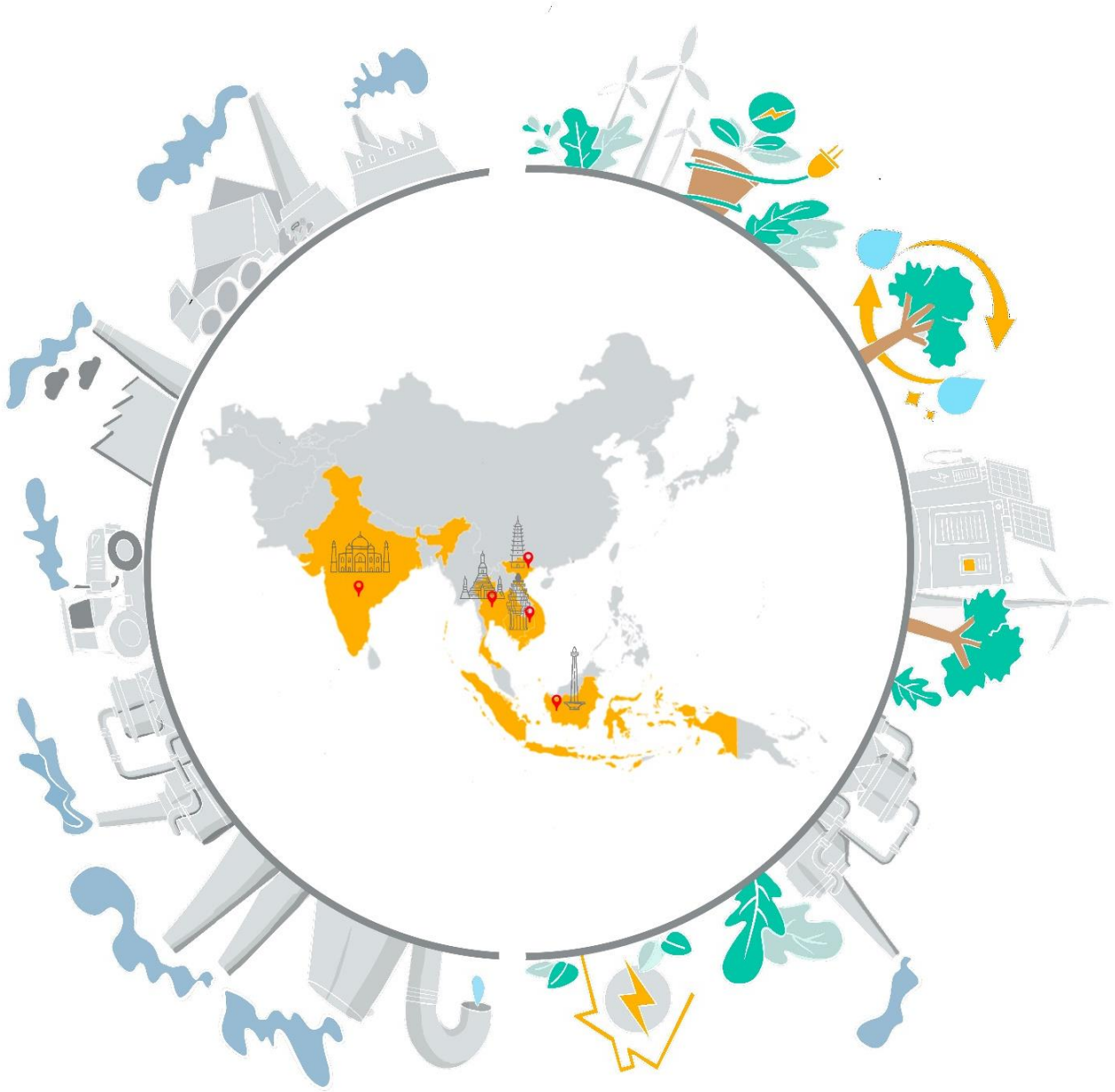


GGGI

ASIA LOW CARBON BUILDINGS TRANSITION PROJECT

Life Cycle Assessment for Transitioning to a Low-Carbon Economy

1. Energy Scenario and Climate Actions in Asia

November 2024

ASEAN CENTRE FOR ENERGY ACE

EESL

HEAT

Supported by:

Federal Ministry for Economic Affairs and Climate Action

IKI INTERNATIONAL CLIMATE INITIATIVE

on the basis of a decision by the German Bundestag

WHAT WILL YOU LEARN?

01 About ALCBT Project

02 Climate Change and Impacts

03 National Commitments

04 Energy Scenario

05 NDCs and Initiatives

06 Challenges and Opportunities

0.1 About the Asia Low Carbon Buildings Transition (ALCBT) Project

Objective:
Present innovative strategies to transform existing and new buildings toward carbon neutrality by 2050 or earlier. The project offers insights into sustainable building practices that improve living conditions and reduce the environmental footprint of the built environment

Rationale:

- The building and construction sector contributes significantly to global climate change, accounting for about 21% of total GHG emissions
- Embodied carbon accounts for about 10% of global energy-related GHG emissions – global floor area of buildings to double by 2060, mostly in Asia and Africa
- Buildings operations account for about 30% of final energy demand – over 20% in Asia, with space cooling as the fastest-growing end use in buildings

Sources: International Energy Agency, 2023; United Nations Environment Programme, 2024

ALCBT Project

Impact: Nationwide transition toward low carbon buildings in Asian countries, substantially reducing GHG emissions from the sector

Outcome: Technical, planning and institutional tools for low carbon buildings have been successfully implemented by key public and private sector stakeholders in **Cambodia, India, Indonesia, Thailand and Vietnam**

Key Project Participants

- National and local government
- Building industry professionals
- Financial services institutions
- Universities and academia

Project Funding: EUR 19.3 million

Target Outputs

- **Standardized tools and systems** for managing building carbon emissions
- **Enhanced capacity** of key stakeholders to deliver low carbon buildings
- **Financial pathways** established for low carbon buildings transition
- Knowledge products produced to facilitate **replication and scaling up**

Implementation period:
August 2023 – August 2028

Total 1.68 million tCO_2eq
Direct and indirect emissions reduced

Total 19,000+ people
Enhanced knowledge and capacity

EUR 140 million
Investment mobilized

ALCBT Project Structure

Project Steering Committee	Government Representatives + Industry Representatives: **Cambodia, India, Indonesia, Thailand, Vietnam** Consortium Representatives + Zukunft – Umwelt – Gesellschaft			
	Meets virtually annually, in line with annual donor reports			
Consortium Partners	Global Green Growth Institute (GGGI)	HEAT International (HEAT)	ASEAN Centre for Energy (ACE)	Energy Efficiency Services Limited (EESL)
	Meets virtually monthly to share project updates			
Technical Advisory Committee				

BUILDING ENERGY PERFORMANCE

Driving factors

*In Asia, around 50% of the buildings that will exist by 2050 are **yet to be built**, which provides great opportunity for decarbonization*

Policy Drivers

- Energy Conservation Acts, Laws or Rules
- Standards and Labeling Program – Mandatory Minimum Energy Performance Standard (MEPS)
- National Action Plan on Climate Change
- National Cooling Action Plan
- Energy Conservation Building Code
- NDC Commitments

Technology Drivers

- Upgradation of MEPS for Appliances – Standards are Raised Every Two Years for Air Conditioners
- Architectural Improvements – Passive Designs, Building Energy Management Systems
- Low Carbon Building Materials
- New Technologies – LGWP Refrigerants, Tri-generation, District Cooling Systems

Market Drivers

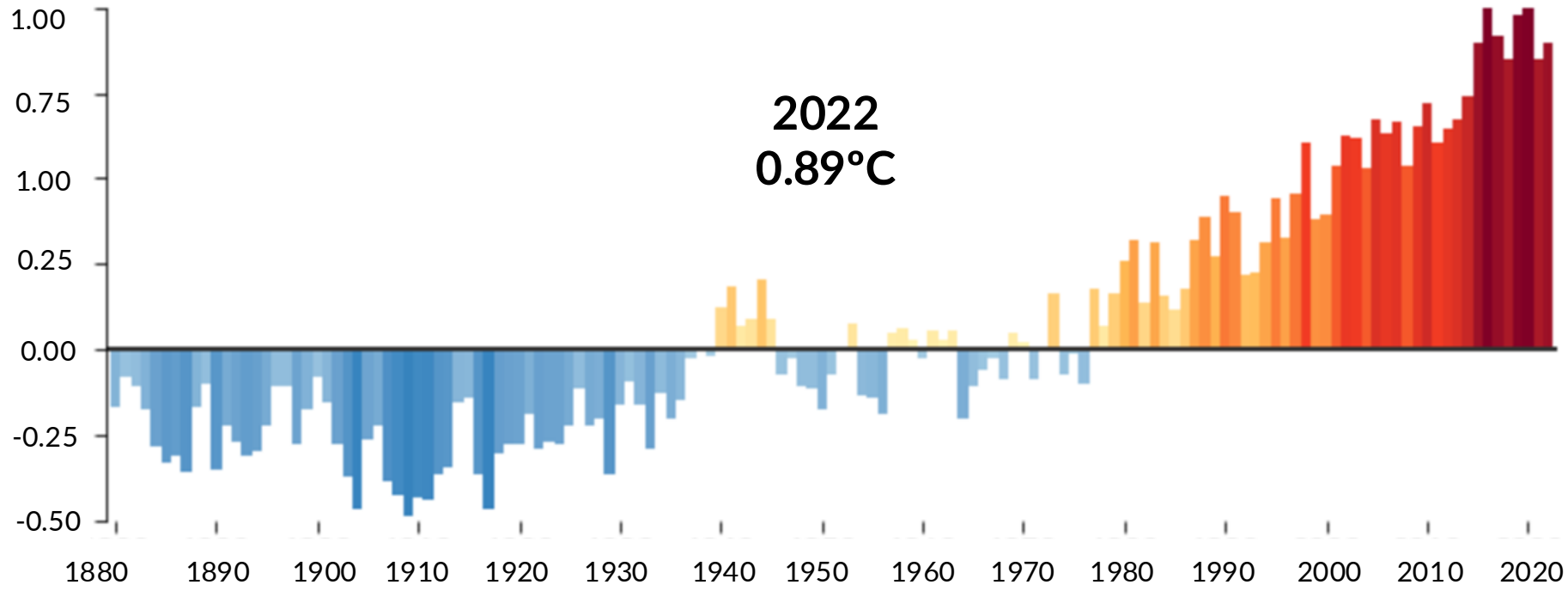
- Public Recognition through Green Certification – LEED, GBC, GEM, etc.
- Rising Energy Demand for Domestic, Institutional and Commercial Sectors
- Demand Side Management and Demand Response Programs by Utilities
- Bulk Procurement to Leverage Economy of Scale
- Consumer Awareness of EE Products and Increase in Per Capita Income

0.2 Climate Change

Impacts: Globally and in Asia

CLIMATE CHANGE

Observed 1.2°C rise in temperature since the late 19th century



Last nine years warmest on record
Global temperature anomaly (°C compared to the 1951–1980 average)

Source: NASA Earth Observatory

CLIMATE CHANGE

Increase in GHG emissions and consequences

Causes:

- Burning of fossil fuels
- Deforestation
- Industrial practices

Consequences:

- Extreme weather events
- Environmental changes
- **Severe heat and cold waves**

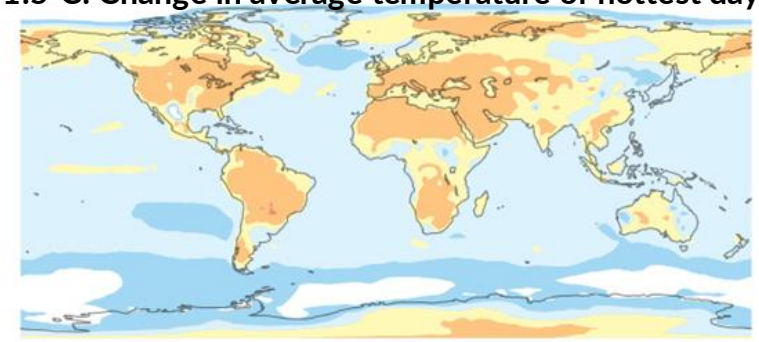
The World Meteorological Organization confirmed that 2023 was the warmest year on record, with global average near-surface temperature at 1.45°C (with a margin of uncertainty of ± 0.12°C) above the pre-industrial baseline

CLIMATE CHANGE

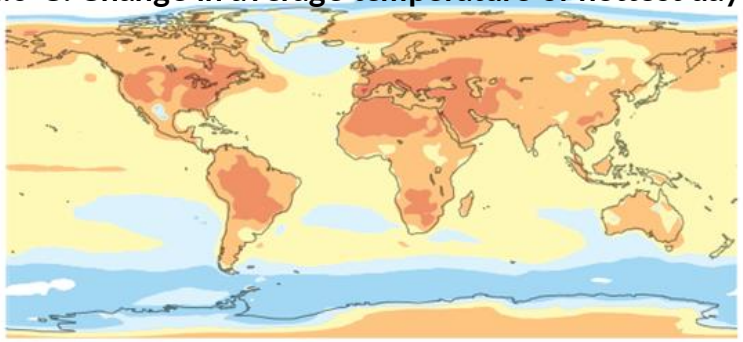
Hazards

- The impacts of climate change are being felt in both inhabited land and oceans
- An average warming of 1.5°C across the whole globe raises the risk of heatwaves and heavy rainfall events, amongst many other potential impacts
- Based on the 'pathways' identified by IPCC, two modeled scenarios with temperature rises of 1.5°C and 2°C are presented pictorially

