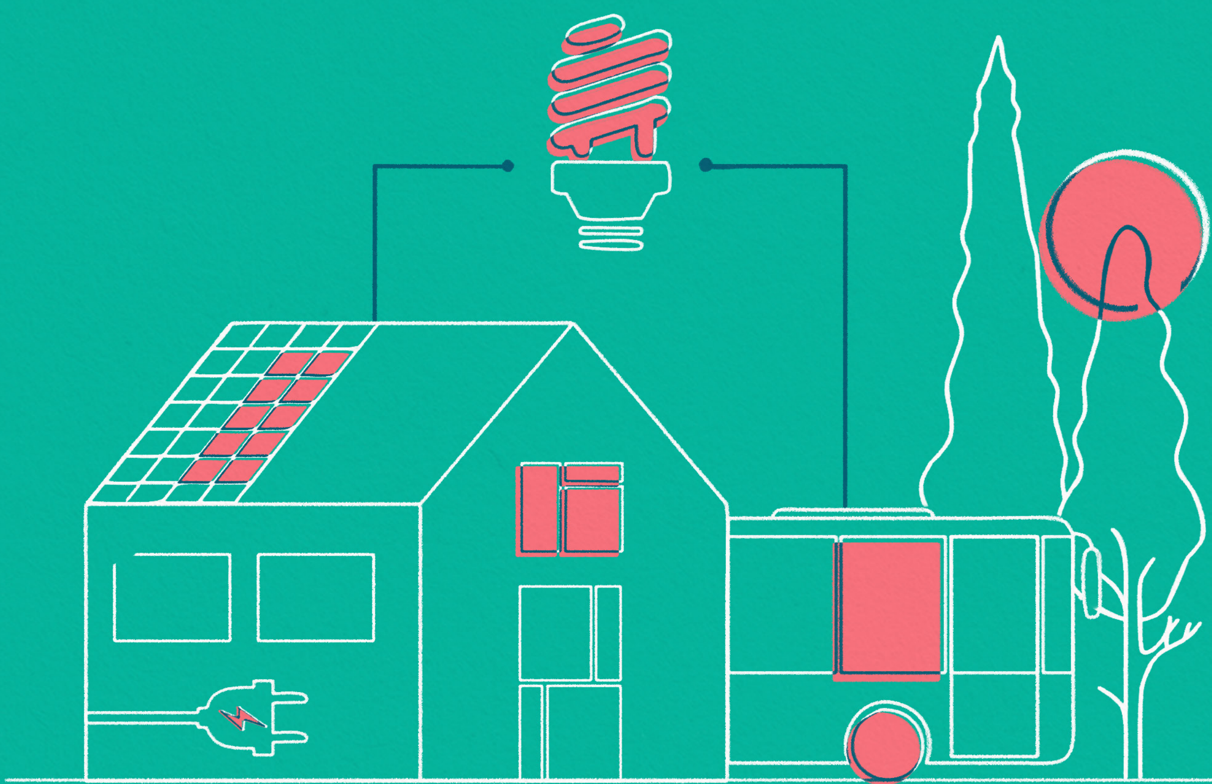
GREEN CLIMATE FUND
READINESS AND PREPARATORY SUPPORT PROJECT

Enhancement of the Nationally Determined Contribution under the Paris Agreement

Additional potential of energy efficiency for the enhancement of Albania's NDC 2030



MINISTRY OF TOURISM AND ENVIRONMENT OF ALBANIA
URBAN RESEARCH INSTITUTE

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FOREWORD

This publication is an analysis of Albania's potential for the reduction of greenhouse gas emissions through energy efficiency; it supports the Ministry of Tourism and Environment in the enhancement of the Nationally Determined Contribution for the reduction of greenhouse gas emissions 2021-2030, as well as in the qualitative fulfilment of the obligations of Albania towards the United Nations Framework Convention on Climate Change and the Paris Agreement. Attached to the analysis, the respective database and the modelling files are made available to the Ministry for further use.

Urban Research Institute is thankful to the Ministry of Infrastructure and Energy and to the Agency of Energy Efficiency for their support with data and information necessary for carrying out this analysis. It is also thankful to the Ministry of Tourism and Environment for the coordination of the inter-institutional communication during the implementation of the Readiness and Preparatory Support Project "Enhancement of the existing NDC" 2020-2022. Finally, Urban Research Institute is grateful to the greenwerk. for the transparent and qualitative work carried out.

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Abbreviations

BAT	Best available technology
CHP	Combined heat and power
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EE	Energy Efficiency
EIB	European Investment Bank
EPBD	Energy performance of buildings directive
ESCO	Energy service company
EV	Electric vehicle
GDP	Gross Domestic Product
GHG	Greenhouse gas
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
KPI	Key performance indicators
LPG	Liquefied petroleum gas
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plan
NES	National Energy Strategy
SCM	Supplementary cementitious materials
VAT	Value Added Tax
WEM	With existing measures
WAM	With additional measures

Executive Summary

This document presents recommendations for additional energy efficiency measures to enhance Albania's Nationally Determined Contribution for 2030. The recommendations are based on a comprehensive analysis of energy trends in Albania, key policy documents on energy, and international best practice in energy efficiency. The LEAP model was used to quantify the potential for enhanced energy saving and emission reductions. The following five measures have been identified and modelled:

1. Promote low-carbon transportation through electrification to increase e-vehicle penetration rates by 2030. The simulation expects EVs to account for 1% of total car passenger-kms by 2025, and 3% by 2030. This could reduce ~70 kt CO_2e until 2030.

2. A low-carbon e-bus programme sets an ambitious target of up to 100% of all new buses to be electric by 2030. The calculations for the forthcoming decade predict that e-buses will represent 5% of total bus passenger-kms by 2025, and 23% by 2030. This could consequently save approx. 80 kt CO_2e/a by 2030.

3. Promoting low-carbon development of Albania's cement industry by application of alternative fuels and sustainable near-zero biofuels, supplementary cementitious materials, best available technology for newly assembled energy-efficient cement installations and material intensity reduction through optimized or alternative design choices. These measures have the potential of reducing up to 30% of energy-related GHG emissions or 160 kt CO_2e/a in 2030.

4. Promoting efficient electric cooking stoves in the residential sector by improving power supply, supporting national energy initiatives, raising awareness, training installation and maintenance staff; and creating incentive systems for sales and demand. Those measures have the potential to reduce up to 18% or 60 kt CO_2e/a of the residential sector's energy-related GHG emissions in 2030.

5. Introduction of district and local heating systems in new districts in urban areas through regulatory framework reforms, setting up a financial support mechanism, demonstration projects in selected municipalities; and capacity-building. Those measures lead to reduced energy consumption in residential buildings, and to a switch from fossil fuel-based heating/cooling appliances to renewable energy with a significant contribution to mitigation, reducing CO_2 emissions by up to 40% or 57 kt CO_2e/a by 2030 in covered buildings/municipalities.

Summing up, the proposed measures have the potential to decrease energy demand / increase energy efficiency by about 1% and reduce emissions by around 5% compared to the baseline scenario of the NES, thus strengthening substantially the ambition of Albania's NDC.

1. INTRODUCTION

This document presents additional energy efficiency policy measures for the reduction of Albania's greenhouse gas emissions over the period 2021-2030. It is prepared in support of the Ministry of Tourism and Environment in the process of enhancement of Albania's Nationally Determined Contribution 2030 and the qualitative fulfilment of its obligations towards the United Nations Framework Convention on Climate Change and the Paris Agreement.

The recommended measures are based on a comprehensive analysis of the key drivers of energy demand, and energy trends in Albania in key national policy documents on climate change and energy, international best practice in energy efficiency, and private sector stakeholders' contribution. The results of the analysis have been consulted with governmental and private sector stakeholders. The financial assistance needed for the proposed energy efficiency measures are estimated, where possible.

The LEAP model was used to quantify the potential for enhanced energy saving and emission reductions. All methodological considerations of the analysis and assumptions on which the recommended measures are based are described clearly and in detail.

2. METHODOLOGY

The methodology used to identify additional energy efficiency options in the enhanced NDC builds on the methodology and models used for the 2015 NDC development as well as on subsequent key energy policy documents, most importantly the Energy Strategy for Albania and the National Energy and Climate Plan. The applied approach consists of the following five methodological steps:

The following 5 steps were completed:

1. Analysis of Albania's energy profile: The final energy consumption and associated demand parameters of all relevant sectors (residential, public and service; transport; industry; agriculture) over the last 10 years were assessed to identify the main drivers of energy consumption trends. This was achieved by defining key performance indicators based on the data collected and analysed for the purpose. The economy's overall energy intensity (e.g. GJ/GPD) is compared by benchmarking specific energy performance indicators to identify sector-specific efficiency and saving potentials (bottom-up analysis). The following indicators were identified and compared with peer countries in the Balkan region, European standards and international best practice:

Figure 1: Methodological steps applied to derive recommendations

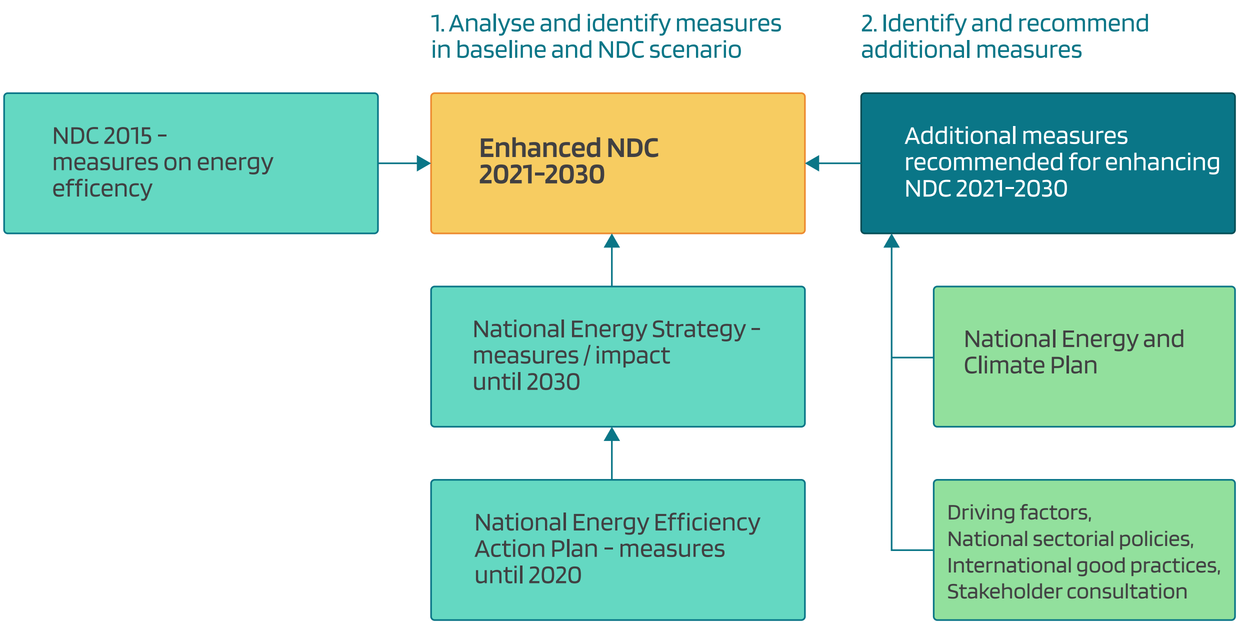


Table 1: Key energy performance indicators of the analysis

Sector	Energy performance indicators	Potential policy recommendation to reduce energy consumption
Building sector	Energy demand per floor area, by building type, age and current energy supply	Enhancement of building codes Incentives to overcome upfront cost barriers, e.g. green mortgages, soft loans
Residential sector	Cooking, warm water supply and related energy consumption	Incentives for low-carbon energy sources, e.g. electricity Energy labelling of devices
Industry sector	Manufacturing energy intensity (toe per USD 1,000 manufacturing value added, in constant 2010 USD)	Capacity building, awareness raising Incentives like soft loans for investment in efficient equipment, e.g. motors
Transport sector	Average energy consumption of vehicle per 100 km Passenger transportation modal split	Efficiency standards for new vehicles Incentives for low-carbon energy sources, e.g. electricity

2. Analysis of EE measures: The NDC 2015 and subsequently published national strategies, particularly the NES and the NECP, were analysed. It is assumed that the enhanced NDC 2021–2030 will be based on all components of the NES, including the first, second and third National Energy Efficiency Action Plan.

3. Identify additional measures: Based on step 2, this report aims to identify potential measures that go beyond the NES/NEEAP. A comparison of other key policies such as the NECP provides the basis for an enhancement and identification of potential additional energy efficiency measures for the NDC 2021–2030. International best practice experiences provide further options for additional measures. Moreover, the performance comparison and benchmarks conducted in step 1 were used to describe different scenarios (e.g. low and high ambition targets) and to prioritize potential measures to enhance energy efficiency. On this basis, suitable and specific technology and policy recommendations, e.g. the introduction and enforcement of minimum performance standards, etc. are provided.

4. Determining additional contributions:

a. The proposed measures are outlined in short profiles reflecting the rationale, type of proposed measures and activities, and the underlying assumptions for quantification.

b. Based on the LEAP model which was also applied to develop the NES and NECP calculations, quantified results in terms of energy savings and GHG emission reduction potential were derived for each proposed measure. The energy baseline scenario was determined for the main sectors, i.e. the building sector, residential sector, industry sector and transport sector, using NES data which were also used for NDC of 2021, to ensure consistency of the modelling results. Based on the derived energy savings potential and recommended policies and actions, the associated financial requirements for energy efficiency measures were estimated (where data were available).

5. Proposed incorporation into the enhanced NDC and update of NDC targets: The final step aggregated all quantified energy efficiency results and presents a package that can be integrated into the NDC main document, leading to increased energy savings and GHG emission mitigation (NDC targets).

3. FINAL ENERGY PROFILE OF ALBANIA

The main sources of energy sector GHG emissions are fuel combustion activities, as well as fugitive emissions from the extraction of solid fuels and the transmission and distribution of liquid and gaseous fuels. The following analysis within the scope of step 1 of the methodology shows that transport is the greatest consumer of energy across all years followed by households, the manufacturing and the construction sectors.

3.1. Final energy consumption by relevant sectors

Total energy consumption in Albania has been decreasing slightly since 2010 to 2.3 Mtoe in 2018, after rapid growth between 1995 and 2005 (+5%/year).

According to Enerdata (2021) Albania's energy consumption per capita is much lower than the EU average at approximately 0.8 toe (73% below the EU average), including nearly 2400 kWh of electricity (57% below the EU average). The country relies primarily on hydropower for its electricity supply.

