The nexus between nationally determined contributions and technology needs assessments: a global analysis

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The nexus between Nationally Determined Contributions (NDCs) and Technology Needs Assessments (TNAs): A global analysis

ABSTRACT

The role of technology in combatting climate change through mitigation and adaptation to its inevitable impacts have been acknowledged and highlighted by the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). In the developing world, this has received particular attention through the Technology Needs Assessment (TNA) process. As Parties put forward their national pledges to combat climate change, the scarcity of resources makes it important to assess (i) whether national processes designed to tackle climate change are working together and (ii) whether existing national processes should be terminated with the initiation of new ones. This study presents an assessment of the existing TNA process and its linkages to the Nationally Determined Contributions (NDCs), soon to enter implementation. The conclusions stem from an assessment of the TNAs completed to date, as well as 71 NDCs from developing countries at various stages of the TNA process. The analyses show that further developing the TNAs could play a vital role in filling gaps in the existing NDCs, specifically those relating to identifying appropriate technologies, their required enabling framework conditions and preparing implementation plans for their transfer and diffusion.

Key Policy Insights:

(1) The full potential of the TNAs has still to be rolled out in many countries.

(2) Developing countries can better maximize the potential of their TNAs by (a) further developing them to explicitly analyse what is needed to implement existing NDCs and support their future strengthening so that their outlined targets can be achieved, and

(b) better aligning focus, scope and up-to-dateness of the TNAs to be more consistent with the priority sectors included in the NDCs.

(3) The request of developing countries for international assistance, through technology transfer, will be better guided by the completion of the TNA process.

(4) Policies for implementing and strengthening the NDCs will benefit from the results of completed, ongoing and future TNA processes.

Keywords: Technology transfer; Nationally Determined Contributions

1. INTRODUCTION

In efforts to mitigate the emission of greenhouse gases (GHG) and adapt to the inevitable impacts of climate change already being experienced, Parties to the United Nations Framework Convention on Climate Change (UNFCCC) have long highlighted the role of technology in facilitating the achievement of their respective development goals in a more sustainable manner (Glachant & Dechezleprêtre, 2017; de Coninck & Puig, 2015; UNFCCC, 2008; UNFCCC, 2001). In the case of developing country Parties to the UNFCCC, assistance in determining their technology needs and priorities, and in promoting the transfer and diffusion of these prioritized technologies is being provided through the global Technology Needs Assessment (TNA) process (http://www.tech-action.org/)[1]. This focused and deliberate assistance is especially important for reasons highlighted in a recent article by Glachant and Dechezleprêtre, noting that, in contrast to emerging economies, developing countries eligible for TNA assistance have remained somehow excluded from international technology flows, thus presenting a critical challenge for the future which should be the focus for negotiations in the coming years (Glachant & Dechezleprêtre, 2017). As the TNA process enters its third phase (a selected group of countries receive assistance in each phase, based on their readiness and willingness to conduct a TNA), all Parties to the UNFCCC are also preparing for the operationalisation and implementation of their Nationally Determined Contributions (NDCs) under the Paris Agreement.

UNFCCC reports have previously analysed linkages between the TNAs and Nationally Appropriate Mitigation Actions (NAMAs)[2] (UNFCCC, 2013) and the TNAs and NDCs (UNFCCC, 2016). Both of these reports focus on the processes and their interlinkages, and the potential for countries to further benefit from synergies between these. Numerous reports also summarize NDCs and the priorities identified in them (see for example USAID, 2016; ADB, 2016 or FAO, 2016, the latter having a focus on the agricultural sector). Rahman & Miah

(2016) perform a content analysis of Intended Nationally Determined Contributions (INDCs) from Middle Eastern and North African countries, finding that the majority of countries identified elements relating to finance, technology transfer and capacity building. However, none of the above-mentioned reports or papers go into detail to provide a systematic analysis of what countries specifically identify as their technology needs to fulfil their NDCs.

Given the limitations of time and other resources available for tackling climate change, especially in the developing world, it is important that efforts are optimized to produce best results, with minimum redundancy and waste of resources. Therefore, at this juncture, it is essential to ask two critical questions; (i) *how and to what extent are technology and technology transfer*[3] *(specifically as underlined in the TNA process) addressed in the NDCs?* and (ii) *is there a need for continuing the TNA process once the implementation of the NDCs has begun?* Answering these questions will be achieved through the two main objectives of this paper. Firstly, this paper will map the linkages between the TNAs and NDCs (where both have been conducted in the respective countries), providing an understanding of whether and how the two processes simultaneously and harmoniously contribute to the overall aims of mitigation of, and adaptation to, climate change. Secondly, it will identify and assess possible avenues for TNAs to prepare the ground work for the implementation and achievement of the NDC targets – specifically in the case of countries that have not yet conducted a TNA – thus providing some guidance to policies determining whether it is useful to still pursue TNAs while also focusing on NDC implementation.

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2. OVERVIEW OF THE TNA AND NDC PROCESSES

2.1. *The TNA process:*

Efforts to facilitate and improve technology transfer to developing country Parties to the UNFCCC through a Technology Needs Assessment process were first initiated in the early part of this century, following decision 4/CP.7 of the COP, in what is now commonly referred to as the *first generation* TNAs (UNFCCC, 2001). Though many lessons were learnt from these first generation TNAs, they were largely incomplete, lacking both in-depth analysis of barriers for technology transfer and diffusion, and the identification of enabling frameworks[4]. As a result, the first generation of TNAs did not produce any technology action plans (TAPs) and were thus unable to fulfil their primary objectives of facilitating technology transfer and diffusion to developing countries.

Originating from the Poznan Strategic Programme on Technology Transfer, which was established through decision 2/CP.14 at the Fourteenth Conference of the Parties (COP 14) to the UNFCCC in 2008, the ongoing TNA process aims to increase the level of investment in the transfer and diffusion of technology to assist developing countries address their needs for environmentally sound technologies (UNFCCC, 2008). These technologies (also referred to in the literature as "climate technologies") are geared at aiding developing countries to follow a more sustainable path towards mitigation of, and adaptation to, climate change (de Coninck & Puig, 2015). The TNA guide note (Haselip, Narkeviciute & Rogat 2015, pp 4.) defines a TNA as '*a set of country-driven, participatory activities leading to the identification, selection and implementation of environmentally sound technologies to decrease GHG emissions (mitigation) and/or to decrease vulnerability to climate change (adaptation)*'. Although the design of the TNA process can be seen as top-down, as it originated from decisions within the UNFCCC at the international level, actual implementation is a stakeholder driven process, with

the participation of stakeholders at all levels from the targeted sectors and institutions in the country. Emphasizing a participatory approach, the TNA process offers flexibility and allows countries to adjust the process and its activities to other existing national processes in order to maximise value added[5]. Importantly, instead of standing alone, the TNA process aims to build on existing national development and climate plans and should be integrated with other similar ongoing processes, in order to support the sustainable development of the country where it is being undertaken. Some of these processes include National Adaptation Plans (NAPs)[6] and NAMAs, which are able to incorporate the results of the TNA to improve the use of technology in achieving their goals.

In 2009, following the establishment of the Poznan Strategic Programme on Technology Transfer, phase one of a *second generation* of TNAs was initiated, guided by handbooks and experiences generated from the first generation (UNFCCC, 2008). The United Nations Environment Programme (UN Environment), through the UNEP DTU Partnership (UDP)[7], is responsible for spearheading the implementation of this new generation of TNAs, which includes three key components aimed at making them more than just a static picture of the technology needs of a country[8]. Instead, the aim is to design and properly conduct a complete TNA, to provide an in-depth analysis of the country conditions, which in turn can help offer answers to some of the questions arising from a country's broader national plans for adaptation to and mitigation of climate change, as they relate to the technology issues. The first component of the TNA process involves the prioritization of technologies through a country driven participatory process, inclusive of all relevant stakeholders. When the technologies have been prioritized, and approved by the national steering committee, the second component involves an analysis of barriers and enabling frameworks for their diffusion and uptake. This is followed by a third component which involves the preparation of technology action plans (Haselip *et al*., 2015). Importantly, the TAPs should systematically address practicalities aimed at removing

or reducing all barriers (policy, finance, social, etc.) to the uptake and scaling up of investment in climate technologies. Funding for the global TNA process is provided through the Global Environment Facility (GEF) (http://www.tech-action.org/) and countries can only apply to take part in the process by submitting an official request to the GEF.

To date, 61 countries[9] grouped into three geographic zones – (i) Africa and the Middle East, (ii) Asia and Eastern Europe, and (iii) Latin America and the Caribbean – have participated in the first 2 phases of the second generation of TNAs (a complete list of these countries is provided in Appendix 1). The preparatory ground work for a third phase of the TNA process started in late 2016 and this phase is expected to run until 2021. All TNA in-country activities are carried out by local consultants led by a national TNA Coordinator, with technical support from UNEP DTU Partnership and collaborating regional centres. The overall budget made available from the GEF for conducting a TNA is around USD 250 000 per country. This is meant to cover several global, regional and local training workshops, tools and methodologies, technical support missions to the countries, costs of local consultants, etc.

To date, there has been limited tracking of the implementation status of the project ideas emanating from TNAs. Nevertheless, examples of implementation include the recent approval of two project proposals from XacBank in Mongolia to the Green Climate Fund, which build on Mongolia's TNA (GCF, 2016; GCF, 2017). In Mali, recommendations on agricultural management techniques put forward in its TAP have been taken forward by the Malian Institute of Rural Economy, together with the UNFCCC Climate Technology Centre and Network (CTCN)[10]. Also, the Government of Moldova has implemented key elements of its TAP for climate change adaptation in the health sector (UDP, 2017).