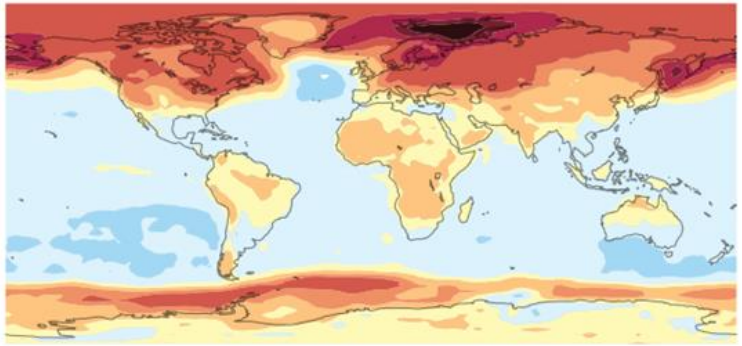
+1.5°C: Change in average temperature of hottest days



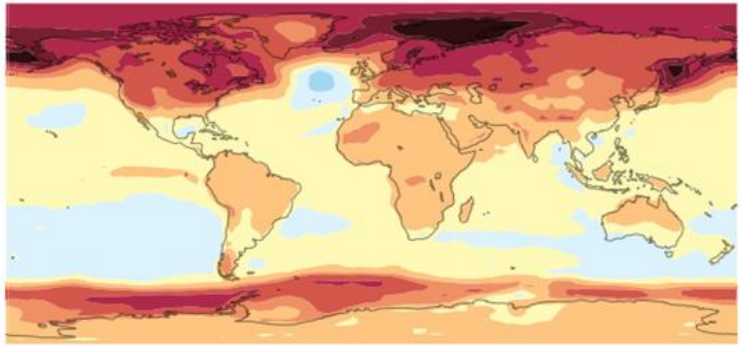
+2.0°C: Change in average temperature of hottest days

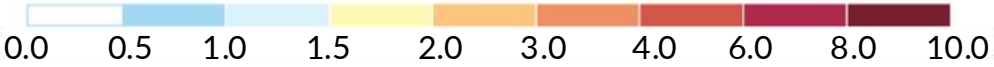


+1.5°C: Change in average temperature of coldest nights



+2.0°C: Change in average temperature of coldest nights





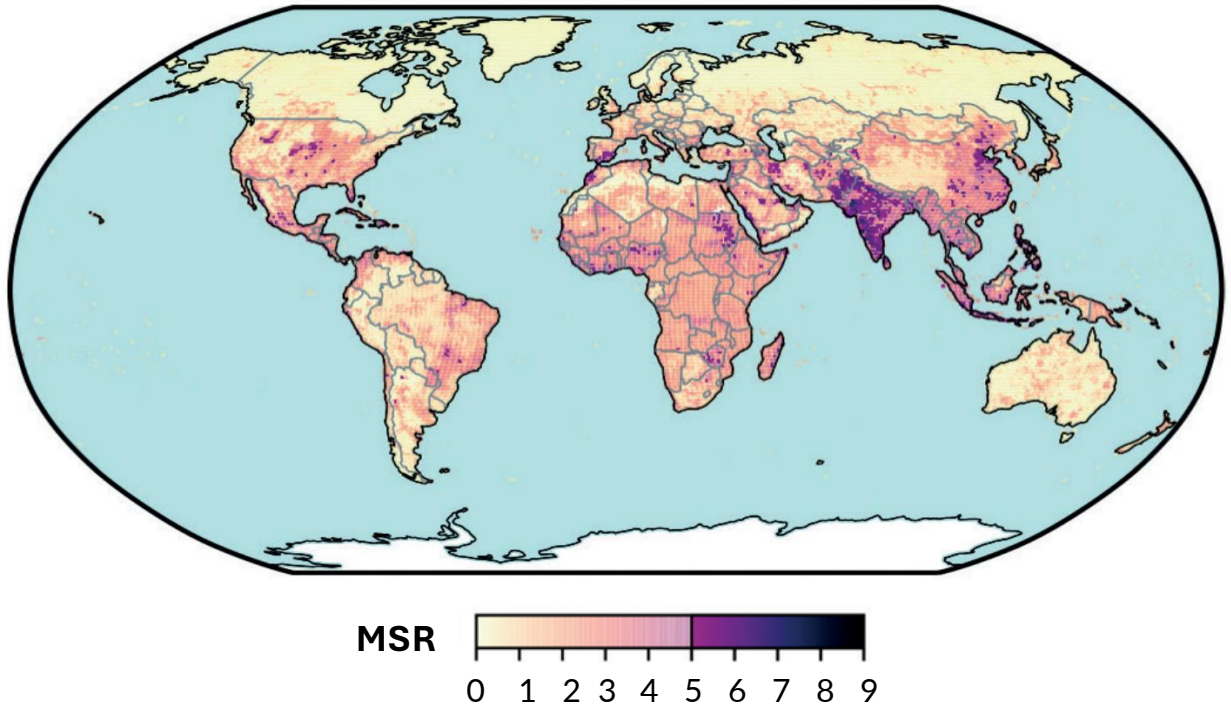
Source: Hoegh-Guldberg, O., et al., 2022

CLIMATE CHANGE

Exposure to risks

- IPCC emphasizes multi-sector risk assessment as a critical tool for understanding the wide-reaching impacts of global warming and climate change
- This approach is essential for evaluating how risk manifests and interacts across various sectors like water resources, agriculture, energy systems, health, infrastructure, economic systems and social systems
- The heat map presented here is a multi-sector risk (MSR) map for a 1.5°C temperature rise with MSR score ranging from 0–9
- Locations having a score above 4 are considered to have multi-sectoral risk due to global warming
- India is significantly impacted, and so are Cambodia, Indonesia and Vietnam

Multi-sector risk (MSR) at 1.5°C temperature rise



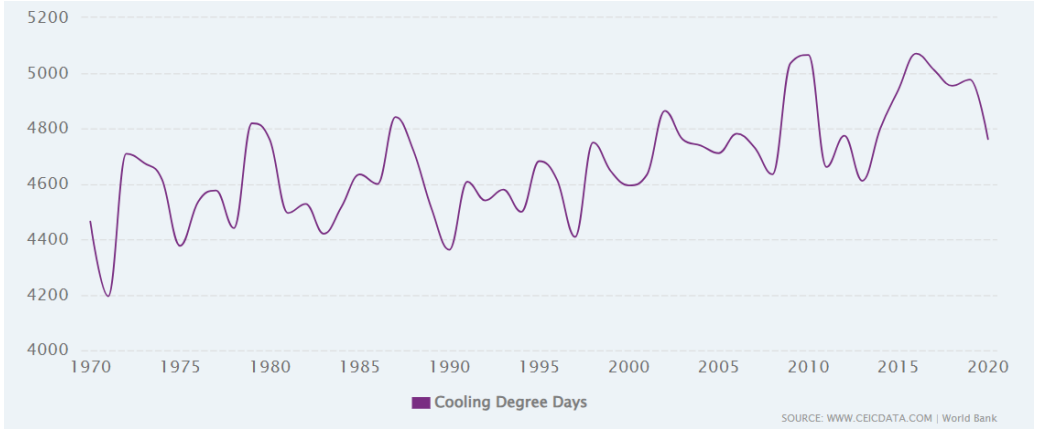
Source: Hoegh-Guldberg, O., et al., 2022

CLIMATE CHANGE

Case example: Increasing heat stress in India and potential hazards

The “Assessment of Climate Change over the Indian Region”, published by the Indian Ministry of Earth Sciences in 2020, highlights the following:

- India’s average temperature has risen by around 0.7°C during 1901–2018
- Frequency of daily precipitation extremes (rainfall intensities >150 mm per day) increased by about 75% during 1950–2015
- The frequency and spatial extent of droughts over India has increased significantly during 1951–2015
- Sea-level rise in the North Indian Ocean occurred at a rate of 3.3mm per year in the last two and half decades (1993–2017)
- Frequency of severe cyclonic storms over the Arabian Sea has increased during the post-monsoon seasons during 1998–2018



India cooling degree days 1970–2020 (an example of increasing heat stress)

Note: A cooling degree day is a measurement designed to track energy use. It is the number of degrees that a day's average temperature is above 18°C (65°F). Daily degree days are accumulated to obtain annual values

Source: https://climateknowledgeportal.worldbank.org

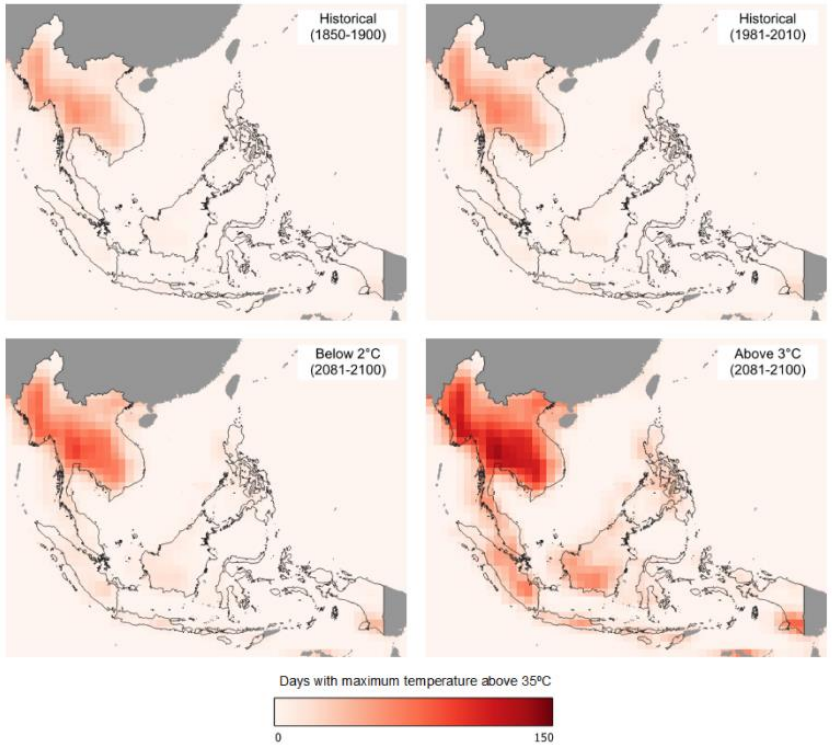
CLIMATE CHANGE IMPACT

Southeast Asia: Increasing cooling demand

IPCC studies show most of Southeast Asia has seen an ***increase in the number of warm nights, and increase in the intensity and frequency of heat waves;*** the subregion would be one of the **most exposed to extreme heat events**

Under a high-emissions scenario (above 3°C), Southeast Asia is projected to face ***48 days of maximum land temperature above 35°C***, which is almost ***four times higher*** than the pre-industrial period. In a low-emissions scenario, the projection is ***25 days***

Space cooling is one of the fastest growing electricity end uses. ***60% of households*** *are* projected to have access to space cooling and **increase in peak demand**



Change in days with maximum temperature above 35°C, 1850–1900, 1981–2010 and 2081–2100

Warm nights are defined by the IPCC as nights where the minimum temperature exceeds the 90th percentile, where the respective temperature distributions are generally defined with respect to the 1961–1990 reference period

Source: International Energy Agency, 2024

CLIMATE CHANGE

Potential disasters: Cambodia, India, Indonesia, Thailand and Vietnam

- Risk assessment of exposure to natural disasters is shown on a scale of 0 to 10 for the year 2025
- Compared to the world's average, all countries in the ALCBT project have high exposure to floods, and medium to high exposure to other natural disasters

Country	Flood	Costal Flood	Drought	Tropical Cyclone
Cambodia	8.7	3.8	4.2	1.8
India	9.2	7.8	6.3	7.7
Indonesia	8.4	8.1	3.3	1.5
Thailand	9.8	5.5	5.5	1.6
Vietnam	9.9	9.6	4.2	5.9
World Average	4.5	3.5	3.4	1.6

Low exposure (0 – 2.99)

Medium exposure (3 – 6.99)

High exposure (7 – 10)