Figure 2: Total energy supply by source, 1990–2018

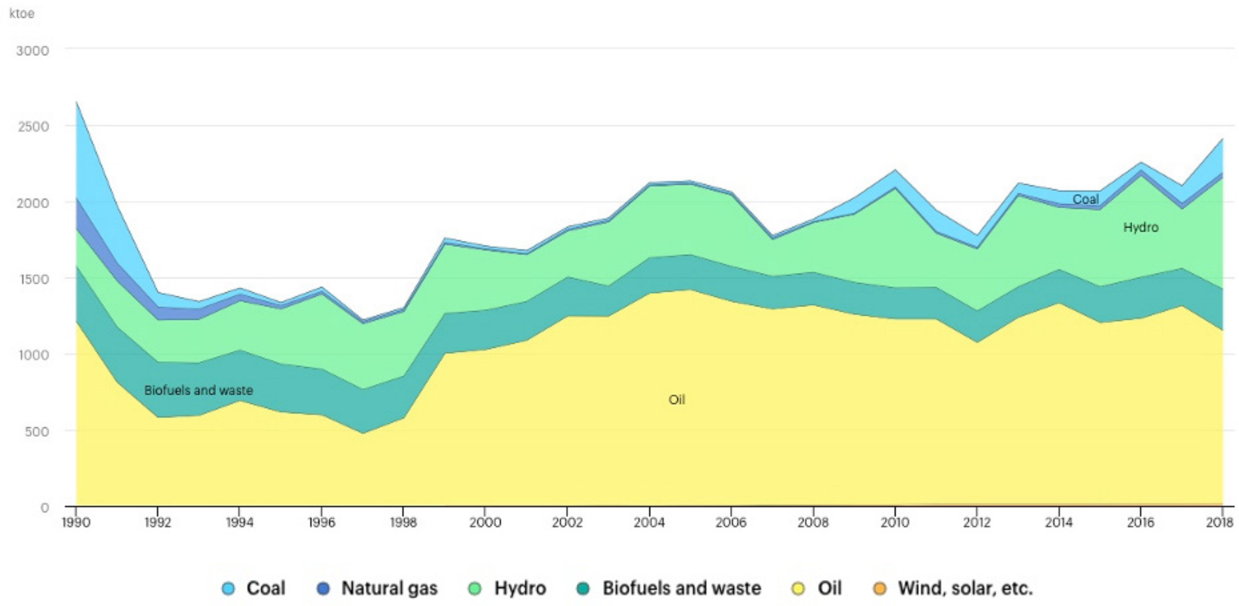
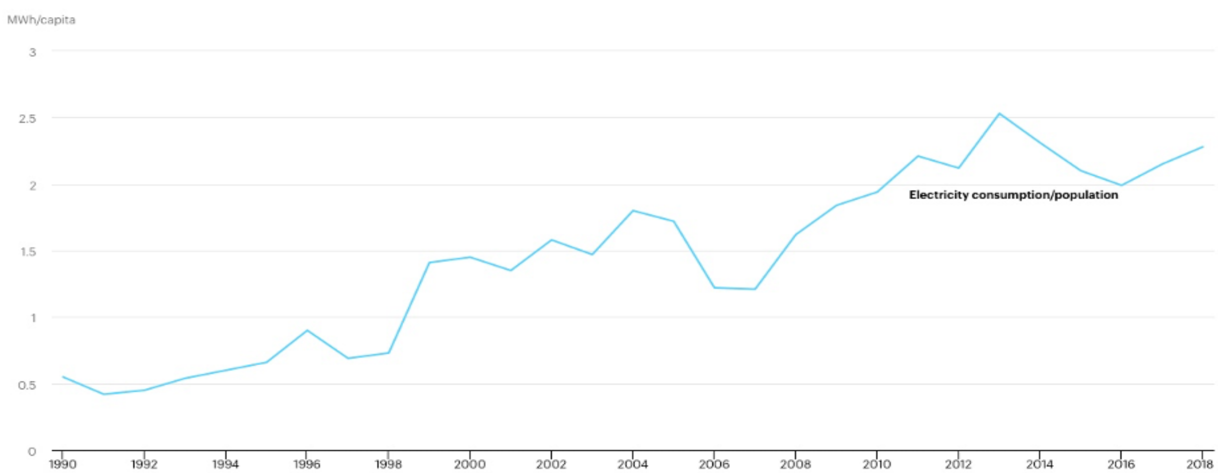


Figure 3: Electricity consumption per capita, 1990–2018

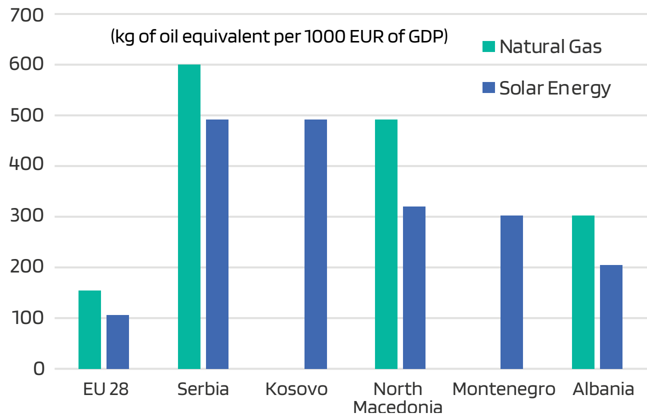


Source: International Energy Agency, 2021

This gives the country an advantage in terms of decarbonizing its electricity sector, but also makes it highly vulnerable to the changing climate, resulting in the need to import electricity in most years. Albania also has a 98 MW gas/oil fired power plant in Vlora, financed by the World Bank, EBRD and EIB, which has never been operational due to technical faults, according to Bankwatch (2021).

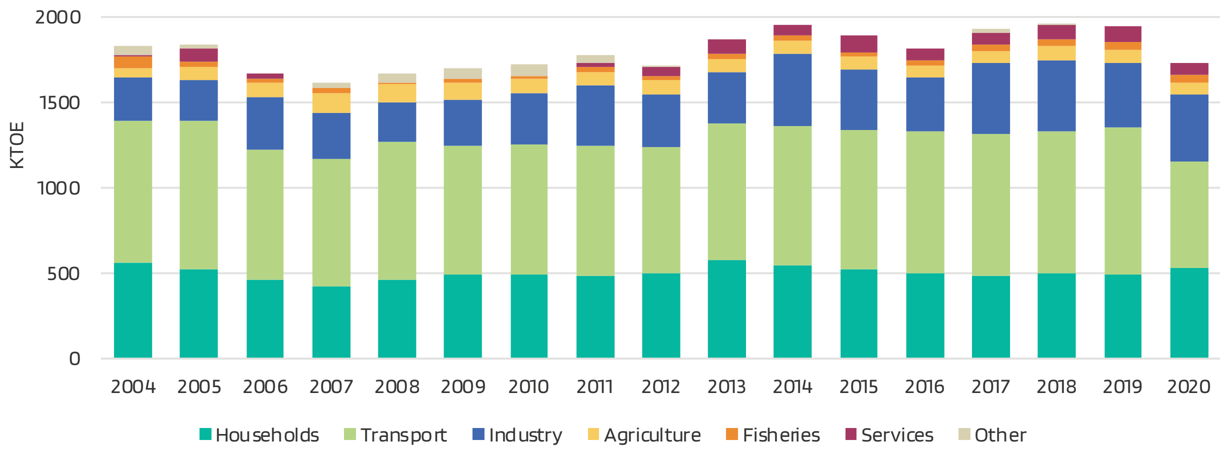
Albania's energy intensity, as is the case in other Western Balkan economies, is high compared to the EU average. Final energy demand is dominated by the residential sector (households), transport and industry.

Figure 4: Energy intensity of economies of the region in 2005 and 2015



Source: Data from Sustainable Quality Consult, 2018

Figure 5: Final energy demand by sectors



Source: Data from Ministry of Infrastructure and Energy, Energy Balance 2004–2020

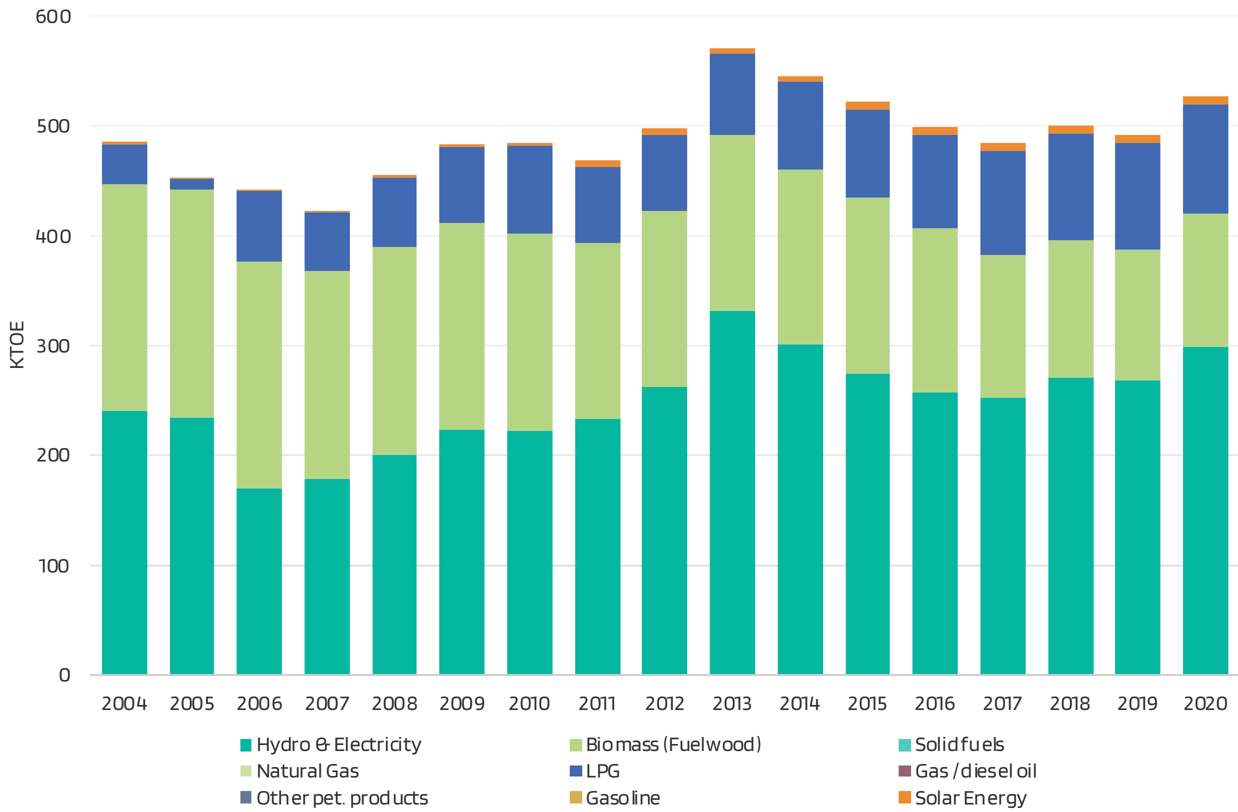
3.2. Development of key driving factors on energy demand

3.2.1. Residential sector

In 2020, final energy consumption in the residential / household sector accounted for approx. 30% of total energy consumption, using 46% of available electricity for final energy consumption. According to Albania's First Biennial Update Report (June 2021), the main drivers of energy consumption in the residential sector are residents and the number of households. Data on the number of persons per household in developed European countries and countries in transition show that household size decreases as the standard of living grows. The decrease is attributable to the aging of the population and the increase in the number of one-member and two-member households. In Albania, the number of persons per household is expected to decrease from 2.92 in 2014 to 2.41 in 2030.

According to Novikova et. al. (2015), the quality of energy services delivered to residential buildings is far lower than the EU average. Albanian homes are only partially heated for a few hours a day. The continued use of outdated wood stoves results in high levels of indoor air pollution and consequently, high rates of respiratory disease. The rise in electricity consumption at the sector level is likely to be even higher than indicated above for thermal energy use. First, there is a far lower penetration of electrical appliances in Albanian households than in households in the EU. Due to the growing demand for electrical goods and market developments, the penetration of electrical appliances will move closer to the EU average, which will increase electricity consumption. Second, a large share of energy demand for cooking is currently covered by LPG and wood. Due to the penetration of more efficient and convenient electrical cooking stoves and the low price of electricity, it is likely that a fuel switch will also take place for cooking. According to Albania's NDC (2015), cooking is responsible for an unusually high share of final energy consumption compared to the European average. Hence, electricity, biomass / fuelwood and LPG are the main energy carriers used in the household sector, as illustrated below.

Figure 6: Final energy demand of households



Source: Data from Ministry of Infrastructure and Energy, Energy Balance 2004-2020

3.2.2. Transport sector

The transport sector is the largest energy consumer in Albania and uses a large amount of energy resources. A significant increase in transport activity, especially road transport, was registered after 1990, leading to a significant rise in transport fuel consumption, mainly diesel and gasoline.

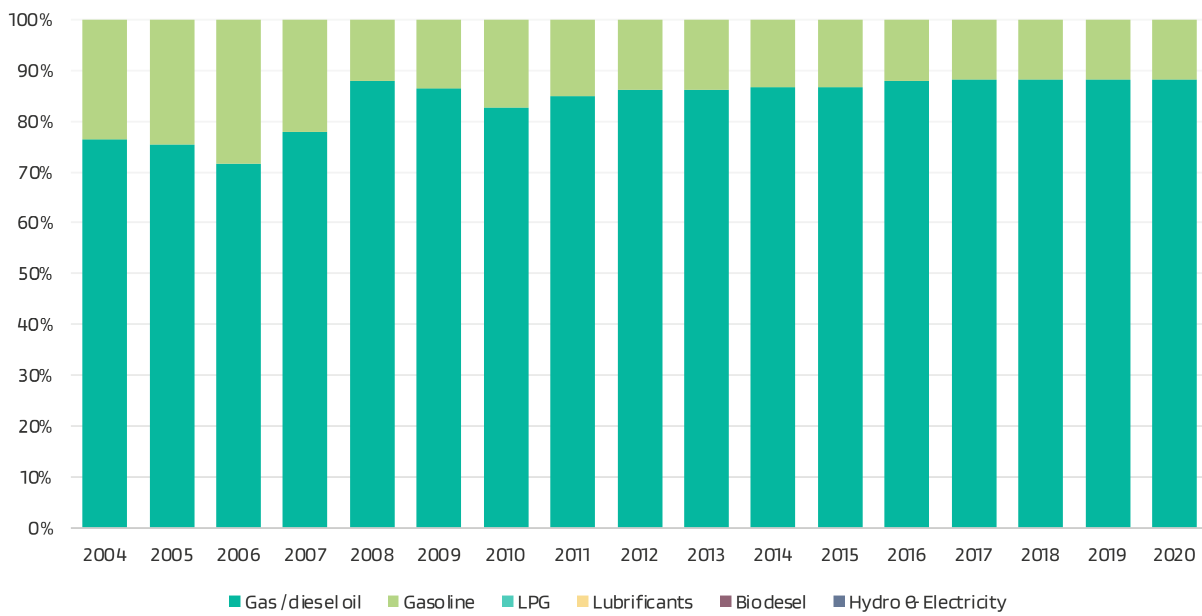
Two major indicators forecast the demand for passenger and freight transport: passenger-km and tonne-km. First Biennial Update Report of Albania to the UNFCCC (2021) estimates that tonne-km will increase by 85% in 2030 compared to 2014, while passenger-km will increase by 37%; road transport accounts for the highest share in total transport. Albania's transport sector has been expanding rapidly since 2000; the number of vehicles in circulation has increased and infrastructure is gradually being improved, leading to an ever-increasing total traffic load; the transport sector consumes significant quantities of energy (mostly in the form of diesel and gasoline), as illustrated in the following figures.

Figure 7: Final energy demand of transport sector

Source: Data from Ministry of Infrastructure and Energy, Energy Balance 2004–2020

As outlined in Figure 8 below, the main fuel used is gas / diesel oil.

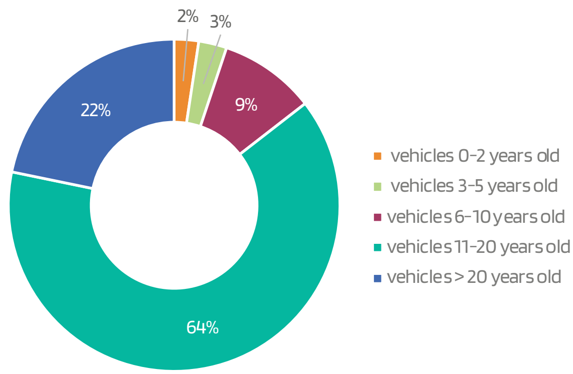
Figure 8: Fuel type split of energy consumption in transport sector



Source: Data from Ministry of Infrastructure and Energy, Energy Balance 2004–2020

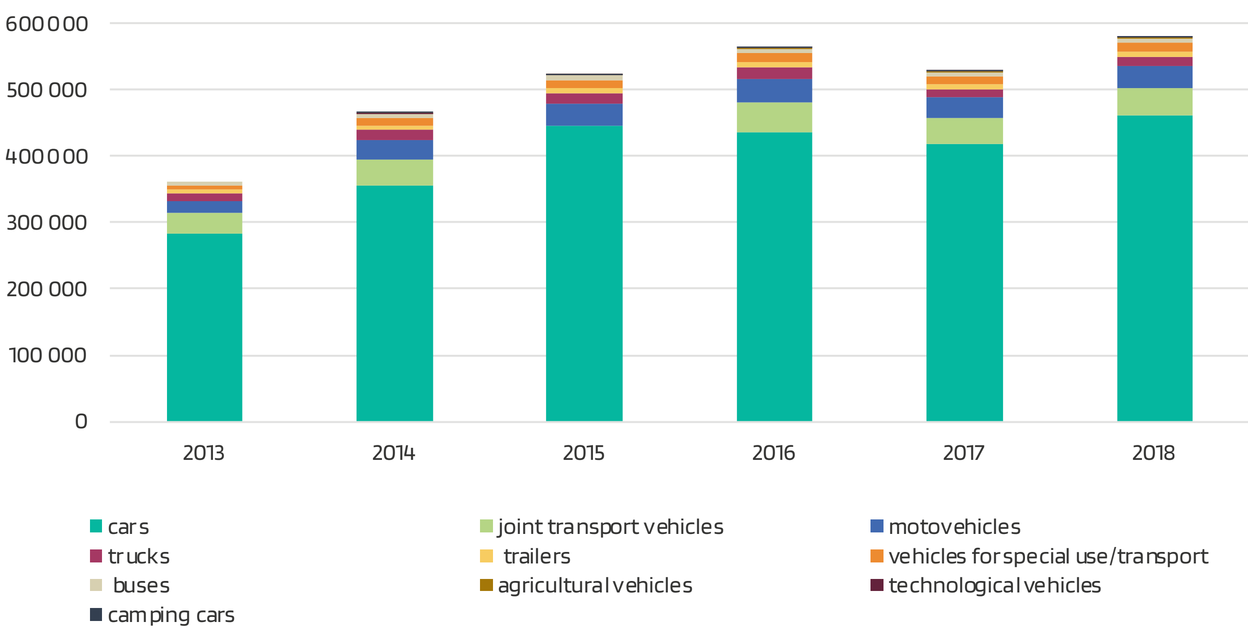
The main driver of energy demand and CO2 emission are the number of old diesel-powered vehicles in Albania. Vehicles older than 11 years account for 64% of all vehicles, and 22% of vehicles are older than 20 years.

