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Implementation of Nationally Determined Contributions

Peru Country Report

For our Environment

Umwelt Bundesamt

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Implementation of Nationally Determined Contributions

Peru Country Report

by

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Introduction to the project

This country report is part of the "Implementation of Nationally Determined Contributions" (NDCs) project (FKZ 3716 4111 80), which considers NDC implementation in 10 countries: Colombia, Ethiopia, Georgia, Indonesia, Iran, Kenya, Marshall Islands, Morocco, Peru, and Viet Nam. This project places a special emphasis on identifying potential barriers to NDC implementation and mitigation potentials, which could go beyond the current NDCs.

The country reports analyze the NDCs in terms of their robustness and coherence with other national or sectoral plans and targets, and put them into the context of additional mitigation potentials and other national circumstances. For countries where coal plays a critical role in consumption or national production, the analysis covers further details on this sector, including the economic relevance and local impacts of coal production or consumption. The content is based on available literature from research and public sector information on policies and institutions.

To be able to analyze the content in more detail, the authors focus the research on a number of relevant fields of action. The fields of action were selected based on historic and projected sectoral emissions development, comprehensive literature on GHG mitigation potentials, identified barriers and emissions reductions as well as feasibility, costs, and co-benefits.

The project was suggested and is financed by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, supervised by the German Environment Agency and carried out by independent think tanks - NewClimate Institute and Wuppertal Institute. The country reports are a continuation of similar previous efforts (project numbers 3713 41 102, 3711 41 120, 360 16 022, 364 01 003 and 363 01 128) and aim to inform policy makers and the interested public about the implementation of NDCs in individual countries. The choice of countries is based on developing countries with which Germany works closely on climate change topics.

The country reports are scientific in nature, and all suggestions are derived by the authors from careful analysis, having in mind the individual backgrounds of countries. They aim to increase knowledge about implementation of mitigation potentials to meet the globally agreed goal of staying within a temperature increase of 1.5°C or well below 2°C above preindustrial levels, without intending to prescribe specific policies.

Overview

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List of abbreviations

AILAC	Association of Independent Latin American and Caribbean States
BAU	Business-as-usual scenario
BID	Interamerican Development Bank
BUR	Biennial Update Report
CDM	Clean Development Mechanism
CEPLAN	National Strategic Planning Centre
CNCC	National Commission on Climate Change
COP	Conference of the Parties
DGCCDRH	General Directorate of Climate Change, Desertification and Water Resources
ENCC	National climate change strategy
ERCC	Regional climate change strategy
FP	Fuerza Popular political party
GHG	Greenhouse gas
GTM	Multisectoral Working Group
GWP	Global warming potential
HDI	Human Development Index
IEA	International Energy Agency
IKI	German International Climate Initiative
INGEI	National greenhouse gas inventory
IPCC	Intergovernmental Panel on Climate Change
JICA	Japanese International Cooperation Agency
LULUCF	Land use, land use change and forestry
MEM	Ministry of Energy and Mines
MINAM	Ministry of Environment
MRV	Measurement, Reporting and Verification
MTC	Ministry of Transport and Communication
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally determined contribution
NUMES	New Sustainable Energy Mix
PlanCC	Planning for climate change project
PMR	Partnership for Market Readiness
SEIN	National electricity grid
UNFCCC	United Nations Framework Convention on Climate Change

1 Part I: Summary

1.1 Country background

Geography. Peru has an area of almost 1.3 million km² and is located on the central western coast of South America facing the Pacific Ocean. It is divided into three natural regions: the coast, the highlands (Andes Mountains) and the Amazon basin (covering 74.2 million hectares of forest)(Ministry of Environment; Ministry of Agriculture, 2009; Ministry of Environment of Peru, 2016).

Population. In 2016, Peru's population stood at 31.7 million inhabitants. Peru is a very centralised country with over 30% of the total population living in its capital city, Lima (Earth Institute, 2011). The urbanisation rate in the country grew from 73% to 78% in the last 15 years, while the average growth rate of the total population is declining since 1990. According to the government's projections, the country's population will reach 40 million by 2050 (Ministry of Environment of Peru, 2016).

Economy. In 2015, Peru's GDP per capita was relatively high at about USD 6,000 in 2015 (Ministry of Environment of Peru, 2016). Peru's poverty rate has substantially decreased in the last decade, reaching levels of 22.7% in 2014 and 4.3% of extreme poverty in the same year (Ministry of Environment of Peru, 2016).

Political system. Peru is a constitutional republic, with the President as the head of the state as well as the head of government. Peru's administrative set-up has 18 ministries which are organised under three different branches of the political system: the executive, legislative and the judiciary powers (Government of Peru, 2017a).

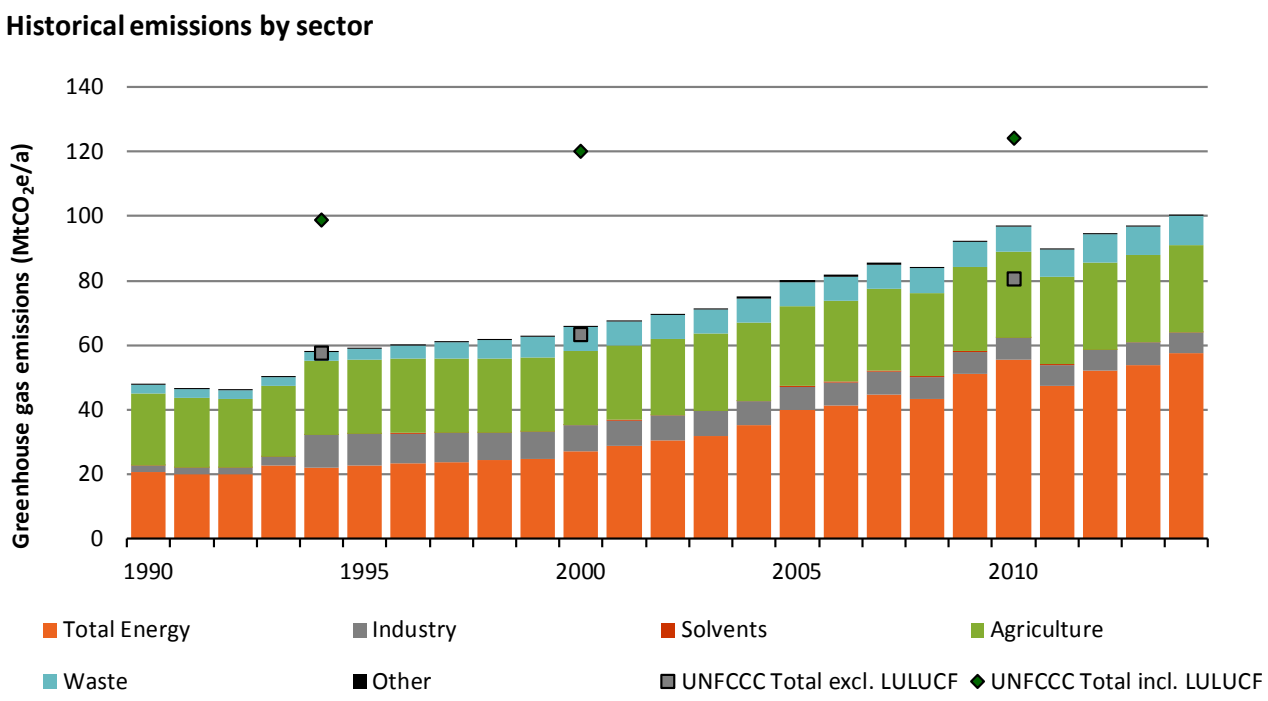
Recent political crisis. Peruvian ex-president, Pedro Pablo Kuczynski, faced a strong opposition from the Fuerza Popular (FP) party, which controls Congress. FP has forced a numerous cabinet shuffles during the first year of Kuczynski's presidency and called for the president's resignation in the wake of new information coming to light about his ties to a Brazilian construction firm, Odebrecht, that admitted to paying bribes to governments across the region. By the end of 2017, the president narrowly avoided impeachment by lawmakers but the process still contributed to the political uncertainty that is likely to affect economic growth forecast for 2018 (The Economist, 2017a). At the end of March, Kuczynski presented his resignation to the presidency. On Friday 22 March, the Viceminister Martin Alberto Vizcarra, assumed the Peruvian Presidency and is organizing a new ministerial cabinet.**Institutions.** The institutional and legal framework for climate change management in Peru is well developed and consistently strengthened over the years. The Ministry of Environment (MINAM) is the national environmental authority, and the central entity in the management of climate change in the country and focus point to the UNFCCC. In addition, as part of the decentralization process, regional governments have the responsibility to formulate their own Regional Climate Change Strategies (ERCC).

1.2 Emission trends

Emissions. According to Peru's National Greenhouse Gas Inventory (INGEI for its acronym in Spanish), Peru's total GHG emissions were close to 170 $MtCO_2e$ in 2012. Historically, the land use, land use change and forestry (LULUCF) sector contributed with between 65% and 50% of the country emissions. The second-largest contributor is the energy sector (26%), where transport emissions represent 40% of the energy emissions. Finally, agriculture is another relevant sector that contributes to about 15% of national emissions, mostly due to enteric fermentation and agricultural soils (Ministry of Environment of Peru, 2016).

The emissions intensity of the economy decreased over 70% between 1990 and 2014; and per capita emissions grew by almost 50% over the same period, reaching 3.2 tCO_2e/cap in 2014, although still below the global average of 6.4 tCO_2e/cap.

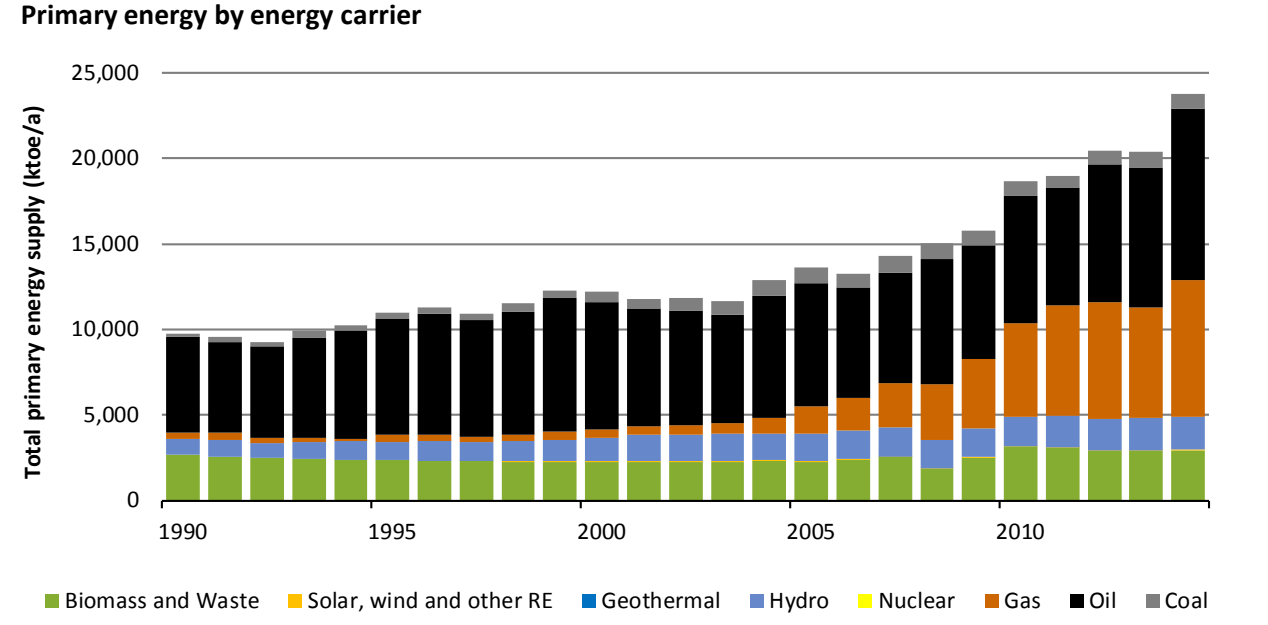
Figure 1: Peru's emission profile (excl. LULUCF)



Data source: Gütschow *et al.* (2016a); UNFCCC (2017a)

Energy system. In 2014, Peru's primary energy demand was met by the use of oil (42 %), gas (34 %), biomass/ waste (12%), hydropower (8 %), and coal (4 %)(IEA, 2016a). The share of fossil fuels (currently at 80%) continuously increased since 2000, when natural gas was strongly promoted by the government. It became one of the main sources of energy for industry and had a great impact in the transport sector where the low prices for gas led users to convert their diesel or gasoline vehicles to compressed natural gas (CNG) (MEM, 2014).

