SCAN (SDG & Climate Action Nexus) tool: Linking Climate Action and the Sustainable Development Goals

Methodology paper

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SCAN (SDG & Climate Action Nexus) tool:

Linking Climate Action and the Sustainable Development Goals

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1 Introduction

1.1 Background

In 2015, leaders from the member states of the United Nations agreed on objectives to shift all economies and societies toward sustainable and decarbonised development through the adoption of the Agenda 2030 on the Sustainable Development Goals (New York, September 2015) and the Paris Agreement on limiting climate warming to well below 2°C (Paris, December 2015). Both frameworks, although negotiated under different multilateral processes, promote the participation of all countries and are highly interlinked: the Paris Agreement emphasizes the need for sustainable development considerations in low-carbon transitions; at the same time avoiding dangerous climate change is one of the 17 Sustainable Development Goals (SDGs) defined in the 2030 Agenda on Sustainable Development. Thus, failure in one process could undermine the success of the other. The implementation of Nationally Determined Contributions (NDCs) –countries' emissions reduction commitments– requires huge investments, which are more likely to be financed if embedded in and benefiting national development plans. While, vice versa, prospects for sustainable development depend on a limitation of global warming.

This interdependency can be seen as an opportunity to move away from the discourse of two different agendas that are often perceived to be in competition; and instead pursue their implementation in a way to maximise mutual benefits. A deeper understanding of the points of intersection between the two agendas is needed to unlock further ambition and to avoid potential conflicts (WRI, 2016). In some cases, interactions between the two may be mutually reinforcing, while in other cases action in one may undermine the achievement of the targets in the other. Policy makers may be faced with strategic choices where insights into climate-development interactions are key for successful development and implementation of policies and targets that serve both agendas. Such understanding can enable coherent policy planning and increase implementation efficiency, in particular when considering limited institutional capacities.

1.2 Objectives

The objective of the study was to develop a tool that helps stakeholders identify links (both synergies and trade-offs) between mitigation and adaptation actions and the SDGs. In this context, we developed the SDG Climate Action Nexus tool (hereafter referred to as the 'SCAN-tool'). The SCAN-tool aims to be user-friendly and practical and it is meant to support policy makers across different departments and state levels, to achieve greater policy coherence, to enable the achievability of multiple goals and to improve the efficiency of implementation by providing them with an initial indication of which climate actions may impact -positively or negatively- specific SDG targets. It may also serve the international community, for example in the role of funders, to identify areas where dual or multiple benefits may be achieved.

In addition, the SCAN-tool can inform the process of putting forward increasingly ambitious pledges of climate action, required every five years under the ambition mechanism of the Paris Agreement1. A better understanding of how climate action can reinforce the achievement of SDG targets may increase countries' confidence to put forward more ambitious NDCs and improve political buy-in.

The first step of the research was to develop tools for mitigation and adaptation that link climate actions across all sectors with the SDGs at the goal and target level. Given the complexities involved, this was done at a high level. In a second step, a deep dive into the electricity and heat mitigation sector was undertaken to map potential linkages in greater detail, aiming to provide much greater granularity of potential synergies and conflicts of specific mitigation actions and technologies with SDG targets.

This methodology paper describes our rationale and approach to analysing potential links between climate action and SDG targets. Section 2 starts with a review of existing tools and studies in the area of SDG and NDC linkages; while Sections 3 describes the approach taken to assess the linkages to mitigation and adaptation measures separately.

2 Existing tools and initiatives

The integration of climate policy and development objectives has long been a topic of discussion in the international arena (WWF & CARE, 2015; UNEP, 2016; Von Stechow *et al.*, 2016). The NDC process and Paris Agreement ambition cycle have added to the need to provide better guidance and insights into how the two policy agendas can be better aligned. Several studies and initiatives have been undertaken to map the interrelationships, synergies and trade-offs of the Agenda 2030 and the Paris Agreement (or more concretely, countries' NDCs). A number of tools to communicate those interrelations have been developed by different institutions or are currently under development.

In order to avoid duplication and to maximise synergies, the study started with a review of existing initiatives which address linkages between NDCs and SDGs (for more details on the studies and tools reviewed, please see Annex I). The review found that most of the tools take the current submitted NDCs as a starting point, to identify potential linkages with SDGs based on the actual text in the NDCs (i.e. searching for explicit mention and recognition of key words related to the SDGs and its targets in the NDCs).

Whilst this mapping provides insights into the degree to which the formulation of the NDCs reflects the SDGs, it does not provide guidance on whether climate actions taken to achieve NDC targets are likely to reinforce or undermine the SDGs and is highly unlikely to capture all potential linkages. For example, a country may have presented an economy-wide NDC target without describing sector

[1] *The Paris Agreement established an ongoing, regular process to increase action by all countries - dubbed the "ratchet" or "ambition mechanism" under which, countries must come together every 5 years to take stock of progress and submit a climate action plan that is progressively more ambitious than the last.*

context or activities in greater detail. The absence of reference to activities relevant to the SDGs does not mean that there may not be synergies or trade-offs associated with those activities. Conversely, a country may have included text describing specific co-benefits, suggesting linkages to SDGs which may not actually occur in practice, or where the linkage is very indirect.