Figure 9: Registered road transport vehicles by age



Source: Data from INSTAT, 2021

Figure 10: Registered road transport vehicles



Source: Data from INSTAT, 2021

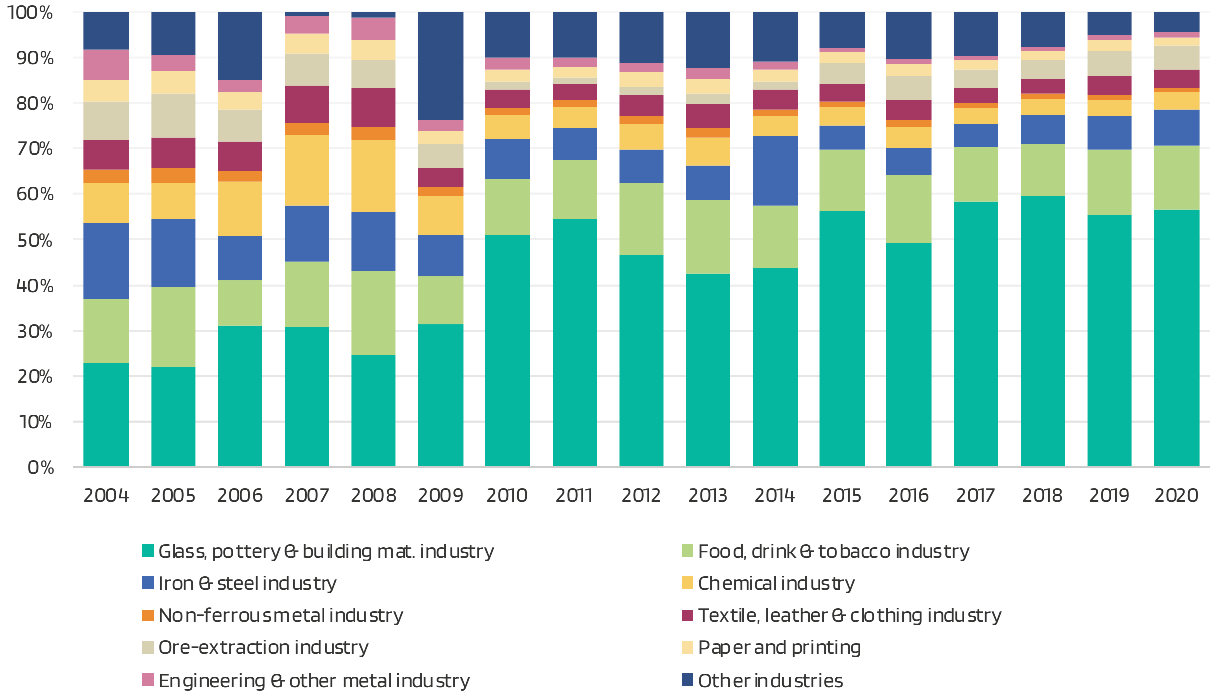
3.2.3. Industry sector

Albania's industry sector is dominated by three industries that consume the highest share of energy based on their final energy consumption of electricity and other fuels: food, metal and building materials. GDP growth is the most influential determinant of energy demand in industry. In addition to overall GDP growth, the value-added structure of Albania's GDP also drives the energy consumption of both the industry and agriculture sectors. As identified in First Biennial Update Report of Albania to the UNFCCC (2021), in the early stages of economic development, agriculture contributes a significant share of GDP.

In the industry sector, the building materials sub-sector (mainly cement) had the highest energy demand in 2020, accounting for around 57% of total energy demand (388 ktoe).

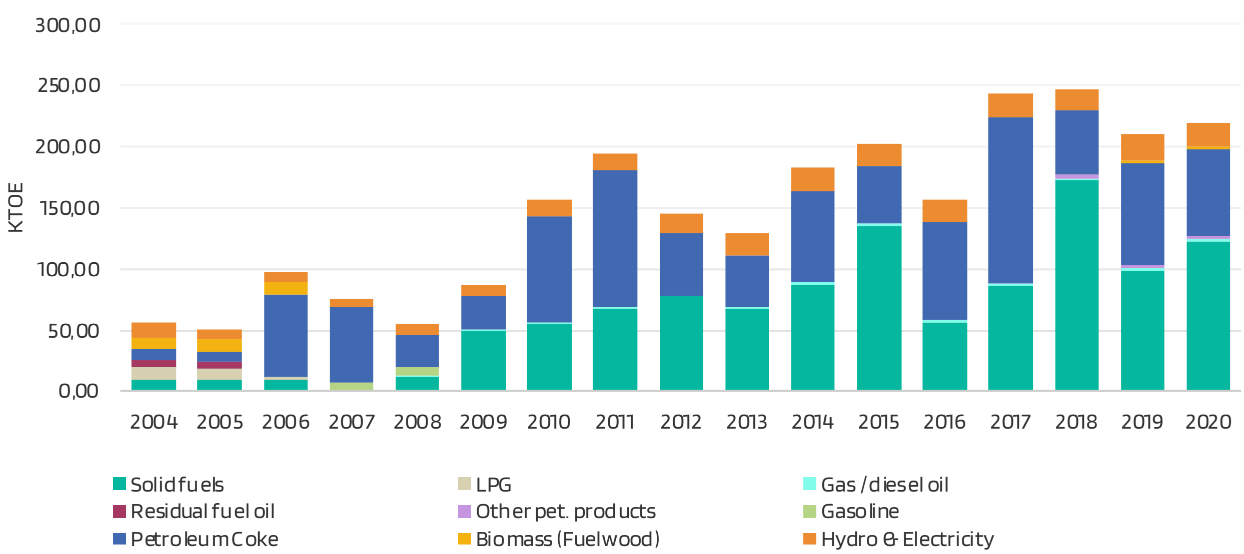
The main fuels used for producing building materials and cement are coal and petroleum coke, resulting in high emissions. According to the First Biennial Update Report of Albania to the UNFCCC (2021), between 2009 and 2016, cement production in Albania accounted for more than 7% of the country's total emission.

Figure 11: Energy demand by industry sub-sector



Source: Data from Ministry of Infrastructure and Energy, Energy Balance 2004–2020

Figure 12: Energy demand of glass, pottery and building materials industries



4. ANALYSIS OF NDC AND ADDITIONAL NATIONAL STRATEGIES

The second methodological step is an analysis of energy efficiency targets, measures and activities included in the first NDC of 2015, the subsequently published national strategies, particularly the NES and the NECP, as well as the draft NDC of 2021. The findings of the analysis represent the basis for the enhancement of the NDC and recommendations on improving the alignment of the documents with the revised NDC 2021–2030, and steps towards their implementation. The methodology used to assess all policy documents consisted of the following steps:

1. Analysis of the applied methodology: for a better understand of the methodology used to assess the policy documents, the general methodological characteristics are described, and the baseline and more ambitious policy scenarios analysed. The three categories comprise several sub-elements that are described and analysed in the following sections:

a. General methodological characteristics:
i. Type of INDC (if applicable)
ii. Base year
iii. Greenhouse gases (GHG) covered
iv. Sectors covered
v. Applied models

b. Baseline scenario analysis:
i. Basic modelling assumptions
ii. Energy consumption per sector, and/or
iii. Energy-related GHG emissions per sector

c. Mitigation scenario:
i. Basic modelling assumptions
ii. List of additional measures and interventions
iii. Energy consumption per sector, and/or
iv. Energy-related GHG emissions per sector

2. In a second step, the current status of policy document implementation is analysed. In this step, the respective measures and interventions are screened according to their legal and technical implementation.

4.1. Summary of the analysis of key policy documents

The following short summaries are based on the comprehensive analysis of the state of implementation of these strategic documents carried out under the same Readiness Programme of the Green Climate Fund for the Ministry of Tourism and Environment of Albania "Enhancement of the existing NDC", Urban Research Institute (2021). To identify gaps, an overview of targets, measures and activities are particularly important and therefore highlighted in the following section.

4.1.1. NDC 2015

Albania's first NDC was published in 2015. Based on three models (PRIMES, SLED and LEAP), a baseline and a NDC scenario were generated to simulate supply and demand results based on various assumed parameters for the service, residential, industry, transport, agriculture, energy and electricity sectors until 2030.

The resulting GHG mitigation measures from the cost-benefit analysis for the NDC scenario are presented in the second column of the table below. The respective measures were based on suggestions in the National Energy Efficiency Action Plan and the Third National Communication. Additional mitigation measures for the transport and industry sectors were considered based on international experience, including the introduction of a 10% biofuel policy for the transport sector until 2030.

The selected measures from the NDC scenario led to the NDC's following emission reduction targets:

- Baseline scenario target: the country commits to reducing its CO_2 emissions by 11.5% compared to the baseline scenario between 2016 and 2030. This is equal to a reduction of 708,000 tonnes of CO_2 emission by 2030.
- CO_2 budget: Albania's emission trajectory envisions achieving a limit of 2 tonnes of GHG emissions per capita annually by 2050.
- Sectors covered: energy and industrial processes.

Table 2: Overview of NDC emissions reduction scenario for 2030

Sector	Measure according to INDC	CO_2 reduction (kt)	Cost of investment (EUR 000)	Source/assumptions
Residential & Service	Thermal insulation of family dwellings (wood, kerosene, LPG)	50[a]	21,000	TNC: Albania-specific cost data
Industry	Establishing most efficient boiler (fuel-like diesel and coal fired)	225[b]	15,000	TNC: GACMO model
	Transition from coal/oil to natural gas	52[c]	0	No additional costs for natural gas-fuelled vs. coal/oil-fuelled equipment; Natural gas is available to main industrial sites under the baseline
Transport	Increase efficiency of oil and diesel fleet with new technology; Road vehicles using alternative fuels (hybrid, EV, gas); Transition from private to public transport	116[d]	195,000	All cost-effective measures in transport MACC; Natural gas is available to vehicle depots at no additional cost for gas distribution (from EU data)
	Modal switch to biofuel by 10% in 2030	265	456,000	A 100 mln litre capacity biofuel plant costs USD 250 mln (from UK data)
Total		708[e]	687,000	

[a] 12,000 for wood; 37,000 for LPG; 1,000 for kerosene
[b] 128,000 for fuel; 97,000 for coal
[c] 5% of total emissions in the industry sector
[d] 3.6% of the 2030 BAU emission projection
[e] 11.5% compared to BAU

Source: Data from Ministry of Environment, 2015

4.1.2. National Energy Strategy

Albania's National Energy Strategy was published in 2018. Its goals, energy sector details and timeline are harmonized with several other strategic and legal documents that are in force, which were adopted or drafted within the same time frame as this document. In this regard, particularly the 1st, 2nd and 3rd Albanian Energy Efficiency Action Plan represent an important foundation for all energy efficiency elements of the NES. Based on LEAP-model simulations, the NES provides several scenarios that deviate from the baseline. Finally, a combined scenario consisting of an energy efficiency-, natural gas promotion-, renewable energy sources- and natural gas promotion scenario has been selected as the basis of the NES. The combined scenario results, inter alia, in the potential to reduce final energy demand by 19.4% and GHG emissions by 28% by 2030 compared to the baseline scenario, National Energy Strategy (2018). The strategy outlines various legal adjustments, market creations and mitigation activities. However, it is not entirely clear which activities have ultimately been included in the NES combined scenario, what precisely they entail and their overall contribution to emission reduction.

4.1.3. National Energy and Climate Action Plan

The NECP was published in 2021. It provides an overview of the current energy system and policy situation and sets out national objectives for each of the five dimensions of the Energy Union and the corresponding policies and measures to meet those objectives for the period 2021 to 2030. The 2030 targets cover energy efficiency, renewable energy and GHG emissions. The baseline of the modelling exercise (based on LEAP) is defined in the so-called "With Existing Measures (WEM)" scenario, which is broadly in line with the NES and the first NDC. It projects the energy system in the future if the policy landscape remains constant and no significant changes are made. The WEM scenario therefore serves as a reference to the alternative scenario "With Additional Measures (WAM)", taking account of new measures that were at the planning stage at the time of the projections were prepared. The WAM model results were compared to the national targets established and adopted in strategic documents. Finally, three targets where derived from the WAM scenario, building on the parameterization of policies and measures that were (or will be) introduced to meet the country's national targets by 2030. Table 3 provides an overview of the 2030 targets considered in the WAM scenario.

Finally, the table below presents key energy efficiency policies and measures (PaMs) affecting the national climate target 2030. The column on the right shows the scenario to which the respective policies and measures were allocated. Note that some of the PaMs have not been implemented in the modelling as they do not directly impact the energy system but are nonetheless important. Some of the PaMs have been implemented in combination with others. A separate analysis for each PaM in such cases is not possible.

Table 3: Policy targets for 2030 scenario with additional measures

Energy efficiency	Change in percentage	-15.5% relative to the NES baseline
	Final energy consumption	3,869 ktoe
Renewable energy	Percentage share	42% of total primary energy supply
GHG emissions	Change in percentage	-11.5% relative to the NES baseline
	Corresponding GHG emissions	6,559 kt CO_2eq (from energy use)

Source: Data from Fraunhofer ISI (2021), p. 9

Dimension	No.	PAM Code	PaM name	Type of PaM	Financial - investments
Dimension: Energy Efficiency	1 (25)	EE-O1	EE obligation scheme and alternative measures for Albania	Regulatory	Technical assistance (initial evaluation: EUR 10-20k)
	2 (26)	EE-L1	Implementation of minimum energy performance requirements in buildings	Regulatory	No overall budget calculated, (i) approx. EUR 0.3 mln for "New green businesses" in Tirana as state aid over two years; (ii) EUR 6.5 mln from KfW for "EE for the Student City"
	3 (27)	EE-L2	Long-term renovation strategy (for public and private buildings)	Regulatory; Financial; Information	EUR 1 mln
	4 (28)	EE-L3	Retrofitting central government public buildings (excluding municipal public buildings, etc.)	Investment; Regulatory	EUR 500 mln 2015-2030 for moderate scenario improvements, renovation costs for public buildings evaluated in SLED study of 2016
	5 (29)	EE-L4	Retrofitting public buildings (excluding central government public buildings)	Investment; Regulatory	Total investment costs for public building retrofits: EUR 1,800 mln 2015–2030
	6 (30)	EE-L5	Financial support schemes for EE in private sector buildings	Financial; Fiscal	Private sector buildings, including residential, needs to be estimated
	7 (31)	EE-S1	Uptake of ESCO models	Regulatory; Financial	No budget calculated
	8 (32)	EE-P1	EE measures for public purchases	Regulatory	No budget currently calculated
	9 (33)	EE-P2	Implementation and reporting of municipal EE action plans	Regulatory; Educational	EUR 45,000 for technical assistance, preliminary budget
	10 (34)	EE-E1	Energy audits for large energy consumers in the industrial sector	Regulatory; Organizational	Energy audit costs expected to be evaluated
	11 (35)	EE-E2	Energy management systems for SMEs	Regulatory; Organizational	EUR 3 mln, considering the multiannual support
	12 (36)	EE-C1	Energy labelling and eco-design requirements	Regulatory; Information	EUR 70 mln
	13 (37)	EE-T1	Energy labelling of new cars	Information; Educational	EUR 2 mln

	Assumptions/Source:	Scenario	Mitigation potential (kt CO_2eq)	Included in the 1st NDC?	Included in the 2nd NDC?
	Reduction in energy consumption for domestic appliances increases to 20% (2050) / n/a	WAM	n.a.	n.a.	n.a.
	Energy intensity in heating, cooling and water heating in the residential sector / SLED study and EC studies on EPBD (with EE-L3)	WAM	n.a.	n.a.	n.a.
	Reduction in energy intensity of public administration, education and health sectors / n/a	WAM	n.a.	n.a.	n.a.
	Energy intensity in heating, cooling and water heating in the residential sector / SLED study of 2015 and EC studies on EPBD (with EE-L1)	WAM	n.a.	n.a.	n.a.
	n/a, unclear whether included in LEAP model	WAM	n.a.	n.a.	n.a.
	n/a, unclear whether included in LEAP model	WAM	n.a.	n.a.	n.a.
	Implicit	WAM	n.a.	n.a.	n.a.
	Public administration's final energy intensity reduced / n/a	WAM	n.a.	n.a.	n.a.
	Implicit	WAM	n.a.	n.a.	n.a.
	Increases the industrial EE gain in WAM to 0.3% p.a. from 0.1% in WEM, starting in 2023 / n/a	WAM	n.a.	n.a.	n.a.
	EE gains to 0.2% for 2021, 2022, part of EE-E1 thereafter, (with EE-E1)	WAM	n.a.	n.a.	n.a.
	Energy intensity for domestic appliances down to 50% (2050) compared to 2020 levels. Source: CHEETAH project, deliverable 5.3	WAM	3	n.a.	n.a.
	Prerequisite for EE-T2 and EE-T3, not explicitly implemented / n/a	WAM	-38,7	n.a.	n.a.