Figure 2: Peru's historical energy profile



Data sources: IEA (2016a)

In the last decade, electricity production grew at an average annual rate of 6.5%, thermal power plants played a key role in this through the expansion of natural gas power plants. In 2015, 63% of total electricity production corresponded to thermal origin, 34% to hydropower and 3% to solar and wind (MINEM, 2015). Electricity access increased from 70.8% in 2003 to 90.3% in 2013 and it is expected to reach values close to 100% by 2025 through expansion of the energy grid, as well as implementing off-grid electricity generation systems in rural areas based on renewables (MEM, 2014).

1.3 NDC and ongoing activities

Climate change strategy	✓
Climate change law	(✓)
Institutional coordination on climate change	✓
Renewable energy targets	✓
Level of NDC ambition (CAT rating)	**Insufficient**

The Peruvian Nationally Determined Contribution (NDC) includes an unconditional economy-wide domestic reduction pledge of 20% versus a business-as-usual (BAU) scenario in 2030, as well as up to 10% additional reduction below BAU in 2030 conditional on availability of international financing and favourable conditions. The NDC also includes a section on adaptation actions (Government of Peru, 2015b). The country's GHG emissions in 2010 were 170.6 $MtCO_2e$, out of which 92.6 $MtCO_2e$ come from LULUCF emissions. Under the BAU scenario, emissions are projected to increase up to 298.3 $MtCO_2e$ in 2030. Under an NDC compatible scenario, emissions would be limited to 240 $MtCO_2e$ by 2030 with the unconditional target, and to 210 $MtCO_2e$ with the conditional target (see Figure 3) (Government of Peru, 2015b).

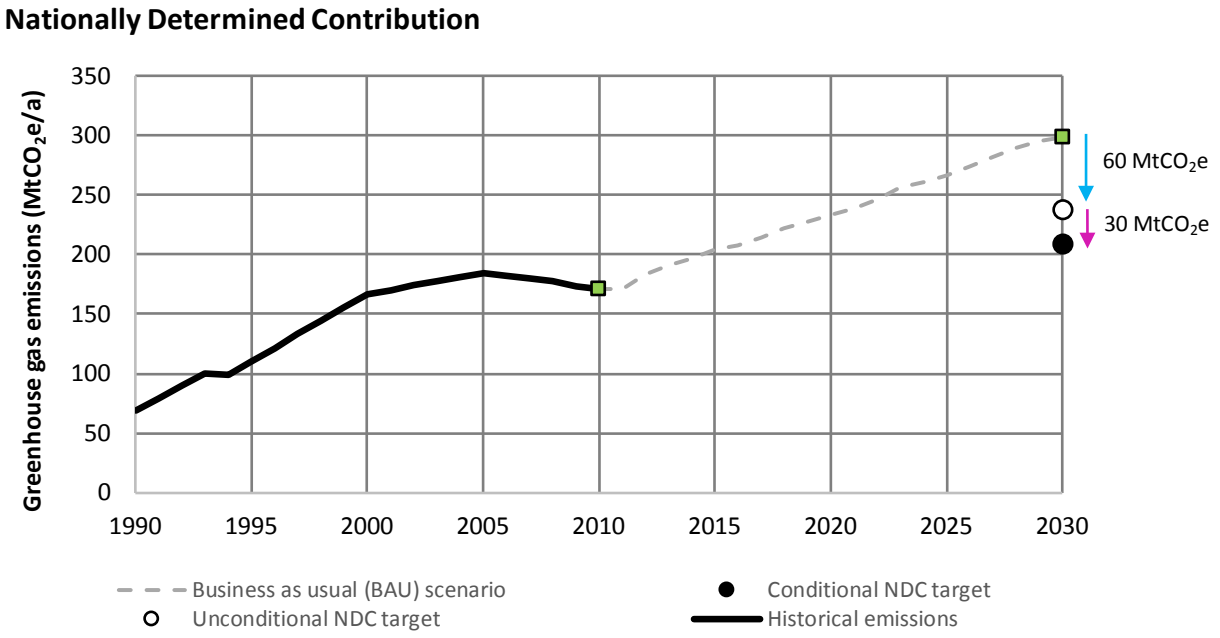
The NDC was developed by a Multisectoral Commission which included the Presidency of the Council of Ministers and 13 ministries[1]. They based their proposal on the diagnosis developed by the PlanCC project, which included a foresight analysis with long-term emission reduction scenarios; the existing Nationally Appropriate Mitigation Actions (NAMAs) in the sectors of energy, agriculture, forestry, waste and transport; other sectoral initiatives that are already being executed or planned; as well as forest programmes, such as the Forest Investment Program (Ministry of Environment of Peru, 2016). The government organised a public consultation process where national and subnational governmental entities, and representatives of civil society, including indigenous organizations participated to ensure transparency of the NDC process (Government of Peru, 2015b). Although the process of developing the NDC used a participatory, bottom-up approach, the official NDC document submitted to the UNFCCC does not break down the overall target into sector specific targets.

According to the Commission's report, 67% of the expected emissions reduction by 2030 would come from the LULUCF sector; 12% from energy; 6% from industrial processes; 5% from agriculture; 4% from transport and 4% from the waste sector (Government of Peru, 2015a). A newly established Multisectoral Working Group (GTM, for its initials in Spanish) is now in the process of reviewing the over 100 mitigation and adaptation measures proposed under the NDC as well as developing a roadmap for successful implementation of the national contribution (MINAM, 2017a).

[1] Ministries of Economy and Finance; Energy and Mines; Agriculture; Transport and Communications; Production, Housing, Construction and Sanitation; Foreign Affairs; Education; Justice and Human Rights; Health; Culture; Development and Social Inclusion; and Environment (which had the Technical Secretariat of this Commission), as well as the National Center for Strategic Planning.

On March 15th 2018, the Peruvian Congress approved with unanimity the "Framework Climate Change Law" as part of the Peruvian response to climate change. The proposed bill was presented in May 2017 by the Minister of Environment, Mrs. Elsa Galarza.

Figure 3: Peru's projected emissions and NDC target[2]



Data source: Government of Peru (2015)

1.4 Mitigation potential

To analyse Peru's mitigation potential, we first looked into the Multisectoral Commission's report which serves as basis for developing the NDC. The report includes 76 mitigation measures that would lead to a reduction of about 89.4 $MtCO_2e$ in 2030, compared to BAU. Based on a set of criteria[3] and expert judgement, we identify specific measures in strategic sectors that, if successfully implemented, could yield to additional emission reductions.

Increasing the share of renewables (excluding hydro)[4] in the electricity generation mix is a first field of action for the energy sector. The NDC includes the national target of 5% of non-conventional renewable energy in power generation, which translates into 2.1 $MtCO_2e$ emissions reduction in 2030 compared to BAU (Government of Peru, 2015a). However, other national studies identified a large potential for increasing renewables as shown in Table 1 (PlanCC, 2017).

[2] National inventories report 11% increase in emissions between 2000 and 2005 mainly due to an increase in deforestation rates. Emissions in 2010 decrease 8% compared to 2005 (again, due to a change in LULUCF). Emissions from all other sectors had an increasing trend between 2000-2012. The LULUCF sector does not show a clear trend for its behaviour and is subject of high uncertainties (Ministry of Environment of Peru, 2016).

[3] Historic and projected sectoral emissions development; share of sector's emissions compared to the country's total emissions; strategic importance; niche where more ambition is possible; co-benefits; literature available and suggestions from the country expert.

[4] For the case of Peru and for this report, when we refer to renewable energy it does not include hydropower generation (small or large scale).

Other studies carried out in collaboration with national experts to explore potential contribution of renewable energy to the energy mix in the future reported that a higher national ambition in this regard is feasible. The 'new sustainable energy mix' (NUMES, for its initials in Spanish) project carried out in 2012 indicated that the most optimal national energy mix structure for 2040 would include 20% power generation from renewable energy, 40% from hydropower and 40% from gas (CENERGIA, 2012). A couple of years after, a very participatory process concluded that about 11% of the power generation in 2030 could come from renewable energy. This would lead to emissions reduction of close to 9.5 $MtCO_2e$ in 2030 compared to BAU, a mitigation impact over four times higher than what is proposed under the NDC (PlanCC, 2014a).

Renewable power generation has made critical strides in the last five years. The price of wind and solar installations continued to drop, and scientists made a series of technical advances that promise to make sustainable energy increasingly efficient and affordable. Thus, studies developed in the country three to five years ago are likely to be proposing conservative estimates of renewable energy shares. New studies are likely to come up with an even higher potential, as costs continue to go down.

Enabling conditions that would have to be in place to support a higher share of renewables in the electricity mix (based on the PlanCC project) could include for example:

i) Increase in the frequency of the auctions as well as the target share (currently at 5%)

ii) Accelerated depreciation rate of installations.

Table 1: Current electricity generation, installed capacity and potential per technology

Technology	Current power generation	Installed capacity	Capacity potential
Hydropower (large and small scale)	23,009 GWh	3,900 MW	70,000 MW
Solar	242 GWh	96 MW	5.2 kWh/m^2
Wind	1,054 GWh	146 MW	22,000 MW
Biomass	138 GWh	61 MW	177 MW
Geothermal	-	-	3000 MW
Total	48,326 GWh	10,150 MW	

Source: COES (2016); PlanCC (2017).

The second field of action for this report is to increase the share of electric vehicles (EVs) by 2030. Transport accounts for the largest share of the energy sector emissions, yet the mitigation potential estimated for transport actions under the NDC was very low. The government has many times expressed interest in addressing the sector, also considering the important societal benefits that this would generate. For this, the country has a NAMA on sustainable urban transport in place which looks into ways to improve public transport. However, government representatives and the Ex-President himself have recently expressed interest in accelerating the entry of electric vehicles (EVs) in the country (El Comercio, 2018). This is a relatively new field in the country and actions to achieve such ambition are only starting to be developed and not yet integrated in the existing strategies for the transport sector.

The NDC includes the increase in the share of EVs as a mitigation action and aims at a 5% share by 2030, which would lead to reducing 0.2 $MtCO_2e$ in 2030, compared to BAU (Government of Peru, 2015a). However, a study to explore feasible mitigation actions in the transport sector, proposes a

share of 30% EVs by 2030, which would represent 2.7 $MtCO_2e$ reduced emissions in 2030, compared to BAU (PlanCC, 2014b). This is 14 times higher emissions reduction than under the NDC.

A list of actions that would contribute to a more ambitious share of electric vehicles in 2030 could be implemented (PlanCC, 2014b):

- 100% reduction of taxes for imports of light electric vehicles.
- Progressive reduction or elimination of the vehicle property tax rate for this type of vehicle.
- A system of green labelling, informing on energy efficiency and emissions levels of the vehicle would help the success of the measure.
- An effective retirement program (scrapping) of old vehicles.
- A clear regulation for the electric load centres and for the driving and use of these vehicles would help encouraging their use.
- Support for expansion of charging infrastructure

Finally, tackling deforestation through the implementation of agroforestry systems for coffee and cacao plantations was chosen as a third field of action. The selection was done while keeping in mind that the LULUCF sector is the largest source of emissions of the country and that the government is already focusing on the "enabling condition for forest conservation" which aims to reduce deforestation. Under the NDC, agroforestry systems for coffee and cacao plantations are expected to contribute to reducing about 0.9 $MtCO_2e$ emissions in 2030 compared to a BAU scenario. This emission reduction potential could be further increased if the level of ambition, i.e. number of hectares under agroforestry systems, was increased (Government of Peru, 2015a).

A previous national study on mitigation action in the forestry sector highlighted that promoting agroforestry systems entails one of the greatest potential for reducing emissions among all sectors. This study reported that the mitigation potential of implementing agroforestry practices in coffee and cacao plantations would lead to about 5.9 $MtCO_2e$ emissions reduction by 2030 (PlanCC, 2014b). This would also contribute to additional co-benefits for the population involved such us improvements of life quality and income of families living from the forest, job creation, improved water quality, reduction of economic losses in the face of extreme climatic events (landslides), etc. (PlanCC, 2014b).

A few enabling conditions could be improved for implementing agroforestry systems for coffee and cacao plantations, including:

- Subsidies or credits with accessible terms that support the conversion of degraded pastures and/or the installation of agroforestry systems. In particular, farmers need support in accessing finance for the up-front investment needed, as well as to cover the first years after installing the system, when the production is still not at its maximum capacity.
- Disincentives to deforestation through a system that monitors, controls and manages forest areas, implemented by the regional state.

2 Part II: Full country analysis

2.1 Country background

Geography. Peru is located in the centre of South America, it shares borders with Ecuador, Colombia, Brazil, Bolivia and Chile; and it occupies a land area of almost 1.3 million km^2. The Andes Mountains cross the country lengthwise, dividing it into three large natural regions: coast, a narrow desert strip bordering the Pacific Ocean; highlands, which range up to over 5000 metres above sea level and comprise agricultural terraces, mountains and glaciers; and Amazon jungle, located on the eastern slope of the Andes Mountains. The forest area of Peru is 74.2 million hectares, making it the ninth country with the largest forest area in the world and the second largest in South America (Ministry of Environment; Ministry of Agriculture, 2009; Ministry of Environment of Peru, 2016).