Source: European Commission Disaster Risk Management Knowledge Centre

0.3 Energy Scenario

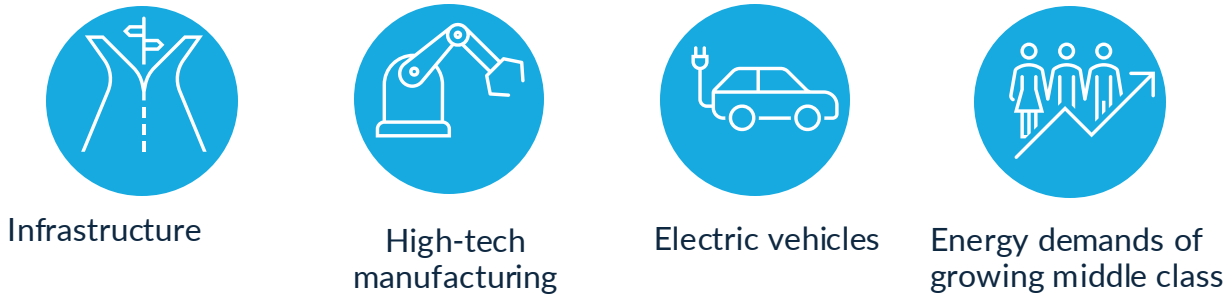
ENERGY SCENARIO

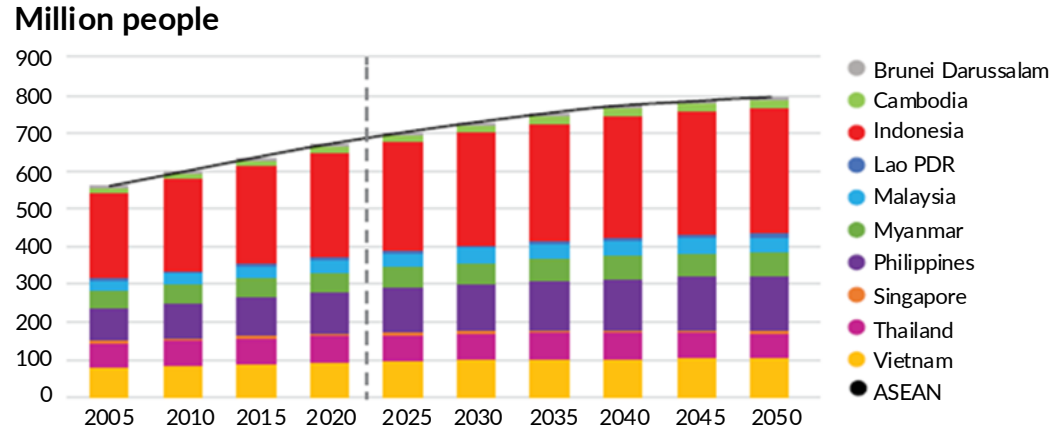
ASEAN region: Economic growth and energy demand

Southeast Asia accounts for *9% of the world's population, 6% of the world's GDP and 4% of world energy consumption*

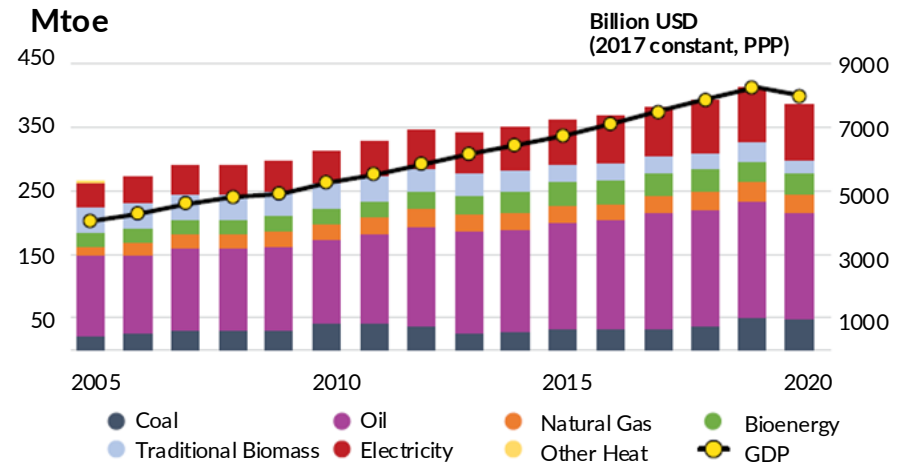
The energy demand in ASEAN region is expected to triple by 2050, from 2020 levels

Potential growth areas in ASEAN member states





Population of ASEAN member states, 2005–2050



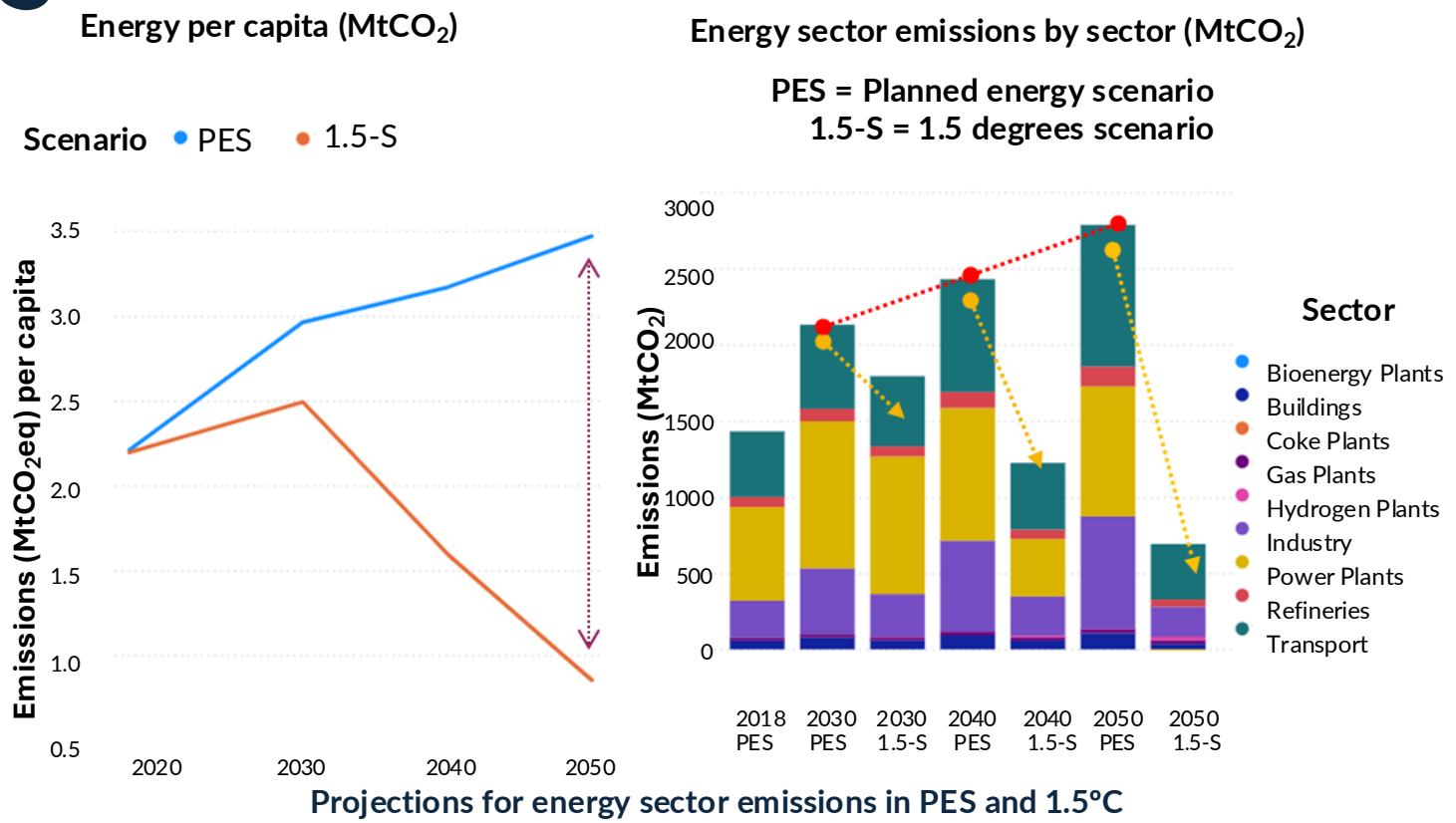
Energy demand by fuel and GDP in ASEAN, 2020–2050

Source: ASEAN Centre for Energy, 2022

ENERGY EMISSIONS

ASEAN region: Projected emissions

- *By 2050, the total CO_2-related emissions from ASEAN is expected to double from 2022 levels – mainly from the transport, power and industrial sectors*
- **Urbanization and motorization** are significant drivers to the **per capita energy demand**
- Per capita total final electricity consumption to increase by 35% by 2030 and 210% by 2050 in planned energy scenario (PES) as compared to 2018
- With the right policy and finance levers, 75% reduction can be achieved



Projections for energy sector emissions in PES and 1.5°C

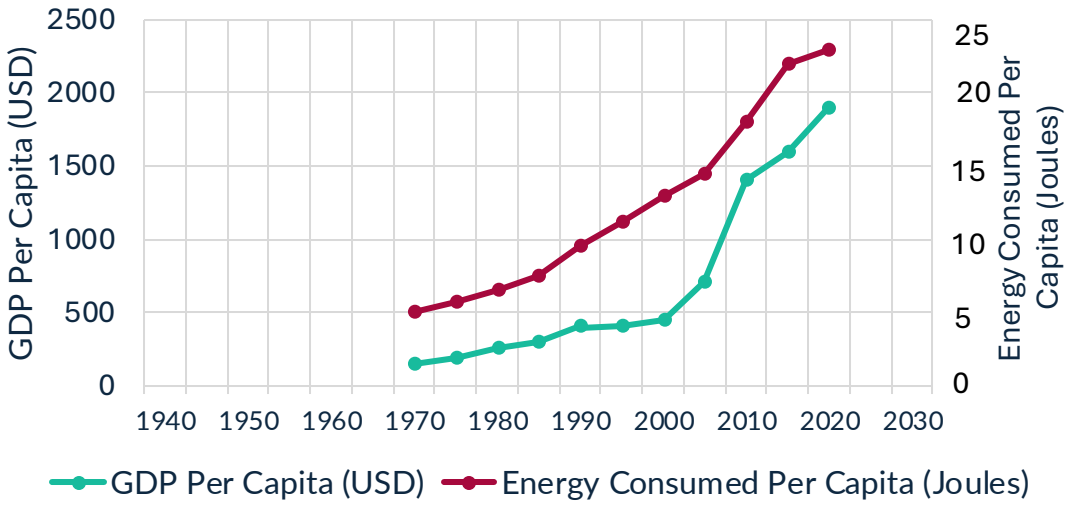
Note: The PES reflects current plans and expected objectives and policies that were approved as of the time of conducting the analysis. The energy transition scenarios are developed by IRENA from the PES. The 1.5-S is a more ambitious energy pathway and outlines options to further reduce CO_2 emissions in challenging sectors. It largely follows the World Energy Transitions Outlook scenario aiming to reach net zero emissions globally by 2050

Source: International Renewable Energy Agency, 2022

ENERGY EMISSIONS

India: Economic growth and energy demand

- **India is the fifth largest economy (USD854.7 billion** by end of March 2022, surpassing the United Kingdom, which was **USD816 billion)**
- **Third largest electricity producer (1,423 TWh) with third largest installed power capacity 429.96 GW (as of Jan 2024)**
- **India's population surpassed China in 2022 with 1.44 billion people**
- **India will peak at 1.7 billion people by early 2060, and will remain as the world's most populated country in the 21st century, according to the UN World Population Prospects Report 2024**
- Historically, the rise in GDP has resulted in a rise in energy consumption per capita
- India's energy demand will double by 2050, and is heavily dependent on fossil fuel consumption, including imports



GDP and energy consumption per capita in India

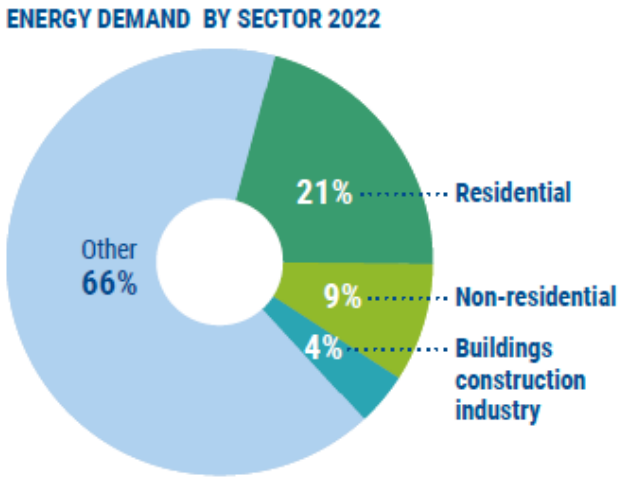
Sources: Bloomberg, Statista and UN Report

Sources: Niti Aayog; Petroleum Planning and Analysis Cell

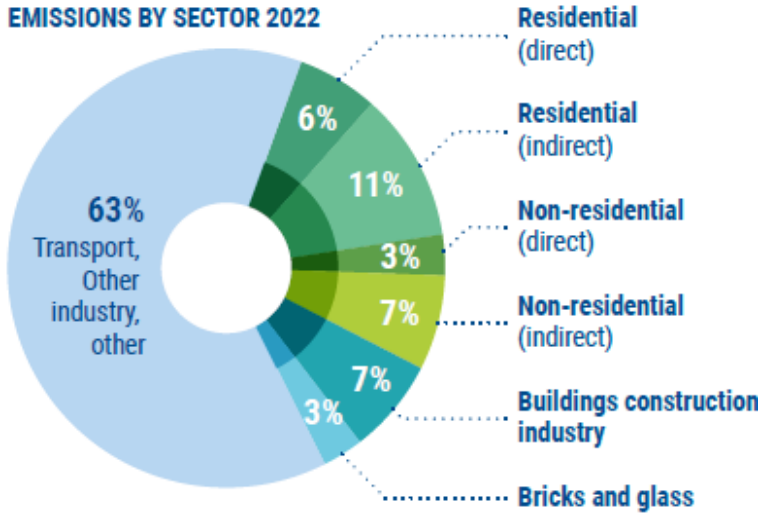
ENERGY AND CARBON EMISSIONS

Global construction and buildings industry

- Globally, buildings consume more than **30%–34% of the total energy demand** for operational requirements and production of construction materials
- In 2022, **CO_2 emissions** from buildings operations and construction reached a new high of **37% of total emissions**