	No.	PAM Code	PaM name	Type of PaM	Financial - investments
Dimension: Energy Efficiency	14 (38)	EE-T2	Increase the share of EVs in the national car fleet	Regulatory; Financial; Fiscal	Approx. EUR 5 mln for charging infrastructure, approx. EUR 0.5 mln to upgrade taxi fleet with hybrid or EVs
	15 (39)	EE-T3	Support mechanisms for EE and clean vehicles	Regulatory; Financial; Fiscal	To achieve the target of 15.5% for EE by 2030 (460 ktoe) the required investment is estimated at approx. EUR 228 mln
	16 (40)	EE-T4	Increase the share of public transport for passengers and freight: roads, railways and waterways	Regulatory	No single value, several projects are related to several interventions for the transport system

Source: Data from National Energy and Climate Plan (2021)

4.1.4. NDC 2021

The revised NDC 2021–2030 provides aggregated values for energy consumption and efficiency impacts per sector only. A detailed list of underlying activities is missing. It is therefore assumed that the enhanced NDC is based on all elements of the National Energy Strategy for Albania pub-lished in 2018, including the underlying first, second and third National Energy Efficiency Action Plan as well as additional energy-related policy documents (compare with NDC 2021, p. 15f). The revised NDC stipulates that the Combined Scenario of the LEAP model is applied, including elements of the Energy Efficiency, Renewable Energy and Natural Gas Promotion scenarios. Emissions for the NDC scenario (with mitigation measures) increase from 4,664 kt CO_2e in 2016 to 6,544 kt CO_2e in 2030 (+40.3%). The difference in 2030 to the BAU scenario is -1,921 kt CO_2e, a mitigation impact of -22.7%. This is in line with the NES.

4.2. Potential additional measures for enhancing NDC

Step 3 of the methodology identifies gaps and the potential for more ambitious energy savings and emission reductions based on the analysis of Albania's energy profile and related driving factors as well as the country's key energy policy documents. This gap analysis revealed that additional climate policy measures should be developed for the following (sub)sectors:

- Transportation: Nearly all overland passenger transportation in Albania relies on motorized traffic, i.e. predominantly cars and buses (compare section 3.2.2). In this context, the National Energy and Climate Plan suggests "the promotion and supporting the use of alternative/clean fuels and energy efficiency vehicle as ways to produce the most significant effects by reducing energy consumption and mainly the reduction of GHG emission through supporting schemes of efficient vehicles and green ones" (NECP, p. 100–102). It further recommends "Supporting by regulatory framework, technical, financial mechanisms the increase of the share of public transportation due to environmentally and economically issues". Since the NES and the NDC enhancement do not specifically stipulate the strengthening of clean fuel for passenger cars and buses, the introduction of electric cars and buses is considered two separate additional measures for a subsequent NDC update.

	Assumptions/Source:	Scenario	Mitigation potential (kt CO_2eq)	Included in the 1st NDC?	Included in the 2nd NDC?
	Share of EV cars, motorcycles increase to 5% in 2030, 30% in 2050 starting from WEM in 2023 / n/a	WAM	-169,6	n.a.	n.a.
	Share of vehicle usage, starting from WEM in 2023, hydrogen use starts 2030; Car - Hybrid gasoline, starting from WEM auto growth, reaching 8% in 2030, 15% in 2030, 33% in 2050; Bus - EV, hybrid gasoline 5% in 2030; 30% in 2050, hydrogen 15% in 2050; Truck - Hydrogen, hybrid gasoline 15% in 2050 / n/a	WEM	n.a.	n.a.	n.a.
	Not explicitly implemented; "Autonomous WEM"[1] expects a considerable increase in hybrid cars / n/a	WEM	n.a.	n.a.	n.a.

- Cement industry: The technical document of INDC (2015) considered clinker replacement as one potential option (see Government of Albania, 2015, p. 29). However, this option was discarded for the final selection of NDC measures, probably due to higher mitigation costs compared to other assessed options. As the mitigation potential of clinker replacement is considerable and the associated abatement costs of an estimated USD 8/tCO_2e are highly competitive, this option has been added to the recommended additional measures.

- Residential cooking: As analysed in section 3.2.1, residential cooking consumes a comparably high share of energy, including the unsustainable use of biomass, leading to increased deforestation. Despite these driving factors, neither the NDC nor NES or NECP address this challenge. Since mature technologies to reduce energy demand and to switch from fuel to carbon-free electricity are available, promoting efficient electric cooking stoves has been considered as an additional measure to enhance Albania's NDC.

- District heating: With reference to the Third National Communication, the technical document of the first NDC 2016 considered district heating to be an appropriate measure for the building industry. Its mitigation potential was estimated at around 38 kt CO_2e per year by 2030. However, the measure was excluded from the final list of activities and has not been considered by the enhanced NDC or NES. Due to the high energy consumption of heating in cities with high density residential areas (compare the analysis in section 3.2.1), solutions such as renewable district heating systems will be essential to reduce local pollutants and GHG emissions. Thus, this option has been considered as an additional measure to enhance Albania's NDC.

1 The autonomous WEM scenario is the technical baseline without any policies.

5. RECOMMENDATIONS OF ADDITIONAL ENERGY EFFICIENCY MEASURES 2021-2030

In accordance with step 4 of the methodology, the following section describes the selected additional energy efficiency measures identified and discussed with stakeholders to further enhance Albania's NDC.

5.1. Energy efficiency measures for ambitious GHG emission reduction target

5.1.1. Promote low-carbon transportation through electrification

Since Albania generates over 98% of its electricity from hydroelectric power, electric mobility is a promising measure for GHG emission mitigation. Due to the low grid emission factor, the level of emissions from an electric car is equivalent to obtaining a fuel efficiency of 0.05 l/100km. However, despite the environmental benefits, the number of electric vehicles (EVs) in Albania is still very limited, Global Environment Facility (2020), page 11. Albania considered promoting electric vehicles in the technical assessment of its 2015 NDC, but ultimately discarded this option due to the high marginal abatement costs at the time. Since then, global digression rates for the purchase and operation of EVs have increased the attractiveness of EVs, and several studies expect total cost of ownership parity between combustion engine cars and EVs to be reached sometime between 2025 and 2030, such as Arthur D. Little (2016). Several policies actively foster the distribution of EVs, e.g. the EU Commission has set ambitious targets for zero-carbon vehicles and anticipates a total phasing out of all combustion-based cars by 2035, having regard to the proposal from the European Commission (2021). [2]

Type of measures: Regulatory, financial, incentive, informational-educational

Based on European standards,[3] there is already an incentive to electrify part of the national fleet. The Government of Albania has already introduced a number of incentives that promote electric vehicles: (i) No "first-time registration fee" for new vehicles; (ii) No vehicle tax for the first 5 years; (iii) VAT exemption (20%) for electric vehicles; (iv) Exemption from VAT for new vehicles with an electric motor to encourage individuals and businesses to purchase such vehicles; and (v) Free travel on toll roads, in the National Energy and Climate Plan (2021), page 100.

To accelerate the adoption of EVs at the national level even further, a package of additional measures could be implemented to encourage the purchase and use of electric cars in Albania:

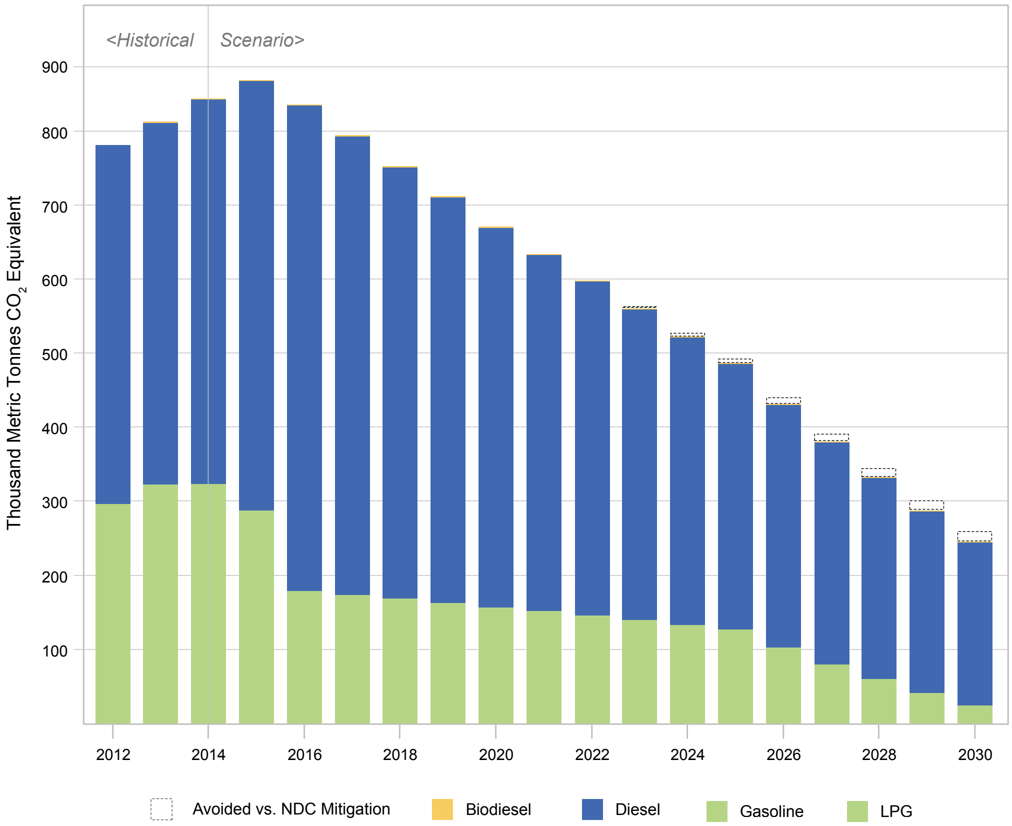
- A conducive regulatory ecosystem for EVs;
- A purchase grant for EVs;
- Attractive loans with e.g. low interest rates for EVs;
- A programme to foster the installation of charging stations in public areas;
- A grant to support the installation of home chargers for buyers of EVs;
- A public awareness campaign; and
- Promotion of EVs among fleet operators, such as taxis, public services, commercial vehicle fleets.

Car sales are low in Albania; less than 1% annually of the total car fleet was newly introduced to the market between 2013 and 2019. While average sales increased slightly, the NES expects an overall decrease of person kilometres by cars. Therefore, even ambitious EV penetration rates (it is assumed that 24% of new registered cars will be plug-in hybrid and 18% battery electric cars by 2030) would only slightly increase the share of EVs in total car volume by 2030 (see also summary in Annex 1). Considering the introduction of EVs in 2022, the calculations expect EVs to account for 1% of total car passenger-kms by 2025, and 3% by 2030. This could consequently save approx. 14 kt CO_2e/a until 2030.

2 The EU envisages strong growth rates of EVs to at least 30 million zero-emission vehicles by 2030, representing a share of about 40% battery electric vehicles among all new registered vehicles by 2030.

3 CO_2 standards for passenger cars and light utility vans 2020/2025/2030, CO2 standards for freight transport.

Figure 13: Direct GHG emissions from road vehicles until 2030: Enhanced NDC Scenario



5.1.2. Low-carbon e-bus programme

At present, Albania's bus fleet is dominated by aged diesel vehicles. Statistical data from Tare (2018) show that most buses are 11-20 years old. In the total stock of buses, 37% are over 20 years old, 49% are 11-20 years old, and only 3% are 0-5 years old. The bus fleets' high emission factors and energy consumption represent a major environmental, economic and social problem. At the same time, cities and public transport are often frontrunners of innovative transport technologies, including electric buses (e-buses). Thus, e-buses are becoming increasingly common and competitive. The ongoing decline in battery costs has brought electric buses closer to cost parity with other bus technologies; in many cases, they are already the cheapest option in terms of total cost of ownership, as according to International Energy Agency (2020). To date, there have only been isolated initiatives to electrify public transport in Albania. A small number of municipalities and bus transport companies (e.g. in Tirana) have introduced e-buses into their fleet or plan to do so in the near future. E-buses still account for a very small share of Albania's municipal transport fleet but with zero tailpipe emissions and low operational costs, they can help municipalities and communities address local noise and air quality issues, and reduce GHG emissions when the grid is based on low-carbon technologies – which is the case for Albania with its strong hydro share.

Type of measure: Regulatory, financial, incentive
The main objective of the proposed "Low-carbon e-bus programme" is a nationwide shift from diesel buses to e-buses. The programme will bundle scattered e-bus initiatives and enable a nationwide introduction of e-buses through the following components:

- Component 1: Strengthen the policy, regulatory and institutional framework to promote, plan and coordinate sustainable public transportation based on electric mobility;
- Component 2: Investment in and construction of public e-bus infrastructure to facilitate sustainable transportation;
- Component 3: Investments in and promotion of sustainable public transportation operating assets through a long-term financial mechanism for private actors.

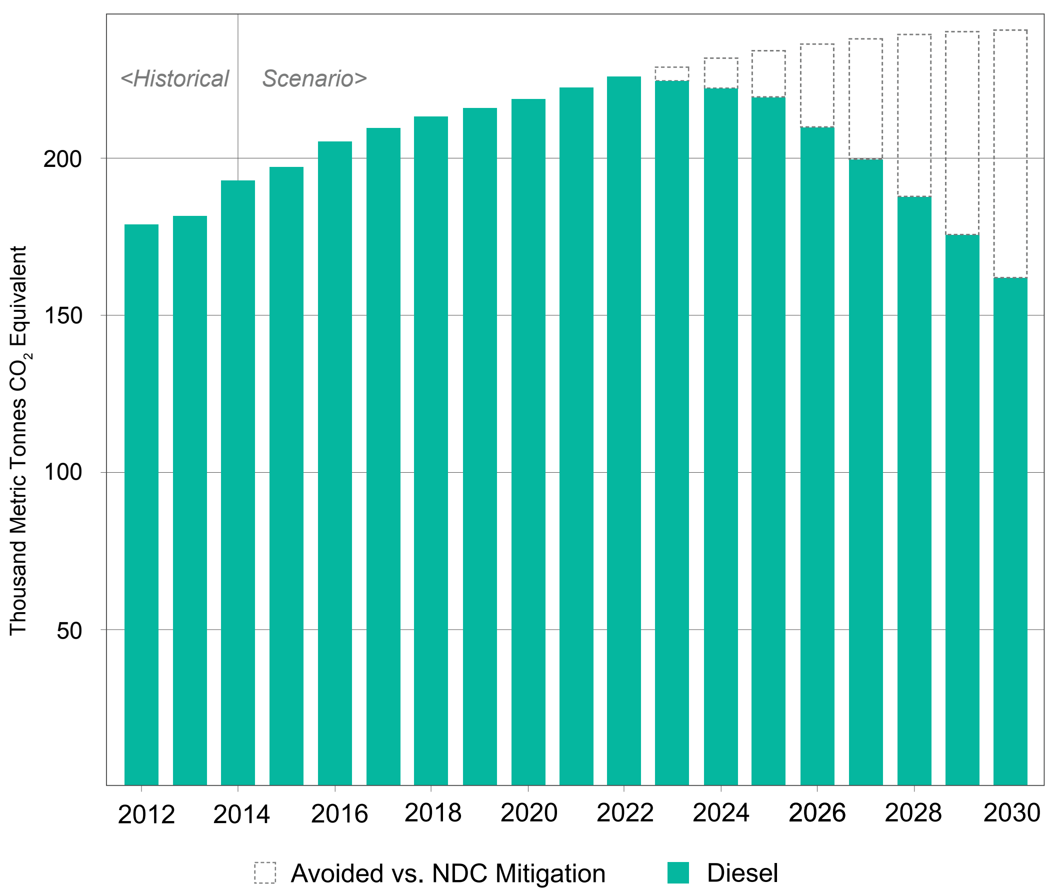
E-bus implementation proposals around the globe suggest ambitious targets of up to 100% of all new buses to be electric by 2030. Since Albania has not yet started to introduce e-bus promotion programmes at a large scale, widespread uptake is expected for 2022. The calculations for the forthcoming decade predict that e-buses will represent 5% of total bus passenger-kms by 2025, and 23% by 2030. This could consequently save approx. 80 kt CO_2e/a in 2030.