In essence, the existing tools serve a mapping purpose and provide an assessment of the status quo, without indicating the existence or type of causal relationships. These tools do not give practical guidance to policymakers on potential synergies or conflicts in a comprehensive way that can be used to inform the development of implementation strategies for the NDCs (or SDGs) or future NDC cycles with SDGs in mind.

3 The SCAN-tool

From the review of existing tools, we concluded that there is a gap for a tool that goes beyond a descriptive approach and that is rather based on the analysis of potential interactions drawing on scientific literature, which would allow users to understand linkages between mitigation and adaptation activities and SDGs to inform policy formulation and implementation and future NDC cycles. To fill this gap, we developed the SCAN-tool which takes mitigation and adaptation actions (rather than the text of a specific country NDC) as a starting point, thus ensuring that all potential activities and sectors are covered. Separate tools were developed for mitigation and adaptation.

Given the range of possible mitigation actions and the breadth of the SDG targets, comprehensively identifying linkages between the two is a complex and time-consuming task. The SCAN-tool is intended to provide an initial, high-level indication of which SDGs and targets may be impacted by specific mitigation actions. **In reality, the linkages are highly context-specific; national circumstances and other factors will greatly influence the magnitude and direction of any linkage. Policymakers and other users will, therefore, need to undertake further research to understand which linkages apply and are most relevant to their situation.** The SCAN-tool can be thought of as an initial step on such a journey. Ultimately, it is intended to help improve policy coherence and integration of the NDCs with national sustainable development goals.

The following section describes the approach taken to develop the SCAN-tool for mitigation and adaptation and its main features.

3.1 SCAN-tool for Mitigation: Methodology and approach

The SCAN-tool for mitigation covers actions across seven sectors: electricity and heat, transport, buildings, industry, waste, agriculture, and forestry. These sectors do not relate to economic activity but to activities that produce emissions, and the actions that can be implemented to reduce those emissions. So, a farmer buying a more energy efficient tractor would be counted as an action in the transport sector, not the agriculture sector.

Generally across all sectors, mitigation actions are grouped into three broad categories of mitigation action. These are 'Changing activity' (actions which reduce the underlying demand for an emissions-intensive activity), 'Reduce emissions intensity' (actions that reduce the emissions produced per unit of activity), and 'Increase energy efficiency' (actions to reduce the amount of energy required per unit of activity).

For transport, buildings, industry and waste sectors, all three categories are relevant whereas for the electricity and heat sector, only the emissions intensity and energy efficiency categories are relevant given that a reduction in the demand of the activity would refer to a reduction in energy demand which is captured in the energy efficiency categories of all other relevant sectors. In the case of agriculture, we do not include the energy efficiency category as the energy required by the agro-industry is assumed to be included either under the industry, buildings or transport sector. For the forestry sector, only the changing activity category is relevant. For each sector, each category then contains one or more mitigation actions that are specific to that sector.

As mentioned before, given the complexities involved, a deep dive into the electricity and heat sector was undertaken to map potential linkages in greater detail, aiming to provide much greater granularity of potential synergies and conflicts of specific mitigation actions and technologies with SDG targets.

Table 1 below lists the categories and mitigation actions for the main seven sectors and gives examples of the mitigation actions that would be included.

Table 1: Categories, mitigation actions and examples (sector specific)

Sector	Category	Mitigation Action	Examples
Electricity & heat	**Reduce emissions intensity**	**Renewable energy: Solar PV**	**Utility scale solar PV power plants supplying grid electricity**
		Renewable energy: Solar CSP	**Utility scale concentrated solar power (CSP) plants supplying grid electricity**
		Renewable energy: Solar heating	**Building-scale solar water heating systems (commercial or residential buildings)**
		Renewable energy: Geothermal	**Utility scale geothermal plants supplying grid electricity**
		Renewable energy: Wind	**Utility scale onshore wind farms supplying grid electricity**
		Renewable energy: Large-hydro	**Utility scale hydropower projects supplying grid electricity**
		Renewable energy: Small-hydro	**Small scale hydropower projects supplying electricity for local use**
		Renewable energy: Ocean	**Utility scale projects supplying grid electricity from wave energy, tidal stream or tidal range**
		Renewable energy: Bioenergy	**Electricity or heat supplied from biomass, whether from direct combustion of biomass or after conversion to biofuels (liquid or gas)**
		Renewable energy: BECCS	**Combustion of biomass in power plants fitted with carbon capture and storage technology (CCS), producing grid electricity with negative GHG emissions (due to carbon absorbed by biomass as it grew)**
		Renewable energy: Off-grid	**Micro scale (household or village scale) renewable energy projects supplying electricity for local use (most likely PV or wind)**