Share of buildings in total final energy consumption (2022)



Share of buildings in global energy and process emissions (2022)

Source: United Nations Environment Programme, 2024

0.4 National Commitments

COP, Pledges and Commitments

GHG EMISSIONS

Plan of action for mitigation and adaptation

Mitigation

153 countries have net zero targets in NDCs, urgent strengthening of targets, and accelerated actions on coal, deforestation, methane and electric vehicles

Adaptation

Boosted efforts to deal with climate impacts, and support vulnerable countries to adapt and ***minimize loss and damage***

Finance

Mobilize public sector finance in USD millions and private sector finance in USD trillions

Collaboration

Over 40 countries endorsed the Breakthrough Agenda

Source: International Energy Agency, 2022

GLOBAL PLEDGES

Conference of Parties (COP)

United Nations Framework Convention on Climate Change (UNFCCC)

- COP is the main decision-making body of the UNFCCC
- COP28 was held in the United Arab Emirates in December 2023

- ***COP3, Kyoto Protocol:*** 37 industrialized countries and the EU committed to ***reduce their emissions by 5%*** from 1990 levels
- ***COP26, Global Methane Pledge:*** Collectively ***reduce anthropogenic methane emissions by 30%*** from 2020 levels by 2030
- ***COP28:*** Set goal to ***triple the share of renewables in energy supply*** *and* ***double the annual rate of increase in energy efficiency from 2% to 4% by 2030***
- ***COP28, Global Cooling Pledge:*** ***Endorsed by 71 countries;*** collective global targets to reduce ***cooling-related emissions by 68% by 2050,*** increase significant access to ***sustainable cooling by 2030*** and increase ***global average efficiency of new air conditioners by 50%***

Sources: UNFCCC; Global Methane Pledge; Global Cooling Pledge

STOCKTAKE FROM COP28

The four pillars

Recognition of the science that indicates **GHG emissions need to be cut by 43% by 2030**, compared to 2019 levels, to limit global warming to 1.5°C

The COP28 Presidency sets four pillars for the summit

Fast-tracking a just, orderly and equitable energy transition

Fixing climate finance

Focusing on people, lives and livelihoods

Underpinning everything with full inclusivity

Source: UNFCCC

COP PARIS AGREEMENT – 2015

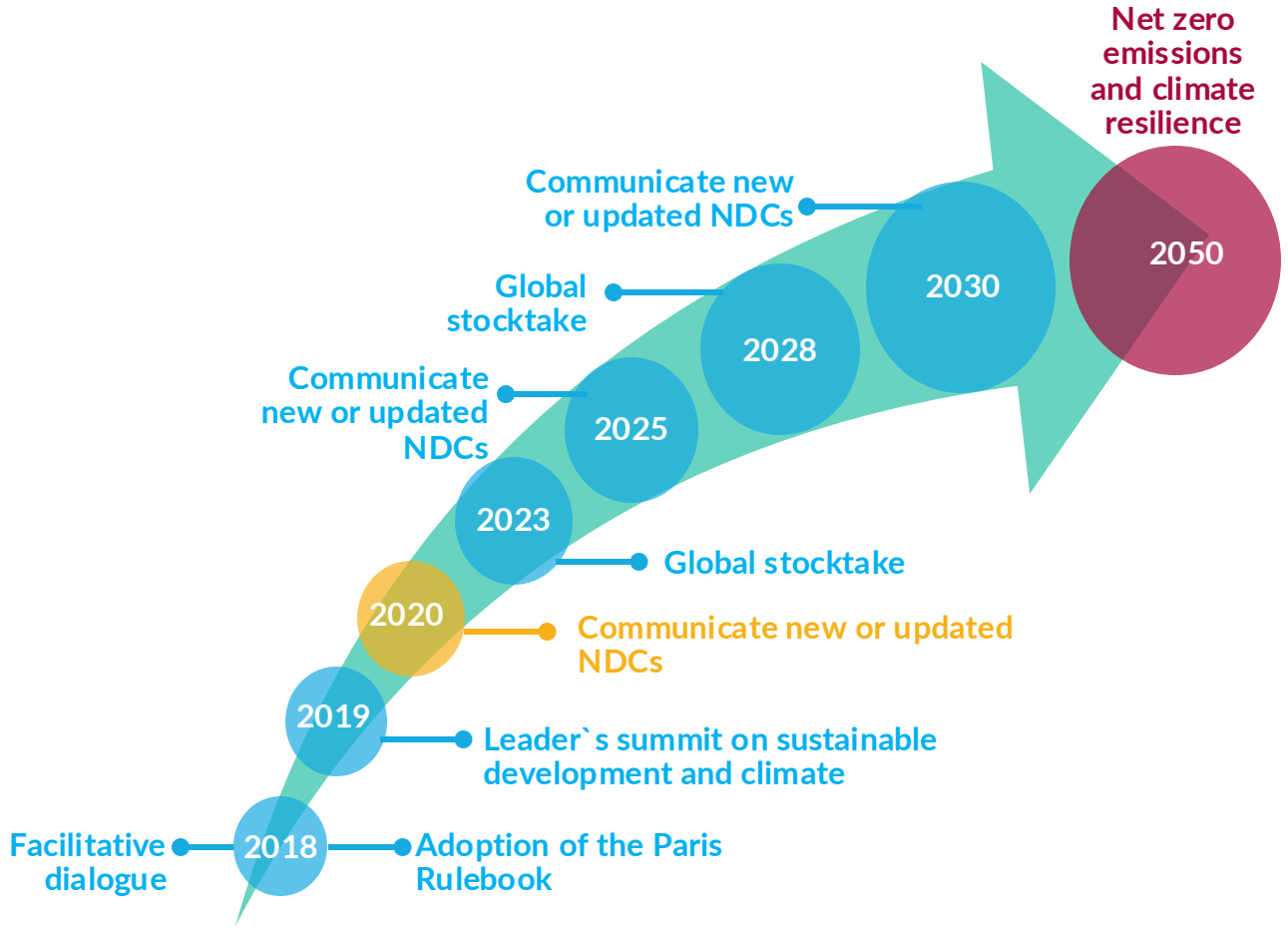
Nationally determined contributions (NDCs)

COP21, Paris (2015)

- Signed by 195 countries and ratified by 190 countries
- Holding the increase in global average temperature to well below 2°C above pre-industrial levels
- Pursuing efforts to limit temperature increase to 1.5°C above pre-industrial levels

NDCs

- Commitments from nations to UNFCCC to reduce their GHG emissions to mitigate climate change
- Revise NDCs every five years and communicate to UNFCCC



Source: Fransen, T. et al. 2017

ASEAN

Joint statement at COP28

Cambodia, Indonesia, Thailand and Vietnam are members of the Association of Southeast Asian Nations (ASEAN)

The regional targets outlined for 2025 in the ASEAN Plan of Action for Energy Cooperation are:

- ***Increase renewable energy share to 23%*** of total primary energy supply and ***35% of installed power capacity***
- ***Reduce energy intensity by 32%*** from 2005 levels

Image source: Wikipedia

Source: ASEAN Centre for Energy, 2024

ASEAN CLIMATE PLEDGES

Global RE, EE and cooling pledges

Pledge Name	Targets	ASEAN Signatories
Global Renewable Energy and Energy Efficiency Pledge	*Triple the global renewable energy generation capacity* to at least 11,000 GW *by 2030* and *double the global average annual rate of energy efficiency improvement* from around *2% to over 4% per year by 2030*	Brunei, Darussalam, Malaysia, Singapore and Thailand
Global Cooling Pledge	*Reduce cooling-related emissions* by a minimum of *68% to 2022 levels by 2050*	Brunei, Darussalam, Cambodia, Singapore, Thailand and Vietnam
Declaration on Hydrogen and Derivatives	Mutual recognition of certification of renewables and hydrogen	Malaysia and Singapore

Source: ASEAN Centre for Energy, 2024

0.5 NDCs

Cambodia, India, Indonesia, Thailand, Vietnam

Cambodia

- Updated NDC 2021: Reduction target of 41.7% from BAU scenario by 2030
- Mitigation (energy, agriculture, FOLU, industry and waste sectors) – USD5.8 billion
- Adaptation (agriculture, infrastructure and water sectors) – USD2 billion
- Long-term Strategy for Carbon Neutrality 2050

India

- Updated NDC 2021: "Panchamrit"
- Increase non-fossil fuel energy capacity to 500GW by 2030
- Meet 50% of energy requirements from renewable energy by 2030
- Reduce total projected carbon emissions by 1 billion tons by 2030
- Reduce carbon intensity of the economy to less than 45% by 2030 from 2005 levels
- Achieve net zero emissions by 2070

Indonesia

- Updated NDC 2022: 29% reduction in GHG emissions (unconditional), 41% reduction in GHG emissions (conditional) below BAU scenario
- Long-term Strategy for Low Carbon and Climate Resilience 2050
- Net zero emissions by 2060
- Energy, AFOLU, IPPU and waste sectors covered

Thailand

- Updated NDC 2022: 30% reduction in GHG emissions (unconditional), 40% reduction in GHG emissions (conditional) below BAU scenario
- Energy, agriculture, IPPU and waste sectors covered
- Long Term – Low Emission Development Strategy
- Carbon neutrality by 2050 and net zero by 2065

Vietnam

- Updated NDC 2022: 9% reduction in GHG emissions (unconditional), 27% reduction in GHG emissions (conditional) below BAU scenario from 2014 levels
- Energy, agriculture, IPPU and LULUCF sectors covered
- Plan for Implementation of the Paris Agreement in 2016, containing 68 objectives related to mitigation, adaptation, human, technical and financial resources, and MRV
- Net zero emissions by 2050

Source: NDC Partnership

BUILDING-RELATED NDCS

Cambodia, India, Indonesia, Thailand, Vietnam

Cambodia	India	Indonesia	Thailand	Vietnam
• Building codes, enforcement/certification for new buildings to reduce electricity consumption by 10% in 2030 • Improved cooling in public sector buildings to reduce 43,000 tCO_2 per year • Passive cooling in buildings to reduce 74.5 tCO_2e	• Energy and material efficiency in buildings and increase climate resilience of cities • Smart city initiatives, integrated planning of cities for mainstreaming adaptation and enhancing energy and resource efficiency, effective green building codes, and rapid developments in innovative solid and liquid waste management	• Embed energy efficiency in buildings through implementation of Green Building Code for new and existing buildings • Promote energy efficient appliances, lighting and systems in buildings • Increase blended cement by increasing the portion of alternative materials for reducing clinker to cement ratio • Promote development of climate proof cities	• Implementation of the National Energy Efficiency Plan (EEP) (2015–2036), which aims to reduce energy demand by 30% in 2036 compared to BAU trajectory • New EEP (2018–2037) aims to reduce energy intensity by 30% by 2037 compared to the baseline year 2010 • EEP (2024 version) is under review and yet to be launched	• Replace construction materials, improve the cement and chemical production processes, and reduce the consumption of hydrofluorocarbons • Improve, develop and apply technology in manufacturing construction materials • Reduce clinker content and implement other measures to reduce GHG emissions in cement production • Develop and use energy-saving construction materials and green materials in housing and commercial sectors