Figure 4: Map of Peru

Source: Google Maps (2018)

Population. In 2016, Peru had a population of 31.7 million inhabitants, of which 55 % live on the coast (which covers about 12% of the territory), 30% in the highlands (28% of the territory) and 15% in the jungle (60% of the territory) (Ministry of Environment, 2013). There is a significant concentration of population in major coastal cities and around 32% of the total population live in Lima, the largest desert city in the world, after Cairo (Earth Institute, 2011). The average growth rate of the population is declining since 1990 but remained positive at 1% between 2013 and 2017. Projections indicate that the country's population will reach 40 million by 2050 (Ministry of Environment of Peru, 2016).

Economy. Peru's GDP per capita grew exponentially between 1990 and 2016, showing very high annual growth rates during this period. However, in the last years, this rapid economic growth is experiencing a slowdown. Average GDP per capita is relatively high at about USD 6,000 in 2015 (Ministry of Environment of Peru, 2016).

Economic growth in the country has been strongly linked to natural resources exploitation, especially in the mining sector. Mining is the major source of foreign exchange earnings for the country which causes the economy to fluctuate in line with the change in these investments (Ministry of Environment of Peru, 2016). Agriculture contributes to about 5% of national GDP and is a sector of great importance as, in the Peruvian Andes, 1.4 million people depend on it for their livelihoods. Furthermore, agriculture is particularly vulnerable to the effects of climate change (Ministry of Environment, 2013).

Peru's poverty rate has substantially fallen in the last decade, reaching levels of 22.7% in 2014 and 4.3% of extreme poverty in the same year, most of which is located in rural areas (Ministry of Environment of Peru, 2016).

Table 2: Key socio-economic figures

Indicator	Peru	% change since 1990	World	Germany	Year
Population [million]	31.7	+146%	7442	82.7	2016
GDP [2016 billion USD]	192.2	+728%	75,641,577	3,467	2016
GDP/Cap [2016 USD/cap]	6,049	+500%	10093	41,313	2016
HDI [0 – 1]	0.74	+121%	n.a	0.92	2015
Electrification rate [%]	92.9%	+154%	84.6%	100%	2014
GINI index [0 – 100]	44.3	-17.5%[5]	n.a	n.a	2015
Corruption index [0 – 100]	35	-	-	81	2016
Urbanization [% of total]	78.9%	+114%	53.9%	75.5%	2016

Data sources: Transparency International (2017); World Bank (2017); UNDP (2016)

Political system. Peru is a constitutional republic, with the President (Pedro Pablo Kuczynski for the period 2016-208 and Martín Alberto Vizcarra finishing his period from 2018-2021) as the head of the state as well as the head of government. The President appoints the Prime Minister and the Council of Ministers (or Cabinet) and all presidential decree laws sent to Congress must be approved by the Cabinet. Peru's administrative set-up has 18 ministries which are organised under three different branches of the political system: the executive, legislative and the judiciary powers. Executive power is exercised by the President and the Government. Legislative power is vested in both the Government and the Congress (130 members elected for a five-year term). The Judiciary is independent of the executive and the legislature (Government of Peru, 2017).

Recent political crisis. The newly elected President Pedro Pablo Kuczynski faces strong opposition from the Fuerza Popular[6] (FP) party, which controls Congress. Only in the first year of the president's term, FP has forced numerous cabinet shuffles, and later gave a vote of no confidence against the president's entire cabinet. This political divisions have limited Mr. Kuczynski's plans for administrative,

[5] Note that the percentage change is calculated based on 1997 data as no earlier data is available

[6] Fuerza Popular sprang from the right-wing populist movement started by Alberto Fujimori, a former president (1990 [illegible] 2000) and deeply divisive figure in the country pant corruption and vote-rigging, and sentenced to 25 years of prison in 2009.

electoral and labour reforms, which many expect will translate in lower growth rates than on the preceding years (The Economist, 2017b).

In a last crisis before the end of 2017, FP called for the president's resignation on 13 December, in the wake of new information coming to light about his ties -which he had previously denied- to Odebrecht -a Brazilian construction firm that has admitted to paying bribes to governments across the region. The president narrowly avoided impeachment but the investigation on his relationship with Odebrecht carries on and the final results are expected before the second half of 2018. This contributes to a prolonged period of political uncertainty which is likely to have a seriously detrimental impact on both consumer and investor confidence in the short-to-medium term. This instability poses a serious downside risk to the economic growth forecast for 2018 (The Economist, 2017a).

Position in the international climate negotiations. The Peruvian government has been actively involved in international negotiations and projects, both within the United Nations Framework Convention on Climate Change (UNFCCC) and with regional country partners (Takahashi and Martinez, 2017). In particular, the period between December 2014 and September 2015 was significant for climate change management in the country, in a context marked by Peru´s performance as Chair of the COP20/CMP10 (Ministry of Environment of Peru, 2016). The main achievement of COP20 was the Lima Call for Climate Action which was lead and facilitated by the Presidency of the COP to reach an agreement on ground rules for how all countries would submit contributions to Paris 2015 Agreement (UNFCCC, 2014).

Peru is part of the G77 (the largest country grouping of developing countries) and of the Independent Association of Latin America and the Caribbean (AILAC), a group of eight countries that share interests and positions on climate change with the objective of generating coordinated, ambitious positions and contribute to the balance in the multilateral negotiations on climate change with a coherent vision for sustainable development that responds to the environment and future generations (AILAC, 2017).

Bilateral Cooperation with Germany. GIZ has been operating since 1975 in Peru and it is mainly focused on: i) Democracy, civil society and public administration; ii) Water management and sanitation; and iii) Sustainable rural development, management of natural resources and climate change. Peru hosts the headquarters of several regional programs that address issues such as violence against women, supra-regional management of protected areas, resources and efficiency (capacity building) for decentralization, professional training and access to insurance (GIZ, 2017).

Peru's First Biennial Update Report (BUR), submitted in 2014, reported German funds -in cooperation with other countries- for the development of four Nationally Appropriate Mitigation Actions (NAMAs) in the agriculture sector (cocoa, coffee, oil palm, livestock; all part of the iNAMAzonia project). In addition, the report lists German funds for five mitigation projects with a disbursal of ca. US$ 17 million (EUR 14.1 million): three of them related to forestry and conservation areas; one on clean cooking stoves; and one on ecoefficiency capacity building (MINAM, 2014).

Peru is also a member of the NDC Partnership that was founded by Germany as a platform for effective NDC implementation. The NDC cluster lists three core NDC implementation activities funded through the German International Climate Initiative (IKI) in Peru: the Support Project for the implementation of the Paris Agreement (SPA project); understanding public investments for adapting to climate change (IPACC II project); and identifying sustainable land use-based alternatives in the Peruvian amazon (BMUB, 2017).

Emissions. Peru's National Greenhouse Gas Inventory (INGEI for its acronym in Spanish), reports total GHG emissions were about 170 $MtCO_2e$ in 2012[7]. According to previous inventories, national emissions increased about 11% between 2000 and 2005 mainly due to an increase in deforestation rates. Emissions in 2010 showed a decrease of about 8% compared to 2005 (again, due to a change in LULUCF emissions which do not follow a clear trend over time) and remained almost constant until 2012 (last available inventory)[8]. The main source of GHG emissions, is the land use, land use change and forestry (LULUCF) sector which has historically represented between 65% and 50% of the country emissions. This sector is also the only greenhouse gas (GHG) sink (due to increase of biomass, perennial crops and natural formation of secondary forests). The second highest category of GHG emissions was Energy, with the transport sector representing almost 40% of the energy emissions. Emissions from agriculture had a significant contribution as well, main emission sources in this sector were enteric fermentation and agricultural soils (Ministry of Environment of Peru, 2016).

Table 3: 2012 emissions data from Peru's Third National Communication

Sector	Value	Unit	Share in 2012
Total (excluding LULUCF)	85	$MtCO_2e$	100%
Energy	45	$MtCO_2e$	53%
Industrial Processes	6	$MtCO_2e$	7%
Agriculture	26	$MtCO_2e$	31%
Waste	8	$MtCO_2e$	9%
LULUCF	87	$MtCO_2e$	
Total emissions (including LULUCF)	172	$MtCO_2e$	

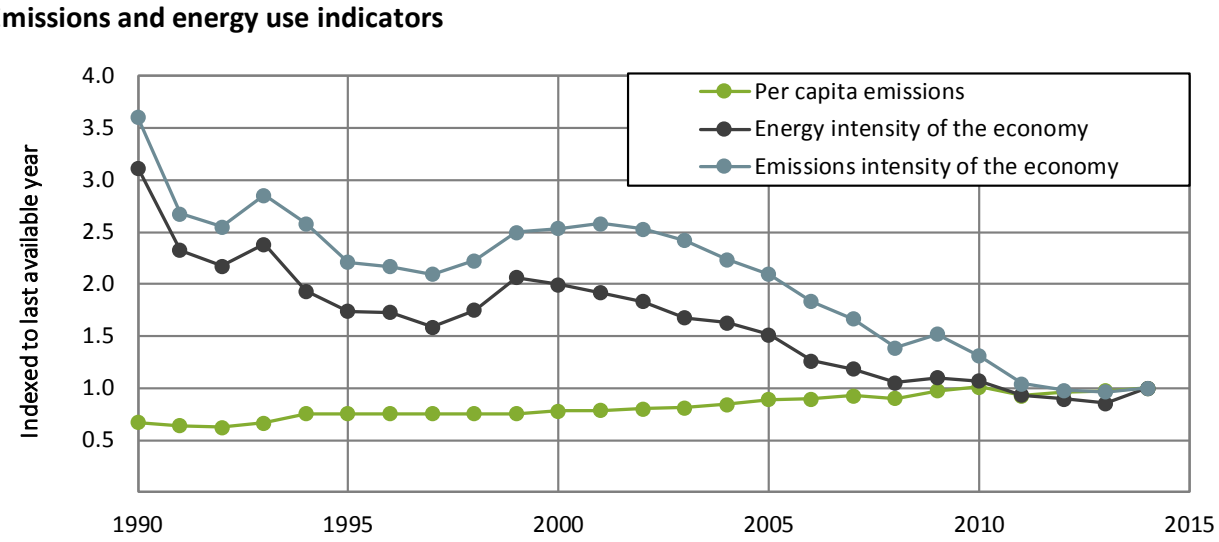
Data source: Ministry of Environment of Peru (2016).

The emissions intensity of the economy decreased over 70% from 1990 to 2014. Per capita emissions grew by almost 50% over the same period, reaching 3.2 tCO_2e/cap in 2014. This, however, remains low compared to the global average of 6.4 tCO_2e/cap. The energy intensity of the economy decreased by 68% (Figure 5, Table 4).

[7] Emissions inventory data published in the Third National Communication was calculated based on IPCC guidelines from 2006 (Ministry of Environment of Peru, 2016).

[8] Emissions from all sectors (except LULUCF) had an increasing trend between 2000-2012. The LULUCF sector does not show a clear trend for its behaviour and is subject of high uncertainties (Ministry of Environment of Peru, 2016).

Figure 5: Relative emissions indicators



Data sources: Gütschow *et al.* (2016); IEA (2016b); ND-GAIN (2017); World Bank (2017)

Energy system. Primary energy demand in 2014 was met by the use of oil (42%), gas (34%), biomass/waste (12%), hydropower (8%), and coal (4%)(IEA, 2016a). The energy sector in Peru developed significantly over the last decade, in line with economic growth of the country which increased the national energy demand. The share of fossil fuels in the energy mix steadily increased since 2000, reaching 80% in 2014, largely due to an increase in the use of natural gas -strongly promoted by the government with very low prices. Thus, natural gas became one of the main sources of energy for industry and had a great impact in the transport sector where the low prices for gas led users to convert their diesel or gasoline vehicles to compressed natural gas (CNG) (MEM, 2014).