		Other technologies: Gas	Utility scale power plants burning natural gas to provide grid electricity
		Other technologies: CCS	Fossil fuel power plants fitted with carbon capture and storage (CCS) technology
		Other technologies: Nuclear	Utility scale nuclear power plants providing grid electricity
	Increase energy efficiency	Power generation efficiency improvement (when using coal, oil, gas)	Improvements in power plant efficiency, reducing the amount of fuel needed per unit of electricity produced
		Increased efficiency through CHP	Combined Heat and Power (CHP) plants producing both electricity (grid or local use) and heat (for local use)
		Reduction in transmission and distribution losses	Improvements in transmission and distribution efficiency to reduce losses and reduce required fuel consumption per unit of electricity consumed by end users
Transport	Changing activity	Reducing transport demand	Sustainable urban planning to reduce need to travel; behaviour change to avoid travel
		Modal share shift	Improved public transport (metro, bus rapid transit etc); cycling infrastructure
	Reduce emissions intensity	Fuel switch to low carbon vehicles	Electric vehicles; fuel cell vehicles; hydrogen; biofuels
	Increase energy efficiency	Increase energy efficiency	Reducing fuel consumption of existing vehicles (more efficient internal combustion engines)
Buildings	Changing activity	Urban planning for energy efficiency	Urban planning to enable efficiency; community and district scale heating / cooling
	Reduce emissions intensity	Fuel switch away from fossil fuels	Moving from gas / oil boiler to biomass boiler; solar thermal
	Increase energy efficiency	Increase energy efficiency	Improved building fabric; more efficient systems and appliances
		Improved cookstoves	More efficient cookstoves that consume less fuel
Waste	Changing activity	Reduce, Reuse, Recycle	Behaviour change to reduce, reuse and recycle waste
	Reduce emissions intensity	Sustainable waste management systems	Landfill gas capture and utilisation
	Increase energy efficiency	Increase energy efficiency	More efficient waste management processes and systems
Industries	Changing activity	Changing activity	Material efficiency in design and production; longer lasting products;
	Reduce emissions intensity	Fuel switch away from fossil fuels	Moving from gas to biomass for process heat
		Non-energy	Reducing process and fugitive emissions e.g. clinker substitution in cement sector; reduced coolant leakage
	Increase energy efficiency	Increase energy efficiency	More efficient processes, systems and appliances
Agriculture	Changing activity	Sustainable consumption practices	Reducing demand for agricultural products; less consumer wastage; reduced meat consumption
	Reduce emissions intensity	Climate smart agriculture	Reduced fertiliser use; better irrigation; soil conservation; manure management
Forestry	Changing activity	Smart cities and green urban planning	Creation of green spaces (positive land use change); vertical gardens; green roofs; green-blue corridors
		Sustainable forest management	Agroforestry; reforestation

The core of the tool are the sector work sheets where information about the linkages between actions and the SDGs is entered. Goals 13 (climate action) and 17 (Partnerships for the SDGs) are not assessed

in the tool. Potential links to SDG 13 are not listed as the SCAN-tool is designed to help identify linkages between climate actions and other development areas, thus these links are implicitly represented in the assessed sectoral mitigation actions. Links to SDG 17 are not included because this goal is about mobilization of international resources to achieve the SDGs and is not a development area comparable to the other SDGs2. Both these SDGs are shaded grey on the overview and sectoral sheets.

The tool was populated using existing literature that maps the climate-development links and collects data from several studies on the nexus between climate action and specific development areas (Iacobuta and Höhne, 2017; Fuso Nerini et al., 2017; Pradhan et al., 2017; IPCC, 2014). The literature-based population of the matrix was complemented by an expert review and inputs from the project team as well as additional reviewers. The description of the links is detailed on the sector sheets of the tool and shows the relationship between a mitigation action (from the list in Table 1) and the targets of each SDG (so the linkages are between an action and for example SDG target 3.x rather than SDG 3 at the goal level).

In each one of the sector sheets, the linkages were classified as either positive (cell marked in green) – where the mitigation action is likely to reinforce the SDG target, or negative (cell marked in orange) – where there may be a negative impact on the SDG target. **The score attributed to a linkage is only indicative of whether it is likely to be positive or negative. The tool does not assess the magnitude of the linkage.** Where both positive and negative linkages were identified between the same mitigation action and the same SDG target, these are separately detailed in the tool (e.g. renewable energy can lead to job creation in renewable energy industries and job losses in fossil fuel industries). An example for the energy sector and the first targets of SDG 1 is shown in Figure 1.

Figure 1: SCAN-tool for mitigation – Electricity and heat sector sheet (example)

Legend: Potential synergy | Potential trade-off | No linkages identified

Goal	Targ	Target text	Category	Mitigation action	Link	Description of link
1. No poverty	1.1	By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day				
	1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	Reduce emissions intensity	Renewable energy: Off-grid		Off-grid renewable energy can help reach remote communities, increasing access to energy (energy poverty reduction), and enabling productive economic activities. Access to electricity also enables refrigerated food storage that can increase food availability year-round for communities at risk of hunger.
	1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	Reduce emissions intensity	Renewable energy: Bioenergy		Biofuels production can lead to land price increase, with impact on food prices which could reduce food access.
	1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	Reduce emissions intensity	Renewable energy: Ocean		Most ocean energy technologies are not commercially mature and deployment will likely lead to increased energy prices
	1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	Reduce emissions intensity	Renewable energy: BECCS		BECCS is not commercially mature and deployment will likely lead to increased energy prices. Additional energy is also required to run the CCS system which will also affect running costs. Biofuels production can also lead to land price increase, with impact on food prices which could reduce food access
	1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	Reduce emissions intensity	Other technologies: CCS		CCS is not commercially mature and deployment will likely lead to increased energy prices. Additional energy is also required to run the CCS system which will also affect running costs
	1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	Reduce emissions intensity	Other technologies: Nuclear		Nuclear energy is likely to be very expensive to deploy in most country situations due to huge infrastructure costs and costs of handling waste and decommissioning nuclear sites.
	1.3	Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable				
	1.4	By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	Reduce emissions intensity	Renewable energy: Large-hydro		Communities could be displaced to build hydropower plants and flood large land areas. Such flooding can also limit agricultural areas.