5.1.3. Promoting low-carbon development of the cement industry

The construction and infrastructure industry in Albania is expected to grow further in the future, resulting in higher demand for building materials such as cement. The country's cement production increased rapidly from 2010–2012 after a new cement plant opened in 2010 (Antea Cement Plant), transforming the country from a net importer to a net exporter of cement. As reported in First Biennial Update Report of Albania to the UNFCCC (2021), Albania's cement production amounts to approx. 2 Mt/year, which corresponds to annual GHG emissions of up to 1.6 MtCO_2. Cement production accounted for approx. 7.40% of total emissions in Albania in 2016, reporting an increase of 12% between 2009 and 2016. CO_2 emissions in the cement industry originate primarily from the decarbonization of calcined limestone to produce clinker (ca. 60% of CO_2 emissions) and from the combustion of fuel used for the calcination of limestone (ca. 40%). Emissions resulting from the calcination of limestone (process emissions) are the consequence of a chemical process inherent in production, and it is very difficult to reduce them. Nearly 90% of GHG emissions from industrial processes in Albania originate from cement production. On the other hand, emissions from fuel combustion depend on the type of fuel and are more feasible to manage.

Cement and clinker production is an energy-intensive process that consumes a significant amount of both thermal and electrical energy. The integrated cement plants in Albania consume mainly solid fuels—lignite and bituminous coal—for clinker production. To significantly decrease fossil fuel consumption and the resultant CO_2 emissions, various types of mitigation levers exist, e.g. the use of waste as alternative fuels with lower emission factors compared to fossil fuels to

Figure 14: Direct GHG emissions from buses until 2030: Enhanced NDC Scenario



substitute part of the needed thermal energy.

There are currently four facilities that produce cement and clinker in Albania, namely two integrated plants and two grinding plants.

There are plans to promote low-carbon development in the cement industry, as formulated in the Nationally Appropriate Mitigation Action – Replacing Fossil Fuels with Non-hazardous Waste in the Albanian Cement Industry (2015 – 2020).

Type of measure: Regulatory, financial, incentive

Description of measure: A sectoral low-carbon development roadmap for the Albanian cement industry should identify the political and technical measures needed to reduce the current emissions from:

- All process emissions from the fuel used to manufacture clinker, and all emissions emitted from the cement plant's facilities. The kilns in Albania are already dry kiln and relatively new and efficient. Energy efficiency gains from reduced mechanical and thermal losses (insulation / preheating) and recovering thermal losses (e.g. CHP) need to be investigated. There is strong potential for the use of alternative fuels (e.g. waste and biomass) through cogeneration.
- Emissions related to the electrical energy consumed in the production of external energy and that depend on the type of energy matrix from which said electrical energy is obtained.
- Product mix: increase the share of products that require less CO_2 with a higher share of substitutes to reduce the proportion of clinker in cement (it is estimated that mainly Portland cement with up to 95% clinker is currently being produced in Albania).

The most promising mitigation levers comprise the following (depending on the individual plant and facility characteristics):

1. Alternative fuels and sustainable near-zero biofuels: Emissions can be considerably reduced by substituting conventionally used fossil fuels with more sustainable fuels such as waste and biomass. Technically, a clinker kiln could be fed with 100% alternative fuels, albeit with some efficiency losses related to heat transfer and increased energy demand for the drying of biomass. The EU's cement industry is the world leader in terms of alternative fuel substitution rates, with an average substitution rate of about 60%, and some plants reaching 95%, according to ECRA (2017). For Albania, the potential availability and competitiveness of sustainable biomass and biogenic waste need to be investigated. There are some barriers to the use of alternative fuels (biomass and waste) owing to the country's waste management practices, as waste is currently not properly separated in different collection bins in Albania. At present, bituminous coal, lignite and petroleum coke are being used as fuel; biomass and waste are currently not being used to a larger extent, but test and feasibility studies are underway (e.g. at the Antea plant). NewClimate (2020) provides

Table 5: Cement and clinker production facilities

Plant/company name	Type	Capacity	Main fuel type	Commissioning years	Location
Antea Cement Sh.A (Titan Group/IFC)	Integrated plant	Cement: 1,400 kt/year Clinker: 3,300 t/day	Approx. 80% bituminous coal, 20% petroleum coke	2010	Boka e Kuqe, Burizanë, 50 km north of Tirana
Colacem Albania Sh.p.k. (Colacem S.p.A.)	Grinding plant	Cement: 500 kt/year	-	2009	Balldre, Lezhë, northwestern Albania
Fushë Krujë Cement Factory Sh.p.k. (Seament Holding)	Integrated plant	Cement: 1,330 kt/year Clinker: 4.000 t/day	Approx. 44% bituminous coal, 56% lignite coal	2007	Fushë Krujë, 35 km north of Tirana
Elbasan Cement Plant (Seament Holding)	Grinding plant	Cement: 300 kt/year	-	1975	Elbasan, central Albania

Source: Data for Antea Cement sh.a on capacity from Titan Antea Cement sh.a. (2021) and on main fuel type from South East Europe Sustainable Energy Policy (2015). Data for Colacem Albania sh.p.k. from Colacem, 2021. Data for Fushë Krujë Cement Factory sh.p.k. on cement capacity from Hastorun and Chung (2020) and on clinker capacity from Global cement (2019), on main fuel type from South East Europe Sustainable Energy Policy (2015). Data for Elbasan Cement Plant from Industry About, 2021.

argument that the European cement industry is expected to achieve an average substitution rate of 70% by 2040, with 50% biomass and 20% waste.With moderate effort, a 20% use of substitutes could be realized in Albania by 2030. As outlined in the NAMA on Replacing Fossil Fuels with Non-hazardous Waste in the Albanian Cement Industry, four key components need to be implemented: 1) Study technological options and feasibility of using municipal solid waste as an alternative fuel in the cement industry; 2) Invest in recycling centres in municipalities; 3) Operate recycling and waste centres, and 4) Build capacity in relevant sections of the waste management system.[4]

2. Supplementary cementitious materials (SCMs) such as natural pozzolans and calcined clays: The clinker-to-cement ratio in the EU averaged 77% in 2017, as in GCCA (2018). Along with the phasing out of coal, the supply of traditional SCMs such as fly ash and granulated blast furnace slag will decrease. To maintain and further improve the clinker-to-cement ratio, new SCMs should be considered. There are several promising alternatives with differing global and regional availability. Calcined clay and natural pozzolanas are such examples. Calcined clay is particularly interesting as it is abundantly available and could substitute up to 50% cement. An average clinker-to-cement ratio of 60% is expected in the EU's cement industry by 2050, argumented in NewClimate (2020). In Albania, the level of potential substitution varies depending on the availability of SCMs and different end-uses of cement. Albania's cement industry presently lags far behind the global goal of 30% clinker substitution by 2030, which is the proposed minimum target.

3. Best available technology for newly assembled energy-efficient cement installations: The past three decades have witnessed a significant improvement in the energy efficiency of clinker kilns, leading to a near complete phasing out of wet kilns in the current EU technology stock. In 2018, almost 50% of the kiln in the EU were dry kilns of BAT standard and the percentage of wet kilns was low. Clinker kilns in Albania are dry kilns. Further room for improvement needs to be investigated at the plant level in Albania. NewClimate (2020) expects that an additional 12% energy efficiency can be achieved in the EU by 2040. This is based on the current EU average of 3,680 MJ/t clinker (2018), which could be improved to 3,150-3,215 MJ/t clinker in the long term, according to ECRA (2017) and GCCA (2018). This level of energy consumption should be the benchmark for Albania. The integrated plants are relatively modern in terms of air emission reduction, e.g. ANTEA operates according to BAT, as explained in Titan Antea Cement (2018), which is in alignment with the Industrial Emissions Directive 2010/75/EU, i.e. the overall efficiency can be assumed to be high, based also on.

4. Material intensity reduction through optimized or alternative design choices, cement and concrete recycling, and advanced fillers and admixtures: The cheapest and most efficient way to reduce emissions is to avoid cement production. Several demand-side measures are available to reduce the primary demand for cement, e.g. cement can be substituted with alternative materials such as wood in buildings and recycled concrete in road infrastructure. The material intensity of cement can be improved through optimized design and increased use of fillers. For Europe, it is expected that 30% of building materials and road infrastructure could be substituted with alternative materials by 2050, while 10%-35% of demand could be reduced through smart design and manufacturing.

These measures have the potential of reducing up to 30% of energy-related GHG emissions in 2030, which corresponds to approximately 10% of the cement industry's annual emissions (in comparison to NDC / "Combined" scenario).

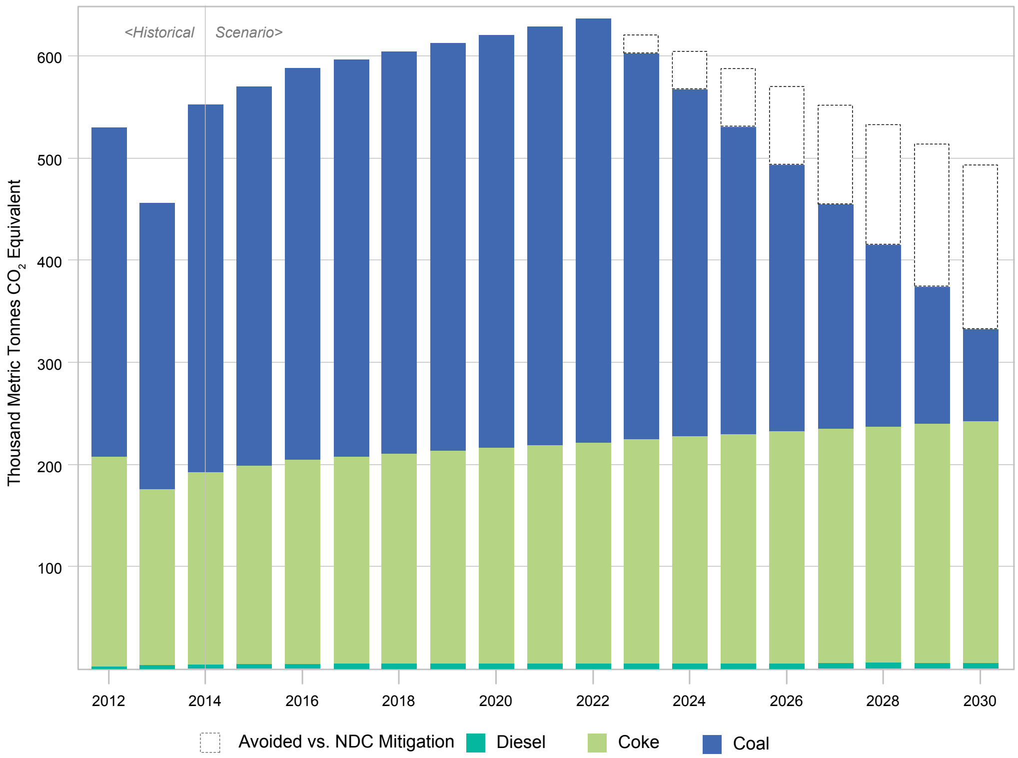
5.1.4. Promoting efficient electric cooking stoves in residential sector

A large share of energy demand for cooking is currently being met by LPG and wood. According to Eurostat, the final energy consumption of households (for cooking) in Albania amounted to approx. 5,700 TJ (1560 GWh/a) in 2019. 39% of energy demand is met by LPG, biomass and fuelwood contribute 33% and the remaining 28% is met by electricity (for electric stoves), (EUROSTAT, 2021). Due to the penetration of more efficient and convenient electrical cooking stoves and the low price of electricity, it is likely that a fuel switch will also take place for cooking but should be further incentivized and promoted. According to Albania's INDC submission (Kelemen et. al., 2015), cooking is responsible for an unusually high share of final energy consumption in Albania compared to the European average, meaning that the impact of this fuel switch will be significant.

The continued use of outdated wood stoves results in high levels of indoor air pollution and consequently in

4 Compare with Annex 1 of the Third National Communication of the Republic of Albania to the UNFCCC 2016.

Figure 15: Direct GHG emissions from cement industry until 2030: Enhanced NDC Scenario



high rates of respiratory disease (Novikova et. al., 2015); following on the same argument, cutting down Albanian forests for residential heating and cooking purposes leads to numerous environmental problems, such as deforestation, biodiversity loss, air pollution and soil degradation. If no new forests are planted, there is no compensation for the GHG emissions released by the burning of this biomass. In addition to the high costs related to the use of LPG, conventional fuels are hazardous to public health and the environment.

Type of measure: Regulatory, incentive, awareness raising

Description of measure: In the residential sector, a switch in cooking systems towards higher electrification can lead to a further decrease of direct emissions. Different strategies and measures to incentivize stove changeover (from LPG to electric) should be explored to promote the shift from LPG and wood-fired cooking stoves to modern electrical devices:

- Improving the power supply in rural areas by promoting energy-efficient stoves, solar systems and solar boilers, and installing electricity connections in houses;
- Supporting national energy initiatives and the development of local markets, incl. negotiations with local appliance manufacturers to include induction stoves in their product lines and the promotion of locally / regionally manufactured stoves through "showroom" events for capacity and awareness building;
- Raising awareness among potential energy users, and training installation and maintenance staff; and
- Creating incentive systems for sales and demand, incl. providing financial incentives, such as cash incentives for LPG stove trade-in; increased taxes on LPG and LPG stoves (Gould et. al., 2018).

In 2014 25% of Albanian households used LPG stoves and 40% used wood stoves for cooking; the remainder used electric stoves. All households have only one type of cooking device. It is assumed that the share of Albanian households using LPG stoves can be decreased to only 12.5% by 2030 by introducing the above-mentioned incentives for stove changeover. As efficient electric stoves (for instance, induction stoves) will also be promoted in rural parts of Albania over the next years, the share of wood stoves can be significantly reduced to only 12% in 2030. It is assumed that 50% of Albanian households will use efficient electric stoves by 2030.

The measures have the potential to reduce up to 18% of the residential sector's energy-related GHG emissions in 2030 (in comparison to "Combined" scenario).

5.1.5 District and local heating systems in new districts in urban areas

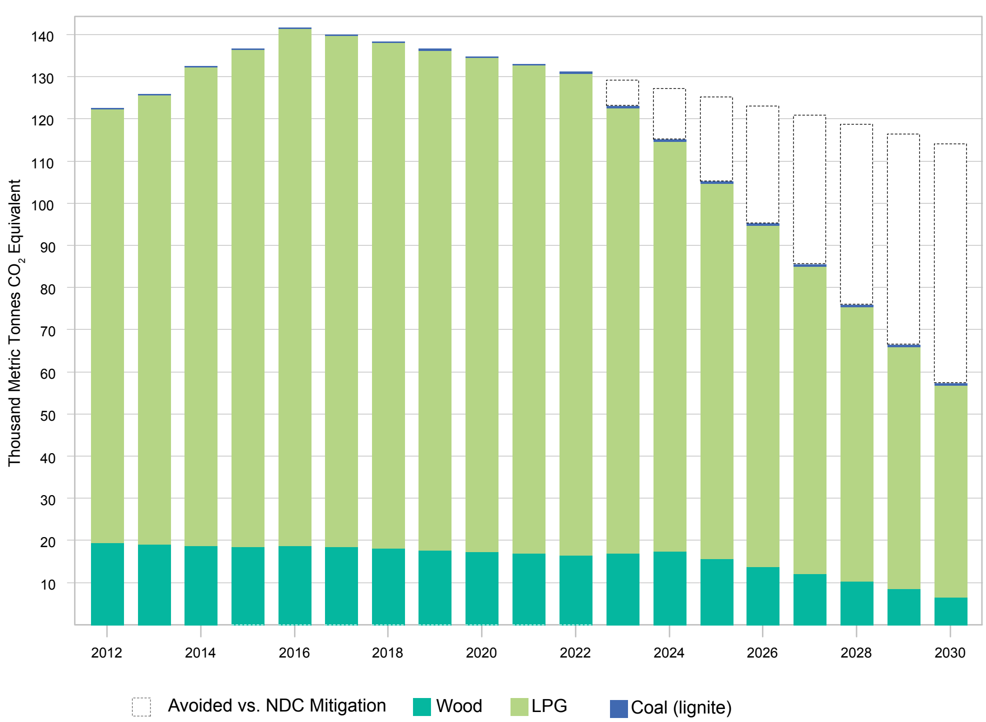
Albanian homes are only partially heated for just a few hours a day, while the continued use of outdated woodstoves results in numerous environmental and health problems. Corresponding to the main energy sources, stoves are the most widely used heating systems (63%), followed by electric heaters (8.5%) and air heat pumps (air conditioners) (6%). Only 3% of private households have central heating (building or dwelling heating), while 4% have a fireplace (Novikova et. al., 2015). Even where a central heating system has been installed, there is a lack of metering and controls to adjust temperature levels. Half of the households in urban areas use stoves fuelled by wood or gas. Electric heaters, heat pumps and other types of heating each account for about 10% in households (Novikova et. al., 2015).