2.2. ***The NDC process:***

Through its decisions 1/CP.19 and 1/CP.20, the Conference of the Parties (COP) invited all Parties to communicate their Intended Nationally Determined Contributions (INDCs) to the UNFCCC secretariat, as part of the negotiations on what became the 2015 Paris Agreement. The INDC process was designed to be entirely country driven, based on national limitations and strengths, but also ambitious in its efforts to tackle climate change. Decision 1/CP.20 also outlined information points that countries were encouraged to include in their INDC. These include (i) planning process, (ii) quantifiable information on the reference point (including, as appropriate, base year), (iii) time frames and/or periods of implementation, (iv) scope and coverage, (v) key assumptions and methodological approaches, (vi) considerations on the fairness and ambition of the INDC, and (vii) how the INDC will lead to achieving the objectives of the Convention (Bakkegaard, Bee, Naswa, Ngara, Olhoff, Sharma & Desgain, 2015). The INDCs contained the Parties' planned efforts towards reduction in GHG emissions (a mitigation component), as well as actions aimed at reducing the vulnerability to the impacts of climate change (an adaptation component). The INDCs – which become known simply as NDCs when countries ratify the Paris Agreement – are viewed by many as a major step forward towards effective international climate action. The climate actions outlined in the INDCs and subsequently in the first NDCs essentially determine whether achieving the long-term goals of the Paris Agreement[11] would be possible (Northrop, Biru, Lima, Bouye, & Song, 2016).

The submission of the first NDCs will be backed up by a process of stock taking in 2018 (and presumably every 5 years thereafter). This will involve an evaluation of collective progress towards achieving the goals of the Paris Agreement, and also inform the modification and/or preparation of updated NDCs. Importantly, the Paris Agreement also emphasizes the need for cooperation in realizing its goals, specifically in terms of assisting developing countries in their efforts to reduce GHG emissions and their vulnerability to the adverse effects of climate change

(UN, 2015). This provides support for processes like the TNA, which are geared specifically towards developing country Parties.

The first NDCs outline a country's overall targets to be achieved by a certain date (usually 2020 or 2030) and generally present alternatives to the business-as-usual scenario which would occur if the proposed actions were not taken. They also provide some general information on the steps that will be taken to protect vulnerable ecosystems and human populations from the expected adverse impacts of climate change. Some rough estimates of the costs of these mitigation and adaptation actions are presented with limited details in the NDCs. Notably, some of the pledges consist of an *unconditional*, as well as a *conditional* element. The unconditional element of the pledge is meant to be met unilaterally, while the conditional element of the pledge is made under the expectation that multilateral assistance will be provided to developing countries.

3. METHODS

Data and Data analysis

At the time of writing, based on information from the website of the UNFCCC secretariat, 165 INDCs had been submitted. Additionally, a total of 169 Parties have submitted their first NDCs (which are largely the same as their original INDC).

The current analyses are based on a review of NDCs and TNAs downloaded from the website of the UNFCCC secretariat (http://www4.unfccc.int/ndcregistry/Pages/All.aspx) and the TNA website (http://database.tech-action.org/), respectively. A complete list of all the countries and reports analysed in the study is presented in Table 1 below. As noted above, 61 countries have prepared their second generation TNAs (through either phase 1 or phase 2) (see Appendix 1),

of which 44 have completed their TNA reports on the results and outcomes of the process (see Appendix 2). TNAs from all of these 44 countries are analysed in this study. We also reviewed a total of 71 NDCs from developing countries at different stages of the TNA process:

- 33 from the 44 countries that have submitted TNA reports (these are believed to have completed their TNAs before finalising their NDCs, and therefore could have been expected to use the results from the former in the development of the latter);
- 9 from countries who are yet to complete and submit their TNA reports;
- 20 from countries preparing to participate in the third phase of the TNA; and
- 9 from countries that have not yet conducted a TNA and are not listed as part of any planned TNA process, but might prepare their TNA in the future.

Appendix 3 provides a detailed summary of the review of these 71 NDCs and their links to the TNA process.

The criteria used to map the linkages between the TNAs and NDCs involved an assessment of (i) whether there is a direct reference to the TNA in the NDC; (ii) whether the two processes prioritize similar sectors; and (iii) whether the technologies prioritized in the TNAs are also identified in the NDC as a means of achieving its targets. We summarised the available new generation TNAs[12], highlighting the prioritized sectors in each country and the prioritized technologies for each of these sectors. The results of this summary are presented in Appendix 2 and discussed in the following section (results and discussion). This summary allowed a more focused analysis of the NDCs from these countries, assessing whether and how specific technology issues from the TNA were being addressed in these policy documents. This also contributed to an assessment of whether there is any scope for the processes and results of the TNAs to play a role (directly or indirectly) in achieving the targets of the NDCs.

To achieve our second objective – identifying and assessing possible avenues for TNAs to prepare the ground work for the implementation and achievement of the targets of the NDCs – the assessment criteria was based on an analysis of the differences between NDCs from the 33 countries that have completed their TNA (and used them in drafting their NDCs) and those from countries yet to undertake the TNA process (along with countries that did not use their TNA results in drafting their NDCs) in terms of their references to the role of specific technologies in helping to achieve the NDC targets. The analysis of these differences was used to assess the importance of the TNA to the development of a more comprehensive NDC that could be successfully implemented.

The review of the 33 NDCs from countries that have already conducted a TNA allowed us to map the existing linkages between the two processes as they are in practice, as opposed to how they are expected to exist (theoretically). The additional review of NDCs from countries that have not yet undertaken or completed a TNA helped identify differences relating to technology issues between the two sets of NDCs. This additional review helped guide the discussion on whether the continuation of the TNA process, even as we move to the phase of NDC implementation, is useful to the Parties that are yet to undertake the process.

Table 1: Countries from which NDCs and TNAs were analysed in this study.

4. RESULTS AND DISCUSSION

4.1. *The Current Status of NDCs*

A country's NDC is designed as a forward-looking pledge for addressing climate change, consisting of both mitigation and adaptation measures. These pledges generally take into consideration the activities, processes, and strategies for mitigation and adaptation already being undertaken, as well as future plans expected to be implemented during the projected period covered by the NDC, all compiled in one document. The clear majority of the NDCs reviewed in this study were developed for the projected period from 2020 to 2030, with a few exceptions also making projections beyond this period. The outlined activities and plans compiled in the NDCs were largely developed through other pre-existing national and sectoral processes designed to address climate change from various angles, under the different ministries and working groups in the countries. Figure 1 presents a schematic model showing examples of the different national processes that contributed to the formulation of a country's NDC. It should be noted that not all of these processes pre-existed in every country, therefore the process of developing the NDC may have varied slightly from one country to another, but the general format was consistent.

Figure 1: Relationship between the NDC and other national processes. The wheel concept – The outer rim of the wheel represents a country's NDC, which is supported and shaped by the arrows (like spokes on a wheel) stemming from the national development plans of the country. These arrows represent (i) the various processes and projects undertaken or implemented at different scales in the country, as well as (ii) the guiding legislation, all put in place to help a country achieve its national development plans. These processes (arrows) are also connected, by the broken circle, because they are not always independent of each other, and sometimes provide support for each other under the right circumstances.

Our review reveals that currently, not all the NDCs are written in an operational or implementable format. While they present the pledges of the Parties, they generally do not, by themselves, present any fully operational, nor implementable plans for achieving the aggregate targets outlined within. Therefore, the current status of NDCs can be described as *political pledges*, and the various processes contributing to their development are expected to continue on their projected track and reach their individual targets, thus individually contributing to achieving the aggregated NDC targets. Some guidelines to help make the NDCs implementable are being prepared by, for example, the World Resource Institute (UNDP & WRI No Year) and the UNEP DTU partnership (Bakhtiari, F., Hinostroza, M., and Puig, D. 2018). To be useful, these guidelines will need to focus on how to keep the strategies and processes which have contributed to the formulation of the NDC on track, as well as the development of new strategies and processes needed for addressing future plans highlighted in the NDCs that are not part of existing processes.

4.2. *Empirical mapping of the linkage between TNAs and NDCs*

A TNA is expected to have fed into the development of the NDC in countries where the TNA was undertaken prior to the NDC development. In countries where they have not yet done a TNA, a future TNA should be linked to the NDC implementation planning. In this section, we provide an empirical analysis of whether TNAs have been used in the development of the NDCs in practice. This contributes to answering the first research question of – "*how and to what extent are technology and technology transfer (specifically as underlined in the TNA process) addressed in the NDCs?"*. To answer this question, we took a closer look at the TNA reports and determined how much of them could be directly identified in the NDCs, thus serving as a source used in their development. The focus was on the prioritized sectors and the

respective technologies prioritized for each of these sectors. Table 2 presents an analysis of the extent to which the NDCs show a link to the results of the TNAs in the 33 countries which conducted their TNAs before developing their NDCs. Additionally, appendix 2 presents a summary of the TNAs (prioritized sectors and technologies), while Appendix 3 presents a more detailed analysis of the NDCs, highlighting the identified linkages to the TNAs (where they have been conducted in the country), as well as possible avenues where the TNA might be helpful to achieving the NDCs' targets (where they have not been conducted in the country).