[2] *Similarly, we do not look into links between mitigation actions and targets ending in letters (e.g. 2.a, 2.b) as these targets relate to the number of resources that need to be in place for achieving the specific goal (similar to Goal 17).*

Moreover, the focus of this study was limited to direct impacts, including only a few indirect ones in cases where an impact was considered evident but could not be directly linked to the target objectives. Many of these cases came as a result of the wording of the SDG target text, for example in SDG 8.3, where the target contains a primary objective ('promote development-oriented polices') and mentions some additional objectives ('that support productive activities, decent job creation… (etc.)'). In this case, mitigation actions such as renewable energy do not directly lead to the promotion of development polices, but they may help support the related activities mentioned in the target text. These indirect links are highlighted in a different colour and include a text warning, so it is evident for the user.

While it is important for policy makers to understand the potential interactions between the mitigation actions that reduce emissions and the SDGs, it is also relevant that they understand how the interventions they may put in place in order to support implementation of those mitigation actions by consumers and the private sector can also have an impact on the SDGs. For example, pricing interventions, if not carefully designed and implemented, carry a high risk of negative impacts relating in particular to affordability. Conversely, awareness raising, and capacity building interventions are likely to be positive in most cases, even if sub-optimally designed and implemented. Impacts from these interventions were also considered in the SCAN-tool and are included as the 'General' sector (see Table 2).

Table 2: Categories, interventions and examples ('General' sector)

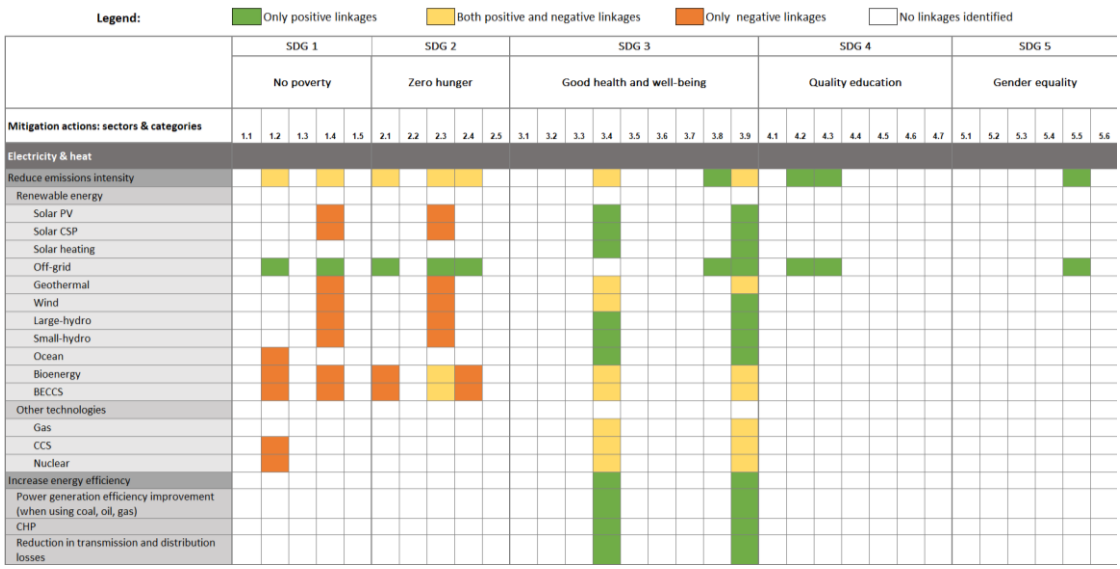
Sector	Category	Intervention	Examples
General	**Awareness**	**Awareness raising programmes**	**Awareness raising campaigns in various media channels; awareness programmes in schools, companies, cities & districts**
	Capacity	**Institutional capacity building**	**Capacity building in government departments, agencies, companies**
		Training programmes	**Training programmes for installers; dedicated university degrees; vocational training**
	Finance	**Dedicated financial products and credit**	**Dedicated low cost credit / soft loans for renewables and EE investments; guarantee schemes; pay as you go schemes; green bonds**
	Pricing	**Carbon and energy pricing interventions**	**Carbon taxes; carbon trading; energy taxes; reduction of fossil fuel subsidies**
	Innovation	**Innovation / R&D programmes**	**R&D grants; testing centres; demonstration programmes**

The SCAN-tool includes an overview sheet which summarises the identified linkages at the level of the SDG target and mitigation actions for each sector, as shown in Figure 2.