Source: Zhou et al., 2019

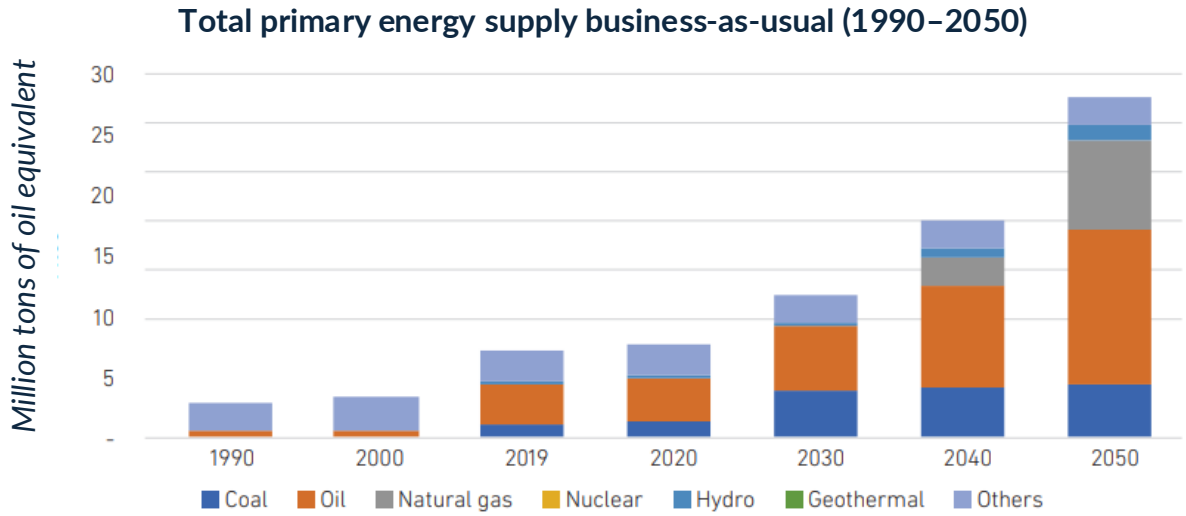
1. Cambodia

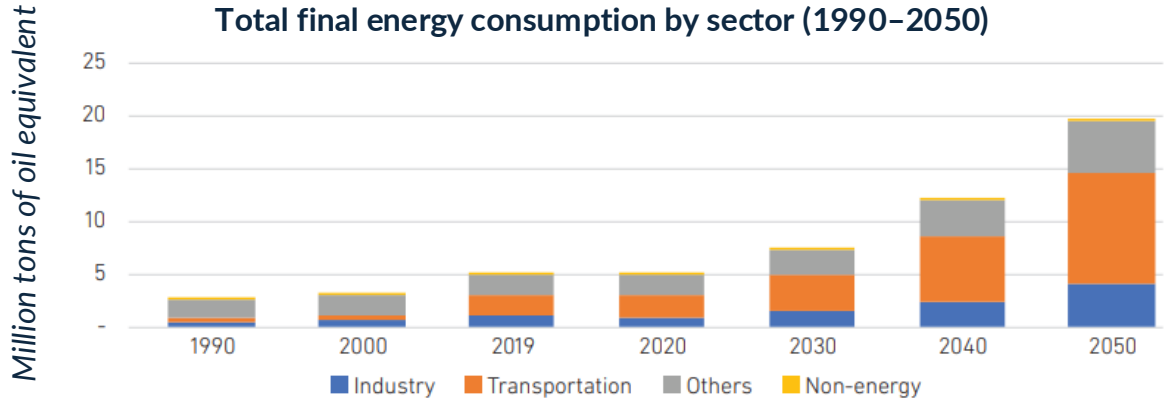
Image source: https://nowboarding.changiairport.com/travel-the-world/travel-guide-cambodia-phnom-penh.htm

ENERGY SCENARIO

Total primary energy supply

- The strongest growth in demand is projected in ***transport,*** which will increase ***fivefold*** at an annual average rate of 5.33% in 2019–2050, from 2.09 Mtoe to 10.46 Mtoe
- The demand in industry is projected to grow 4.32 times at an annual rate of 4.85%, from 0.95 Mtoe in 2019 to 4.11 Mtoe in 2050, followed by 'others' at 3.07%, from 1.91 Mtoe in 2019 to 4.88 Mtoe in 2050



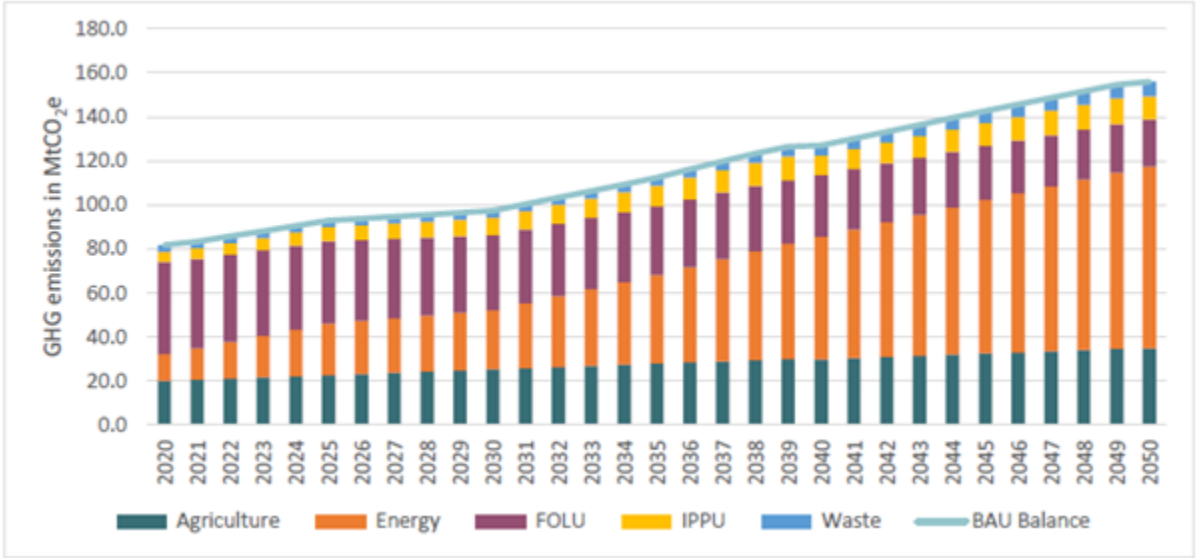


Source: Kimura et al., 2023

GHG EMISSIONS

Emissions by sector

- According to Cambodia's Long-term Strategy for Carbon Neutrality, the forestry and land use (FOLU) sector was responsible for 51 $MtCO_2e$ of emissions in 2016, the largest share of emissions in Cambodia. Deforestation is the major cause of emissions
- 2020: Largest emissions from FOLU
- BAU 2050: Largest emitter is expected to be the energy sector



GHG emissions projections in the BAU scenario by sector

Source: Government of Cambodia, 2021

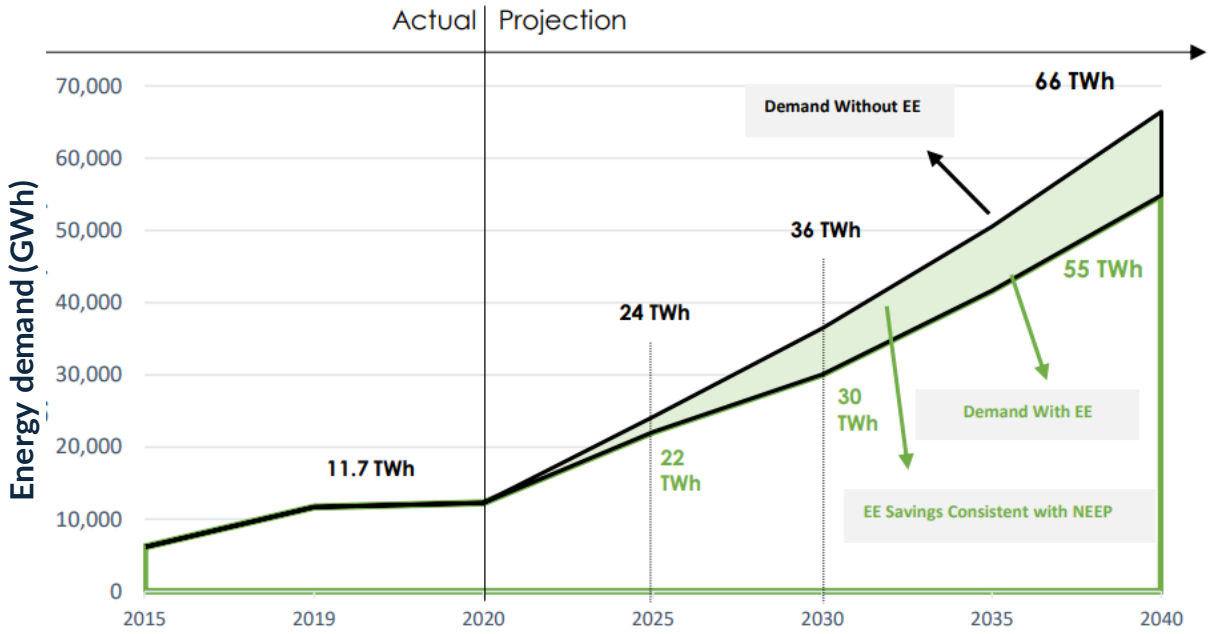
ENERGY DEMAND

2022–2040

- According to Cambodia's Power Development Masterplan (PDP) 2022–2040, the country's peak demand for electricity is expected to grow by ***7.5%–8.9% annually***. This would result in a ***peak demand of 8.9 GW by 2040***

- The PDP projects that by 2040, **63% of Cambodia's power capacity will come from renewable sources, with 32% from solar photovoltaic and 30% from hydropower**

PDP energy demand forecast (GWh/TWh)



Energy demand forecast (GWh) and average annual growth rates (%)

	Actual		Projection					Average Annual Growth Rate (%)				
GWh	2015	2019	2020	2025	2030	2035	2040	2019/2015	23/2019	2025/2019	2030/2019	2040/2019
Base (without EE)	6,144	11,705	12,290	24,184	36,465	50,405	66,187	17.50%	13.90%	12.90%	11.5%	8.8%
Base (with EE)	6,144	11,705	12,290	22,108	30,080	41,579	54,597	17.50%	9.40%	9.50%	9.4%	7.7%

GHG EMISSIONS

Cambodia emissions compared to Southeast Asian countries

- **Fastest emissions growth** rate; transition risks
- Most **carbon intensive** economy after Myanmar
- Fastest **growing sources** of GHG emissions are **electricity and heat generation**; cooling and industrial uses
- Construction industry is a **key pillar** and **significant contributor to GDP**, and will impact sectoral emissions

Cambodia has low but rapidly rising GHG emissions

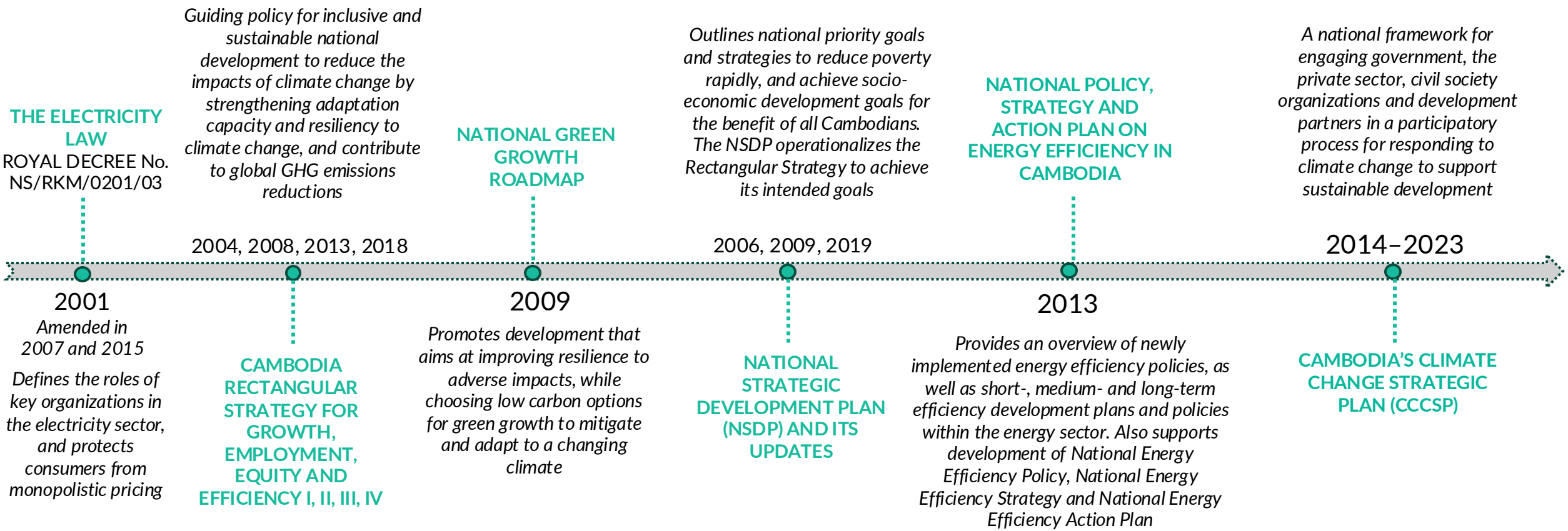
	GHG emissions per capita (tCO_2e per person)	Carbon intensity (tCO_2e per US$ million of GDP)	Total GHG emissions ($mtCO_2e$)	Annual emissions % growth rate (2010–2019)
United States	17.6	270	5771	-0.5
Malaysia	12.4	1081	396	0.8
OECD members	10.6	258	13797	-0.6
China	8.6	844	12055	2.2
Indonesia	7.2	1751	1960	6.3
Thailand	6.3	804	437	4.4
Lao	5.5	2104	39	3.6
Vietnam	4.5	1326	438	5.2
Myanmar	4.5	3537	243	0.5
Cambodia	**4.4**	**2649**	**72**	**8.2**
Philippines	2.2	628	237	3.5

Source and notes: Climate Analysis Indicators Tool. Emissions are all GHG emissions and estimates for 2019. Annual emissions growth is calculated as the compound annual growth rate.