Table 2: Analysis of whether the NDC shows a link to the results from the TNA process (Analysis of 33 countries that had conducted both the TNA and the NDC)

A review and analysis of the 33 NDCs from countries that have undertaken and completed TNAs (with the submission of final reports) show varying levels of linkages between the two processes (see table 2). On one hand, 12 of these countries have explicitly used the results of their TNAs to help develop their NDCs. In these cases, the TNAs are referred to for first identifying the key technologies that will contribute to achieving specific targets later outlined in the NDC. Given that the TNA process does not stop at identifying technologies, but goes on to analyse the barriers and enabling frameworks affecting their diffusion in the respective societies and countries being assessed, it also provides a base for facilitating international assistance in the form of technology transfer. This is important in the context of working towards the future implementation of the NDCs. As noted above, the third step of the TNA process includes the preparation of TAPs, and project ideas to be implemented in the country. The implementation of these TAPs contributes to achieving the overall targets of the NDC and they are therefore listed as part of the overall strategy in the NDC. Being part of the NDC suggests that the TNA provides useful information for addressing some of the challenges that will be posed in the eventual implementation of the NDC. Figure 2 illustrates the example of Cuba, which has directly used the results and outcomes of its TNA process to contribute to the development of its NDC.

Figure 2: The direct integration of the results of the TNA in the development of the NDC – the case of Cuba.

On the other hand, 13 of these 33 countries make no mention or linkage to the TNA process and its outcomes in their NDC. This is despite the consistent reporting (in all NDCs reviewed) that the NDC is based on other national strategic climate change related documents and processes. Additionally, we observe that 8 of the 33 countries make a limited link between their NDCs and TNA processes. In these cases, the results of the TNA do not feature clearly in the NDC, however, there is some mention of the TNA process being completed in the country. Therefore, it is not always clear whether the results of the TNA process truly contributed to the development of the NDC in countries where the former was undertaken before the formulation of the latter.

In the case of countries that have not yet undertaken the TNA process (or did not complete the process before the development of their NDC) we observe a trend that technology is mainly addressed in the form of highlighting the need for technology transfer as a form of international assistance to help achieve the NDC targets. However, little or no specific information is provided on the types of technologies, and how they could be successfully transferred and diffused into the country. This points to the lack of useful information needed for the future implementation of the NDC. Moreover, it should also be noted that countries like Chile and the Central African Republic, specifically call for a TNA process to be conducted, to provide information that facilitates achieving the targets of the NDC.

4.3. *International assistance in the form of technology transfer*

All the NDCs reviewed in this study are written in a very general format, following some minimum content requirements (as outlined in decision 1/CP.20, and proposed by supporting organisations like UDP and WRI), without providing much information on what will be needed to achieve many of the outlined targets. This is certainly the case with regards to technology

transfer. The majority of the NDCs analysed in this study identify the need for technology transfer as a means of international cooperation to help meet their set goals, specifically under their conditional targets. Examples include (i) Chile's NDC – *'Chile still requires a technology development and transfer strategy in order to face the national challenges related to Climate Change'* – and (ii) Central African Republic's NDC – *'Evaluation of needs and development of a national strategy in the area of technology transfer'.*

However, the NDCs generally do not provide any specifications as to what sectors are being considered for technology transfer and exactly what technologies are needed. While some countries which have completed the TNA process have attempted to provide some specific information explaining the need for technology transfer, this information is especially lacking in the case for countries that have not linked the results of their completed TNA to their NDC, and for countries that have not yet undertaken the TNA process. Additionally, the NDCs from these countries simply mention the need for technology transfer without providing any details on how the process can be facilitated. Some countries, such as Chile and the Central African Republic, acknowledge the lack of this kind of information in the NDC, and specifically highlight the need for a TNA to help identify the appropriate technologies that can be transferred as a means of international assistance to help achieve their NDC targets. This is because the TNA process follows a more targeted format than the NDC, tailored to assess the technology needs of the country based on the existing circumstances affecting the individual sectors of production, as well as on the locally and globally available climate technologies. Therefore, if implemented with a scope that is consistent with the priority sectors included in the NDC, the TNA process can be a means of filling some gaps in the NDCs, making them more easily implementable.

4.4. *The future of TNAs*

The actions and examples of countries that have used their TNAs to articulate how technology transfer can help achieve the targets of their NDCs lends strong support to the continuation of the TNA process in countries that have not yet undertaken the process. However, would they need to be done differently, to better support the implementation of the NDC? In answering this question, it should be noted that although the results of the TNA process made useful contributions to the development of the NDCs (in countries where TNAs were completed), in some cases the TNAs were conducted with a very limited scope, only focusing on one or two specific sectors of the country's economy. In these cases, the information provided by the TNAs are incomplete and were unable to provide full guidance for achieving the targets of the NDCs. This supports the case for further developing the TNAs in countries that undertook the process with a very limited scope, to be more consistent with the NDCs by including other sectors of the economy that form a major part of its focus. This will ensure that the information provided by the TNA is up-to-date, broad ranging and encompassing all sectors of the economy as needed for guiding the implementation of the NDC. The recent efforts of the Technology Mechanism of the UNFCCC to focus on strengthening national systems of innovation (as highlighted by Ockwell and Bryne, 2016) is a step in the right direction, that could lend additional support to expanding national TNAs in developing countries.

Another argument that can be raised is one for the importance of continuously updating TNAs in countries' efforts to identify and develop implementation plans helping to achieve the targets in their NDCs, even/especially as conditions change. An example of this is the case of Cambodia, where the NDC acknowledges the limitations in the current scope of the TNA and calls for additional TNAs to be carried out at the start of its implementation phase, in order to provide the necessary guidance for appropriate technology transfer and diffusion ('*Cambodia has developed technology needs assessment for adaptation and mitigation, and technology*

needs also feature prominently in the sectoral climate change action plans. At the start of the NDC implementation phase Cambodia will also need to carry out a detailed technology needs assessment.' – Cambodia's NDC). Therefore, based on this paper's analysis of the current status of the TNA process, there is no case for TNAs to be done completely differently, per se, but rather they should be further developed and broadened in their scope to better align with wide-ranging processes like the NDCs, which encompass most sectors of the national economy. However, the biggest limitation to this aspect could be the need for increased funding to enable the developing countries and their supporting institutions to secure appropriate technical expertise and other necessary resources. Nonetheless, as seen during the technology negotiations at COP 23 in 2017, there is increasing pressure on the GEF to continue its support to TNAs beyond the planned TNA Phase three (UNFCCC 2017). This could open up the opportunity for countries to apply for resources to update their TNA, bearing in mind the potential for using it to facilitate NDC implementation.

5. CONCLUSION

The NDCs are designed and developed taking into consideration both conditional and unconditional components. This allows them to take a much broader format, more inclusive of all economic sectors than other climate related processes such as the TNA. Unlike the NDCs, the TNAs only take into consideration the existing conditions in the country being assessed, and the available climate technologies for providing solutions to identified problems. Even though a TAP sets the ambition for the scale of transfer of a technology, the main aim of a TNA is not to set targets to be achieved, but rather to identify and facilitate the diffusion of improved climate friendly technologies in the sectors of the economy being assessed. The major component of the TNA is to identify the required enabling framework conditions for technology transfer and the end product focuses on the possible actions for scaling up investments in low carbon or climate resilient technologies. Therefore, the NDCs are not replacements for TNAs but instead they set ultimate targets and offer an aggregate view of the contributions of all national processes (including the TNA) contributing to the mitigation of and the adaptation to climate change. Given the significance of technology in the fight against climate change, the TNAs will continue to play a key role in achieving targets set in the NDCs, helping to identify what technologies are most appropriate for achieving NDC targets and under which conditions these technologies can be transferred and diffused to where they are needed. However, the full potential of the TNAs has still to be rolled out in many countries. This can be achieved by (a) further developing the TNAs to explicitly analyse what is needed to implement existing NDCs and support their future strengthening so that their outlined targets can be achieved, and (b) better aligning focus, scope and up-to-dateness of the TNAs to be more consistent with the priority sectors included in the NDCs. This will make them better able to support the successful implementation of the NDCs.

Any policies for operationalising and implementing the NDCs will rely heavily on the results of completed TNA processes, as well as on new TNAs that will have to be conducted as local conditions change and improved technologies become available. Moreover, our analyses show that developing countries that have not yet undertaken the TNA process are currently unable to inform on the specifics of their need for technology transfer, and this in turn limits any guidance for facilitating technology transfer provided in their NDCs. Therefore, a national TNA will be imperative to identify the technology needs (the first of a series of steps described earlier) and the required enabling frameworks for their diffusion and uptake, thus facilitating the required technology transfer for achieving the targets of the NDC.

5.1. *Recommendations and Future perspectives*

The TNA process provides a methodology for considering and integrating technologies in national planning processes and initiatives to reach national sustainable development objectives, including climate change related goals. Likewise, TNAs can be seen as a national planning tool for identifying current and future technology needs for sustainable development, in combination with achieving mitigation and adaptation benefits.

The existing TNAs could serve as one of the logical starting point for countries that are developing their NDC implementation plans. To utilize the synergies between the processes of TNAs and NDCs, the methodology of TNAs should be further developed to provide a sound basis for identifying pathways for parties to reach their NDC targets (as well as NAMAs and NAPs). With that in mind, an integrated approach by countries towards TNAs and NDCs could possibly support a post-2020 climate policy framework by means of using the TNA prioritization and assessment of technologies in line with NDC targets and sectors, and align targets set in TAPs to achieve the targets set in NDCs. Additionally, to improve the usefulness

of the results of the TNA to the implementation of the NDCs, it is important that they are broadened to encompass all sectors of the economy addressed in the NDCs. This would however require additional resources in comparison to what is today made available for a TNA.