No extensive district heating or cooling systems have been installed in Albania. Following the report of Energy Community on Albania (2021), draft amendments of the Albanian law on energy efficiency envisage obligations to assess the country's high-efficiency cogeneration and efficient district heating and cooling potential. In National Energy Efficiency Action Plan of Albania, 2nd and 3rd (2015), it is estimated that there are over 20 smaller district heating systems and seven CHP units in operation in Albania. These, however, are mostly very small operations supplying large individual public buildings or a few flats, and their combined market share in the supply of heat is negligible. This is despite the fact that several regions in Albania have cold climates and high building densities that offer strong potential for local communal solutions. According to the draft NECP, Albania's power supply is currently based exclusively on hydropower, with solar power plants projected to be included in the existing measures until 2040. There is no fossil-fuelled power plant in operation and no electricity generation from biomass. Cogeneration of heat and electricity in existing plants is therefore not an option and no district heating networks are currently planned. However, the potential for such networks exists in larger agglomerations. Even though industries that could provide a source for district heating (cement, iron and steel, ferro-alloy production) are limited, there is general potential for district heating, as the use of fuel wood for heating is high in older buildings, which are covered by an extensive reconstruction scheme (National Energy and Climate Plan, 2021). The Third National Communication estimates the po-tential for district heating at 14 MW and for central heating at 13 MW by 2030.

Type of measure: Regulatory, incentives, awareness raising

Description of measure: As with the Building Renovation Strategy, a review of the potential for high-efficiency cogeneration and efficient district heating

Figure 16: Direct GHG emissions from cooking until 2030: Enhanced NDC Scenario



and cooling for Albania has yet to be developed. Some of the root causes and barriers preventing the modernization of buildings and energy supply are:

1. Access to finance;
2. High energy consumption due to low energy standards;
3. Institutional coordination;
4. Limited public funds / budget for investments in EE Lack of trained / qualified staff. Similar to other countries in the Balkan region, such as in Serbia, the utilization of district, local and central heating should be promoted through a strategy to facilitate the de-risking of low carbon investment in buildings' energy supply, creating supply and demand for energy-efficient building technologies to improve the enabling environment, increasing the supply and enhancing the demand for EE investments:

- A regulatory framework (incl. energy pricing reform, enhanced energy auditing), e.g. increasing the energy performance of buildings, is a necessary precondition for transition to consumption-based billing in district heating systems;
- Setting up a financial support mechanism and innovative business models, e.g. for energy service companies (ESCOs);
- Demonstration project-selected municipalities, e.g. EE and heating systems based on renewable energies, voluntary agreements with large consumers and the associated required audits they must undertake, will support the implementation of CHP in this sector where such audits identify it as a cost-effective solution; and Capacity-building / training.

The district and local heating systems can lead to reduced energy consumption in residential buildings, and to a switch from fossil fuel-based heating (and cooling) appliances to renewable energy with a significant contribution to mitigation, reducing CO_2 emissions by up to 40% in covered buildings/ municipalities.

5.2. Energy and GHG emission reduction potential 2021–2030

In accordance with step 5 of the methodology, this section summarizes the impact of all proposed additional energy efficiency measures. The following table aggregates the quantified results and presents a package that can be integrated into the main document of the NDC, leading to increased energy savings and GHG emissions compared to the NES baseline (compare NES 2018, p. 17).

Table 6: Aggregated results of all proposed measures

Proposed measure	Energy savings potential in 2030 (GJ/a)[5]	Cumulative energy savings until 2030 (GJ)	Emission reduction potential in 2030 (kt CO_2e)	Cumulative emission reduction potential until 2030 (kt CO_2e)
Increased market penetration of EV passenger cars	135,000	700,000	14	70
Low-carbon e-bus programme	785,000	2,940,000	80	290
Low-carbon development of cement industry	-	-	160	700
Promote efficient electric cooking stoves (in the residential sector)	270,000	790,000	60	250
District and local heating systems in new districts in urban areas	-	-	57	-
Aggregated results	1,190,000	4,430,000	371	1,310
Results baseline scenario NES	162,000,000		7,411	
% of reduction potential against NES baseline	1%		5%	

5 Due to data availability limitations, modelling of the energy demand changes for M 03 and M 05 was not possible in the LEAP model.

Summing up, the proposed measures have the potential to decrease energy demand / increase energy efficiency by about 1% and reduce emissions by around 5% compared to the baseline scenario of the NES.

The following figures summarize the comparison of emissions reduction potentials of the NES "Recommended Development" scenario (compare NES, 2018, p. 23) with the "NDC Enhanced" scenario (with proposed measures by the authors), i.e. indicating the additional emission reduction potential estimated for the five measures described above.

In total, an additional 5% emission reduction could be achieved compared to the baseline

5.3. Recommendations on the enhancement of the NDC 2021-2030

It is recommended for the Government of Albania, specifically the Ministry for Energy to regularly take stock of sectoral EE and mitigation activities to achieve the targets of the NDC. This could be embedded in the Annual Report under the Energy Efficiency Directive prepared by the Agency for Energy Efficiency. Those areas of action not covered or less ambitiously pursued in the current NDC, such as the additional proposed measures, should be included in future revisions. In the meantime, the measures could be put forward as part of the NDC Action Plan with the perspective of enhanced NDC ambition in the future. In this respect, the opportunities and challenges for enhanced EE under the NDC and beyond should be identified. This will provide a basis for developing a roadmap for implementing and integrating GHG emission mitigation from EE into the NDC as part of the NDC Action Plan.

Figure 17: Direct GHG emissions for energy demand sectors 2012–2014 and projected 2015–2030

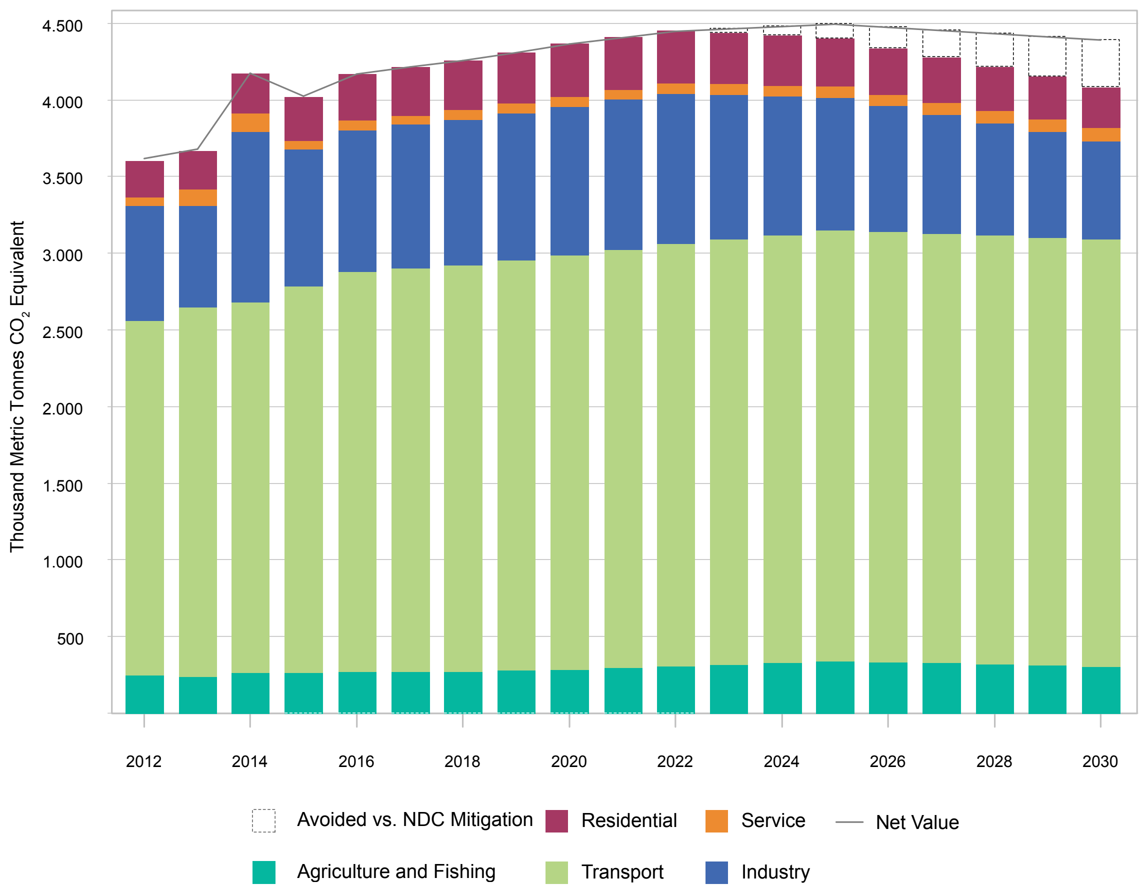
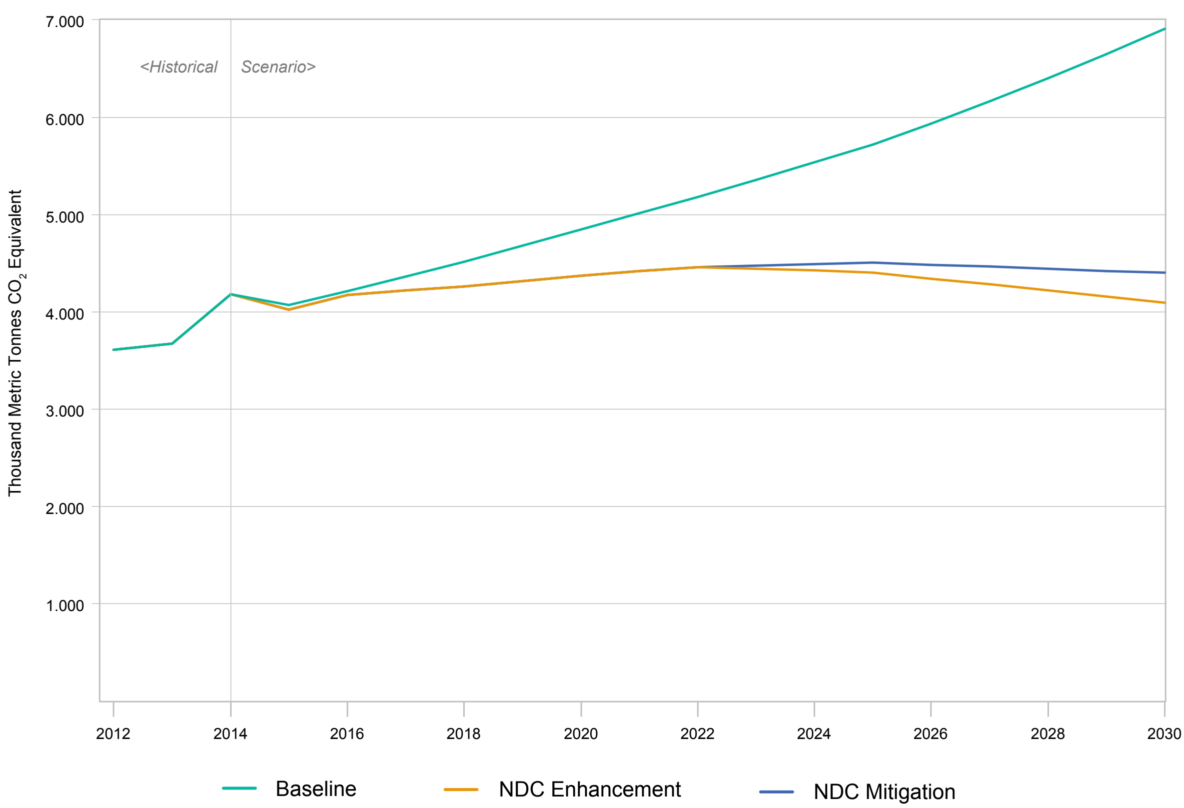


Figure 18: Emission pathways until 2030



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ANNEX 1:

Summary of the additional energy efficiency measures

RESIDENTIAL SECTOR

<table>
<tr><th>No.</th><th colspan="4">Name of measure/activity: Promoting efficient electric cooking stoves (in residential sector)</th></tr>
<tr><td rowspan="3">M 04</td><td colspan="4"> Rationale: A large share of energy demand for cooking is currently met by LPG and wood. According to Eurostat, the final energy consumption of households (for cooking) in Albania amounted to approx. 5,700 TJ (1560 GWh/a) in 2019. 39% of energy demand is met by LPG, biomass and fuelwood contribute 33% and the remaining 28% is met by electricity (for electric stoves).[1] Due to the penetration of more efficient and convenient electric cooking stoves and the low price of electricity, it is likely that a fuel switch will also take place for cooking but should be further incentivized and promoted. According to Albania's INDC submission (Kelemen et al., 2015), cooking is responsible for an unusually high share of final energy consumption in Albania compared to the European average, meaning that the impact of this fuel switch will be significant.
The continued use of outdated wood stoves results in high levels of indoor air pollution and consequently, high rates of respiratory disease.[2] According to Novikova Szalay et al. (2015), cutting down Albanian forests for residential heating and cooking purposes leads to numerous environmental problems, such as deforestation, biodiversity loss, air pollution and soil degradation. If no new forests are planted, there is no compensation for the GHG emissions released by the burning of this biomass. In addition to the high costs involved in the use of LPG, conventional fuels are also hazardous to public health and the environment.
Type of measure: Regulatory, incentive, awareness raising
Description of measure: In the residential sector, a change in cooking systems towards higher electrification can lead to a further decrease in direct emissions. To promote the shift from LPG and wood-fired cooking stoves to modern electrical devices, different strategies and measures to incentivize stove changeover (from LPG to electric) should be explored:

Improving power supply in rural areas by promoting energy-efficient stoves, solar systems and solar boilers and installing electricity connections in houses;
Supporting national energy initiatives and the development of local markets, incl. negotiations with local appliance manufacturers to include induction stoves in their product lines and promoting locally / regionally manufactured stoves through "showroom" events for capacity and awareness building;
Raising awareness among potential energy users, and training installation and maintenance staff; and
Creating incentive systems for sales and demand, incl. providing financial incentives, such as cash incentives for LPG stove trade-ins; increased taxes on LPG and LPG stoves.[3]

Modelling assumptions in LEAP:
Technology penetration: In 2014, 25% of Albanian households used LPG stoves and 40% used wood stoves for cooking; the remainder used electric stoves. All households have only one type of cooking device. It is assumed that through the introduction of the above-mentioned incentives for stove changeover, the share of Albanian households using LPG stoves can be reduced to only 12.5% in 2030. As efficient electric stoves (for instance, induction stoves) will also be promoted in rural parts of Albania over the next years, the share of wood stoves can be significantly reduced to only 12% in 2030. It is assumed that 50% of Albanian households will use efficient electric stoves in the year 2030.
The measures have the potential of reducing up to 18% of the residential sector's energy-related GHG emissions in 2030 (in comparison to "Combined" scenario). </td></tr>
<tr><td>Energy savings potential in 2030 [GJ/a]</td><td>Cumulative energy savings until 2030 [GJ]</td><td>Emission reduction potential in 2030 [kt CO_2e]</td><td>Cumulative emission reduction potential until 2030 [kt CO_2e]</td></tr>
<tr><td>270,000</td><td>790,000</td><td>60</td><td>250</td></tr>
</table>

