh provincial government has benefited through direct interaction with the scientists during project implementation. A decision support toolbox for local governments was planned to be developed to support sustainable urban planning (but no information has been collected on this tool).
- The national government has benefited from the research carried out in a small city whose results can be applicable to many other small cities in Vietnam.

Climate-related monitoring

In so far as this research project is concerned with data collection and modelisation of climate change effects one can say that climate related monitoring is at its core though it is embedded in the project itself and no specific monitoring system has been designed for the intervention as such.

Expected sustainability

Sustainability of research results is inherent to the interest and relevance of such results. In the case of the WAMADE project results appear both relevant and crucial to future urban planning. It is likely that they will be very useful for the future.

Moreover, VLIR's collaboration with Vietnam in relation to climate issues goes on.