Table 4: Key emissions, energy and environmental data

Indicator	Peru	% change since 1990	World	Germany	Year
GHG/cap [tCO_2e/cap]	3.26	+49%	6.42	10.76	2014
GHG/GDP [tCO_2e/mln 2017 USD]	502	-72%	593	225	2014
Energy/GDP [ktoe/mln 2017 USD]	0.12	-68%	0.17	0.08	2014
Global share of emissions [%]	0.14%	-13%	n.a.	1.76%	2014
Air pollution index (P2.5)	27.6	+4%	41.7	13.6	2014
Vulnerability index [0 – 1]	0.41	-15%[9]	n.a.	0.23	2014

Data sources: Gütschow et al. (2016); IEA (2016b); ND-GAIN (2017); World Bank (2017)

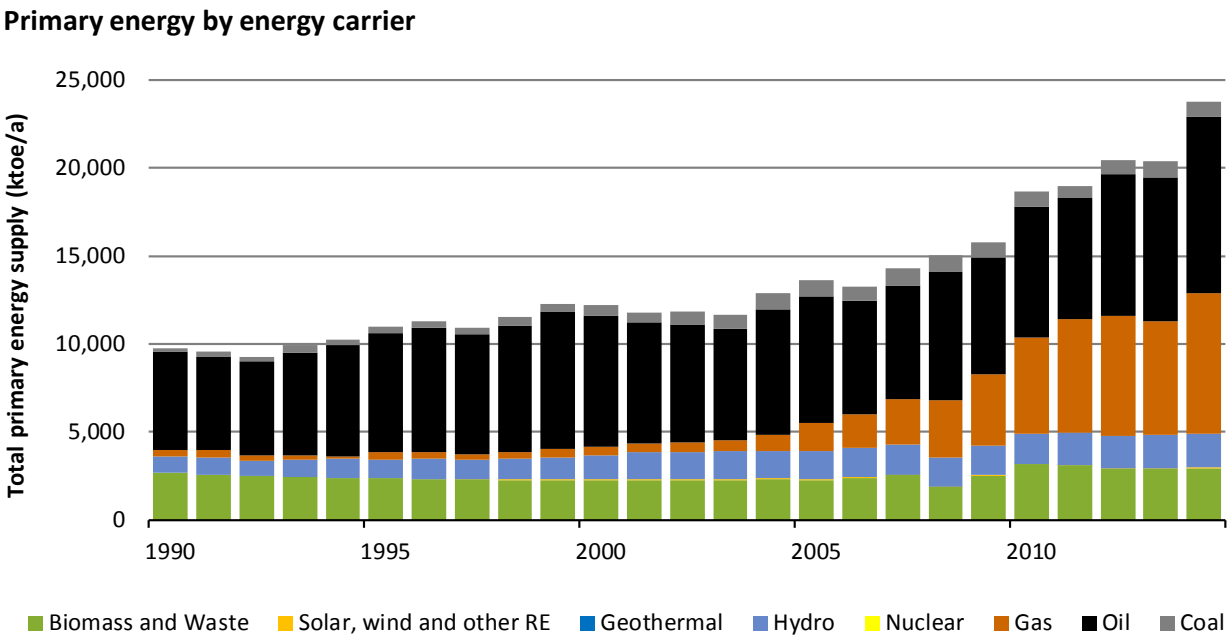
Electricity production grew at an average annual rate of 6.5% in the last ten years, thermal power plants played a key role and grew an annual average of 12%, mostly due to natural gas. The installed generation capacity grew from 6,200 MW in 2005 to 12,251 MW in 2015, that is 98% increase in that

[9] Please note that the percentage change is calculated based on 1995 data due to unavailability of earlier data.

period. In 2015, 63% of total electricity production corresponded to thermal origin, 34% to hydro-power and 3% to solar and wind (MINEM, 2015).

Access to electricity increased from 70.8% in 2003 to 90.3% in 2013 and it is expected to reach values close to 100% by 2025, through energy grid expansion, as well as by implementing off-grid electricity generation systems in rural areas based on renewables (MEM, 2014).

Figure 6: Peru's historical energy profile



Data sources: (IEA, 2016a)

Table 5: 2014 total primary energy supply by fuel

Fuel	Value	Unit	Share in 2014
Biomass and waste	2,910	ktoe	12%
Solar, wind and other renewables	42.8	ktoe	0%
Geothermal	0	ktoe	0%
Hydro	1,909	ktoe	8%
Nuclear	0	ktoe	0%
Gas	8,025	ktoe	34%
Oil	10,051	ktoe	42%
Coal	840	ktoe	4%

Data source: IEA (2016a)

2.2 Institutional set up

The institutional and legal framework for climate change management in Peru started to develop in 1993 after ratifying the UNFCCC, followed by the ratification of the Kyoto Protocol in 2002. In 2003,

the National Commission on Climate Change was established and chaired by the Ministry of the Environment (MINAM) since 2008, when MINAM was created by Legislative Decree 1013.

MINAM is the national environmental authority, and the central entity in the management of climate change in the country, responsible for coordinating not only from the sector scope, but also at the regional and local levels. MINAM defines the priority objectives, guidelines and national standards through the National Environmental Policy, including the guidelines that address emissions management and adaptation to climate change (Ministry of Environment of Peru, 2016). In 2016, the government of Peru, represented by MINAM, was one of the first 20 countries to ratify the Paris Agreement and present its Nationally Determined Contribution (NDC).

MINAM has two vice-ministries: The Vice Ministry of Environmental Management and the Vice Ministry of Strategic Development of Natural Resources. The second one includes the General Directorate of Climate Change and Desertification (DGCCD) which focuses on designing, promoting and providing assistance to the different public entities to achieve the inclusion of climate change in the planning and action process of the State. The DGCCD has the Technical Secretariat of the National Commission on Climate Change (CNCC) and led the Multisector Commission responsible for preparing the Peruvian NDC (Ministry of Environment of Peru, 2016). Further, MINAM is currently leading the Multisectoral Working Group (GTM, for its initials in Spanish) for implementation of the NDC, as well as its regular update. The working group involves 13 ministries[10] and the National Strategic Planning Centre (CEPLAN) and has a lifetime of 18 months (until July 2018) (MINAM, 2017a).

Peru has been going through a process of decentralization and reallocation of powers, including the transfer of functions to subnational governments. In 2003, the Organic Law of Regional Governments was established and requires regional governments to formulate their own Regional Climate Change Strategies (ERCC), including the creation of Regional Technical Groups on Climate Change (GTRCC) to monitor the continuous process of establishing measures, their evaluation and update. Currently, 16 of the 25 regions of the country have developed their climate change strategies (Ministry of Environment of Peru, 2016).

On March 15th 2018, the Peruvian Congress approved with unanimity the "Framework Climate Change Law" as part of the Peruvian response to climate change. The proposed bill was presented in May 2017 by the Minister of Environment, Mrs. Elsa Galarza.

The Framework Law overcomes important gaps in climate change governance and integrated management, especially by establishing a sustainable institutional landscape for climate change management. It Law establishes conditions and instruments that will allow to develop resilient projects and concretize cli-mate change adaptation and mitigation actions in regions and sectoral ministries for the implementation of the NDC.

2.3 Description and evaluation of the INDC

Peru's NDC contains an unconditional economy-wide domestic reduction pledge of 20% versus a business-as-usual (BAU) scenario in 2030, as well as up to 10% additional reduction below BAU in 2030 conditional on availability of international financing[11] and the existence of favourable conditions (Figure 7). The NDC reports country's total GHG emissions in 2010 to be 170 $MtCO_2e$, out of which 93 $MtCO_2e$ are generated by the LULUCF sector. BAU emissions, as defined in the NDC, would be 298.3

[10] Ministries of Economy and Finance; Energy and Mines; Agriculture; Transport and Communications; Production, Housing, Construction and Sanitation; Foreign Affairs; Education; Justice and Human Rights; Health; Culture; Development and Social Inclusion; and Environment (which had the Technical Secretariat of this Commission).

[11] It should be noted that Peru will not assume conditional commitments that might result in public debt.

$MtCO_2e$ by 2030 including LULUCF, and 139.3 $MtCO_2e$ excluding LULUCF. The Peruvian NDC also includes a section on Adaptation (Government of Peru, 2015b).

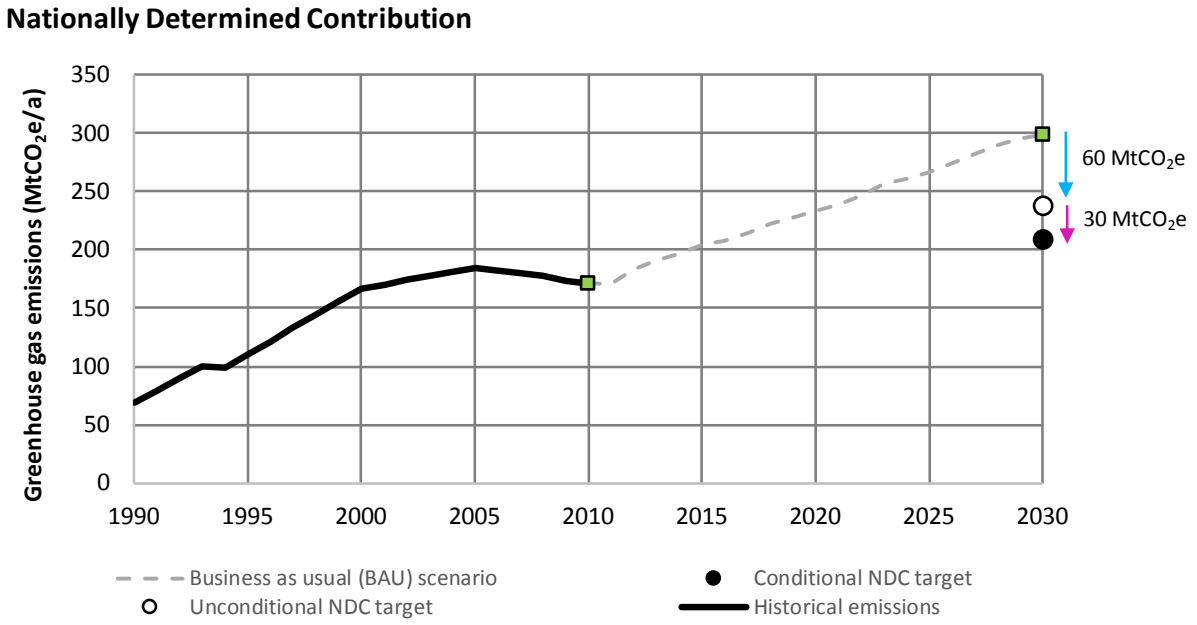
To develop the Peruvian NDC, the government created a Multisectoral Commission to provide a space for high-level political dialogue and to come up with a proposal for the national contribution. The Commission brought together the Presidency of the Council of Ministers and the 13 Ministries[12] and produced a technical report on which the NDC was based. The report includes a BAU scenario developed by national experts in coordination with the relevant government stakeholder based on the estimation of sectoral BAU scenarios according to the sector's own dynamics. The NDC scenario was based on the diagnosis developed by the PlanCC project, which included a foresight analysis with long-term emission reduction scenarios; the existing NAMAs in the sectors of energy, agriculture, forestry, waste and transport; other sectoral initiatives that are already being executed or planned; as well as forest programmes, such as the Forest Investment Program (Ministry of Environment of Peru, 2016). Once the scenarios were ready, the government held a public consultation process where national and subnational entities, as well as representatives of civil society, including indigenous organizations, participated to ensure transparency in the process (Government of Peru, 2015b). Although the process of developing the NDC used a participatory, bottom-up approach, the official NDC document submitted to the UNFCCC does not break down the overall target into sector specific targets.

Peru's unconditional emission reduction target is at the least stringent end of a wide range of possible approaches that determine a "fair share" of the global effort to each country (Climate Action Tracker, 2017). Peru's is therefore compatible with the Paris Agreement only from a limited perspective on what could be considered a fair contribution, under most perspectives it is not. The Climate Action Tracker therefore rates the NDCs and not being consistent with the Paris Agreement's.

As part of the national efforts to push NDC implementation, a Multisectoral Working Group (GTM, for its initials in Spanish) is now in the process of reviewing the over 100 mitigation and adaptation measures proposed under the NDC as well as developing a roadmap for successful implementation of the national contribution (MINAM, 2017a). According to national experts, the revision process is moving quite slowly and there has been no official report of progress since the establishment of the GTM in February 2017.

[12] Same as in the GTM.

Figure 7: Peru's projected emissions and NDC target[13]



Data source: Government of Peru (2015)

2.4 MRV of GHG emissions

Regarding Measurement, Reporting and Verification (MRV) systems for emissions[14], Peru has submitted three national communications and one Biennial Update Report to the UNFCCC. The first national communication was submitted in 2001, the second one in 2010 and the third one in April 2016 (UNFCCC, 2017b). In 2014, the government of Peru created a national GHG inventories system called INFOCARBONO. The INFOCARBONO platform is under the responsibility of MINAM and its expected to contribute to:

- The optimization of the methodologies of quantification of emissions/removals, the control and assurance of the quality of results, as well as their uncertainty.
- The periodic report of national GHG inventories.
- The formulation of policies, strategies and development plans that reduce GHG emissions at the national level.
- The fulfilment of the commitments assumed by the country before the UNFCCC and the Kyoto Protocol.

Still, the last available year for emissions inventory is 2012 (published in the third National Communication) which no longer reflects the country's current emissions profile and there is no indication of the emissions developments in the last five years.