Where there is no colour shading in a particular cell, no links were identified between the corresponding SDG target and sectoral mitigation action. Green shading indicates that one or more potential positive links exist, and orange that one or more negative links could exist. Where both positive and negative linkages were found, the cell is marked in yellow. As described above, more

detailed information about the identified links is shown in the sector sheets, including a brief description that explains the linkage.

Figure 2: SCAN-tool for mitigation – Overview sheet (excerpt)



3.2 SCAN-tool for Adaptation: Methodology and approach

The SCAN-tool for adaptation was developed alongside the SCAN-tool for mitigation and uses a similar approach and structure, although the sectors, categories and actions are fitted to capture a wide range of adaptation actions.. To define the adaptation sectors, a list of adaptation actions was compiled using the World Bank's adaptation NDC platform3; covering the set of realistic and intended actions proposed by countries. These actions were then combined into the sectors shown in Table 3.

As with the SCAN-tool for mitigation, a 'General' sector was created to capture options and instruments that cut across different sectors or are not sector-specific. Actions in the General sector are cross-cutting whose results are non-sector-specific. The General sector is categorized into two useful categories, which distinguish cross-cutting actions by their purpose: those that are preventive of impacts ("Avoiding potential impact"), and those that improve in coping capacities ("Strengthening adaptive capacity") (BMZ, 2014). Avoiding potential impact category includes actions such as awareness raising programmes, building early warning systems, institutional development which includes risk assessments, and scientific projections that aid socioeconomic planning, and research and development which include research on technological advancements, training programs and demonstration programs. Under Strengthening Adaptive Capacity, subcategories such as financial

[3] *The World Bank classifies the NDCs into 16 sectors: Agriculture, Building, Coastal Zone, Cross-cutting areas, Disaster Risk Management, Economy-wide, Education, Energy, Environment, Health, LULUCF/Forestry, Social Development, Tourism, Transport, Urban, and Water.*

support in the form of loans and credit, subsidies, and climate risk insurance; enhancing disaster emergency response; and providing access to basic services such as health centres are found.

Drawing on the IPCC AR5, the sector-specific adaptation actions were classified into two relevant categories of risks: vulnerability and exposure. Vulnerability is defined as "the propensity or predisposition to be adversely affected" (IPCC AR5, WGII). A possible reduction in vulnerability as used in this tool refers to adaptation action directed to livelihoods and communities that reduces the likelihood of incurring damages, despite exposure to events. This category captures both the preventive actions (sensitivity that determines potential impact), and coping mechanisms (increase in adaptive capacity). On the other hand, exposure is defined as "the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected." (IPCC AR5, WGII). In this tool, a possible reduction in exposure refers to preventive actions by means of avoidance to exposed locations and/or livelihoods. We recognize here that exposure, not only depends on climatic parameters, but also the environment through which these climatic parameters are transformed to damaging conditions. For instance, an area with high precipitation is not a dangerous parameter itself, but flooding is; and flooding depends on the effectiveness of drainage systems to cope with precipitation from within the region or outside (if water gets channelled through). Therefore, we factor in environmental structures -- both natural and manmade -- in framing exposure risk; and consequently, adaptation actions that avoid exposure risk. In the same way, lack of precipitation will not always lead to drought if there are infrastructures such as water basins and irrigation systems set in place. We consider this as a reduction in exposure risk because despite deficient precipitation, crops are not exposed to drought.

The two broad categories are further classified into four types of adaptation action, with two actions corresponding to a reduction in vulnerability and the other two to a reduction in exposure. The full list of sectors and examples of actions are shown in Table 3.

Table 3: Definition and list of sectors, categories, and adaptation actions

Sector	Category	Adaptation Action	Examples
Agriculture (includes crops, livestock)	**Reduction in vulnerability**	**Technological improvement to increase resilience**	**Developing crop varieties resilient to CC (i.e., drought-resistant, high temperature-tolerant and short-maturity crops); improved soil management by increasing water retention; vaccination/intervention that minimize livestock disease; Post-processing of raw food to prolong shelf life (e.g., drying, smoking)**
		Increase resource efficiency	**Developing agroecological fish-farming techniques; integrated agroforestry; sustainable aquaculture practices to improve water efficiency; vertical integration into the supply chain**
	Reduction in exposure	**Change of livelihood or physical location**	**Diversification/change in product/livelihood (e.g., shift to crops that naturally require less water); change in traditional agricultural practices to resilient and sustainable techniques;**
		Physical protection	**Building of irrigation facilities; construction of reservoirs for micro-irrigation and livestock watering; restoration of vegetation cover to avoid erosion; construction of micro watersheds.**