Source: World Bank, 2023a

CAMBODIA INITIATIVES

Timeline for policies in climate and energy



Source: https://asiapacificenergy.org/apef/index.html#main/lang/en/time/[2018,2024]/geo/[]/search

CAMBODIA INITIATIVES

Timeline for policies in climate and energy

CAMBODIA'S INTENDED NATIONALLY DETERMINED CONTRIBUTION (INDC)

2016

A multi-sectoral policy document. In the INDC, Cambodia proposes a GHG mitigation contribution for 2020–2030, conditional upon the availability of support from the international community. Key sectors being energy, manufacturing and transport

A roadmap for various stakeholders, including businesses, to implement actions that will contribute to addressing climate change issues and move toward a low carbon resilient economy

2016–2018

CLIMATE CHANGE ACTION PLAN FOR MINES AND ENERGY SECTORS

CAMBODIA BASIC ENERGY PLAN

2019

Sets numerical targets for each energy issue covered by the plan. The objective of the plan is to seek an energy supply for Cambodia with the following conditions: affordability, accessibility, security (sustainable security), safety and transparency in the energy market. It covers key areas like oil, renewable energy, ***energy efficiency,*** *energy security and energy outlook*

Sets the guiding principles for the regulatory framework of the construction sector. The law ***highlights building efficiency and green building concepts*** *that ensure green development, and natural resource and environmental protection; construction quality, security and safety; and the protection of property and well-being of construction.*

Minimum energy efficiency standards are incorporated

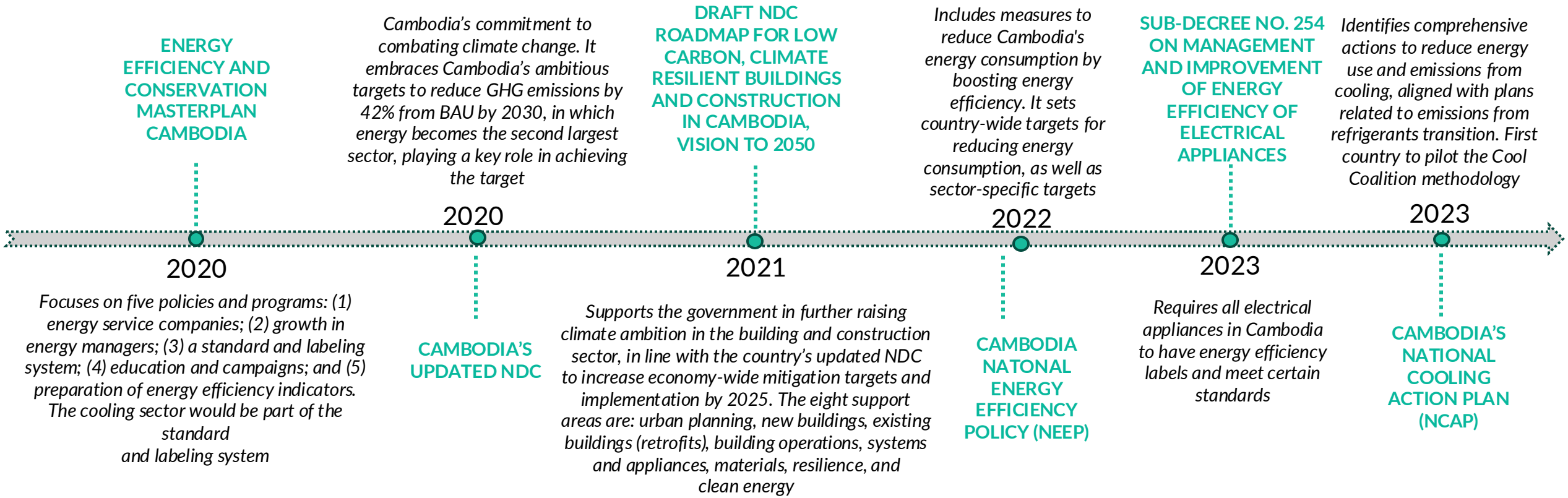
2019

CONSTRUCTION LAW

Source: https://asiapacificenergy.org/apef/index.html#main/lang/en/time/[2018,2024]/geo/[]/search

CAMBODIA INITIATIVES

Timeline for policies in climate and energy



Source: https://asiapacificenergy.org/apef/index.html#main/lang/en/time/[2018,2024]/geo/[]/search

INSTITUTIONAL MECHANISMS

Climate change policy: National committee for implementation

The institutional framework established to lead Cambodia's climate response includes:

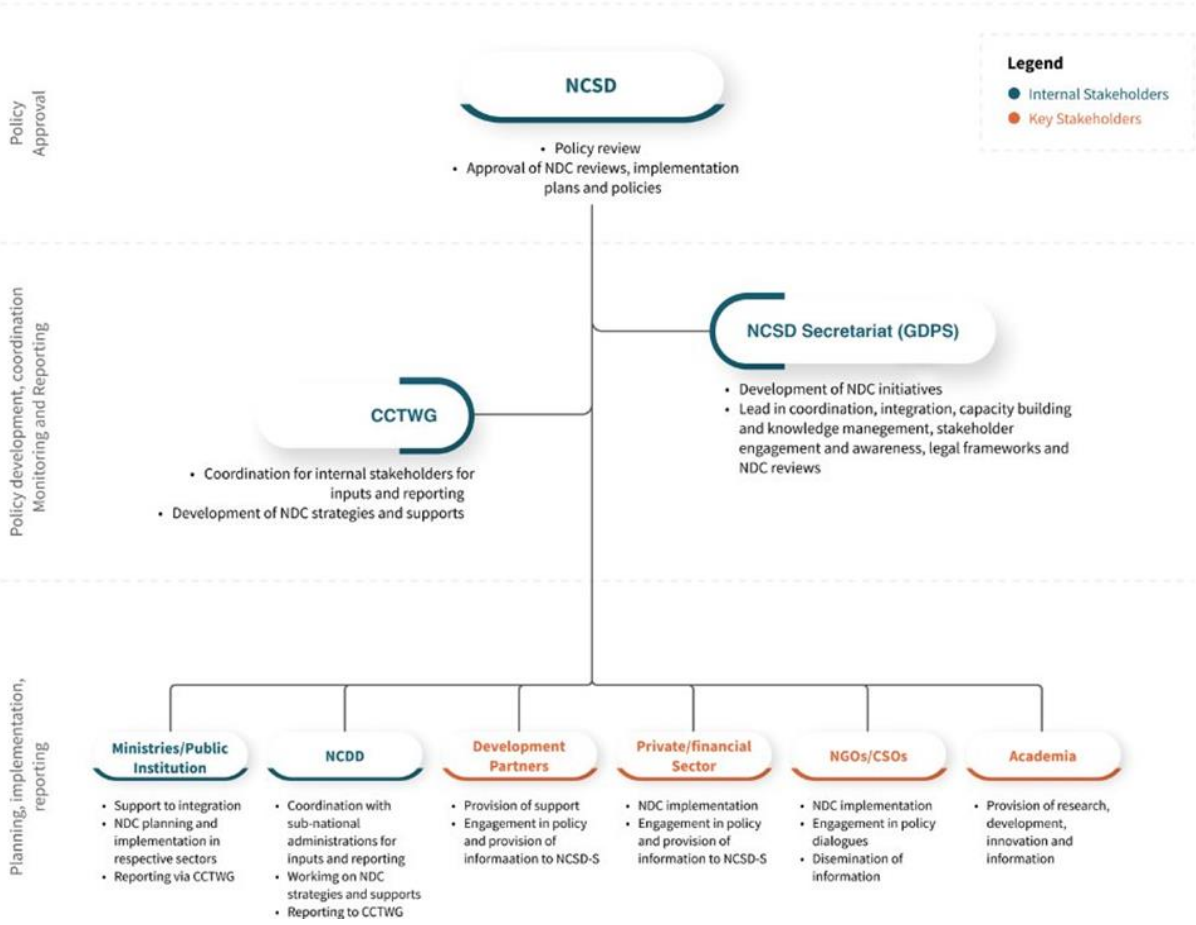
National Council for Sustainable Development (NCSD), and ***its Secretariat, General Directorate of Policy and Strategy (GDPS)*** (Royal decree no. NorSor/RorKorTor/0515/403 and sub-decree No. 59 OrNorKrar.BorKor in 2015)

Council's Climate Change Technical Working Group (CCTWG) (Prakas NO.002 S.S.R NCSD in 2017)

Specifies the roles and tasks for the development and management of climate change monitoring and evaluation (M&E) instruments, and the national M&E framework for climate change response

Policy approval: NCSD

Policy development and monitoring: GSSD and CCTWG



Source: National Council for Sustainable Development, Government of Cambodia

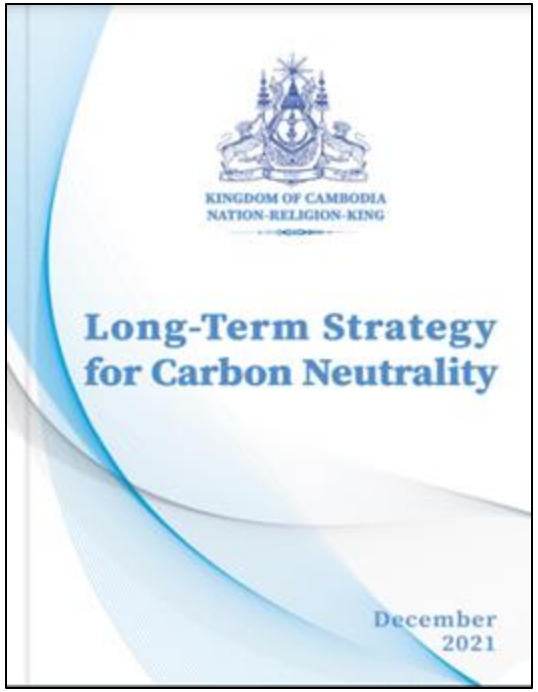
STRATEGY FOR MITIGATION

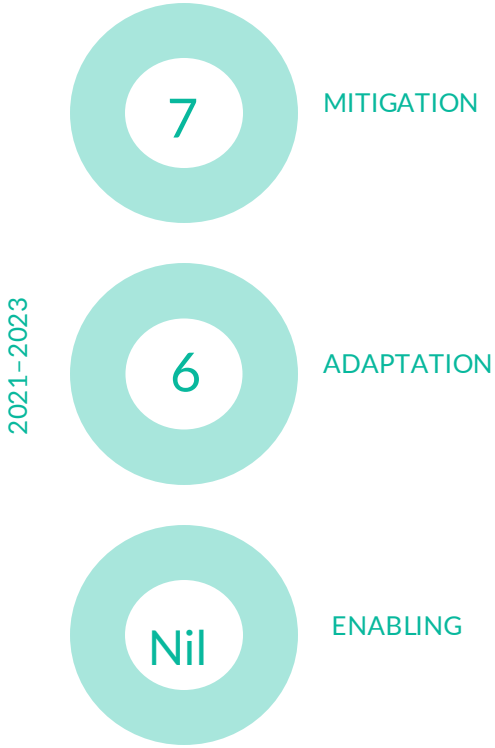
LTS4CN mitigation, adaptation and enabling actions

Cambodia's ***Long-term Strategy for Carbon Neutrality (LTS4CN)*** serves as a roadmap or vision document that outlines priority mitigation actions for each sector to achieve the country's goal of a carbon neutral economy in 2050. The strategy largely builds on the updated NDC

Mitigation actions:
33 prioritized actions in 7 sectors
7 in the construction sector
42% reduction in emissions compared to BAU

Adaptation actions:
58 prioritized actions in 11 sectors;
6 in the construction sector
Reduce vulnerability to climate change





Implementation actions in sectors that impact the building and construction industry

Source: National Council for Sustainable Development, Government of Cambodia

Source: Government of Cambodia, 2021

UPDATED NDCs

Cambodia 2021

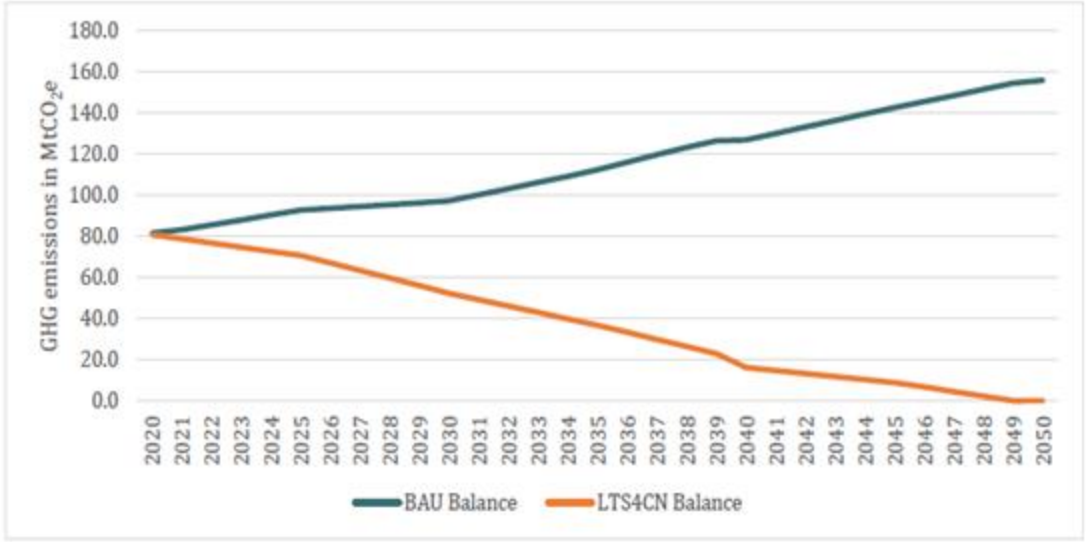
AGRICULTURE FOLU ENERGY TRANSPORTATION INDUSTRIES WASTE