[13] National inventories report 11% increase in emissions between 2000 and 2005 mainly due to an increase in deforestation rates. Emissions in 2010 decrease 8% compared to 2005 (again, due to a change in LULUCF). Emissions from all other sectors had an increasing trend between 2000-2012. The LULUCF sector does not show a clear trend for its behaviour and is subject of high uncertainties (Ministry of Environment of Peru, 2016).

[14] According to WRI (2016), Measurement, Reporting, and Verification (MRV) systems could be of 3 types: related to emissions, related to mitigation actions and one related to support for mitigation.

The first Biennial Update Report, submitted end of 2014, reports the first inventory numbers from INFOCARBONO. The BUR inventory reports emissions for 2010 using the 1996 IPCC guidelines and Global Warming Potential (GWP) values according to the Second Assessment Report of the IPCC (1995) for a 100-year period. The second BUR is expected in 2018, with an update on the country's emissions levels and its efforts with regards to mitigating those emissions (MINAM, 2017b).

Although there is no mandatory reporting scheme in place for corporations and industries, many of them are already reporting emissions on an individual and voluntary basis. Moreover, those companies listed in the stock exchange are required to report on their corporate sustainability, including whether they measure the corporate carbon footprint or not, with the option to report the estimated emissions level (MEF, 2015).

Further, the Peruvian government submitted a market readiness proposal to the Partnership for Market Readiness (PMR) in 2016. In this document, the Peruvian government plans to establish a solid Mitigation Action Management System (MAMS) that will encompass a process that fosters NAMAs and other mitigation actions from their design to their implementation and post-implementation monitoring, reporting and verification (MRV) and potential accreditation. This project focuses on the implementation of readiness activities that will lead to the design and implementation of an MRV system appropriate to Peru's national circumstances (Peru, 2016). However, to date, the project remains in its initial phase and very little additional information is available on its progress.

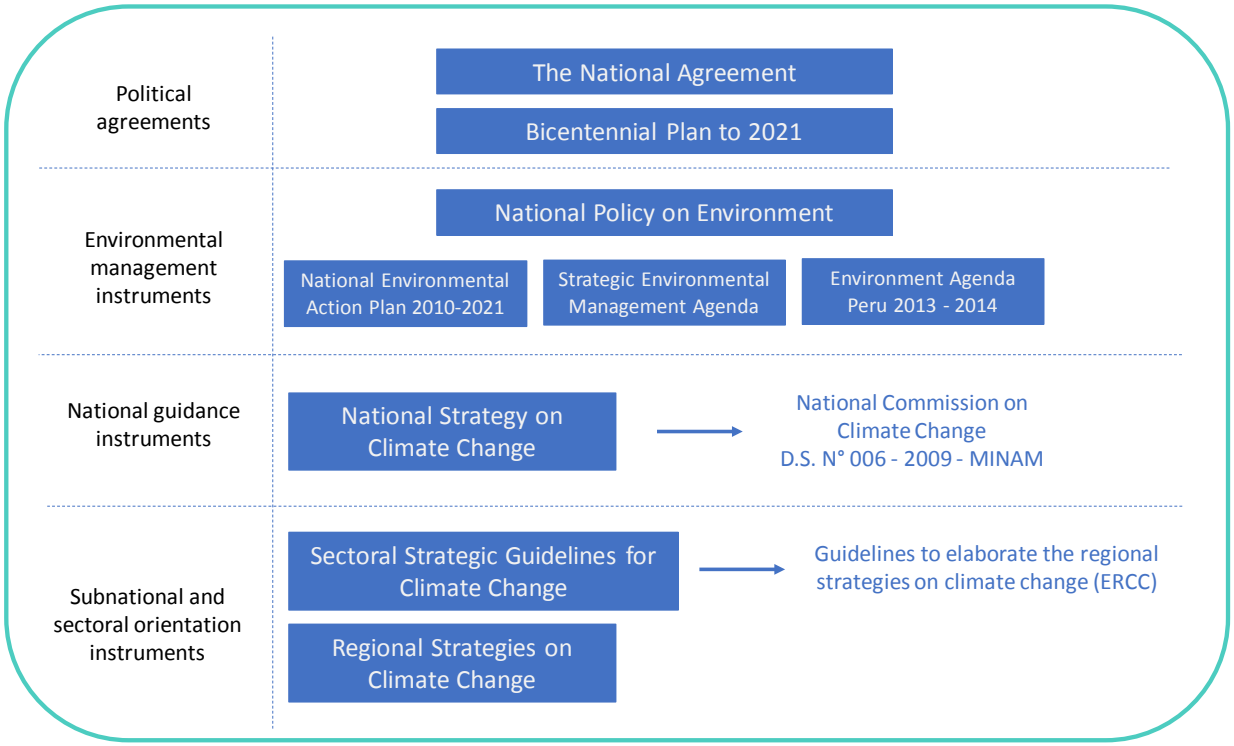
2.5 Overarching climate change mitigation policies and strategies

National strategies. The most relevant policy instruments related to climate change management in Peru are: The National Agreement, the National Strategic Development Plan to 2021 (Bicentennial Plan), the Multiannual Macroeconomic Framework, the National Policy on Environment, the National Environmental Action Plan 2010-2021, the National Commission on Climate Change, the National Strategy on Climate Change (ENCC, for its initials in Spanish) and the Regional Strategies on Climate Change (ERCC, for its initials in Spanish) (see Figure 8).

In order to give continuity to the targets under the ENCC and to establish the framework for successful implementation of the NDC, the Peruvian government created a commission to develop the national Climate Change Law. At the time of the elaboration of this report, the commission had summited a draft of the law to the Congress for evaluation and it is pending approval (Government of Peru, 2017b). On March 15th 2018, the Peruvian Congress approved with unanimity the "Framework Climate Change Law" as part of the Peruvian response to climate change. The proposed bill was presented in May 2017 by the Minister of Environment, Mrs. Elsa Galarza.

The Framework Law overcomes important gaps in climate change governance and integrated management, especially by establishing a sustainable institutional landscape for climate change management. It Law establishes conditions and instruments that will allow to develop resilient projects and concretize climate change adaptation and mitigation actions in regions and sectoral ministries for the implementation of the NDC.

Figure 8: Policy instruments to plan, promote and manage climate change in Peru



Source: Authors' own elaboration based on Ministry of Environment of Peru (2016)

The **National Agreement**, ratified in 2002, establishes commitments of the State in terms of poverty reduction, sustainable development and environmental management, while the **National Development Strategic Plan for 2021**, published in 2015, is the first national development plan that reaffirms the need to consider climate change in all development, planning and management instruments (CEPLAN, 2016).

The **National Policy on Environmen**t, approved in 2009, was the first general planning instrument on environmental matters established by the MINAM to provide policy guidelines that ensured environmental viability of productive activities. Among those guidelines were the implementation of adaptation measures as well as GHG management through the use of technologies and the development of forestry projects (Ministry of Environment of Peru, 2016).

The **National Strategy on Climate Change (ENCC)**, approved in its first version in 2003 and updated in September 2015, is the main instrument for managing climate change in Peru. It establishes the commitment of the Peruvian government to "... act in the face of climate change in an integrated, transversal and multisectoral manner, complying with the international commitments assumed by Peru before the UNFCCC" (MINAM, 2015). The strategy proposes a vision for 2021 to ensure that Peru adapts to the adverse effects of climate change and takes advantage of the opportunities that could come with it, laying the foundations for a low-carbon sustainable development.

In line with the decentralization process the country is going through, regional governments are required to formulate their own **Regional Climate Change Strategies (ERCC)** to be able to better adapt to and to mitigate the effect of climate change. Currently, 16 of the 25 regions of the country have developed their climate change strategies (Ministry of Environment of Peru, 2016).

Peru is in the process of designing 11 NAMAs in different sectors as detailed in As in other countries in the region, Peru is still in the process of aligning its exiting climate policies with other sectoral policies. This is also why the GTM working on the NDC implementation roadmap is having a slow progress in

ratifying the mitigation actions under the NDC that would have to be implemented by other sectors and ministries.

Table 6. In addition, Peru has been active in the UNFCCC's Clean Development Mechanism (CDM), under which 65 projects are listed −50 of them related to renewable energies− with a total cumulative emission reduction estimated at 3,166 $MtCO_2e$ (MINAM, 2014).

As in other countries in the region, Peru is still in the process of aligning its exiting climate policies with other sectoral policies. This is also why the GTM working on the NDC implementation roadmap is having a slow progress in ratifying the mitigation actions under the NDC that would have to be implemented by other sectors and ministries.

Table 6: List of NAMAs being design by the Peruvian government

Sector	Subsector	Responsible entity
Solid waste	Municipal solid waste	Ministry of the Environment
Transport	Urban transport	Ministry of Transportation and Communications
Industry	Construction materials (cement, steel, bricks)	Ministry of Production
Energy	Energy grid and energy efficiency	Ministry of Energy and Mines
	Bioenergy	Ministry of Energy and Mines
Buildings	Sustainable buildings	Ministry of Housing, Construction and Sanitation
	Sustainable construction	Ministry of Housing, Construction and Sanitation
Agriculture	Cocoa	Ministry of Agriculture and Irrigation
	Coffee	Ministry of Agriculture and Irrigation
	Palm oil	Ministry of Agriculture and Irrigation
	Livestock	Ministry of Agriculture and Irrigation

Source: Ministry of Environment of Peru (2016)

2.6 Additional mitigation potential

To analyse Peru's mitigation potential, we first looked into the report of the Multisectoral Commission which served as basis for preparing the country's NDC (Government of Peru, 2015a). The report lists an extensive list of mitigation actions for each sector as well as their mitigation potential under a certain ambition level[15]. The report concluded that 76 mitigation measures would lead to a reduction of about 89.4 $MtCO_2e$ in 2030, and that this would be the basis for the country's mitigation commitment.

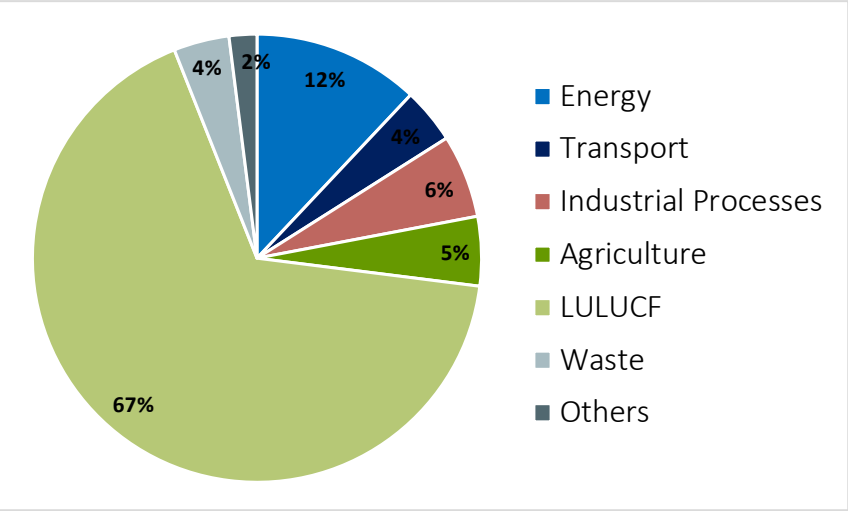
According to the Commission's report, about 65% of this emissions reduction would come from mitigation actions that are well advance in the planning phase or already in the implementation phase, with at least some indications of available funding within the sectors (Government of Peru, 2015a). It also indicates that 67% of the expected emissions reduction by 2030 would come from the LULUCF

[15] The ambition level is action-specific and can take different formats, e.g. increasing the share (%) of electric vehicles or increasing the number of hectares in the forest that would be under a specific sustainable management scheme (conservation, agroforestry, etc.).

sector; 12% from energy; 6% from industrial processes; 5% from agriculture; 4% from transport and 4% from the waste sector, as shown in Figure 9 (Government of Peru, 2015a).

Based on the literature available (CENERGIA, 2012; PlanCC, 2014b; Government of Peru, 2015a, 2015b; COES, 2016) and suggestions from country experts, we identify specific measures in strategic sectors that, if successfully implemented, could yield to important additional emission reductions. The fields of action in this section were selected based on several considerations, including historic and projected sectoral emissions development; share of sector's emissions compared to the country's total emissions; strategic importance; niche where more ambition is possible; co-benefits; amongst others, as shown in Figure 10.

Figure 9: Sectoral contribution to emissions reduction in 2030



Source: Government of Peru (2015a)

The first field of action is increasing renewable energy (excluding hydro)[16] in the electricity generation mix. Currently, the National Energy Plan for 2025 establishes a national target of 5% of electricity generation coming from renewable energy. This target was also included as a mitigation action under the NDC although other studies carried out in collaboration with several national stakeholders identified a larger potential for it. For example, a study to develop a 'new sustainable energy mix (NUMES)' published in 2012, suggests that the renewable energy contribution electricity generation should be of 20% by 2040 (CENERGIA, 2012). Similarly, the PlanCC project identified potential to increase the share of renewables in electricity generation to 11% by 2030 (PlanCC, 2017). This field was chosen given its strategic importance for meeting the country's energy security challenge, its mitigation potential and its important co-benefits.