Coastal Zone (includes coastal industries such as tourism and fisheries)	**Reduction in vulnerability**	**Technological improvement to make products CC-resilient**	**Post-processing of raw fish (drying, smoking) that help in reducing dependency of fish resource fluctuation; improve design of existing structures (e.g., floating hotels to reduce impact of sea-level rise)**
		Increase resource efficiency	**Management of coastal and fisheries resources through non-destructive fishing techniques;**
	Reduction in exposure	**Change of livelihood or physical location**	**Change in livelihood. (e.g., fishing to tourism); relocation of households away from coastal areas**
		Physical protection	**Construction of cyclone shelters in coastal areas; climate-proofing infrastructure to strengthen coastal protection against erosion; building of active protection structures (groynes, breakwaters and passive recovery e.g. barriers against strong winds, replanting/protection of mangroves); improvement in housing and living conditions to withstand severe climate impacts**
Forestry (LULUCF)	**Reduction in vulnerability**	**Technological/design improvement to make products CC-resilient**	**Planting of climate-resilient trees; creating fire corridors (against forest fires)**
		Increase resource efficiency	**Expansion of conservation areas; migration corridors**
	Reduction in exposure	**Change of livelihood or physical location**	**Increase in eco-tourism; better manage slash-and-burn practices**
		Physical protection	**Enhance afforestation, particularly reforestation of degraded landscapes to fight against floods, violent winds, soil erosion**
Ecosystem management	**Reduction in vulnerability**	**Technological improvement to make products CC-resilient**	**Prevention of illnesses and diseases in animals (e.g., through vaccination)**
		Increase resource efficiency	**Reduce, reuse, recycle**
	Reduction in exposure	**Change of livelihood or physical location**	**Development of waste-management techniques and facilities; assisted migration of valued species**
		Physical protection	**Establish water points for wildlife in protected areas; building of water basins to reduce risk of landslides and soil erosion**
Energy	**Reduction in vulnerability**	**Technological improvement to make products CC-resilient**	**Increase energy access; rural electrification; Installation of micro-hydro power units in river systems, solar PV parks, waste-to-energy technology, wind turbines; multi-hazard-resistant infrastructure**
		Increase resource efficiency	**Implementation of energy-saving strategies; construction of multi-purpose hydropower to expand water storage**
	Reduction in exposure	**Change of livelihood or physical location**	**Decentralize power generation (e.g., less reliance on hydro power in anticipation of drought risk); use of alternative sources of energy to reduce deforestation and consequent loss of livelihood options**
		Physical protection	**Physical infrastructure to protect power plants from flooding, earthquakes, etc**
Health	**Reduction in vulnerability**	**Technological improvement to make products CC-resilient**	**Increase vaccination/ prevention against water and vector-borne diseases**
		Increase resource efficiency	**-**
	Reduction in exposure	**Change of livelihood or physical location**	**Change in livelihood (e.g., from field to office work)**
		Physical protection	**Increase access to clean drinking water; increase health facilities; building of infrastructure that protects against heat (ventilation or shaded areas)**
Transport	**Reduction in vulnerability**	**Technological improvement to make products CC-resilient**	**Making existing infrastructure heat-resistant/flood-resistant; design improvement in modes of transport (more ventilation, less sensitivity to flooding)**
		Increase resource efficiency	**-**

	Reduction in exposure	Change of livelihood or physical location	Travel less
		Physical protection	Repair and rehabilitation of road infrastructure; building infrastructure against flooding (e.g., for subway stations)
Urban	Reduction in vulnerability	Technological improvement to make products CC-resilient	Reduction of heat-island effect through smart city design
		Increase resource efficiency	Increase efficiency in water distribution systems; Increase in water usage efficiency;
	Reduction in exposure	Change activity/product	Relocation of human settlements away from hazard-prone areas; strengthening of rural settlements to prevent excessive urban migration
		Physical protection	Building/rehabilitation of drainage systems, dykes; building of water treatment plants; development of modern solid waste management plants; building of decentralized infrastructure for rain water collection and usage; building of water reservoirs
General	Avoiding potential impact	Awareness raising programmes	Awareness raising campaigns in various media channels; awareness programmes in schools, companies, cities & districts; awareness campaigns for water, sanitation and hygiene practices
		Building Early Warning Systems	Strengthening of multi-hazard early warning systems
		Institutional Development	Capacity building in government departments, agencies, companies; mainstreaming of CCA to development plans; development of sector-specific plans; improvement in data acquisition/processing/analysis of impacts and risks for vulnerability mapping, forecasting, revision of building codes, strengthening of multi-hazard early warning systems, flood monitoring; capacity building for the preparation of eligibility for GCF
		R&D	R&D grants; testing centres; demonstration programmes; training programs
	Strengthening adaptive capacity	Financial support	Dedicated low cost credit / soft loans; insurance schemes; subsidies
		Enhance disaster emergency response	Strengthening emergency response mechanisms (in the absence or failure of physical protection) for sudden onset events

Similar to the mitigation tool, the SCAN-tool for adaptation also includes an overview sheet that summarises the links between the SDG target and the adaptation action (see Figure 3). Where there is no colour shading in a cell, no links were identified; green shading indicates that one or more potential positive links exist; and where both positive and negative linkages were found, the cell is marked in yellow. We found that for each of the negative linkages identified in the sector sheets, there are corresponding solutions that could negate these possible negative impacts without altering the action itself. Thus, no 'only negative' links were found in the adaptation tool. Detailed information about the links and a description explaining the linkage is available in each of the sector sheets (an example for the agriculture sector and SDG 1 is shown in Figure 4.