Mitigation areas of LTS4CN

42% net GHG reductions below BAU by 2030
(*conditional on international support)*

Reduction by 2030 below BAU

FOLU: 50%
Energy: 40%
Agriculture: 23%
Industry (IPPU): 42%
Waste: 18%

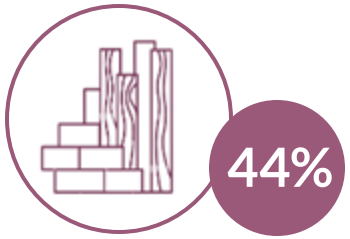


GHG emissions projections, BAU and LTS4CN scenarios

Source: Government of Cambodia, 2021

NDC MITIGATION

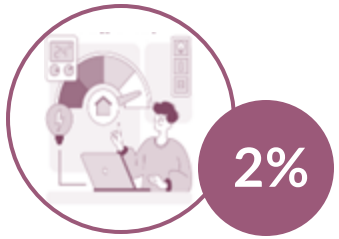
The building and construction sector's key mitigation actions and reduction targets by 2030



SUSTAINABLE BRICK MANUFACTURING

TOOL FOR URBAN HEAT ISLAND EFFECT

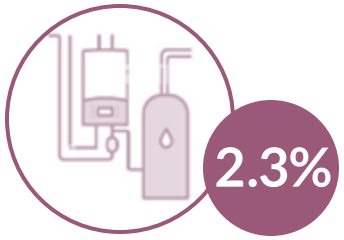
ENERGY MANAGEMENT IN INDUSTRIES



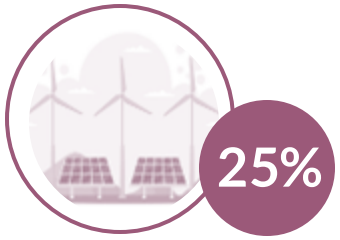
PUBLIC AWARENESS

BUILDING CODE ENFORCEMENT NEW AND RETROFIT

LABELING AND MEPS



EE MOTORS AND BOILERS



RE INTEGRATION - ENERGY MIX

NCAP IMPLEMENTATION

PASSIVE COOLING SYSTEMS IN BUILDING ENERGY CODE

ADDRESSING URBAN HEAT ISLAND EFFECT IN CITIES

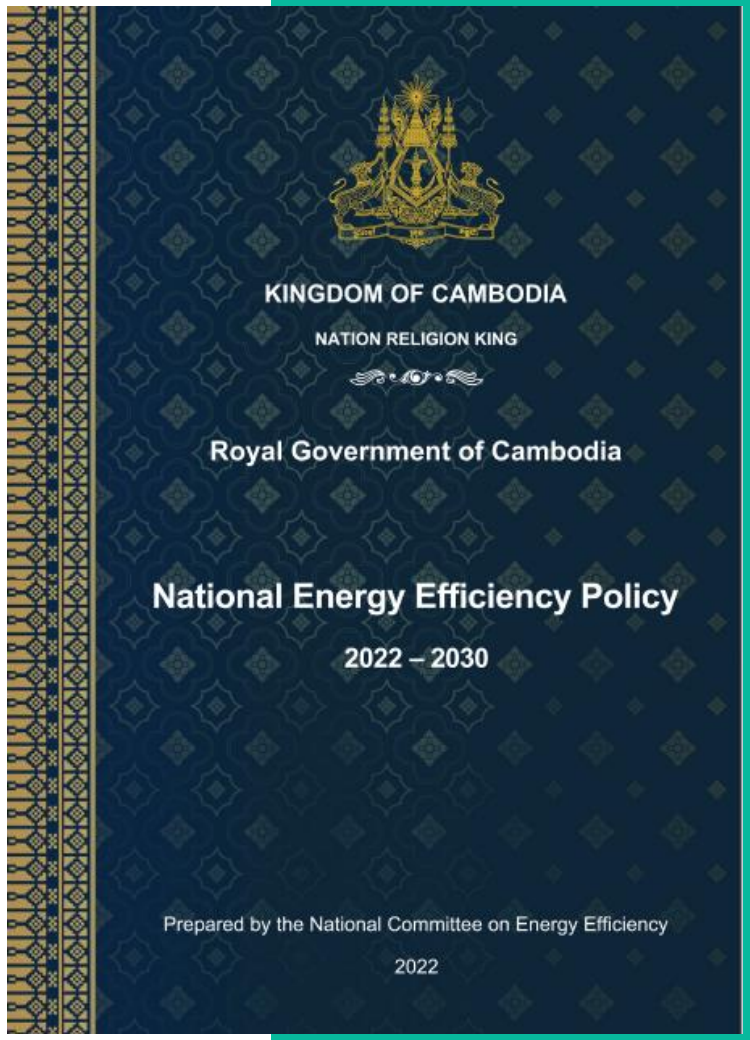
Source: NDC Partnership

NEEP

National Energy Efficiency Policy 2022–2030

Vision

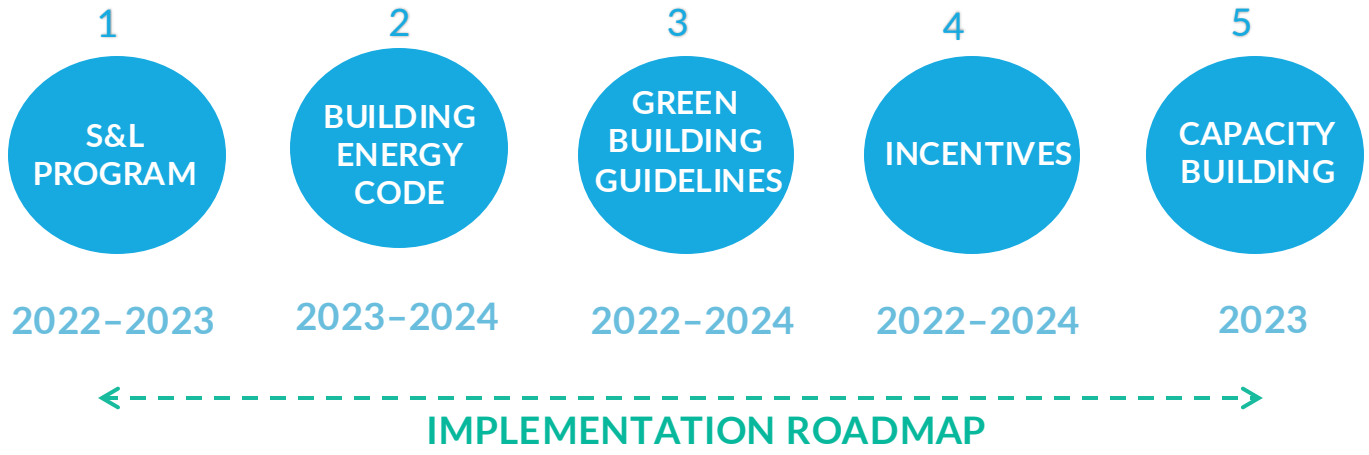
Transform energy consumption in Cambodia by adopting energy efficiency, thereby contributing to a strong, vibrant and competitive economy while fostering sustainable development

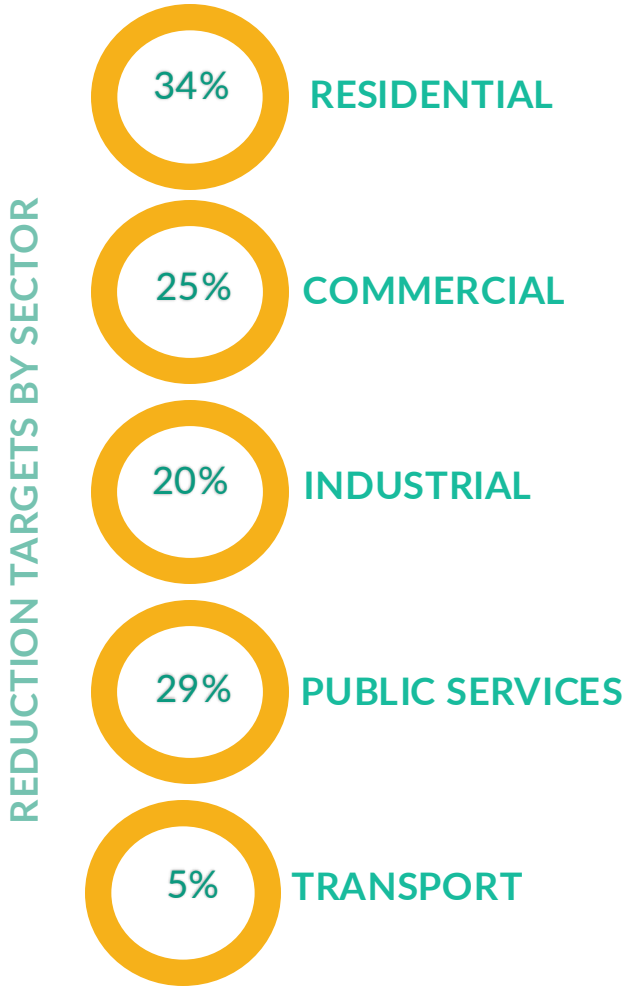


Source: National Committee on Energy Efficiency, Government of Cambodia, 2022

BUILDING SECTOR

National targets and strategic pillars





Source: National Committee on Energy Efficiency, Government of Cambodia, 2022

INSTITUTIONAL STRUCTURE

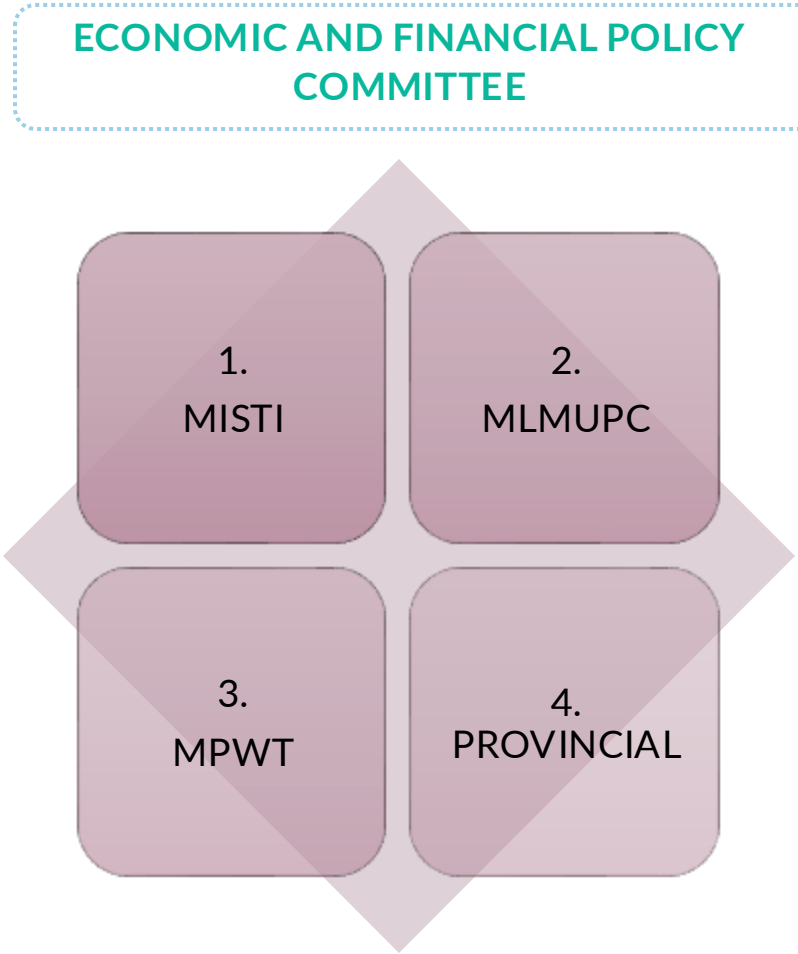
NEEP

1. Subnational Committee on Energy Efficiency led by Ministry of Industry, Science, Technology and Innovation (MISTI)
Formulate and implement Sectoral Energy Efficiency Action Plan in industry

2. Subnational Committee on Energy Efficiency led by Ministry of Land Management, Urban Planning and Construction (MLMUPC)
Formulate and implement Sectoral Energy Efficiency Action Plan in buildings

3. Subnational Committee on Energy Efficiency led by Ministry of Public Works and Transport (MPWT)
Formulate and implement Sectoral Energy Efficiency Action Plan in public works and transport

4. Subnational Committee on Energy Efficiency led by capital and provincial administrations
Formulate and implement Sectoral Energy Efficiency Action Plan in integration with capital and provincial administrative bodies



Governance Structure of NEEP

EE PROGRAMS AND PROJECTS

Cambodia

PASSIVE COOLING IN CAMBODIA

MINISTRY OF ENVIRONMENT + COOL COALITION + ESCAP

- Policy interventions through the inclusion of passive cooling solutions in building energy regulations
- Demonstration of passive cooling applications in buildings
- Delivery of awareness raising and capacity building for large-scale replication
- Support the inclusion of GHG emissions reductions from passive cooling solutions in the next cycle target for Cambodia's NDC