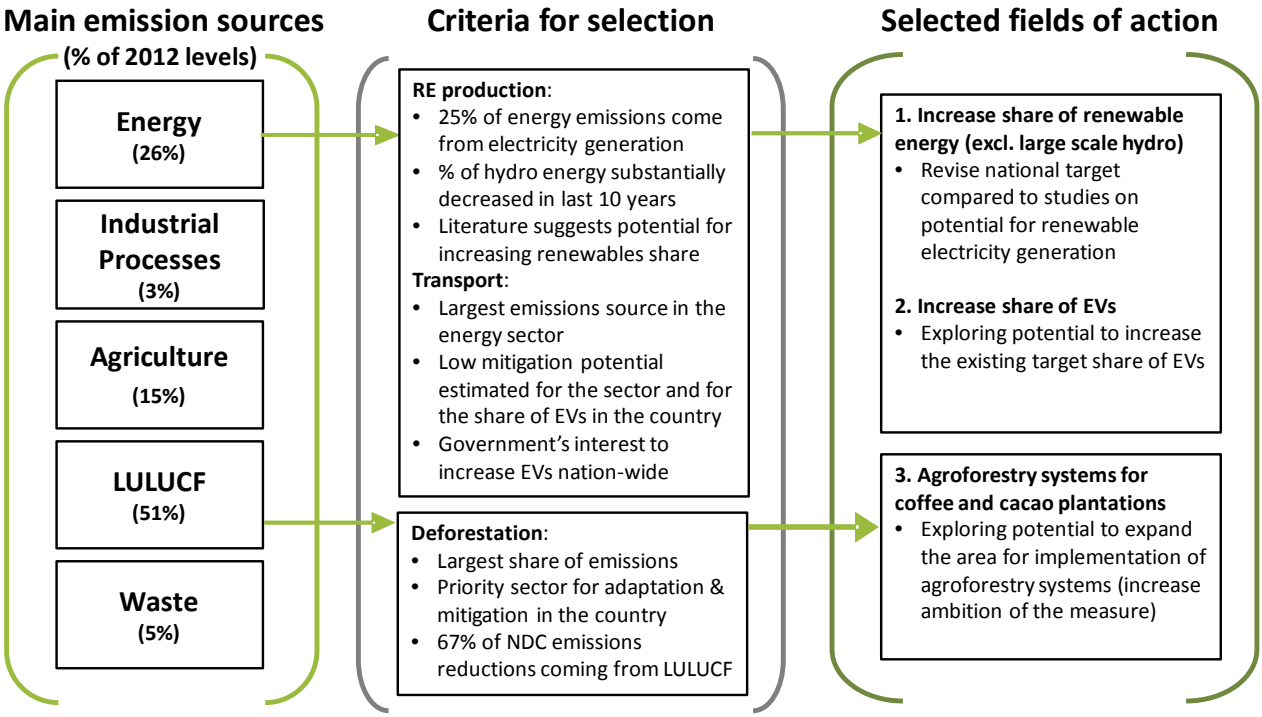
Transport accounts for the largest share of energy related emissions, yet the mitigation potential estimated for transport actions under the NDC was very low compared to other sectors, leaving room for further increasing the level of ambition of the specific actions listed under the NDC. In particular, the current government has express interest in accelerating the entry of electric vehicles (EVs) in the country and the Ex-President has stated that his government wants to facilitate the entry of EVs to

[16] For the case of Peru and for this report, when we refer to renewable energy it does not include hydropower generation (small or large scale).

help achieve this (El Comercio, 2018). The NDC includes the increase in the share of EVs as a mitigation action and aim at a 5% share by 2030, a relatively low target compared to the national statements (Government of Peru, 2015a). Hence, the second field of action is to increase the share of EVs by 2030.

Finally, the third field of action relates to tackling deforestation through the implementation of agroforestry systems for coffee and cacao plantations. The LULUCF sector is the largest source of emissions of the country and the government is focusing on "enabling conditions for forest conservation" to reduce deforestation, which includes monitoring, control and management of the forest territory. The background study for developing the NDC lists these actions with relatively low ambition level (in this case defined as the number of hectares where agroforestry measures could be implemented). Therefore, focusing on supporting agroforestry systems would entail a larger number of hectares under this scheme which translates into additional mitigation contributions of the sector.

Figure 10: Criteria for selecting fields of action



Source: Authors

As the previous chapters have shown, Peru is in the process of developing a range of measures for some other sectors. Plans are advancing in the industry and waste sectors, where several NAMAs are being designed. Regarding waste emissions, for example, the sector has received support from the Nordic Council of Ministers to develop a NAMA on solid waste management. JICA and BID have also financed the implementation of several waste management projects in the last years. Similarly, in the industry sector, a NAMA for cement production was proposed and shared with the relevant stakeholders at the beginning of 2016. Also, a NAMA on bricks industry is being developed. Industrial processes remains a sector were relatively straight forward actions are needed, with few players and where international cooperation would play a smaller role (Government of Peru, 2015a). These sectors have thus not been chosen for the subsequent analysis. Instead, the focus in the following chapters is placed on detailed mitigation measures that could have additional impact beyond what is currently foreseen or expected.

2.6.1 Renewable energy[17] for electricity generation

Since 2000, GDP in Peru grew by 86% and the electricity production by 92%, which reflects the significant increase in electricity access, going from 72% in 2000, to 92% in 2014 (World Bank, 2017), as well as the steady growth in electricity demand at 8% per year over the past decade (IRENA, 2014).

The electricity sector represents the second largest share of emissions in energy (29%) and was responsible for almost 12 $MtCO_2e$ in 2012 (Ministry of Environment of Peru, 2016). Power production in Peru has a comparably low emission factor of 237 gCO_2/kWh as a result of the large share of hydro power in the country (around 50%) (Brander et al., 2011).

In 2015, Peru's total installed capacity for power generation was 10.2 GW and electricity production stood at 44,530 GWh/a. Gas-fired electricity capacity has been the fastest-growing technology in Peru's electricity mix, largely due to the government's desire to exploit the country's natural gas reserves which led to regulations to promote gas-fired power at the expense of hydro and other thermal units since 2000 (MEM, 2014). Gas currently generates 48% of the country's power and uses 67% of the country's national gas production for it (see Figure 11). As consequence of the growth in gas-fired power generation, the share of hydro energy has gone down from over 80% in 2000, to about 50% in 2015 (PlanCC, 2017). Hydro-power holds an installed capacity of 3.9 GW in the country, including small- and large-scale hydro. Finally, about 3% of Peru's electricity is being generated based on renewable energy as shown in Table 7 (COES, 2016; PlanCC, 2017).

The Ministry of Energy and Mines (MEM) has recently highlighted the importance of increasing the share of renewable energy, recognising that the gas reserves will eventually run out and the very high potential for renewable energy that exists in the country (Gestion, 2014). The National Energy Plan for 2025 establishes a national target of 5% of electricity generation from renewables by 2025. This same target was included for 2030 when developing the NDC, as part of the mitigation actions for the energy sector. Under the BAU scenario[18], the share of gas-fired electricity generation would go from 48% in 2014 to 40% in 2030; hydro-power would shift from 50% in 2014 to 55% in 2030; and renewable energy would only increase slightly from its current share of 3% (in about 0.3%) until 2030; under the NDC scenario, the proposal is that this share will increase up to 5% and reduce close to 2.1 $MtCO_2e$ by 2030, compared to BAU (Government of Peru, 2015a).

Solar and wind resources, although with high potential, have been largely untapped and contribute only with a small share to the current energy mix. Expanding renewables instead of gas-fired plants to meet growing energy demand in the future thus represent important potential to prevent future emissions increase. The costs of renewable energy installations have dropped significantly in the last few years, reaching parity with fossil fuel powered electricity in many countries. Hence, an updated BAU prepared today would probably already include a higher share of renewables compared to the BAU prepared in 2015.

Table 7: Current electricity generation, installed capacity and potential per technology

Technology	Current power generation	Installed capacity	Generation potential
Hydropower (large and small scale)	23,009 GWh	3,900 MW	70,000 MW
Solar	242 GWh	96 MW	5.2 kWh/m^2

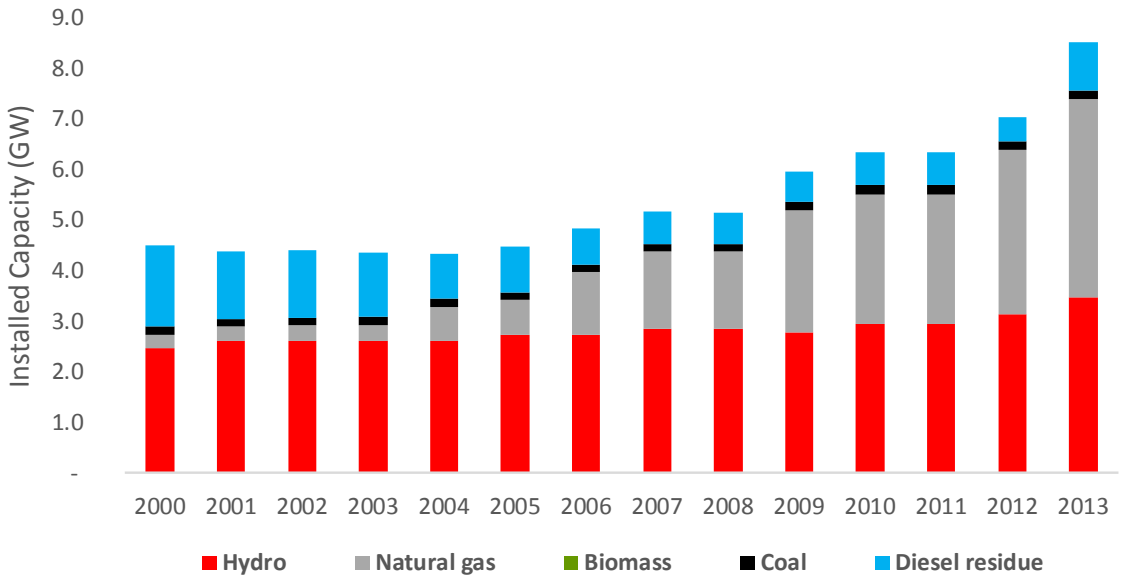
[17] For the case of Peru and for this report, when we refer to renewable energy it does not include hydropower generation (small or large scale).

[18] During the preparation of the NDC, a BAU scenario for the energy sector was developed in collaboration with national experts.

Wind	1,054 GWh	146 MW	22,000 MW
Biomass	138 GWh	61 MW	177 MW
Geothermal	-	-	3000 MW
Total	48,326 GWh	10,150 MW	

Source: COES (2016); PlanCC (2017).

Figure 11: Peru's power capacity by source (2000 – 2013)



Data source: IEA (2016c)

Energy poverty. In Peru, 10% of the population –living primarily in rural and remote areas– lack access to electricity (Ministry of Environment of Peru, 2016). To tackle this, the National Plan of Rural Electrification (2015-2024), developed by the National Directorate of Rural Electrification of the Ministry of Energy and Mining (DGER/MEM), was proposed in a way that its content is compatible with regional and local development plans and it has been implemented in coordination with regional and local governments (Climate Parliament, 2017).

To date, progress on rural electrification in Peru –within the context of the National Plan– has so far entailed extending the grid to isolated communities. However, this expansion is expected to reach the edge of technical feasibility within three to four years. In order to reach the whole Peruvian population, future efforts on rural electrification must be based on renewables, and particularly solar PV (Climate Parliament, 2017).

Policies. The electricity sector in Peru went through a reform in 1992, which started with the promulgation of the Electricity Concessions Law[19] which sets the legal framework for the activities in the electricity sector and promotes a pricing system for greater economic efficiency by setting up a tariff for

[19] Ley de Concesiones Eléctricas (LCE) Law Nº 25844. D.S. 009-93-EM.

end-users. In 2006, the Law for Efficient Generation Development[20] came into force to complement the Electricity Concessions Law and aims to guarantee efficient electricity generation, reducing the vulnerability of the Peruvian electrical system to price volatility and long blackout periods (IRENA, 2014).

Two instruments set the legal framework for the renewable electricity sector. The Legislative Decree No. 1002 for the promotion of investment in electricity generation with the use of renewable energy[21] and the Regulation for electricity generation with renewable energy. The first of these, establishes the promotion of renewable energy as a national priority and promotes the connection of renewable electricity to the national grid (SEIN) through regular auctions. The second regulation determines the administrative procedure for announcing renewable energy auctions and granting concessions for the development of renewable power generation. It also sets the requirements for submitting, evaluating and awarding bids, as well as marketing procedures and renewable energy generation tariffs (IRENA, 2014).