Linking sectors, technologies, and implementation measures across TNAs and NDCs furthermore would ensure that coherent climate targets and actions are mainstreamed and embedded in national policies and frameworks.

Notes

1. Although not the focus of this paper, there exist other international processes which support technology transfer. However, the structure and focus of the TNA is unique. de Coninck & Puig, 2015 provides an analysis of some of these international processes and presents a limited comparison between them.
2. According to the UNFCCC, Nationally Appropriate Mitigation Actions (NAMAs) refer to any action that reduces emissions in developing countries and is prepared under the umbrella of a national governmental initiative. They can be policies directed at transformational change within an economic sector, or actions across sectors for a broader national focus. NAMAs are supported and enabled by technology, financing, and capacity-building and are aimed at achieving a reduction in emissions relative to 'business as usual' emissions in 2020 (UNFCCC website).
3. The Intergovernmental Panel on Climate Change (IPCC) defines technology as ‘a piece of equipment, technique, practical knowledge or skills for performing a particular activity’, and technology transfer as ‘...processes covering the exchange of knowledge, money and goods amongst different stakeholders that lead to the spreading of technology for adapting to or mitigating climate change’. Accordingly, technologies may be soft – such as training and information technology, or hard –

such as wind energy and certain coastal protection technologies (IPCC, 2000, pp 432).

4. Enabling factors or enabling framework refer to the set of resources and conditions within which the technology and the target beneficiaries operate. The resources and conditions that are generated by structures and institutions that are beyond the immediate control of the beneficiaries should support and improve the quality and efficacy of the transfer and diffusion of technologies (Nygaard & Hansen. 2016). These enabling factors are largely influenced and managed by the governments and related ministries through legislations and regulations within which project developers and private investors operate.
5. It should be noted that although the TNA process is conceived, funded and managed by government agencies and international donors, the process of prioritizing technologies and developing TAPs takes place at the local level through the participation of private and public stakeholders, making it demand driven and based on the needs of the country.
6. According to the UNFCCC, the national adaptation plan (NAP) process was established under the Cancun Adaptation Framework (CAF) in 2015. It enables Parties to formulate and implement national adaptation plans (NAPs) as a means of identifying medium- and long-term adaptation needs and developing and implementing strategies and programmes to address those needs. It is a continuous, progressive and iterative process which follows a country-driven, gender-sensitive, participatory and fully transparent approach (UNFCCC website). Technical

guidelines for the process to formulate and implement NAPs are available at the UNFCCC homepage (http://unfccc.int/nap and http://unfccc.int/7279)

7. The UNEP DTU Partnership (UDP) is an international research organization and a UN Environment collaborating centre. The UDP is based on a tripartite agreement between the UN Environment, the Technical University of Denmark (DTU) and the Danish Ministry of Foreign Affairs.
8. See the TNA explanatory notes for a more in-depth description of the process and the organisation of institutional structures for conducting the TNAs.
9. Phase one was conducted between 2010 and 2013 in 36 countries, while phase two has been conducted in 25 countries between 2014 and 2018 (http://www.tech-action.org/), see Appendix 1.
10. Following the UNFCCC website, the Climate Technology Centre and Network (CTCN) is the implementation body of the Technology Mechanism of the UNFCCC. It facilitates the transfer of technologies through three core services, which include: (i) Providing technical assistance at the request of developing countries to accelerate the transfer of climate technologies, (ii) Creating access to information and knowledge on climate technologies, particularly through its knowledge management system, and (iii) Fostering collaboration among climate technology stakeholders via its network of regional and sectoral experts.
11. The Paris Agreement aims at (i) holding the increase in the global average temperature to well below 2 degrees Celsius, (ii) to pursue efforts to limit the increase to 1.5 degrees Celsius, and (iii) to achieve net zero emissions in the second half of this century (UN, 2015). Under the Paris Agreement, the published INDC became the first Nationally Determined Contribution (NDC) when a country ratifies the agreement, unless they decide to submit a new NDC at the same time. See https://unfccc.int/focus/indc_portal/items/8766.php for more information on the processes

and decisions leading to the development of the INDCs and the NDCs. This figure is as of the 7th of August, 2017.

12. Given the differences in methodologies and outcomes of the first generation and the new generation of TNAs, only new generation TNAs were analysed in this study. We believe the this allowed for more updated and consistent analyses, leading to more useful conclusions in the study.

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Table 1:

#	Countries/Parties to the UNFCCC	Submitted TNA (Phase)		iNDC completion Date (mm/yy)		Comments: iNDC updated as 1st NDC on the UNFCCC website. (by March 2017)
		mit.	*adp.*	*mit.*	*adp.*	
	Latin American and Caribbean Countries					
1	Antigua & Barbuda	No (p3)	No (p3)	10/2015	10/2015	Yes
2	Argentina	Yes (p1)	Yes (p1)	10/2015	10/2015	Yes
3	Bahamas	No	No	11/2015	11/2015	Yes
4	Barbados	No	No	09/2015	09/2015	Yes
5	Belize	No (p2)	No (p2)	10/2015	10/2015	Yes
6	Bolivia*	No (p1 & p2)	No (p1 & p2)	10/2015	10/2015	Yes
7	Brazil	No	No	09/2015	09/2015	Yes
8	Chile	No	No	01/2016	01/2016	Yes
9	Colombia	Yes (p1)	Yes (p1)	09/2015	09/2015	No
10	Costa Rica	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
11	Cuba	Yes (p1)	Yes (p1)	11/2015	11/2015	Yes
12	Dominica	No (p3)	No (p3)	09/2015	09/2015	Yes
13	Dominican Republic	Yes (p1)	Yes (p1)	08/2015	08/2015	No
14	Ecuador	Yes (p1)	Yes (p1)	10/2015	10/2015	No
15	El Salvador	No (p1)	Yes (p1)	11/2015	11/2015	Yes
16	Grenada	No (p2)	No (p2)	09/2015	09/2015	Yes
17	Guatemala	No (p1)	No (p1)	09/2015	09/2015	Yes
18	Guyana	No (p2)	No (p2)	11/2015	11/2015	Yes
19	Haiti	No (p3)	No (p3)	09/2015	09/2015	No
20	Honduras	Yes (p2)	Yes (p2)	10/2015	10/2015	Yes
21	Jamaica	No (p3)	No (p3)	11/2015	11/2015	No
22	Mexico	No	No	03/2015	03/2015	Yes
23	Panama	No (p2)	No (p2)	04/2016	04/2016	Yes
24	Paraguay	No	No	10/2015	10/2015	Yes
25	Peru	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
26	St. Kitts & Nevis	No	No	12/2015	12/2015	Yes
27	St. Lucia	No	No	11/2015	11/2015	Yes
28	St. Vincent & Grenadines	No	No	11/2015	11/2015	Yes
29	Suriname	No	No	10/2015	10/2015	No

		(p3)	(p3)			
30	Trinidad & Tobago	No (p3)	No (p3)	10/2015	10/2015	No
31	Uruguay	Yes (p2)	Yes (p2)	09/2015	09/2015	No
32	Venezuela	No	No	12/2015	12/2015	No
African and Middle Eastern Countries						
33	Central African Republic	No (p3)	No (p3)	09/2015	09/2015	Yes
34	Chad	No (p3)	No (p3)	10/2015	10/2015	Yes
35	Cote d'Ivoire	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
36	Djibouti	No (p3)	No (p3)	10/2015	10/2015	Yes
37	Eritrea	No (p3)	No (p3)	09/2015	09/2015	No
38	Ethiopia	No (p1)	No (p1)	06/2015	06/2015	Yes
39	Ghana	No (p1)	Yes (p1)	09/2015	09/2015	Yes
40	Guinea	No (p3)	No (p3)	09/2015	09/2015	Yes
41	Kenya	Yes (p1)	Yes (p1)	07/2015	07/2015	Yes
42	Lebanon	Yes (p1)	Yes (p1)	09/2015	09/2015	No
43	Liberia	No (p3)	No (p3)	09/2015	09/2015	No
44	Malawi	No (p3)	No (p3)	10/2015	10/2015	No
45	Mali	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
46	Mauritius	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
47	Morocco	Yes (p1)	Yes (p1)	08/2015	08/2015	Yes
48	Niger	No (p3)	No (p3)	10/2015	10/2015	Yes
49	Rwanda	Yes (p1)	Yes (p1)	12/2015	12/2015	Yes
50	Sao Tome & Principe	No (p3)	No (p3)	09/2015	09/2015	Yes
51	Senegal	Yes (p1)	Yes (p1)	09/2015	09/2015	No
52	Sudan	Yes (p1)	Yes (p1)	11/2015	11/2015	No
53	Uganda	No (p3)	No (p3)	10/2015	10/2015	Yes
54	Zambia	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
	Asian and CIS Countries					
55	Afghanistan	No (p3)	No (p3)	09/2015	09/2015	Yes
56	Azerbaijan	Yes	Yes	09/2015	None	Yes