Figure 3: SCAN-tool for adaptation – Overview sheet (excerpt)

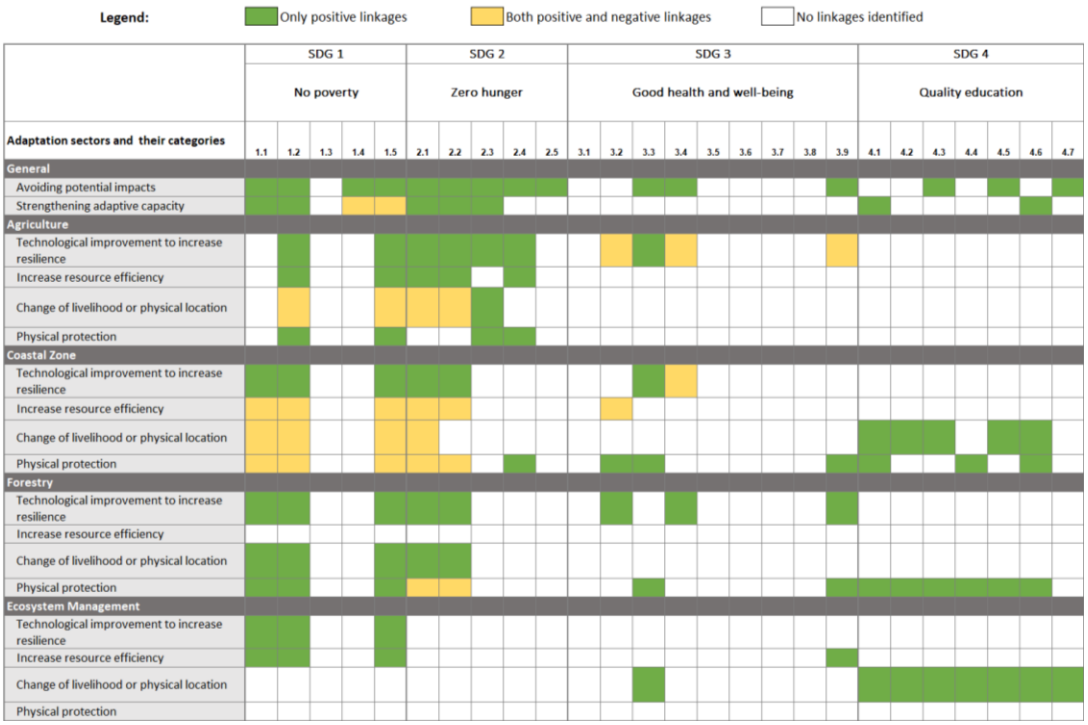


Figure 4: SCAN-tool for adaptation – Agriculture sector sheet (example)

Legend: Potential synergy | Potential trade-off | No links found

Goal	Targ	Category	Adaptation Action	Link	Description of link
1. No poverty	1.1.	Vulnerability	Technological improvement to increase resilience		Protecting income of poor households and resiliency of livelihood through drought-tolerant crop varieties
	1.1.	Vulnerability	Increase resource efficiency		Improving resiliency of the poor engaged in climate sensitive livelihoods through reduction in use of inputs through efficency measures (e.g., water efficiency and recycling, better soil management)
	1.1.	Exposure	Change of livelihood or physical location		Protecting income of poor agricultural households through shifting of products to higher value added, naturally more CC resilient agricultural produce
	1.1.	Exposure	Change of livelihood or physical location		Relocation of households away from coastal areas will, at least in the shortrun, disrupt livelihoods and can cause a loss of sense of place and cultural identity; erosion of kinship and familial ties
	1.1.	Exposure	Change of livelihood or physical location		Relocation of households that may cause a loss sense of cultural identity may be beneficial to alleviating poverty. Culture sometimes acts as a major barrier to embracing four of the most successful livelihood strategies: labour migration, working for development projects, gardening, and the engagement of women in economic activities.
	1.1.	Exposure	Physical protection		Protecting households from asset loss, crop loss, and potential food price shocks through building of infrastructures, such as irrigation facilities; reservoirs for micro-irrigation and livestock watering; restoration of vegetation cover to avoid erosion
	1.2	Vulnerability	Technological improvement to increase resilience		Protecting income of poor households and resiliency of livelihood through drought-tolerant crop varieties
	1.2	Vulnerability	Increase resource efficiency		Improving resiliency of the poor engaged in climate sensitive livelihoods through reduction in use of inputs through efficency measures (e.g., water efficiency and recycling, better soil management)
	1.2	Exposure	Change of livelihood or physical location		Protecting income of poor agricultural households through shifting of products to higher value added, naturally more CC resilient agricultural produce
	1.2	Exposure	Change of livelihood or physical location		Relocation of households away from coastal areas will, at least in the shortrun, disrupt livelihoods and can cause a loss of sense of place and cultural identity; erosion of kinship and familial ties
	1.2	Exposure	Change of livelihood or physical location		Relocation of households that may cause a loss sense of cultural identity may be beneficial to alleviating poverty. Culture sometimes acts as a major barrier to embracing four of the most successful livelihood strategies: labour migration, working for development projects, gardening, and the engagement of women in economic activities.
	1.2	Exposure	Physical protection		Protecting households from asset loss, crop loss, and potential food price shocks through building of infrastructures, such as irrigation facilities; reservoirs for micro-irrigation and livestock watering; restoration of vegetation cover to avoid erosion
	1.3				
	1.4				
	1.4				
	1.5	Vulnerability	Technological improvement to increase resilience		Protecting income of poor households and resiliency of livelihood through drought-tolerant crop varieties
	1.5	Vulnerability	Increase resource efficiency		Improving resiliency of the poor engaged in climate sensitive livelihoods through reduction in use of inputs through efficency measures (e.g., water efficiency and recycling, better soil management)

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5 Annex I: Relevant reviewed tools on SDG and NDC linkages

We provide an overview of the most relevant tools available in the field of SDG and NDC linkages and their main features.