1 EUROSTAT, 2021

2 Novikova et. al., 2015

3 Gould et. al., 2018

No.	Name of measure/activity: Introduction of district and local heating systems in new districts in urban areas			
M 05	**Rationale:** Albanian homes are only partially heated for just a few hours a day, while the continued use of outdated woodstoves results in numerous environmental and health problems. Corresponding to the main energy sources, stoves are the most widespread heating systems (63%), followed by electric heaters (8.5%) and air heat pumps (air conditioners) (6%). Only 3% of private households have central heating (building or dwelling heating), while 4% have a fireplace.[4] Even where central heating systems have been installed, there is a lack of metering and controls to adjust temperature levels. Half of the households in urban areas use stoves fuelled by wood or gas. Electric heaters, heat pumps and other types of heating each account for about 10% in households.[5] No extensive district heating or cooling systems have been installed in Albania. Draft amendments of the Energy Efficiency Law envisage obligations to assess the country's high-efficiency cogeneration and efficient district heating and cooling potential.[6] It is estimated that there are over 20 smaller district heating systems and seven CHP units in operation in Albania.[7] These, however, are mostly very small operations supplying large individual public buildings or a few flats, and their combined market share in the supply of heat is negligible. This is despite the fact that several regions in Albania have cold climates and high building densities that offer strong potential for local communal solutions. According to the draft NECP, Albania's power supply is currently based exclusively on hydropower, with solar power plants projected to be included in the existing measures until 2040. There is no fossil-fuelled power plant in operation and no electricity generation from biomass. Cogeneration of heat and electricity in existing plants is therefore not an option and no district heating networks are currently planned. However, the potential for such networks exists in larger agglomerations. Even though industries that could provide a source for district heating (cement, iron and steel, ferro-alloy production) are limited, there is general potential for district heating, as the use of fuel wood for heating is high in older buildings, which are covered by an extensive reconstruction scheme.[8] The Third National Communication estimates the potential for district heating at 14 MW and for central heating at 13 MW by 2030.[9] **Type of measure:** Regulatory, incentives, awareness raising **Description of measure:** As with the Building Renovation Strategy, a review of the potential for high-efficiency cogeneration and efficient district heating and cooling for Albania has yet to be developed. Some of the root causes and barriers preventing the modernization of buildings and energy supply are 1) Access to finance; 2) High energy consumption due to low energy standards; 3) Institutional coordination; 4) Limited public funds / budget for investments in EE, and 5) Lack of trained / qualified staff. Similar to other countries in the Balkan region, such as in Serbia, the utilization of district, local and central heating should be promoted though a strategy to facilitate the de-risking of low carbon investment in buildings' energy supply, creating supply and demand for energy-efficient building technologies to improve the enabling environment, increasing the supply and enhancing the demand for EE investments: • A regulatory framework (incl. energy pricing reform, enhanced energy auditing), e.g. increasing the energy performance of buildings, is a necessary precondition for transition to consumption-based billing in district heating systems; • Setting up a financial support mechanism and innovative business models, e.g. for energy service companies (ESCOs); • Demonstration project-selected municipalities (e.g. EE and heating systems based on renewable energies), e.g. voluntary agreements with large consumers and the associated required audits they must undertake will support the implementation of CHP in this sector where such audits identify it as a cost-effective solution; and • Capacity-building / training. District and local heating systems can lead to reduced energy consumption in residential buildings, and to a switch from fossil fuel-based heating (and cooling) appliances to renewable energy with a significant contribution to mitigation, reducing CO_2 emissions by up to 40% in covered buildings/municipalities. Modelling assumptions in LEAP: n/a. Potentials are estimated in the Third National Communication of the Republic of Albania under the United Nations Framework Convention on Climate Change.			
	Energy savings potential in 2030 [GJ/a]	Cumulative energy savings until 2030 [GJ]	Emission reduction potential in 2030 [$ktCO_2e$]	Cumulative emission reduction potential until 2030 [$ktCO_2e$]
	–	–	57[10]	–

4 Novikova et. al., 2015

5 Novikova et. al., 2015

6 Energy Community. Implementation: Albania, Energy Efficiency

7 National Energy Efficiency Action Plan of Albania, 2015

8 National Energy and Climate Plan of the Republic of Albania, 2021

9 Third National Communication of the Republic of Albania under the UNFCCC, 2016

10 Third National Communication of the Republic of Albania under the UNFCCC, 2016

TRANSPORT SECTOR

No.	Name of measure/activity: Increased market penetration of battery electric passenger cars
M 01	

Rationale: Since Albania generates over 98% of its electricity from hydroelectric power, electric mobility is a promising measure for GHG emission mitigation. Due to the low grid emission factor, the level of emissions from an electric car is equivalent to obtaining a fuel efficiency of 0.05 l/100km. However, despite the environmental benefits, the number of electric vehicles (EVs) in Albania is still very limited.[11] Albania considered promoting electric vehicles in the technical assessment of its 2015 NDC, but ultimately discarded this option due to the high marginal abatement costs at the time. Since then, global degression rates for the purchase and operation of EVs have increased the attractiveness of EVs, and several studies expect total cost of ownership parity between combustion engine cars and EVs to be reached sometime between 2025 and 2030.[12] Several policies actively foster the distribution of EVs, e.g. the EU Commission has set ambitious targets for zero-carbon vehicles and anticipates a total phasing out of all combustion-based cars by 2035.[13]

Type of measures: Regulatory, financial, incentive, informational-educational

Based on European standards,[14] there is already an incentive to electrify part of the national fleet. The Government of Albania has already introduced a number of incentives that promote electric vehicles: (i) No "first-time registration fee" for new vehicles; (ii) No vehicle tax for the first 5 years; (iii) VAT exemption (20%) for electric vehicles; (iv) Exemption from VAT for new vehicles with an electric motor to encourage individuals and businesses to purchase such vehicles; and (v) Free travel on toll roads.[15]

To accelerate the adoption of EVs at the national level even further, a package of additional measures could be implemented to encourage the purchase and use of electric cars in Albania:

- A conducive regulatory ecosystem for EVs;
- A purchase grant for EVs;
- Attractive loans with e.g. low interest rates for EVs;
- A programme to foster the installation of charging stations in public areas;
- A grant to support the installation of home chargers for buyers of EVs;
- A public awareness campaign; and
- Promotion of EVs among fleet operators, such as taxis, public services, commercial vehicle fleets.

Modelling assumptions in LEAP:

Technology penetration: Car sales are low in Albania; less than 1% annually of the total car fleet was newly introduced to the market between 2013 and 2019. While average sales increased slightly, the National Energy Strategy expects an overall decrease of person kilometres by cars. Therefore, even ambitious EV penetration rates (it is assumed that 24% of new registered cars will be plug-in hybrid and 18% battery electric by 2030) would only slightly increase the share of EVs in total car volume by 2030. Considering the introduction of EVs in 2022, the calculations expect EVs to account for 1% of total car passenger-kms by 2025, and 3% by 2030.

Technology performance: It is assumed that battery electric passenger cars use 0.10 kWh/passenger-km[16] (at a "load factor" of 2 passengers per car), representing significantly less final energy intensity compared to diesel- and gasoline-powered cars.

Incremental investment needs: The modelled EV penetration entails decreasing incremental investment needs compared to conventional cars that aggregate to about USD 38 million until 2030. Aside from the existing measures, the incremental purchase costs could be further reduced through purchase grants or attractive loans. Total cost of ownership parity with combustion engine cars can be expected between 2025 and 2030.

Energy savings potential in 2030 [GJ/a]	Cumulative energy savings until 2030 [GJ]	Emission reduction potential in 2030 [kt CO_2e]	Cumulative emission reduction potential until 2030 [kt CO_2e]
135,000	700,000	14	70

11 Global Environment Facility, 2020

12 Arthur D Little, 2016

13 The EU envisages strong growth rates for EV to achieve at least 30 million zero-emission vehicles by 2030, representing a share of about 40% of battery electric vehicles from all new registered vehicles by 2030

14 CO2 standards for passenger cars and light utility vans 2020/2025/2030, CO2 standards for freight transport

15 National Energy and Climate Plan, 2021

16 Electric Vehicle Database, 2021

<table>
<tr><th>No.</th><th colspan="4">Name of measure/activity: Low-carbon e-bus programme</th></tr>
<tr><td rowspan="3">M 02</td><td colspan="4"> Rationale: At present, Albania's bus fleet is dominated by aged diesel vehicles. Statistical data show that most buses are 11-20 years old. In the total stock of buses, 37% are over 20 years old, 49% are 11-20 years old, and only 3% are 0-5 years old.[17] The bus fleets' high emission factors and energy consumption represent a major environmental, economic and social problem.
At the same time, cities and public transport are often frontrunners of innovative transport technologies, including electric buses (e-buses). Thus, e-buses are becoming increasingly common and competitive. The ongoing decline in battery costs has brought electric buses closer to cost parity with other bus technologies; in many cases, they are already the cheapest option in terms of total cost of ownership.[18] To date, there have only been isolated initiatives to electrify public transport in Albania. A small number of municipalities and bus transport companies (e.g. in Tirana) have introduced e-buses into their fleet or plan to do so in the near future. E-buses still account for a very small share of Albania's municipal transport fleet but with zero tailpipe emissions and low operational costs, they can help municipalities and communities address local noise and air quality issues, and reduce GHG emissions when the grid is based on low-carbon technologies – which is the case for Albania with its strong hydro share.
Type of measure: Regulatory, financial, incentive
The main objective of the proposed "Low-carbon e-bus programme" is a nationwide shift from diesel buses to e-buses. The programme will bundle scattered e-bus initiatives and enable a nationwide introduction of e-buses through the following components:

Component 1: Strengthen the policy, regulatory and institutional framework to promote, plan and coordinate sustainable public transportation based on electric mobility;
Component 2: Investment in and construction of public e-bus infrastructure to facilitate sustainable transportation;
Component 3: Investments in and promotion of sustainable public transportation operating assets through a long-term financial mechanism for private actors.

Modelling assumptions in LEAP:
Technology penetration: E-bus implementation proposals around the globe suggest ambitious targets of up to 100% of all new buses to be electric by 2030. Since Albania has not yet started to introduce e-bus promotion programmes at a large scale, widespread uptake is expected for 2022. The calculations for the forthcoming decade predict that e-buses will represent 5% of total bus passenger-kms by 2025, and 23% by 2030.
Technology performance: Battery electric buses use ~0.06 kWh/passenger-km[20] (at a "load factor" of 40 passengers per bus), representing significantly less final energy intensity compared to diesel- and gasoline-fuelled buses.
Incremental investment needs: The modelled penetration of e-buses entails decreasing incremental investment needs compared to conventional buses that aggregate about USD 254 million until 2030. Aside from the existing measures, the incremental purchase costs could be further reduced through purchase grants or attractive loans. Total cost of ownership parity with combustion engine cars can be expected between 2025 and 2030. </td></tr>
<tr><td>Energy savings potential in 2030 [GJ/a]</td><td>Cumulative energy savings until 2030 [GJ]</td><td>Emission reduction potential in 2030 [kt CO_2e]</td><td>Cumulative emission reduction potential until 2030 [kt CO_2e]</td></tr>
<tr><td>785,000</td><td>2,940,000</td><td>80</td><td>290</td></tr>
</table>

17 Tare, 2018

18 International Energy Agency, 2020

19 Sustainable Bus, 2020

INDUSTRIAL SECTOR

No.	Name of measure/activity: Low-carbon development of Albania's cement industry
M 03	

Rationale: The construction and infrastructure industry in Albania is expected to grow further in the future, resulting in higher demand for building materials such as cement. The country's cement production increased rapidly from 2010–2012 after a new cement plant opened in 2010 (Antea Cement Plant), transforming the country from a net importer to a net exporter of cement. Albania's cement production amounts to approx. 2 Mt/year, which corresponds to annual GHG emissions of up to 1.6 $MtCO_2$. Cement production accounted for approx. 7.40% of total emissions in Albania in 2016, reporting an increase of 12% between 2009 and 2016.[21] CO_2 emissions in the cement industry originate primarily from the decarbonization of calcined limestone to produce clinker (ca. 60% of CO_2 emissions) and from the combustion of fuel used for the calcination of limestone (ca. 40%). Emissions resulting from the calcination of limestone (process emissions) are the consequence of a chemical process inherent in production, and it is very difficult to reduce them. Nearly 90% of GHG emissions from industrial processes in Albania originate from cement production.[22] On the other hand, emissions from fuel combustion depend on the type of fuel and are more feasible to manage.

Cement and clinker production is an energy-intensive process that consumes a significant amount of both thermal and electrical energy. The integrated cement plants in Albania consume mainly solid fuels—lignite and bituminous coal—for clinker production. To significantly decrease fossil fuel consumption and the resultant CO_2 emissions, various types of mitigation levers exist, e.g. the use of waste as alternative fuels with lower emission factors compared to fossil fuels to substitute part of needed thermal energy. The use of renewable energy could be promoted for electrical energy consumption to reduce dependence on conventional fossil energy.

There are currently four facilities for cement and clinker production in Albania, namely two integrated plants and two grinding plants.

Plant / company name	Type	Capacity	Main fuel type	Commissioning years	Location
Antea Cement Sh.A. (TITAN Group / IFC)	Integrated plant	Cement: 1,400 kt/year Clinker: 3.300 t clinker per day[23]	Approx. 80% bituminous coal, 20% petroleum coke[24]	2010	Boka e Kuqe, Burizanë, 50 km north of Tirana
Colacem Albania Sh.p.k. (Colacem S.p.A.)	Grinding plant	Cement: 500 kt/year	-	2009[25]	Balldre, Lezhë, northwestern Albania
Fushë Krujë Cement Factory, Sh.p.k. (Seament Holding)	Integrated plant	Cement: 1,330 kt/year[26] Clinker: 4.000 t clinker per day[27]	Approx. 44% bituminous coal, 56% lignite coal[28]	2007	Fushë Krujë, 35 km north of Tirana
Elbasan cement plant (Seament Holding)	Grinding plant	Cement: 300 kt/year	-	1975[29]	Elbasan, central Albania

20 First Biennial Update Report of Albania to the UNFCCC, 2021

21 First Biennial Update Report of Albania to the UNFCCC, 2021

22 Titan Antea Cement sh.a. About us

23 South East Europe Sustainable Energy Policy, 2015

24 Colacem Albania. Company profile

25 Hastorun and Chung, 2020

26 Global Cement, 2019

27 South East Europe Sustainable Energy Policy, 2015

28 Industry About. Albania Cement Industry

No.	Name of measure/activity: Low-carbon development of Albania's cement industry
M 03	There are plans to promote low-carbon development in the cement industry, as formulated in the Nationally Appropriate Mitigation Action (NAMA) – Replacing Fossil Fuels with Non-hazardous Waste in the Albanian Cement Industry (2015–2020). **Type of measure:** Regulatory, financial, incentive **Description of measure:** A sectoral low-carbon development roadmap for the Albanian cement industry should identify the political and technical measures needed to reduce the current emissions from: • All process emissions from the fuel used to manufacture clinker, and all emissions emitted by the cement plant's facilities. The kilns in Albania are already dry kiln and relatively new and efficient. Energy efficiency gains from reduced mechanical and thermal losses (insulation / preheating) and recovering thermal losses (e.g. CHP) need to be investigated. There is strong potential for the use of alternative fuels (e.g. waste and biomass) though cogeneration. • Emissions related to the electrical energy consumed in the production of external energy and that depend on the type of energy matrix from which said electrical energy is obtained. • Product mix: increase the share of products that require less CO_2 with a higher share of substitutes to reduce the proportion of clinker in cement (it is estimated that mainly Portland cement with up to 95% clinker is currently being produced in Albania). The most promising mitigation levers comprise the following (depending on the individual plant and facility characteristics): 1. **Alternative fuels and sustainable near-zero biofuels:** Emissions can be considerably reduced by substituting conventionally used fossil fuels with more sustainable fuels such as waste and biomass. Technically, a clinker kiln could be fed with 100% alternative fuels, albeit with some efficiency losses related to heat transfer and increased energy demand for the drying of biomass. The EU's cement industry is the world leader in terms of alternative fuel substitution rates, with an average substitution rate of about 60%, and some plants reaching 95% (ECRA, 2017). For Albania, the potential availability and competitiveness of sustainable biomass and biogenic wastes need to be investigated. There are some barriers to the use of alternative fuels (biomass and waste) owing to the country's waste management practices, as waste is currently not properly separated in different collection bins in Albania. At present, bituminous coal, lignite and petroleum coke are being used as fuel; biomass and waste are currently not being used to a larger extent, but test and feasibility studies are underway (e.g. at the Antea plant). For the European cement industry is expected to achieve an average substitution rate of 70% by 2040, with 50% biomass and 20% waste.[30] With moderate effort, a 20% use of substitutes could be realized in Albania by 2030. As outlined in the NAMA on Replacing Fossil Fuels with Non-hazardous Waste in the Albanian Cement Industry, four key components need to be implemented: 1) Study technological options and feasibility of using municipal solid waste as an alternative fuel in the cement industry; 2) Invest in recycling centres in municipalities; 3) Operate recycling and waste centres, and 4): Build capacity in relevant sections of the waste management system.[31] 2. **Supplementary cementitious materials (SCMs) such as natural pozzolans and calcined clays:** The clinker-to-cement ratio in the EU averaged 77% in 2017 (GCCA, 2018). Along with the phase out of coal, the supply of traditional SCMs such as fly ash and granulated blast furnace slag will decrease. To maintain and further improve the clinker-to-cement ratio, new SCMs should be considered. There are various promising alternatives with differing global and regional availability. Calcined clay and natural pozzolanas are such examples. Calcined clay is particularly interesting as it is abundantly available and could substitute up to 50% of cement. An average clinker-to-cement ratio of 60% is expected in the EU's cement industry by 2050.[32] In Albania, the level of potential substitution varies depending on the availability of SCMs and different end-uses of cement. Albania's cement industry presently lags far behind the global goal of 30% clinker substitution by 2030, which is as the proposed minimum target. 3. **Best available technology (BAT) for newly assembled energy-efficient cement installations:** The past three decades have witnessed a significant improvement in the energy efficiency of clinker kilns, leading to a near complete phasing out of wet kilns in the current EU technology stock. In 2018, almost 50% of the kiln in the EU were dry kilns of BAT standard and the percentage of wet kilns was low. Clinker kilns in Albania are dry kilns. Further room for improvement needs to be investigated at the plant level in Albania. It is expected that an additional 12% energy efficiency can be achieved in the EU by 2040.[33] This is based on the current EU average of 3,680 MJ/t clinker (2018), which according to ECRA could be improved to 3,150-3,215 MJ/t clinker in the long term (ECRA, 2017; GCCA, 2018). This level of energy consumption should be the benchmark for Albania. The integrated plants are relatively modern in terms of air emission reduction, e.g. ANTEA operates according to BAT, in alignment with industrial Emissions Directive 2010/75/EU, i.e. the overall efficiency can be assumed to be high.[34] 4. **Material intensity reduction through optimized or alternative design choices, cement and concrete recycling, and advanced fillers and admixtures:** The cheapest and most efficient way to reduce emissions is to avoid cement production. Several demand-side measures are available to reduce the primary demand for cement, e.g. cement can be substituted with alternative materials such as wood in buildings and recycled concrete in road infrastructure. The material intensity of cement can be improved through optimized design and increased use of fillers. For Europe, it is expected that 30% of building materials and road infrastructure could be substituted with alternative materials by 2050, while 10%-35% of demand could be reduced through smart design and manufacturing.