		(p1)	(p1)			
57	Bangladesh	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
58	Bhutan	Yes (p1)	Yes (p1)	09/2015	09/2015	No
59	Cambodia	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
60	Fiji	No (p3)	No (p3)	10/2015	10/2015	Yes
61	Georgia	Yes (p1)	Yes (p1)	09/2015	09/2015	No
62	Indonesia	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
63	Kazakhstan	Yes (p1)	Yes (p1)	09/2015	None	Yes
64	Laos	Yes (p1)	Yes (p1)	10/2015	10/2015	Yes
65	Mongolia	Yes (p1)	Yes (p1)	09/2015	09/2015	Yes
66	Myanmar	No (p3)	No (p3)	09/2015	09/2015	No
67	Nauru	No (p3)	No (p3)	11/2015	11/2015	Yes
68	Nepal	No (p1)	No (p1)	02/2016	02/2016	Yes
69	Sri Lanka	Yes (p1)	Yes (p1)	04/2016	04/2016	Yes
70	Thailand	Yes (p1)	Yes (p1)	10/2015	10/2015	Yes
71	Vietnam	Yes (p1)	Yes (p1)	10/2015	10/2015	Yes

* Although Bolivia was initially included in phases 1 and 2 of the TNA, they withdrew on both occasions and never went on to start the TNA process.

p1: phase 1 (2009 to 2013), p2: phase 2 (2013 to 2018) & p3: phase 3 (2018 to 2021)

Table 2:

Countries	Degree to which NDC shows a link to the TNA
Latin American and Caribbean Countries	
Argentina	✓
Colombia	✗
Costa Rica	✓
Cuba	✓
Dominican Republic	✱
Ecuador	✗
El Salvador	✱
Honduras	✗
Peru	✗
Uruguay	✱
African and Middle East Countries	
Cote d'Ivoire	✗
Ghana	✱
Kenya	✗
Lebanon	✓
Mali	✓
Mauritius	✓
Morocco	✓
Rwanda	✱
Senegal	✱
Sudan	✓
Zambia	✓
Asian and Eastern European Countries	
Azerbaijan	✗
Bangladesh	✱
Bhutan	✗
Cambodia	✗
Georgia	✗
Indonesia	✗
Kazakhstan	✗
Laos	✗
Mongolia	✱
Sri Lanka	✓
Thailand	✓
Vietnam	✓

✓ : NDCs show clear usage of the TNA results in their development

✱ : NDCs show limited linkage to the results of the TNA process in their development

✗ : NDCs show no evidence of the use of the TNA results in their development

TNA - Technology Needs Assessment; NDC - Nationally Determined Contributions;

APPENDICES

Appendix 1: Countries listed in phase I and II of the TNA process and the status of their TNA reports

Phase I (2009 to 2013)			
#	**Countries Included**	**Region**	**Submitted TNAs**
1	Cote d'Ivoire	Africa & Middle East	Mitigation & Adaptation
2	Ghana	Africa & Middle East	Adaptation only
3	Kenya	Africa & Middle East	Mitigation & Adaptation
4	Lebanon	Africa & Middle East	Mitigation & Adaptation
5	Mali	Africa & Middle East	Mitigation & Adaptation
6	Mauritius	Africa & Middle East	Mitigation & Adaptation
7	Morocco	Africa & Middle East	Mitigation & Adaptation
8	Rwanda	Africa & Middle East	Mitigation & Adaptation
9	Senegal	Africa & Middle East	Mitigation & Adaptation
10	Sudan	Africa & Middle East	Mitigation & Adaptation
11	Zambia	Africa & Middle East	Mitigation & Adaptation
12	Ethiopia	Africa & Middle East	None
13	Azerbaijan	Asia & CIS	Mitigation & Adaptation
14	Bangladesh	Asia & CIS	Mitigation & Adaptation
15	Bhutan	Asia & CIS	Mitigation & Adaptation
16	Cambodia	Asia & CIS	Mitigation & Adaptation
17	Georgia	Asia & CIS	Mitigation & Adaptation
18	Indonesia	Asia & CIS	Mitigation & Adaptation
19	Kazakhstan	Asia & CIS	Mitigation & Adaptation
20	Laos PDR	Asia & CIS	Mitigation & Adaptation
21	Moldova	Asia & CIS	Mitigation & Adaptation
22	Mongolia	Asia & CIS	Mitigation & Adaptation
23	Nepal	Asia & CIS	None
24	Sri Lanka	Asia & CIS	Mitigation & Adaptation
25	Thailand	Asia & CIS	Mitigation & Adaptation
26	Vietnam	Asia & CIS	Mitigation & Adaptation
27	Argentina	Latin America & Caribbean	Mitigation & Adaptation
28	Bolivia	Latin America & Caribbean	None
29	Colombia	Latin America & Caribbean	Mitigation & Adaptation
30	Costa Rica	Latin America & Caribbean	Mitigation & Adaptation
31	Cuba	Latin America & Caribbean	Mitigation & Adaptation
32	Dominican Republic	Latin America & Caribbean	Mitigation & Adaptation
33	Ecuador*	Latin America & Caribbean	Mitigation & Adaptation
34	El Salvador	Latin America & Caribbean	Adaptation only
35	Guatemala	Latin America & Caribbean	None
36	Peru	Latin America & Caribbean	Mitigation & Adaptation
Phase II (2014 to 2018)			
1	Burkina Faso	Africa & Middle East	None
2	Burundi	Africa & Middle East	None
3	Egypt	Africa & Middle East	None
4	Gambia	Africa & Middle East	Adaptation only
5	Jordan	Africa & Middle East	Mitigation & Adaptation
6	Madagascar	Africa & Middle East	None

7	Mauritania	Africa & Middle East	Mitigation & Adaptation
8	Mozambique	Africa & Middle East	Adaptation only
9	Seychelles	Africa & Middle East	None
10	Swaziland	Africa & Middle East	Adaptation only
11	Tanzania	Africa & Middle East	Mitigation & Adaptation
12	Togo	Africa & Middle East	Mitigation & Adaptation
13	Tunisia	Africa & Middle East	Mitigation & Adaptation
14	Armenia	Asia & CIS	Mitigation & Adaptation
15	Malaysia	Asia & CIS	None
16	Philippines	Asia & CIS	None
17	Uzbekistan	Asia & CIS	None
18	Turkmenistan	Asia & CIS	None
19	Pakistan	Asia & CIS	Mitigation & Adaptation
20	Belize	Latin America & Caribbean	None
21	Grenada	Latin America & Caribbean	None
22	Guyana	Latin America & Caribbean	None
23	Honduras	Latin America & Caribbean	Mitigation & Adaptation
24	Panamá	Latin America & Caribbean	None
25	Uruguay	Latin America & Caribbean	Mitigation & Adaptation

* Submitted only one TNA, addressing both Mitigation and Adaptation simultaneously, and not as separate components of addressing climate change.

Countries from phase II that have not yet submitted their TNAs may still do so in the near future. The information in the table is based on the available data when the analysis was being conducted in the first quarter of 2017.

Appendix 2: A summary of the prioritized sectors and technologies from the completed TNA reports for countries from Phase I and Phase II.

Phase I - Countries	Prioritized sectors in TNA		Prioritized technologies	
	Mitigation	Adaptation	Mitigation	Adaptation
Africa and Middle east countries				
Cote d'Ivoire	Energy	Agriculture	1. Solar PV Kit 2. Photovoltaic Water Pumping System 3. Small hydropower 4. Extension of a thermal power plant in combined cycles 5. Energy Efficiency in Buildings 6. Radiation oven 7. Combustion of biomass for cogeneration 8. Combustion of biogas for cogeneration	1. Introduction of «rain guard» in heveïcoles for the protection of latex in rainy seasons 2. Rapid multiplication under tunnel or under bins of resistant varieties of plantain and cuttings of cassava varieties resistances to water stress (xerophyte). 3. Production of rubber clones and varieties of cocoa, banana and Nerica rice seed tolerant to water stress. 4. Production of yam seeds from aerial stem cuttings. 5. Production of seeds of leguminous plants for the restoration of soil fertility. 6. Production of papaya leaf-based fungicides against moisture-related cocoa and mango diseases (brown pod rot, anthracnose mango, sooty mold). 7. Production of vegetable crops under hydroponic conditions. 8. Production of neem leaf insecticides against seasonal cocoa and mango insect pests (cocoa mirids, mango mealy bugs).
		Water resources		1. Capture of groundwater using a Human Hand Pump.

				2. Use of standpipes for drinking water in peri-urban districts. 3. Drinking Water Supply by Improved Village Water Supply System (HVA) in rural areas. 4. Transfer of drinking water. 5. Pumping systems by wind and solar energy. 6. Treatment and recycling of wastewater. 7. Water catchment through a retaining dam. 8. Implementation of hydrological data acquisition devices.
Ghana*		Water		1. Rainwater collection from ground surfaces. 2. Post construction support for community managed water systems. 3. Improving resilience of protected wells to flooding. 4. Demarcation and Protection of Buffer Zones for water bodies.
		Agriculture		1. Community Based Extension Model; 2. Water User Associations; 3. Integrated Soil Nutrient Management. 4. Ecological Pest Management
Kenya	Energy	Agriculture	1. Solar Home Systems 2. Solar Dryers	1. Drought Tolerant Sorghum Variety. 2. Drip Irrigation.
	Waste management	Water Resources	1. Methane capture from bio-digesters 2. waste paper recycling	1. Surface runoff water harvesting 2. Roof rain water harvesting