Since 2009, Peru has held renewable-energy auctions for grid connected generation and for off-grid electrification. The amount of electricity (GWh) auctioned in each call is calculated according to the projected needs to meet the national 5% target by 2025 minus the renewable energy already contracted. Auctions are technology-specific and have a non-disclosed price-cap per technology, with offers above the cap automatically disqualified (IEA, 2017). Table 8 provides a summary of auctions in Peru.

Table 8: Summary of Peru's renewable energy auctions

Auction	Date	Type	Wind (GWh/yr)	Solar (GWh/yr)	Biomass (GWh/yr)	Hydro* (GWh/yr)
4th	Feb-16	Required	1300			450
		Awarded	738.6	523.4	29	448.2
3rd	Aug-13	Required	0	0	0	1300
		Awarded	N/A	N/A	N/A	1278 (240 MW)
2nd	Apr-11	Required	419	43	593	681
		Awarded	416	43	14	680 (102 MW)
1st, 2nd call	Mar-10	Required	0	8	419	338 MW
		Awarded	N/A	0	11.7 (1.5MW)	92 (19 MW)
1st, 1st Call	Oct-09	Required	320	181	813	500 MW
		Awarded	571	173	143	161 MW

* Only when the installed capacity does not exceed 20 MW.

Source: IEA (2017)

2.6.1.1 Measures that could increase mitigation potential

In 2015, about 3% of Peru's electricity was being generated based on renewable energy (COES, 2016). For its NDC, the government of Peru included a target to increase renewable energy power generation

[20] Law Nº 28832

[21] For these instruments, renewable energy is understood as biomass, wind, solar, geothermal and tidal. Hydro power is accounted as renewable only when the installed capacity does not exceed 20 MW.

to 5% by 2030. Although this target represents an increase in ambition compared to BAU, other studies have found that a larger share of renewables in the electricity mix is realistic and feasible (CENERGIA, 2012; MINEM, 2016a; PlanCC, 2017).

In 2012, a study was commissioned by MINEM to explore future developments of the energy mix and to come up with a 'new sustainable energy mix' (NUMES, for its initials in Spanish). The study concluded that the most optimal energy mix structure for 2040 would be to have 40% power generation coming from gas, 40% from hydropower and 20% from renewable energy (CENERGIA, 2012). In 2014, the PlanCC project estimated that the share of renewables in electricity could be of 11% in 2030 (and a sustain increase after that to reach 24% in 2050) with a mitigation potential of about 9.5 MtCO2e avoided emissions in 2030 (PlanCC, 2014a). In contrast, the 5% target under the NDC would have a mitigation potential of about 2.1 MtCO2e in 2030 (Government of Peru, 2015a). All studies available are likely to be proposing conservative shares of renewable energy generation as the price of wind and solar installations has dropped significantly in the five years, and scientists continue to make technical advances that promise to make sustainable energy increasingly efficient and affordable.

The PlanCC project also identified a set of enabling conditions that would have to be in place to support a higher share of renewables in the electricity mix, including:

i. Increase in the frequency of the auctions as well as the target share (currently at 5%)
ii. Accelerated depreciation rate of installations
iii. Increase in electricity prices
iv. Further research to better estimate the potential for each technology in the country

Since the publication of the PlanCC results in 2014, the Peruvian government commissioned studies to better estimate the potential for wind energy across the country and the potential for hydro in the south of the country. Both studies were published at the beginning of 2017 and are expected to serve as key instruments to push for further investments in both technologies in the coming years (MINEM, 2016a, 2016b). Regarding solar energy, the country has calculated an annual average daily irradiation of 5,24 kWh/m2 but has not yet estimated potential for solar power generation across the national territory (Ministry of Environment of Peru, 2016).

Further, prices of renewable energy technologies have continued to go down, making these technologies much more competitive than in past years. In fact, at the beginning of 2016, the results of the fourth energy auction had surprisingly low prices: projects totalling 162 megawatts (MW) of wind energy got 20-year power purchase agreements (PPAs) at an average $37.49 per megawatt-hour (MWh), and another 184.5 MW of solar PV will do the same at an average $48.39/MWh. The fourth auction has been the most successful to date and the pricing on both wind and solar is remarkable. The winners must begin to deliver energy by December 2018, which will also buy a little time to allow for further reductions in solar technology costs (St. James, 2016).

According to the several studies, the co-benefits of increasing the share of renewables in power generation include increase in energy security and reliability by diversifying the energy mix; geographic decentralisation of the energy grid; development of the national industry; reduced environmental impact and improved sustainability; increase in rural electrification; amongst others (CENERGIA, 2012; PlanCC, 2017).

2.6.1.2 Barriers to implementation

There are several challenges or barriers to the progress of renewable energy-based electrification in Peru. These barriers were identified by a group of relevant stakeholders during the Renewable Readiness Assessment workshop in 2014 for the IRENA Report on Peru's renewable energy sector. A summary of the key challenges identified are listed below:

- **Up-front investment costs** are highly variable depending on the technology or installations are delayed due to expectations of prices significantly decreasing in the future.
- **Operation & maintenance and transport & construction infrastructure** require significant capacity building and human resources training.
- **Environmental** considerations included the fact that some of the technologies need a vast land area available which might conflict with biodiversity conservation and other land uses, and which could also create potential conflicts due to lack of register and ownership titles for land. Some technologies might also cause visual and noise pollution in surrounding areas.
- **Financial** barriers mostly refer to bankers' lack of knowledge of renewable energy market and profitability; credit officers' lack of knowledge about renewable energy project evaluation and regulations; and the need for technical assistance to credit lines.
- **Administrative** barriers refer to delays caused by central and regional governments during project management.
- **Subsidised natural gas to electricity generators** was also pointed out as a barrier that reduces generation competitiveness of other technologies.
- Finally, the **lack of smart grid and automatic generation control** which reduces network connectivity opportunities.

In addition to the above described challenges, renewable electrification in rural areas may encounter some additional barriers for implementation, as described by Climate Parliament (2017):

- **Electrification projects in remote rural areas are perceived as not being socially profitable**. The Public Investment System (SDIP) uses a methodology that does not quantify and monetise social benefits such as improved access to health, education, better environment, gender equality, among others and therefore came to the conclusion that it is not socially profitable.
- Due to the low consumption of electricity in rural communities it may be **necessary to guarantee the economic sustainability of investment**, creating a system that replaces the current subsidy set by the Rural Electrification Law, and the Social Electricity Compensation Fund (FOSE). Further studies are needed to determine the feasibility of a direct subsidy to the operation and maintenance of PV systems and mini-grids.
- There is only very **limited statistical data about rural households**.

2.6.2 Increasing the share of electric vehicles in the country

In 2014, about 78% of Peruvians lived in urban areas and urban population is currently growing faster than the country´s total population. This trend can be observed particularly in the Lima Metropolitan Region (LMR), where population grew from 7.3 million in 2000 to approximately 10 million in 2015 (UN, 2017). In line with urban population growth, the transport sector is also experiencing a significant increase in its numbers. The share of private car ownership is rapidly increasing, with 150,000 – 200,000 new private vehicles registered every year and projections show that the number of overall motor vehicles per person is forecasted to substantially increase in the future (GIZ, 2015). This trend, although influenced to some extent by the growth in urban population, can also be attributed to factors such as the liberalisation of the transport sector in the 90s (unregulated car imports), having very limited mass transit network; a public transport system that is unregulated and with low-capacity; and the rising economic wealth of the population.

As consequence, the population is affected by high levels of traffic congestion which translate into time losses as well as increased air and noise pollution (GIZ, 2015). Already today, Lima is the second most polluted city in Latin America (WHO, 2016). A local research consortium (CIES) reported in 2014 that over 5,000 Peruvians died between 2007 and 2011 as a consequence of particles exposure and urban air pollution. Further, 80% of the deaths where directly attributed to the transport sector (Peru21, 2014). Air pollution also contributes to respiratory diseases and it affects children and the elderly

more severely. These problems are likely to be aggravated in the near future if some significant action to reverse trends in the sector is not taken.

In terms of emissions, the transport sector contributed to almost 12% of the national emissions in 2012. With a share of close to 40% (or 17.5 $MtCO_2e$), the transport sector represents the largest contributor in terms of energy-related emissions. Further, according to national GHG inventories, transport emissions have increased by 65% since 2005 (Ministry of Environment of Peru, 2016). Still, when developing the NDC, a comparably low mitigation potential was attributed to the sector. According to background documentation for the preparation of the NDC, the implementation of 10 mitigation actions in the transport sector would contribute to reducing about 4 $MtCO_2e$ or 4% of the emissions reduction by 2030 (Government of Peru, 2015a). This leaves room for further increasing the level of ambition defined for specific actions listed under the NDC.

Measures proposed under the NDC for transport include e.g. the conversion of private, commercial and public vehicles to compressed natural gas (CNG); the introduction of hybrid and electric light-duty vehicles; the implementation of emission limits; replacement of rural minibuses and taxis through low-emission busses; the expansion of the Metro Lima and an integrated public mass transport system in Lima (Government of Peru, 2015a). Most of these measures where included when developing a Sustainable Urban Transport NAMA (TransPeru) which was presented in 2016. The TransPeru NAMA aims to reverse the trend towards car-dominated urban conglomerates, based on two main building blocks: the provision of high-quality public transport and the optimization of the public transport vehicle fleet. The NAMA lists a set of actions to be implemented and highlights a mitigation potential in the range of 5.6 - 9.9 $MtCO_2e$ accumulated over the period 2015 – 2025 (GIZ, 2015).

As the TransPeru NAMA is focused mostly on public transport systems improvements, it does not include actions outside this field. The NDC on the other hand, also includes some additional actions like the conversion of heavy duty vehicles and private vehicles to CNG or the introduction of hybrid and electric light-duty vehicles in the local market. In particular for the latter, the Peruvian government is in the process of developing a NAMA to promote electric transport (TransElectrico) in the country. Actions included are mostly related to tax exemptions and reduced tariffs (MEM, 2017). Unlike the TransPeru NAMA, developed and coordinated by the Ministry of Transport, the TransElectrico is being developed by the Ministry of Energy. This is seen as a positive sign as it means involvement of one additional actor in the implementation of the included action. However, this NAMA is still at the beginning of the development process and very little information is available on its current state, although the topic of electric vehicles is starting to attract more attention in the political arena.

Recently, the representatives from the Ministry of Energy and the ex-President himself have expressed interest in accelerating the entry of electric vehicles (EVs) in the country. Conversely, the NDC target for increasing the share of EVs aims at having 5% share of EVs by 2030 (Government of Peru, 2015a), which falls short in comparison to recent government statements. Moreover, other studies carried out in collaboration with several stakeholders in the sector have identified a very high potential for increasing EVs, as Peru currently has about 75% oversupply of energy (PlanCC, 2014b; MEM, 2017).

Policies. In 2012, the Ministry of Transport and Communication (MTC) issued its Multiannual Sectoral Strategic Plan 2012 - 2016 with the overarching goal to maintain, expand and modernize the transport infrastructure in order to promote social inclusion, enhance accessibility, and improve the competitiveness and security of the transport system and services (MTC, 2012). Also, Peru has a Maximum Allowable Emission Limits regulation in place since 2007 which rules that new personal vehicles being imported into the country have to comply with Euro 3 or Tier 1 and cannot surpass an age of 5 years. However, the lack of stringency in enforcement and institutional capacity hinders an effective implementation and actual compliance with this regulation (GIZ, 2015).

There are two fleet renovation programmes in Lima: one targeting replacement of mini- and micro-buses with an age over 20 years and a Vehicle Scrapping Programme (which is temporarily suspended since 2015). The country has no regulation on the national level which establishes competencies and functioning of scrapping schemes on the sub-national level.

2.6.2.1 Measures that could increase mitigation potential

When developing the NDC, the Multisectoral Commission proposed a list of 10 mitigation actions to be implemented in the transport sector. One of which refers to the promotion of hybrid and EVs to help them enter the national market and increase their share in the vehicle fleet. The target aims to reach 15% share of hybrid vehicles (current share is 1%) and 5% share of EVs (currently at 0.3%) by 2030. According to the Commission's report, this mitigation action would contribute reducing 0.2 $MtCO_2e$ in 2030 (Government of Peru, 2015a). However, a previous study developed in collaboration with several relevant stakeholders of the sector reported potential to aim for much higher shares of electric vehicles. The study proposes a share of 30% EVs by 2030, which would lead to 2.7 $MtCO_2e$ reduced emissions in 2030 (PlanCC, 2014a).