Examining the alignment between the Intended Nationally Determined Contributions and Sustainable Development Goals (WRI, September 2016)

WRI published a working paper on the degree of alignment between (I)NDCs and SDGs. The paper identifies examples of alignment in 92 (I)NDCs based on key word searches and their relevance to specific SDG targets. The paper features an extensive and transparent Annex including a global mapping of the (I)NDCs' links to the SDGs. By using text analysis, the paper informs on linkages to SDGs that were explicitly mentioned by those developing the (I)NDCs.

Further studies have been developed on the basis of this working paper, such as for example "Connecting the dots: elements for a joined-up implementation of 2030 Agenda and the Paris Agreement." (WRI/GIZ forthcoming).

For more information, see: https://www.wri.org/sites/default/files/WRI_INDCs_v5.pdf *and* *http://www.wri.org/sites/default/files/annex-1-global-analysis_0.pdf*

SDG footprint of Asian NDCs: Exploring synergies between domestic policies and international goals (TERI, July 2017)

TERI carried out a study to explore the linkages between NDCs of Asian countries and the SDGs. The analysis was done using a content-textual approach, i.e. keywords were identified and searched for in the text of each NDC. The findings were further analysed for the strength of the match, i.e. whether they were direct matches (explicitly referenced in the NDC goals) or indirect matches (referenced in the background information on NDC goals). The report and several country profiles provide details regarding the country's key development indicators and GHG emissions; along with a snapshot of its commitment to combat climate change; and an analysis of the SDG footprint on its NDC. Overall, it informs on linkages to SDGs that were explicitly mentioned in the NDCs and provides some concrete country examples of the links.

For more information, see: http://www.ndcfootprints.org/index.php

UNDP Climate action impact tool: Assessing climate action contributions to the Sustainable Development Goals (UNDP, October 2017)

The bottom-up tool enables stakeholders to identify and quantify direct impacts, define indicators, set targets and track the progress of actions towards the SDGs. The tool is separated into various impact categories that are linked to the relevant SDGs allowing policy makers to track the impact of NDC mitigation actions on the SDGs. The tool can be applied to various types of climate actions defined under an NDC that are either national, regional, sectoral or local. The outcome of the tool is a very detailed and comprehensive assessment of each mitigation action. The robustness of the output depends on the quality and extent of quantitative and qualitative data provided by the user. This tool

enables users to undertake their own detailed assessments, and could be quite complementary to the more generic initial guidance provided by the SCAN-tool developed by this project.

For more information, please see: https://climateimpact.undp.org/#!/

Climate Watch: Data on climate action (WRI, November 2017)

Climate Watch is an online platform managed by WRI in collaboration with several partners under the NDC Partnership. It brings together several datasets to enable users to analyse and compare the NDCs under the Paris Agreement, among other features. A section on sustainable development objectives identifies actual alignment between countries' NDCs and the SDGs. This assessment is based on findings of WRI's (2016) working paper described above.

For more information, please see: https://www.climatewatchdata.org/ndcs-sdg

NDC-SDG Connections: Connecting climate action to the Sustainable Development Goals (SEI, November 2017)

NDC-SDG Connections is a joint initiative of the German Development Institute / Deutsches Institut für Entwicklungspolitik (DIE) and Stockholm Environment Institute (SEI) to highlight synergies between the 2030 Agenda and the Paris Agreement, and thus to identify potential entry points for more coherent policy-making and action. The database is based on the identification of "activities" in the (I)NDCs, meaning statements on future (conditional or unconditional) activities under the NDC. From a total of 161 (I)NDCs, 7080 climate activities were derived. The NDC-SDG Connections initiative uses mainly text analysis, counting the frequency of key words as well as the volume of committed activities of a country in a certain policy sector. The analysis informs about potential linkages to SDGs that were explicitly mentioned in the NDCs in a visualised online format allowing also for country comparisons.

For more information, see: https://klimalog.die-gdi.de/ndc-sdg/

Other guidance documents that do not map or directly identify linkages between NDCs and SDG but are also available and we list some of them below. This is not an exhaustive list, but rather a compilation of tools and documents that have been made available recently, following the adoption of both agendas.

Aligning NDCs & SDGs Lesson learned and practical guide (UNDP, November 2017)

For more information, see: http://www.undp.org/content/undp/en/home/librarypage/climate-and-disaster-resilience-/ndcs-and-sdgs.html

Planning for NDCs implementation – A quick start guide and reference manual, Appendix 1: NDCs & SDGs

For more information, see: https://www.cdkn.org/ndc-guide/book/planning-for-ndc-implementation-a-quick-start-guide/ndcs-and-the-sustainable-development-goals