Lebanon	Energy (power)	Agriculture	1. Combined cyclic Gas Turbine (CCGT) 2. Hydropower 3. Wind power 4. Photovoltaic (PV) cells	1. Selection of Adapted Varieties and Rootstocks, 2. Conservation Agriculture 3. Risk Coping Production Systems over more costly and less applicable technologies
	Transport	Water	1. Bus technologies using diesel and natural gas for revitalizing the public transport 2. Hybrid electric vehicles 3. Fuel efficient gasoline vehicles for renewing the passenger cars fleet.	1. Rainwater harvesting from greenhouses 2. Rainwater harvesting from roads 3. Water User Associations.
Mali	Energy	Agriculture	1. Hydropower 2. The solar photovoltaic 3. Improved fireplaces 4. Biofuels	1. Forage crop practices of the three crop varieties of fodder to cover ecological zones 2. Development of cropland by contour lines 3. Agrometeorological techniques 4. Improved varieties of millet, rice, maize and sorghum adapted to climate change
	Agriculture	Water Resources	1. Intensive Rice System 2. Microdose 3. Reforestation	1. Drilling 2. Small water retention dams 3. Digging of ponds 4. Modern wells (large diameter wells)
Mauritius	Energy Industries	Water	1. Wind (utility scale) 2. PV (>1 MW) 3. EE Boilers (heat recovery)	1. Desalination 2. Rainwater harvesting 3. Hydrological modelling
		Agriculture		1. Up-scaling of locally proven Integrated Pest Management technologies

				2. Micro irrigation (gravity fed drip & mini and micro sprinkler irrigation) 3. Decentralised rapid pest and disease diagnosis service (plant clinic)
		Coastal zones		1. Restoring coastal vegetation 2. Wetland protection 3. Dune restoration 4. Rock revetment
Morocco	Energy (efficiency and renewable)	Water Resources	1. Energy Efficiency Technologies in the Social Housing program (insulation, lighting Efficiency and use of solar energy) 2. Molten salts as fluid heat transfer in thermodynamic solar power plants 3. Photovoltaic concentrate for power stations solar power 4. Hydropower (electricity generation)	Water Resources Sub-sector: 1. Rainwater harvesting; 2. Flood warning and alert systems; 3. Inflatable dams; 4. Artificial recharge of the aquifers. Sub-sector of drinking water: 1. Desalination of seawater for the production of drinking water; 2. Desalination with coupling of renewable energies; 3. Elimination of toxic cyanobacteria in drinking water treatment units.
		Agriculture		1. Localized irrigation technique 2. Equipment for new irrigated areas located downstream of existing dams 3.Development of an Agricultural Information System in Irrigated and diffusion of good cultivation practices of in DryLand 4. Direct seeding technique.
Rwanda	Energy	Agriculture	1. Small Hydropower plants	1. Seed and grain storage

			2. Kivu methane Combined Cycle Gas Turbine with Carbon Capture and Sequestration 3. Geothermal power 4. Plug-in Hybrid Vehicles 5. Large Solar Photovoltaic	2. Agro-forestry 3. Radical terraces 4. Drip irrigation 5. Rainwater Harvesting
Senegal	Energy	Agriculture	1. Biomass technology; direct combustion for electricity generation 2. Onshore wind for electricity generation 3) Solar Photovoltaic 4. Solar water heater 5. Low consumption lamps (LBC) 6. Efficient refrigeration appliances 7. Portable Solar Lamp 8. Cogeneration by Single Combined Cycle 9. Device for improving the power factor (cosine phi)	1. Improved seed bank 2. Natural Regeneration Assisted 3. Agroforestry (corridor corridor) 4. Constitution and conservation of fodder reserves
		Water resources		1. Use of flow reducers 2. Drip irrigation 3. Desalination
Sudan	Agricultural, Forestry and Other Land Use (AFOLU)	Agriculture	1. Improved stoves 2. Biogas units	1. Improved crop varieties 2. Zero tillage technology
	Energy (Sub-sectors: Electricity and Transportation)	Water Resources	1. Compact Fluorescent lamps 2. Mass transport technology	1. Rain water harvesting 2. Seasonal forecasting and early warning systems

	Industry		Efficient boiler with dual fuel	
Zambia	Energy	Water and energy	1. Geothermal-Electricity generation 2. Biodiesel from jatropha-biofuels 3. Energy management systems-Energy efficiency 4. Improved cooking stoves 5. Brick Kiln-Improved charcoal production 7. Off-grid systems: biomass gasifier	1. Rainwater collection from ground surfaces 2. Boreholes/tubewells for domestic water supply 3. Improving the resilience of protected wells to flooding.
	Agriculture, land use change and forestry, and waste	Agriculture and food security	1. Conservation agriculture - Agriculture land use change and forestry	1. Soil management (conservation farming, land Husbandry and agro-forestry) 2. Sustainable farming systems (mixed farming) 3. Sustainable crop management (crop diversification and new varieties).
Asia and CIS countries				
Azerbaijan	Energy (Alternative sources)	Water	1. Grid-connected wind power; 2. Passive solar energy (hot water) and solar photovoltaic (electricity); 3. Small hydro-powers on mountain rivers.	1. Rainwater Collection from Ground Surfaces—Small Reservoirs and Micro-catchments 2. Flood warning 3. Water reclamation and reuse 4. Reducing water leakages in water management facilities
	Commercial and Residential	Agriculture	1. High efficiency lighting systems; 2. Heating pumps; 3. Biogas for cooking and electricity and efficient stoves.	1. Optimizing of location and structure of agricultural lands with introduction of crop species resistant to expected climate changes 2. Enhance the application of windbreaks

				3. Application of water saving technologies, such as drop or spray irrigation, at irrigated lands 4. Application of conservative agricultural technologies
Bangladesh	Energy	Water	1. Natural gas combined cycle 2. Solar home PV 3. Advanced combustion turbine 4. Advanced natural gas combined cycle 5. Integrated Gasification Combined Cycle (IGCC) Single unit 6. Integrated Gasification Combined Cycle (IGCC) Double unit 7. Advanced Pulverized Coal (APC) Single Unit 8. Advanced Pulverized Coal (APC), Double Unit 9. Compact fluorescent lamp (CLF) 10. Linear fluorescent lamp (LF)	1. Rehabilitation of existing embankments/ dykes and dredging infrastructure development, 2. Comprehensive disaster management incorporating early warning systems and involving community tidal system and infrastructures management, 3. Monitoring of sea level rise, tidal fluctuation, salinity intrusion, sedimentation and coastal erosion, 4. Tidal river management including computer simulation of tidal flow, 5. Tidal barriers (Sluice gate), 6. Urban Infrastructure development.
		Agriculture		1. Development of salinity-tolerant rice varieties, 2. Development of drought-tolerant rice varieties, 3. Development of short-maturing rice varieties, 4. Establishment of climate-smart Technology Dissemination Center, 5. Training on improved farming

				practices for crops, irrigation and water management, soil fertility management (conservation and restoration of soil quality) etc. 6. Establishment of special agricultural R & D centre and 7. Land-use planning
Bhutan	Solid waste disposal (on land)	Water Resources	1. Composting 2. Reduce, reuse, recycle (3 Rs) 3. Anaerobic digestion/ biogas plants	1. Micro/Mini hydro power 2. Efficient irrigation methods 3. Solar power (Photovoltaic)
	Transport (fuel combustion activities)	Agriculture	1. Transport Management Systems 2. Non-motorized Transport 3. Mass Transit	1. Agro-forestry 2. Development of drought resistant and pest resistant varieties of crops 3. Sloping Agriculture Land Technology (SALT)
	Manufacturing industries and Construction (fuel combustion activities)	Natural Disaster and Infrastructure	1. Construction of energy efficient infrastructure (Energy efficiency in construction) 2. Improvement in process-related energy efficiency (Cement, iron and steel and ferro alloy industries) 3. High efficiency electric motors (Cement, iron and steel and ferro alloy industries)	1. Real-time weather stations and weather forecasting (multi-range) 2. Climate resilient roads 3. Community based early warning systems
Cambodia	Transport	Water	1. Energy efficient urban Mass Transport 2. Vehicle emission standards	1. Household Safe Water Supply: - Rainwater Harvesting from Rooftops - Wells for Domestic Water Supply 2. Community Water Supply:

				- Small Reservoirs, Small Dams and Micro-Catchments
	Energy (efficiency)	Coastal zones	1. Energy efficient lighting 2. Energy efficient household appliances	1. Mangrove management
Georgia	Energy	Coastal zones (The Black Sea)	1. Manufacturing and use of high Efficiency residential wood stoves; 2. Efficient construction technologies including integrated building design, energy efficient materials and construction practices 3. Solar water heaters for residential and commercial use.	1. Artificial filling with inert material, including creation of gravel-pebble beaches; 2. Creation of artificial capes; 3 Artificial extension of coastal dunes (knolls) in width and in height. In case of rapid sea-level rise – construction of dams; 4 Creation of artificial reefs using reef-balls; 5. Setting up of decentralized early warning system. 6. Setting up of early warning system; 7. Increase of Poti City Canal capacity; 8. Construction of sediment-retaining pier at the Poti Canyon and boons south to the "Didi" Island; 9. Pilling of rocks and stones, beach nourishment in the area of "Didi" Island. 10. Beach nourishment at the Adlia emergency section; 11. Construction of the boon system in the Batumi-Adlia coastal zone; 12. Creation of stone piles at the emergency strip near Adlia; 13. Construction of sediment retainers in

				front of Batumi underwater canyon.
		Agriculture		1. Soil water erosion protective technology USLE (pilot proposal) 2. Terrace 3. Agro-forestry-Wind breakers 4. Low till with synchronized soil processing options 5. No till
		Extreme events (natural disasters)		1. low-cost protective measures against the landslides 2. Cleaning and levelling of riverbeds against mudflows 3. Mapping of hazardous geological sites and providing long-term forecast of their development
Indonesia	Forestry	Food Security	1. Measurement and monitoring for reducing emission. 2. Carbon sequestration measurement and monitoring. 3. Peat re-mapping.	1. Crop (rice) tolerance to drought and flood, 2. Mari-culture development, 3. Cattle meat development.
	Energy	Water Resource	1. photovoltaic 2. Efficient electric motor 3. Mass rapid transit (MRT)	1. Technologies for rain water harvesting (well and infiltration pond), 2. Water recycling from wastewater 3. Modelling for water resource projection.
	Waste	Coastal Zones	1. Mechanical Biological Treatment (MBT) 2. In-Vessel Composting (IVC) 3. Low Solid Anaerobic Digestion (LSAD)	1. Seawall and Revetment 2. Coastal Reclamation 3. Groyne technology.
Kazakhstan	Energy (electric power production)	Agriculture	1. Small hydro-power (electricity)	1. No-till for crop production 2. Diversification of crop production