A list of actions could be implemented that contribute to a more ambitious share of electric vehicles in 2030 (PlanCC, 2014b) using the opportunity presented by the government's expressed interest in promoting EVs in Peru and the potential for further increasing the ambition of the NDC (El Comercio, 2018; Gestion, 2018; MEM, 2017):

- 100% reduction of taxes for imports of light electric vehicles.
- Progressive reduction or elimination of the vehicle property tax rate for this type of vehicle.
- A system of green labelling, informing on energy efficiency and emissions levels of the vehicle would help the success of the measure.
- An effective retirement program (scrapping) of old vehicles.
- A clear regulation for the electric load centres and for the driving and use of these vehicles would help encouraging their use.
- Support for expansion of charging infrastructure

2.6.2.2 Barriers to implementation

The transport sector is a very complex and challenging one. Most of the mitigation action in the sector are strongly interlinked and also require important behavioural changes in society. For the case of electric vehicles in particular, some additional technical and economic barriers need to be address. Below, a grouping of the existing barriers according to the Peruvian government (MEM, 2017):

- Technical barriers:
  - Lack of charging infrastructure
  - Very long charging time required
  - Very little alternatives (EVs) in the national market
- Economic and finance barriers:
  - Comparably high purchase price
  - Mechanisms to quantify negative externalities
  - Negative trend in electricity and fuels costs
- Social barriers:
  - Lack of dissemination and education regarding EVs and its impacts
  - High informality in taxis sector
  - Taxi drivers expect/need a short-term return of investment
- Regulatory barriers:
  - Lack of leadership in sustainable mobility for the country
  - Lack of a regulatory framework and technical and legal standards for charging facilities

2.6.3 Implementing agroforestry systems for coffee and cacao plantations

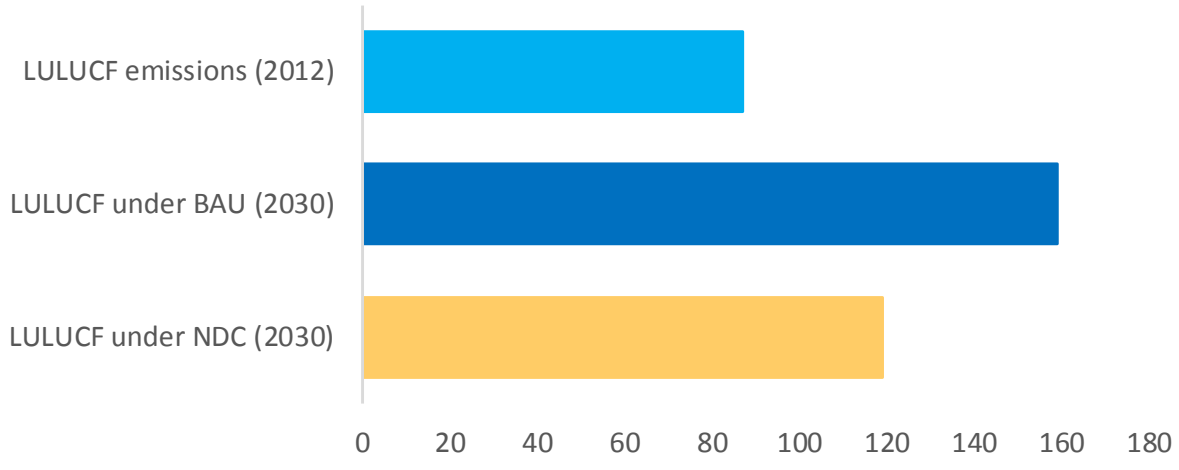
Peru has 74.2 million hectares of forests, 94% of which are part of the Amazon rainforest (MINAM, 2016a). It has the second largest extension of Amazon forest in Latin-America and the fourth largest area of tropical forest, worldwide (MINAM, 2016b). Although this ecosystem covers over 57% of the national territory, it holds only around 13% of the country's population including native communities from 56 distinct ethnic groups, whose traditions and livelihoods are closely tied to the forest (EIA, 2012).

The economic value of the forest sector is low compared to other forested countries in the continent. According to the Forest Investment Program, forest-related activities account for no more than 1% of the country's GDP. Moreover, the largest part of Peru's forest sector activity is informal; meaning that, while forest resources are an important part of people's livelihoods, they are not exploited on a scale or manner that creates additional value to the economy (GGGI, 2014).

According to the most recent emissions inventory, in 2012, over 85 $MtCO_2e$ or half of the country's emissions were generated through activities in the LULUCF sector. Furthermore, over 97% of the LULUCF emissions come from the deforestation of the Amazon forest for agriculture, cattle raising and other activities. The government recognises the high potential for emissions reduction in the sector but also highlights that complex enabling conditions are required for the successful implementation of mitigation actions in the sector, given the high rate of informality in the sector, the weak presence of the government, low access to credits, amongst other factors (Government of Peru, 2015a).

Under a business as usual scenario, Peru's emissions are expected to grow up to about 300 $MtCO_2e$ (and about 160 $MtCO_2e$ coming from LULUCF) in 2030. In its NDC, Peru takes on the commitment of reducing 30% of those emissions, based on a technical feasibility study that estimated that LULUCF sector holds the largest potential for reducing emissions –about 67% of that emissions reduction under NDC. Thus, LULUCF emissions under NDC scenario would be reduced to about 120 $MtCO_2e$ in 2030 (about 40 $MtCO_2e$ less than in the projected emissions for the sector, as shown in Figure 12) (Government of Peru, 2015a).

Figure 12: LULUCF emissions in 2030 under BAU and NDC scenario ($MtCO_2e$)



Data source: Government of Peru (2015c); Government of Peru (2015a).

Policies. In the past decade, Peru has undertaken a deep reform in the forestry sector aiming to improve governance. Some milestones in this process so far are:

- Creation of the Supervisory Body for Forest and Wildlife Resources **(OSINFOR)** in 2008.

- Establishment of the National Forest Conservation Program for Climate Change Mitigation (**Forest Program)** in 2010.
- The **Forestry and Wildlife Law** (Law 29763) was enacted in 2011, the first to be developed in collaboration with indigenous and local populations; and its 4 supporting Decrees
- the **National Policy for Wildlife and Forests** (PNFFS) was approved in 2013 and the National Forest and Wildlife Service (**SERFOR**) began operating in the following year.

OSINFOR is the national entity in charge of to supervise and monitor the sustainable use and conservation of forest and wildlife resources. The **Forest Program** aims to preserve 54 million ha of tropical forest through mapping of forest and deforested areas; promoting the development of sustainable productive systems based on forests; and strengthening forest conservation capacities of regional and local governments. The **Forestry and Wildlife Law** defines the scope of forest regulations while developing the criteria and establishing mandates for their monitoring, their granting to individuals and its sustainable use. The **National Policy for Wildlife and Forests** involves all levels of government and public and private actors. Finally, **SERFOR** is the new national governing body for forests, which promotes the sustainable and participatory management of forest resources and wildlife, and the use of their ecosystem services, providing quality services that contribute to the well-being of citizens.

2.6.3.1 Measures that could increase mitigation potential

During the preparation of the NDC, the multisectoral commission identified 11 mitigation actions that would lead to significant emissions reduction in the LULUCF sector. These actions can be grouped as activities to promote sustainable forest management under different schemes: forest management by native communities; consolidating natural protected areas; agroforestry practices (Government of Peru, 2015a).

Two of the listed actions were related to establishing agroforestry systems, one looking into coffee plantations and the second one into cacao plantations. This means establishing agroforestry systems for coffee or cacao plantations combined with timber trees in degraded pasture areas and abandoned deforested areas of the Peruvian Amazon. This system sequesters greater amounts of carbon than pastures and allows to generate greater net profits for farmers, compared with the traditional coffee and cacao systems. The estimated mitigation potential for these two actions under the NDC was of about 0.4 $MtCO_2e$ for coffee plantations and 0.5 $MtCO_2e$ for cacao plantations, in 2030. The report clearly states that emission reduction potential of the proposed actions could be increased if the level of ambition or scope of the actions was increased (Government of Peru, 2015a).

In a study carried out one year before to explore national mitigation scenarios, experts actually highlighted actions in forest management measures and agroforestry systems as the ones with the greatest potential for reducing emissions among all sectors. This study reported that, under certain assumptions (see Table 9), the mitigation potential of these two actions would be of 5.9 $MtCO_2e$, 3.4 $MtCO_2e$ from coffee plantations and 2.5 $MtCO_2e$ for cacao plantations in 2030 (PlanCC, 2014b).

Table 9: Summary of assumptions for modelling agroforestry mitigation actions

	Coffee plantations	Cacao plantations
Ambition level (2014-2050)	895,619 ha of new plantations	142,105 ha of new plantations
Agroforestry system combined with trees (emissions removal)	2 tCO_2/ha/year	2 tCO_2/ha/year
Normal plantation system (emissions removal)	1.75 tCO_2/ha/year	1.75 tCO_2/ha/year

Increase in yield	From 550 kg/ha/year (2009) to 1,120 kg/ha/year (2050)	From 400 kg/ha/year (2009) to 1,200 kg/ha/year (2050)

Source: PlanCC (2014b)

This potential reported in PlanCC is a significantly higher mitigation potential as that included when developing the NDC (see Table 10). Moreover, the report also states that the emissions reduction calculated could be even higher if the agroforestry systems where to be installed in abandoned and degraded pastures (as this would also contribute to reducing deforestation and capture carbon instead) (PlanCC, 2014b).

Table 10: Potential emissions reduction for agroforestry systems calculated by different studies

	Coffee plantations	Cacao plantations
Mitigation potential under NDC	0.4 $MtCO_2e$/year	0.5 $MtCO_2e$/year
Mitigation potential estimated by PlanCC study	2.4 $MtCO_2e$/year	1.7 $MtCO_2e$/year

Source: PlanCC (2014c); Government of Peru (2015a)

According to the results of the PlanCC study, the implementation of the mitigation scenario in the LULUCF sector would give value to almost half a million hectares of degraded and abandoned land in the amazon forest through reforestation projects and the implementation of agroforestry systems for coffee and cacao plantations. Additional co-benefits would be improvements of life quality of families living from the forest as well as of their income, job creation, improved water quality, reduction of economic losses in the face of extreme climatic events (landslides), etc. (PlanCC, 2014b).

2.6.3.2 Barriers to implementation

The enabling conditions play a key role in determining the successful implementation of any action in the LULUCF sector, even though major mitigation potential exists. A few conditions would be required for implementing agroforestry systems for coffee and cacao plantations, some of the most relevant are:

- Subsidies or credits with accessible terms that support the conversion of degraded pastures and/or the installation of agroforestry systems. In particular, farmers need support in accessing finance for the up-front investment needed, as well as to cover the first years after installing the system, when the production is still not at its maximum capacity.
- Disincentives to deforestation through a system that monitors, controls and manages forest areas, implemented by the regional state.

Finally, the main barrier for taking forward most of the mitigation actions in the LULUCF sector, including agroforestry systems, is the lack of government capacity to monitor and control deforestation. However, since the submission of the NDC, the government has committed to work on this (also referred as "enabling condition for forest conservation" in the national context) as a priority in the coming years.

2.7 Conclusions

The Peruvian government has been very active regarding climate change negotiations and projects. The government recognised the challenges and opportunities that climate change poses for the country and is in the process of developing the technical capacities to deal with it. Currently, Peru is not a

large emitter worldwide, but its emissions (excluding LULUCF) have steadily increase in line with national economic growth. The country recognises the importance of decoupling the national projected development from GHG emissions in order to contribute to the goal of stabilising the planet´s temperature increase to well below 2°C above pre-industrial levels.

Several national studies confirm the Peru's potential for increasing ambition of emissions reduction, while still generating important social and economic benefits for society. Increasing the share of renewable energy in power generation would increase energy security, contribute to the decentralisation of the energy grid and create jobs, while contributing to a clean and low-emissions energy sector. Similarly, increasing the share of EVs in the country will make use of the country's oversupply of energy and help reducing air and noise pollution in the cities -specially in Lima, 2nd most polluted city in Latin America. Further, implementing agroforestry systems in coffee and cacao plantations will also contribute to improve quality of life and income of families working in the forest sector, job creation, improved water quality, reduction of economic losses in the face of extreme climatic events (landslides), etc. If these three measures were implemented (in part supported by other countries), Peru's emissions in 2030 would be about 7% lower than the NDC conditional target.

Still, low-carbon and climate resilient development is a challenge for Peru. In this sense, the actions to be implemented for GHG management must be aligned with cross-cutting development policies carried out, exploiting benefits such as the ones identified for the measures studied in this report. Climate finance is a very relevant aspect due to the large-scale investments needed for many of the mitigation actions the country could take on. Peru still struggles with limited knowledge about funding sources, limited choice of financial instruments used and limited technical ability to access financial resources. Moreover, there are gaps in legislation and a lack of financial infrastructure to access climate finance. Peru also requires support for research, technological development and innovation.

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