29 NewClimate, 2020

30 Compare Annex 1 of Third National Communication of the Republic of Albania under the UNFCCC, 2016

No.	Name of measure/activity: Low-carbon development of Albania's cement industry			
M 03	**Modelling assumptions in LEAP:** Technology penetration: Alternative fuels: Constant use of substitutes of 20% waste by 2030 (for the "Glass Pottery and Building Materials" industry) Clinker ratio: No modelling of emission impact and reduced clinker production. However, the improved clinker ratio will allow for higher cement production in the future, meeting the increasing demand for building materials. Energy efficiency: 10% reduction of fuel intensity already assumed in the mitigation scenario of the NES ("Combined" scenario). No further enhancement assumed. The use of alternative fuels may increase the energy consumption of kilns. The measures have the potential to reduce up to 30% of energy-related GHG emissions in 2030, which corresponds to approximately 10% of the cement industry's annual emission (in comparison to the "Combined" scenario).			
	Energy savings potential in 2030 [GJ/a]	Cumulative energy savings until 2030 [GJ]	Emission reduction potential in 2030 [kt CO_2e]	Cumulative emission reduction potential until 2030 [kt CO_2e]
	-	-	160	700

31 NewClimate, 2020

32 NewClimate, 2020

33 Titan Antea Cement sh.a..2018

ANNEX 2:

Database of energy efficiency data

Annex is attached to the document in electronic form.

ANNEX 3:

Modelling file of the additional energy efficiency measures

Annex is attached to the document in electronic form.

ANNEX 4:

Report on energy efficiency data gaps

1. ENERGY DATA

The primary source of climate change data in general, and energy data related to climate change, are the governmental and non-governmental authorities with the legal responsibility for the collection, measurement, monitoring, reporting and verification of the data. This responsibility has been legally regulated for the first time in law no. 155, date 17.12.2020 "On climate change" (the law), which enters into force in July 2021. The governmental and non-governmental authorities, which according to this law, are the primary source of data on climate change are:

- Ministry of Tourism and Environment
- National Environmental Agency
- National Agency of Natural Resources
- Line ministries which field of responsibility is related to climate change
- Local government units
- Private operators subject of the law

On this basis, for energy data related to climate change, the line ministry responsible is the Ministry of Infrastructure and Energy.

The energy data necessary for the purpose of the calculation of Albania's potential of energy efficiency in the reduction of greenhouse gas emissions have been collected from these primary sources.

The data have been grouped into two categories: economic wide data and sector specific data, as in the following paragraphs.

a. Economic wide data

The group of economic wide data comprise the national energy balance. The energy balance is currently produced in Albania from three national sources:

- Ministry of Infrastructure and Energy
- National Agency for Natural Resources
- Energy Regulatory Authority
- National Institute of Statistics

b. Sector specific data

TRANSPORT

The data for modal split of inland passenger transport is defined as the percentage share of each mode of transport in total inland transport, expressed in passenger-kilometres (pkm). It is based on transport by passenger cars, buses and coaches, and trains. All data should be based on movements on national territory, regardless of the nationality of the vehicle. On the other hand, the share of kilometres in total travelled is the share of each mean of transportation versus the total number of kilometres travelled.

Driver	Indicator	Measure unit
Modal split of inland passenger transport	total passenger kilometres travelled by all transportation modes	pkm
	passenger kilometres travelled by road	pkm
	passenger kilometres travelled by air	pkm
	passenger kilometres travelled by sea	pkm
	passenger kilometres travelled by rail	pkm
	shares of kilometres in the total travelled, by transportation mode	
	share of car kilometres in the total travelled	%
	share of air kilometres in the total travelled	%
	share of rail kilometres in the total travelled	%
	rate of penetration of collective inland passenger transport	%

The energy consumption of vehicles is the average energy consumption in MJ of each category of vehicles. For the data collection different vehicle categories have been selected based on the categories used by the Directorate of Customs in Albania, such as: cars and other motorized transport vehicles that are designed for the transport of passenger; cars and other motorized transport vehicles that are designed for the transport freight etc.

Driver	Indicator	Measure unit
Energy consumption of vehicles	average energy consumption of vehicles per 100 km, by vehicle category	
	average energy consumption of category... per 100 km	MJ/100 km
	average energy consumption of category... per 100 km	MJ/100 km
	average energy consumption of category... per 100 km	MJ/100 km

The registration of road transport vehicles is the number of registered vehicles as of the categories in the above table and based on their period of manufacture.

Driver	Indicator	Measure unit
Registration of road transport vehicles	number of owned cars per person	car
	number of registered vehicles, by category and age	
	number of registered category...	vehicle
	number of registered category...	vehicle
	number of registered category...	vehicle
	number of registered vehicles... years old	vehicle
	number of registered vehicles... years old	vehicle
	number of registered vehicles... years old	vehicle
	rate of electrification of inland passenger transport	%
	rate of electrification of passenger transport by road	%

Level of freight transportation is clearly different from passenger transport. Freight transport is the physical process of transporting commodities and merchandise goods and cargo. The level of freight is measured by tonne kilometres freight transported.

Driver	Indicator	Measure unit
Level of freight transportation	tonne kilometres freight transported by all transportation mode	tkm
	tonne kilometres freight transported by road	tkm
	tonne kilometres freight transported by air	tkm
	tonne kilometres freight transported by sea	tkm
	tonne kilometres freight transported by rail	tkm
	rate of empty runs in the freight transportation	%
	average load of the freight	ton

Fuel price, is the average price of each type of fuel at a moment in time. The common fuel used is diesel, petrol and LP gas.

Driver	Indicator	Measure unit
Fuel price	average price of diesel	USD/lit
	average price of petrol	USD/lit
	average price of LP gas	USD/lit

RESIDENTIAL CONSTRUCTION

The heating and cooling consumption is the average consumption of energy for heating and cooling purposes. Heating and cooling includes a wide range of end-use applications and technologies. In the buildings sector, it includes cooking, water heating, ambient heating, ambient cooling and refrigeration. It also includes lighting of buildings and areas.

Driver	Indicator	Measure unit
Heat / Cooling consumption	average net floor area heated / cooled	m^2
	average heat / cooling consumption per net floor area	KWh/m^2
	shares of energy consumption in the total, by end use	
	share of space heating in the total energy consumption	%
	share of space cooling in the total energy consumption	%
	share of water heating in the total energy consumption	%
	share of cooking in the total energy consumption	%
	share of lighting in the total energy consumption	%
	share of appliances in the total energy consumption	%
	share of end use...in the total energy consumption	%

The type of heat carriers includes information on number of units used for the heating of the building sold. It includes boilers, gas condensation boiler, air conditioner units, other heat supply types. The data are also calculated as a share of each heat supply type to the total number of heat supply types.

Driver	Indicator	Measure unit
Type of heat carriers	heat supply unit sales, by type	
	boiler unit sales	unit sales
	gas condensing boiler unit sales	unit sales
	air conditioner unit sales	unit sales
	heat supply type... unit sales	unit sales
	shares of heat supply unit sales in the total, by type	
	share of boiler unit sales in the total heat supply unit sales	%
	share of gas condensing boiler unit sales in the total heat supply unit sales	%
	share of air conditioner unit sales in the total heat supply unit sales	%
	share of heat supply type...unit sales in the total heat supply unit sales	%
	average of heat consumption, by source	
	average consumption of electricity	PJ / MWh
	average consumption of oil	PJ / MWh
	average consumption of gas	PJ / MWh
	average consumption of biomass	PJ / MWh

The share of cooking and warm water supply category collects data on type of warm water supply units and their unit sale, as well as the share of each category to the total number of unit sold. Moreover, the category collects information on the average energy consumption for warm water supply for each type.

Driver	Indicator	Measure unit
Share of cooking and warm water supply	warm water supply unit sales, by type	
	gas unit sales	unit sales
	oil unit sales	unit sales
	biomass unit sales	unit sales
	warm water supply type... unit sales	unit sales
	shares of warm water supply unit sales in the total, by type	
	share of gas unit sales in the total warm water supply unit sales by type	%
	share of oil unit sales in the total warm water supply unit sales by type	%
	share of biomass unit sales in the total warm water supply unit sales by type	%
	share of warm water supply type... unit sales in the total warm water supply unit sales by type	%
	average of energy consumption for warm water supply, by source	
	average consumption of electricity	PJ / MWh
	average consumption of oil	PJ / MWh
	average consumption of gas	PJ / MWh
	average consumption of biomass	PJ / MWh
	average of energy consumption for cooking, by source	
	average consumption of electricity	PJ / MWh
	average consumption of oil	PJ / MWh
	average consumption of gas	PJ / MWh
	average consumption of biomass	PJ / MWh

Penetration rate of electric appliances includes the penetration rate in the country of the electric appliances such as lighting appliances, washing machines, refrigerators etc. it also includes the average year of these type of appliance as well as their technical and energy efficiency level based on the EU energy label.

Driver	Indicator	Mea
Penetration rate of electric appliances	penetration rate of appliances, by type	
	penetration rate of lighting	%
	penetration rate of washing machines	%
	penetration rate of refrigerators	%
	penetration rate of kitchen stoves	%
	penetration rate of water heaters	%
	penetration rate of air conditioners	%
	penetration rate of air coolers	%
	penetration rate of appliance...	%
	average age of appliances, by type	
	average age of lighting	year
	average age of washing machines	year
	average age of refrigerators	year
	average age of kitchen stoves	year
	average age of water heaters	year
	average age of air conditioners	year
	average age of air coolers	year
	average age of appliance type...	year
	annual growth of appliance ownership	%
	technical / efficiency level	
	average EU energy label (A+++ to G)	EU energy label

The demography chapter includes information on the number and the annual growth of dwelling as well as the actual building stock segregated in rural and urban areas.

Driver	Indicator	Measure unit
Demography	number of dwellings	dwelling
	annual growth of dwellings	%
	building stock, by type	
	number of buildings in rural areas	building
	number of buildings in urban areas	building
	share of buildings in rural areas	%
	size of the building stock	m^2
	average age of the building stock	year
	average net floor area per dwelling	m^2
	average household size	person

Energetic refurbishment of building stock

Driver	Indicator	Measure unit
Energetic refurbishment of building stock	building investment level	
	average annual refurbishment rate	%
	average annual new construction rate	%
	improvements to the thermal efficiency of buildings	
	average heat demand after refurbishment	KWh/m^2
	average electricity demand after refurbishment	KWh/m^2
	average state subsidies for energetic refurbishment	USD

Commercial and public construction

The commercial and public construction includes the same categories as in the residential construction chapter including energy consumption, type of heat carriers, penetration rate of electric appliances, energy furbishing of building stock.

Driver	Indicator	Measure unit
Energy consumption	average net floor area heated / cooled	m^2
	average heat / cooling consumption per net floor area	KWh/m^2
	average energy consumption by end use	
	average energy consumption for lighting	MWh
	average energy consumption for information and communication technologies	MWh
	average energy consumption for end use...	MWh

Driver	Indicator	Measure unit
Penetration rate of electric appliances	penetration rate of appliances, by type	
	penetration rate of lighting	%
	penetration rate of water heaters	%
	penetration rate of air conditioners	%
	penetration rate of air coolers	%
	penetration rate of appliance...	%
	average age of appliances, by type	
	average age of lighting	year
	average age of water heaters	year
	average age of air conditioners	year
	average age of air coolers	year
	average age of appliance...	year
	annual growth of appliance ownership	%
	technical / efficiency level	
	average EU energy label (A+++ to G)	EU energy label

Driver	Indicator	Measure unit
Energetic refurbishment of building stock	number of buildings	building
	annual growth of buildings	%
	size of the building stock	m^2
	average age of the building stock	year
	building investment level	
	average annual refurbishment rate	%
	average annual new construction rate	%
	improvements to the thermal efficiency of buildings	
	average heat demand after refurbishment	KWh/m^2
	average electricity demand after refurbishment	KWh/m^2
	average state subsidies for energetic refurbishment	USD

INDUSTRY

The Industry / sub-sector structure gives an information regarding the industrial as foreseen in the International Standard Industrial Classification of All Economic Activities of United Nations Statistics Division (UNDS).

Driver	Indicator	Measure unit
Industry / sub-sector structure	classification of industry present in the country	
	industrial activities clustered in ISIC*	industrial activity
	energy intensive sub-sectors (steel, cement, chemical, non-ferrous metal production etc.)	sub-sectors

The industrial production growth presents the average manufacturing value added and the unit output or activity from different activities in the industry sector. It is presented as a share of the total GDP of Albania.

Driver	Indicator	Measure unit
Industrial production growth	average manufacturing value added, by sub-sector	
	average of sub-sector... manufacturing value added	% GDP / USD
	average of sub-sector... manufacturing value added	% GDP / USD
	average of sub-sector... manufacturing value added	% GDP / USD
	average of sub-sector... manufacturing value added	% GDP / USD

Energy Intensity of production shows the quantity of energy required per unit output or activity or otherwise Manufacturing Value Added. It is broken down in different sub-sectors of the industry. Moreover, and average mechanical energy consumption is calculated for fans, pumps and other industrial appliances.

Driver	Indicator	Measure unit
Energy intensity of production	energy consumption per MVA by sub-sector	
	energy consumption per sub-sector ...MVA	PJ or MWh/MVA
	energy consumption per sub-sector ...MVA	PJ or MWh/MVA
	energy consumption per sub-sector ...MVA	PJ or MWh/MVA
	energy consumption per sub-sector ...MVA	PJ or MWh/MVA
	mechanical energy consumption	
	average mechanical energy consumption of fans	MWh
	average mechanical energy consumption of pumps	MWh
	average mechanical energy consumption of other...	MWh

AGRICULTURE AND FORESTRY

This group of data presents data on agricultural areas in Albania, what is the area that is irrigated with system based on fossil fuel and what is the energy used.

Driver	Indicator	Measure unit
Agricultural area	agricultural land area	ha
	agricultural land area with irrigation systems based on fossil fuels	ha
	average energy consumption from the irrigation system based on fossil fuels	GWh
	installed capacity of pumps	MW

Another set of data is related to the type and average age of machinery used in agriculture. It also includes the average consumption of these machineries.

Driver	Indicator	Measure unit
Age and use of machinery	average age of machinery used, by type	
	average age of machinery type... used	year
	average age of machinery type... used	year
	average age of machinery type... used	year
	average energy consumption of machinery used, by type	
	average energy consumption of machinery type... used	MWh
	average energy consumption of machinery type... used	MWh
	average energy consumption of machinery type... used	MWh

2. AVAILABILITY OF ENERGY DATA

Most of the sector-specific data necessary for the calculation of Albania's potential of energy efficiency in the reduction of greenhouse gas emissions are currently not available from the governmental authorities responsible. There are two basic reasons for this:

- at first, the legal basis which determines the responsibility for climate change data has only recently been adopted and has enters into force as of July 2021; therefore, the legal basis remains yet not implemented;

- at second, there is yet no sub-legal act regulating the system of climate change data collection, measurement, monitoring, reporting and verification; a draft sub-legal act of 2017 is being prepared, specifically on monitoring and reporting GHG emissions and other information relevant to climate change at the national level, including related procedures and timing; the draft is being prepared from the Ministry of Infrastructure and Energy, based on Regulation no 525/2013 of the European Parliament and of the Council, of 21 May 2013, "On a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC".

Specifically relating to energy efficiency data of the industry sector, data are not available for the following reasons:

- there is no legal basis regulating the minimum energy efficiency standards of the industrial technology and infrastructure, thus, industrial private operators are licensed and commissioned without requirement on these standards, and consequently, energy efficiency data cannot be collected from them.

Data are available from the National Institute of Statistics only for a limited number of indicators, as in the database, attached to the Report.

The economy wide data necessary for the calculation of Albania's potential of energy efficiency in the reduction of greenhouse gas emissions are currently available; the Ministry of Infrastructure and Energy collects these data from the national operator for electric energy production and distribution.

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