			2. Pulverized coal combustion with high efficiency	3. Distant pasture and pasture stabling of sheep on an industrial scale 4. Transhumance system (southern part of the republic)
	Industry (Cement production)	Water Resources	1. Energy efficiency and saving 2. Transition from wet to dry production technology	1. Drip irrigation systems 2. Metering of water for irrigation and watering 3. Early warning systems for dangerous hydrological phenomena
Laos	Forestry	Water	1. Effective Protection and Protected Area 2. Optimal Agro-Forestry 3. Optimal Plantation 4. Sustainable Community Forest Management	1. Early warning system 2. Disaster impact reduction fund 3. River basin and watershed management 4. Water supply system
	Agriculture	Agriculture	1. Organic farming 2. Biogas digester 3. Feeds improvement 4. Agriculture residue to energy	1. Livestock disease prevention and control; 2. Agricultural Development Subsidy Mechanism; 3. Climate Resilient Rural Infrastructure and 4. Crop Diversification.
Moldova	Energy	Agriculture	1. Combined heat and power plants based on internal combustion engines of at most 500 kW (Electricity Supply subsector) 2. Gasification of Municipal Solid Waste for Electricity/Heat production (Heat Supply subsector);	1. Conservation system of soil tillage without herbicides for winter wheat; 2. Applying of 50 t/ha of manure with bedding to agricultural soils once per five years; 3. Vetch field as green fertilizer into 5 year crop rotation.

			3. Hybrid Electric Vehicles (Transport subsector).	
	Agriculture	Human Health	1. The No-Till soil cultivation system 2. Mini-Till soil cultivation system 3. Classic tillage, including a vetch field (two yields per year –autumn and spring), as a "green fertilizer field" into a five fields crop rotation	1. Supply of high guarantee quality water to rural population. Construction of local water pipe system (aqueducts) 2. Provisional posts of emergency care and prompt rehabilitation during critical periods of heat waves
Mongolia	Energy	Agriculture: Sub-sectors: (i) Arable farming and	1. Large hydropower plant; 2. Wind turbines; and 3. Pulverized coal combustion technologies.	1. System of wheat intensification (SWI) 2. Vegetable production system (VPS) with drip irrigation 3. Potato seed production system (PSPS)
	Residential and Commercial	Sub-sectors: (ii) Animal husbandry)	1. Efficient lighting; 2. Improved insulation of panel apartment buildings; 3. Improved heating stoves and 4. LPG for cooking	1. Seasonal to Inter-annual Prediction and Livestock Early Warning system 2. High quality livestock (HQL) through selective breeding and animal disease management 3. Sustainable pasture management
Sri Lanka	Energy	Food	1. Building Management Systems. 2. Conversion of Biomass and Waste to Energy 3. Smart Grid Technology for Wind & Solar Integration with Hydro	1. Culture-based fisheries Crop diversification and precision farming 2. Crop diversification and precision farming 3. Sustainable land management
	Transport	Health	1. Integration of Non-motorized transport methods in Colombo along with regularized	1. Early Warning Systems and net-working for information exchange on extreme events and

			public transport system 2. Promote carpooling and park-and-ride systems during rush hours and on roads with heavy volumes of vehicles 3. Electrification of the existing railway system	other Climate Change related events 2. Transfer of knowledge and skills to Health Personnel 3. Management of Health Care waste
	Industry	Water	1. Energy Efficient Motors 2. Variable Speed Drivers for Motors 3. Biomass Residue Based Cogeneration Combined Heat and Power CHP	1. Restoration of minor tank networks 2. Rainwater harvesting from rooftops for drinking and household uses 3. Boreholes/tube wells as a drought intervention for domestic water supply
		Coastal		1. Sand dune rehabilitation 2. Restoration of Mangroves 3. Restoration of coral reefs
		Biodiversity		1. Restoration of degraded areas inside and outside the protected area network to enhance resilience 2. Increasing connectivity through corridors, landscape/matrix improvement and management 3. Improve management, and possibly increase extent of protected areas, buffer zones and create new areas in vulnerable zones 4. Focus on conservation of resources and carryout special management

				for restricted range, highly threatened species and ecosystems 5. Ex-situ conservation for highly threatened species and possible reintroduction
Thailand	Energy	Agriculture	1. Smart grid 2. Waste to power generation 3. Second and third generation of biofuels 4. Energy efficiency in combustion in the industrial sector 5. Carbon capture and storage (CCS)	1. forecasting and early warning systems 2. Crop improvement technology 3. Precision farming technology (17%)
		Water Resource		1. The networking (via pipes or canals) and management of infrastructures (including zoning) under the technology group “Operation of Water Infrastructures.” 2. Seasonal climate prediction under the technology group “Weather & Hydrological Modelling.” 3. Sensor webs using observation and/or modelling data under the technology group “Early Warning.”
		Modelling		Weather Research and Forecasting models
Vietnam	Energy	Agriculture	1. Wind Power 2. Energy-saving compact fluorescent lamps 3. Heat and Power (Cogeneration) 4. Bus rapid transit	1. Plant genetics/Plant breeding 2. Rice to upland grains 3. Triple cropping to double cropping plus a shrimp/fish/ poultry crop
	Agriculture	Forestry	1. Anaerobic manure	1. Plant science/Plant genetics 2. Agro-forestry

			digestion to produce biogas fuels 2. Nutrition improvement through controlled fodder supplements 3. Wet and dry irrigation in certain rice growth stages	
	Land Use, Land Use Change and Forestry (LULUCF).	Coastal zones	1. Sustainable forest management 2. Afforestation and reforestation 3. Rehabilitation of mangrove	1. Sae dyke 2. Coastal wetland rehabilitation
		Water Resources		1. Rooftop rainfall harvesting for household usage 2. Harvesting runoff water 3. Integrated river basin management
Latin America and the Caribbean				
Argentina	Energy	Observation and measurement of Climate and Hydrological variables	1. Cogeneration technology based on the steam turbine 2. Cogeneration technology based on the Otto engine.	1. Expansion in quality and extent of the hydro-meteorological data network 2. Establishment of a Data Centre, or a Weather agency.
	Transport		1. Longer trains 2. Multimodal transport systems applied to agricultural products.	
	Waste		1. (Treatment of Solid Urban waste) Capture of Landfill Gases for the production of energy (thermal & electricity). 2. (Treatment of Industrial Effluents) Covered lagoons for the capture and utilization of	

			Methane for the production of thermal energy (heat & electricity). 3. Anaerobic reactors	
	Agriculture		1. Research to determine local emission factors 2. Incorporation of "Gramineae" (e.g. cereals, maize, etc.) to crop rotation cycles. 3. Technologies for the optimization of the use of nitrogen in Agricultural activities.	
Colombia	Industry (Sub-sectors include: Metal Mechanics and Brass mechanics)	Coastal zones	1. Auto-regenerating crucible furnaces 2. Auto-recuperative burners 3. Auto-regenerating burners 4. Induction furnaces 5. MK-2 Ecological furnaces 6. Vertical furnaces 7. Forced air furnaces	1. Advance monitoring systems for threats and vulnerability. 2. Periodic beach support (against threats posed by a rising sea level and related damages) 3. Beach restoration
Costa Rica	Energy	Infrastructure	1. Integration of public transport and decongestion of roads 2. Conservation and Electrical Efficiency	1. Increased quality of the national asphalt road network.
	Land Use, Land Use Change and Forestry (LULUCF)	Water	1. Expansion of Payment for Environmental Services 2. Prefabricated wooden houses (Habicom)	1. Adaptive management of watersheds 2. SENARA Geographic Information System 3. More detailed weather/climate scenarios

	Waste (solid) management	Forestry	1. Comprehensive Waste Management Plan (Recycling, electrical production, sanitary landfills) 2. Use of methane in landfills	1. Expansion of Payment for Environmental Services 2. Prefabricated wooden houses (Habicom)
	Agriculture	Agriculture	1. Sustainable Agricultural Production	1. Sustainable Agricultural Production
Cuba	Energy (Sub-sectors: (i) Electricity generation, (ii) Agriculture, (iii) Transport)	Agriculture	1. Combined gas cycles 2. Gasification of sawmill waste 3. Increase the use of rail/trains for cargo transportation.	1. Improved water management in the Rice Production systems through irrigation and drainage.
		Water Resources		1. Drilling, coating and design of the exploitation of shallow wells for extraction of water or for the recharge of the underground mantle
		Coastal zones		1. Construction of coastal houses above the flood level
Dominican Republic	Energy (Sub-sectors: Electricity and Transport)	Water	1. Energy efficiency: Use of energy efficient light bulbs 2. Biomass inventory 3. Road training program - efficient driving; 4. More efficient vehicles - change of fuel.	1. Rehabilitation of water treatment plants (wastewater) 2. Rapid filtration treatment of portable water 3. Water quality monitoring system 4. National level Management of watersheds 5. Rain water harvesting 6. Efficient irrigation systems
		Tourism		1. Informal education of the public in the form of awareness raising, informing and training

				2. Rehabilitation of mangroves and wetlands
		Forestry		1. National forest monitoring system 2. Sustainable harvesting of forest plantations and agroforestry 3. Soil conservation in micro watersheds.
Ecuador*	Agriculture (Management of irrigation water)	Water	1. Rainwater harvesting 2. Restoration of aquifers 3. Reservoirs 4. Sprinkler irrigation 5. Drip irrigation	1. Participatory management plan for the management of fragile ecosystems 2. Climate monitoring system and watershed modelling 3. Restoration of degraded ecosystems 4. Water User Groups 5. Management of aquatic weed
El Salvador*		Agriculture		1. Drip irrigation systems 2. Agroforestry
		Health		1. Construction of elevated latrines for homes in floodable communities
		Infrastructure		1. Gallery forests 2. Elevated housing
		Education		1. Research to improve the physical infrastructure of schools
		Energy		1. Energy efficiency measures: efficient lighting and air conditioners in Government and autonomous institutions
Peru	Waste (solid)	Water Resources	1. Manual Sanitary landfills 2. Recycle 3. Compost 4. Process of minimization and segregation of solid waste	1. Reservoirs and Irrigation systems 2. Terrace systems 3. Fog water collection panels 4. Rain water harvesting from roofs

				5. Wastewater treatment plants
Phase II - Countries	**Prioritized sectors in TNA**		**Prioritized technologies**	
	Mitigation	**Adaptation**	**Mitigation**	**Adaptation**
Africa and Middle east countries				
Gambia[x]		Agriculture		1. Conservation Agriculture 2. Tidal Irrigation: 3. Aquaculture and Fish Farming
		Coastal zones		1. Sustainable Sand Management 2. Breakwater systems 3. Groyne Systems
		Water Resources		1. Water Conservation 2. Relocation of Water Points 3. Aquifer Recharge
Jordan	Energy	Water	1. Solar Thermal 2. Photovoltaic for water pumping 3. Photovoltaic for electrification	1. Rainwater harvesting 2. Water users association 3. Desalination/Brackish water treatment and re-use
	Transport	Agriculture	1. Bus rapid transit 2. Improved pedestrian infrastructure 3. Ticketing System	1. Drip and sub-surface irrigation 2. Water harvesting for irrigation 3. Promoting plant varieties resistant to impacts of climate change
Mauritania	Energy	Agriculture	1. Solar Photovoltaic technology 2. Wind technology 3. Hydro-electricity	1. Solar pumping system 2. Storm-water collection technology 3. Introduction and multiplication of new adapted crop varieties
	Waste	Forestry	1. Energy recovery from Incineration of household and similar waste 2. Composting of agricultural waste and manure; 3. Production of kitchen biogas from	1. Fixing the dunes 2. Forage reserves 3. Improved Fireplaces

			the Methanisation of agricultural waste (manure).	
Mozambique[x]		Coastal Zones		1. Flood warning system 2. Beach protection systems 3. Restoration of mangroves
Swaziland[x]		Water Resources		1. Integrated River Basin Management 2. Artificial groundwater recharge 3. Wetland restoration
		Agriculture		1. Livestock and Poultry selective breeding 2. Conservation agriculture 3. Crop diversification
		Forestry, Biodiversity and Ecosystems		1. Afforestation 2. Conservation of genetic resources 3. Alien invasive species management
Tanzania	Forestry	Agriculture	1. Sustainable Forest Management 2. Agroforestry 3. Mangrove Conservation Rehabilitation and Restoration	1. Improved seed varieties 2. Rice intensification systems 3. Drip irrigation system
	Energy	Water Resources	1. Mini and Micro Hydro 2. Sustainable use of biomass fuel 3. Solar PV	1. Rainwater harvesting from roof tops 2. Water leakage reduction programme 3. Water recycling and reuse
Togo	Energy - Electricity production	Agriculture	1. High-power hydroelectric plant 2. Solar Photovoltaic (PV) grid connected 3. Small or Mini hydroelectric power plant;	1. Agricultural Land Management 2. Integrated Agricultural Production Systems 3. Off-Season Agriculture
	Energy - Transport	Water Resources	1. Improvement of road infrastructure	1. Mini-water supply

			decongesting urban centres 2. Development of public transport by bus 3. Establishment of standards for means of transport.	2. Rehabilitation of surface water reservoirs 3. Gravity drainage of rainwater.
Tunisia	Industry	Agriculture	1. Co-processing 2. High efficiency electric motors	1. Conservation agricultural practices 2. Payment mechanism for environmental services from forests
	Transport	Water Resources	1. Geolocation of vehicles by GPS 2. Promotion of "Hybrid cars"	1. Early warning systems 2. Intelligent drinking water network
		Coastal zones (Marine areas)		1. Coastal management system 2. Strengthening of the information and decision support system
Asia & CIS Countries				
Armenia	Energy	Agriculture	1. Cogeneration - Small Scale Combined Heat and Power production. 2. Improving energy efficiency in multi apartment buildings. Registry creation, development. 3. Mandatory realization of the Industrial Energy Audit as a mitigation component. 4. Reactive capacity (power) compensation in the RA electric energy system. 5. Correspondence of natural gas tariff structure to the methodology approved by decision of Public	1. Windbreaks as climate change adaptation tool 2. Local melioration and low-volume drip irrigation for newly planted orchards 3. Diversification of agriculture

			Services Regulatory Commission (PSRC).	
	Industry	Water Resources	1. Production of synthetic rubbers from butadiene instead using natural gas 2. Production and usage of photo luminescent materials with long-term lightening. 3. New type of "Entirely Plastic solar water heater".	1. Creation of circulatory water system for fisheries 2. Installation of compact treatment plants and Application of natural and hybrid treatment systems 3. Spreading and expansion of drip irrigation system
	Land Use (LULUCF)		1. Degraded Grassland radical improvement. 2. Sustainable Forest management. 3. New technology of cultivation of Perennial plants.	
	Water management		1. Utilization of methane form Yerevan city landfill for electricity and heat production. 2. Existing Lusakert biogas plant operation and reissuance organizational technology. 3. Complex processing of Artik tufa mining waste and agricultural lands to prevent their further degradation.	
Pakistan	Energy (Sub-sectors: Industry. Building and Electricity production)	Agriculture	1. Improvement of Boiler and Furnace energy efficiency 2. Reduced energy consumption in homes and offices through building designs 3. Solar energy	1. Drought resistant crop varieties 2. High efficiency irrigation systems for rainfed and irrigated areas 3. Early warning system - Climate

			4. Micro & Small hydropower plants 5. Wind generators for electricity generation 6. Biogas - power generation 7. Nuclear power for electricity 8. Clean coal technology 9. Large hydro-power	monitoring and forecasting
	Agriculture and Forestry (LULUCF)	Water	1. Appropriate fertilizer application and Soil Carbon management 2. Rice cultivation by alternate wetting and drying/ aerobic 3. Enteric fermentation 4. Biogas - Compressed bio-methane including Waste and Bagasse 5. Social/Farm forestry as Carbon sinks 6. REDD+	1. Surface rainwater harvesting 2. Groundwater recharge 3. Urban storm-water management
	Transport		1. Efficient railway transportation 2. Rapid bus transport in urban areas 3. Adjustment of air-fuel mixture for better ignition 4. Conventional technologies of transport management	
Latin America & The Caribbean Countries				
Honduras	Energy (Sub-sectors: Electricity production and efficient consumption)	Agro-food	1. Hydro-electric energy production 2. Energy production from agricultural biomass 3. Biogas energy production	1. Drought resistant varieties 2. Efficient irrigation systems 3. Community drought monitoring system

			4. Energy production from municipal waste. 5. Improved wood stoves 6. Electrical appliances of high efficiency	
	Agriculture	Water Resources	1. Bio-digesters 2. Organic agriculture	1. Management of water basins 2. Construction of multipurpose reservoirs 3. National Meteorological Network
Uruguay	Agriculture	Terrestrial and Coastal ecosystem protection	1. Sustainable management of natural pastures 2. Improved animal comfort: Water supply and shade	1. Use of "geotubes": to strengthen and protect the coast 2. Early warning systems: against extreme climatic events
	Transport	Climate Services	1. Implement a vehicle energy efficiency labelling system 2. Expand mandatory vehicle inspection 3. Strengthen and expand current programs for efficient driving and vehicular maintenance 4. Introduction of new economic, tax and financial incentives, based on vehicle efficiency 5. Introduction of minimum standards of vehicle efficiency 6. Generate information based on the periodic characterization of consumers	1. Create a space for the coordination and promotion of climate services within the scope of the National System of Response to Climate Change. 2. Establish a public service for the proper handling of satellite images.

	Energy and Industry		1. Harvesting of "Wave Energy"	
	Waste		1. Incineration with energy recovery 2. Mechanical-biological treatment 3. Anaerobic digestion in biological reactors	

Appendix 3: Analysis of how countries "relate to" or use/mention TNAs (results, outcomes or processes) and technology (as defined in the Step-by-Step guide to conducting TNAs) in their NDCs.