ENERGY EFFICIENCY CONTEST

CCCSP + CUBE

- Creation of EE building contest with a target of minimum 25 participant buildings in the first year
- Behavioral change tools and materials adapted to the local Cambodian context
- A social media campaign targeting many beneficiaries
- Student involvement through youth associations
- Sharing of best practices between universities
- Capacity building of researchers from the Institute of Technology of Cambodia to create a pool of experts on EE in Cambodia
- Policy advisory report and meetings with relevant governmental institutions to share the results of the contest and put forward the EE agenda

Sources: Cool Coalition; National Council for Sustainable Development, Government of Cambodia

EE PROGRAMS AND PROJECTS

Cambodia

PILOTING ENERGY EFFICIENCY IN BUILDINGS AND SOLAR MICRO GRIDS

- Walk-through audits in five government buildings
- Installation of real-time energy monitoring equipment (hardware and software)
- Analysis of building energy data and selection of feasible EE measures for implementation
- Consultation with planning and finance departments and the Ministry of Economy and Finance
- Develop EE procurement guidelines
- Technical support implementation of EE measures
- Guidelines for building energy management (BEM)
- Develop training package and conduct training of trainers
- Pilot BEM training for facility managers

Source: National Council for Sustainable Development, Government of Cambodia

EE IN THE COOLING SECTOR

Initiatives in building and industry

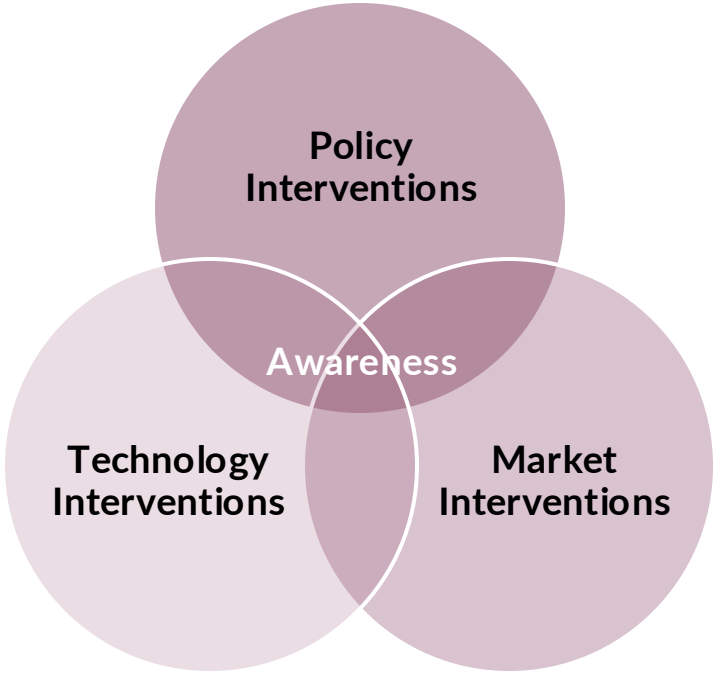
CAMBODIA'S NATIONAL COOLING ACTION PLAN (NCAP)

POWER DEVELOPMENT MASTERPLAN 2022–2040

NATIONAL COOLING ACTION PLAN

Proposed short-term (5 years) and mid-term (10 years) policy interventions

- Establish and enforce building codes / certification for new buildings and those under major renovation
- Reduce dependency on air conditioning in public sector buildings
- Adopt minimum energy performance standards (MEPS) and energy labels for air conditioning



Source: Ministry of Environment, Government of Cambodia, 2022

WAY FORWARD

Addressing policy and institutional barriers

- Strengthen governance framework on energy efficiency, including institutional mandates, roles and mechanisms for coordination among government agencies
- Develop sector-specific policies and regulations to foster investments in energy efficiency (e.g., in the form of codes, labels and standards)
- Develop market mechanisms and regulations to support the development of energy efficiency services and energy audits, in particular a building energy code, empanelment of ESCOs and the accreditation of energy auditors
- Establish a framework and enforcement mechanism for the measurement, reporting and verification of energy consumption in large consumer segments, including industries and buildings
- Ensure the availability of sub-sectoral data and data sharing mechanisms on energy consumption across line ministries
- Establish an accreditation framework for energy auditors and managers
- Strengthen capacities of government agencies both at the national and subnational level to identify, develop and implement energy efficiency projects
- Provide fiscal and financial incentives to support and reward the adoption of energy efficiency

Source: National Committee on Energy Efficiency, Government of Cambodia, 2022

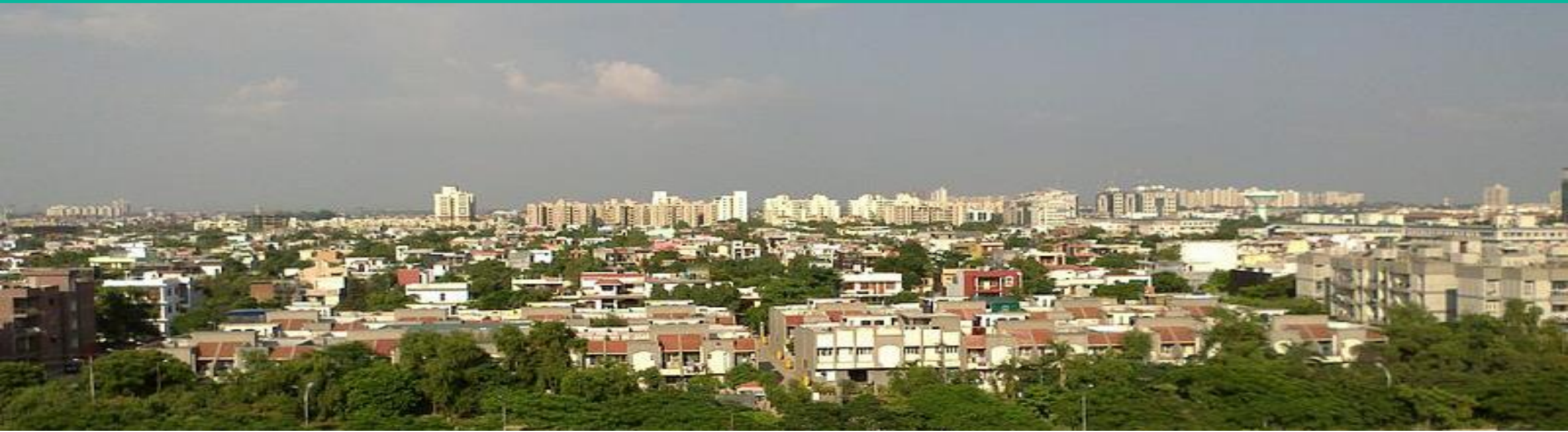
WAY FORWARD

Opportunities

- Insufficient supply, high electricity prices and grid insecurity make Cambodia a highly suitable market for energy efficiency initiatives. The Cambodia Climate Change Strategic Plan (CCCSP) stresses the importance of EE in the residential and real estate sector
- The General Department of Energy, Ministry of Mines and Energy, and Economic Research Institute for ASEAN and East Asia to come up with the Energy Efficiency and Conservation Masterplan for Cambodia that focuses on five policies and programs: (1) energy service companies; (2) growth in energy managers; (3) a standard and labeling system; (4) education and campaigns; and (5) preparation of energy efficiency indicators
- Development of the Building Energy Code

Source: National Committee on Energy Efficiency, Government of Cambodia, 2022

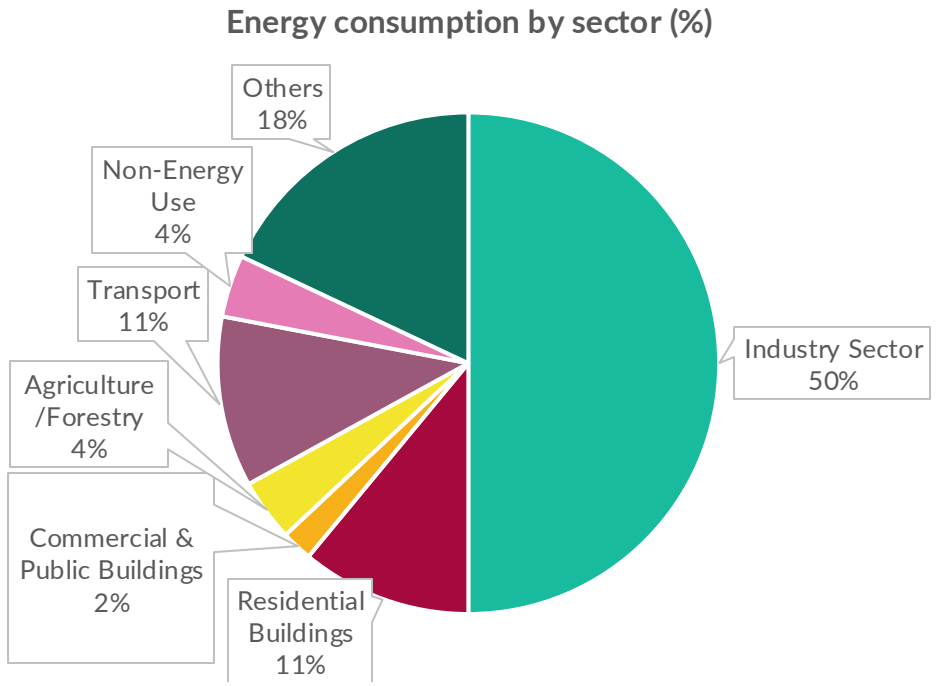
2. India



ENERGY SCENARIO

Energy consumption in different sectors (2022–2023)

- The industrial sector was the largest energy consumer with more than half of TFEC (50.59%)
- Residential, commercial and public buildings accounted for 13% of TFEC
- Agriculture and forestry, non-energy uses, and others accounted for 26% of TFEC
- The transport sector accounted for 11% of TFEC



Total final energy consumption (TFEC) by major sectors In the Indian economy

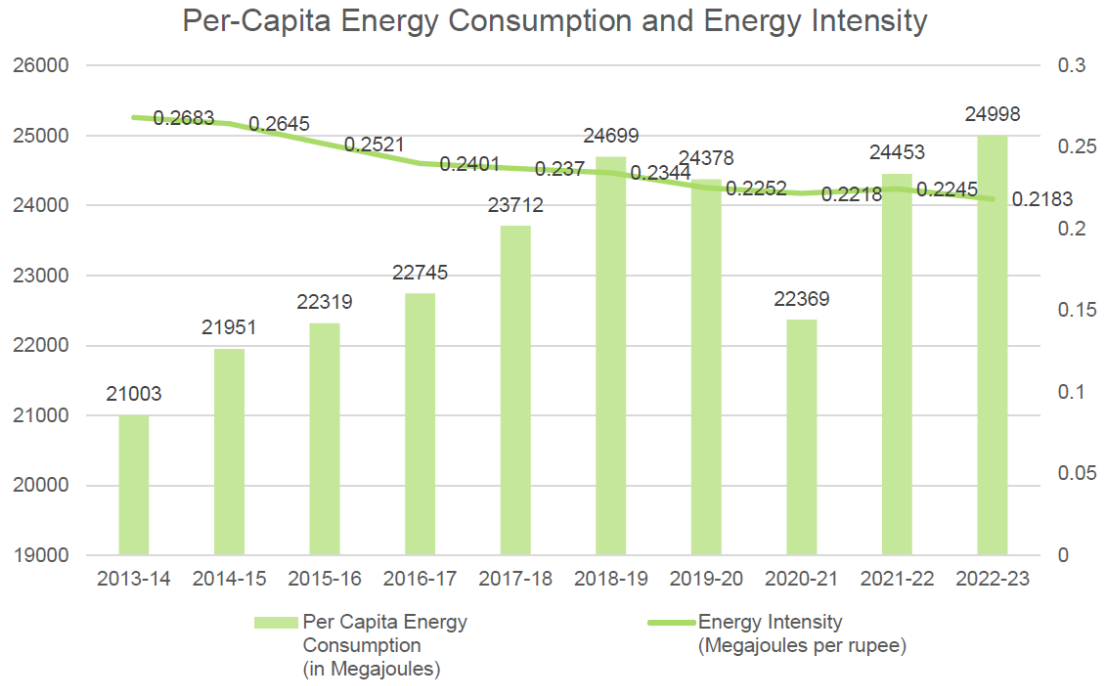
Source: Ministry of Power and Bureau of Energy Efficiency, Government of India, 2023

ENERGY SCENARIO

Per capita energy consumption and energy intensity

Total final energy consumption in India (2022–2023)

- India's energy intensity decreased from 0.2683 megajoules per rupee in FY 2013–2014 to 0.2183 (P) megajoules in FY 2022–2023, which is a ***significant improvement of 18.65%***
- *India successfully reduced emissions intensity vis-à-vis its GDP by 33% between 2005 and 2019*, ***thus achieving the initial NDC target for 2030, 11 years ahead of schedule.*** This decline is attributed to the ***deployment of energy efficiency programs,*** among other factors
- India achieved ***40% of installed electric power capacity through non-fossil fuel sources, nine years ahead of the target for 2030.*** Between 2017 and 2023, India ***added around 100 GW of installed electric power capacity; 80% of this capacity is attributed to non-fossil fuel-based resources***



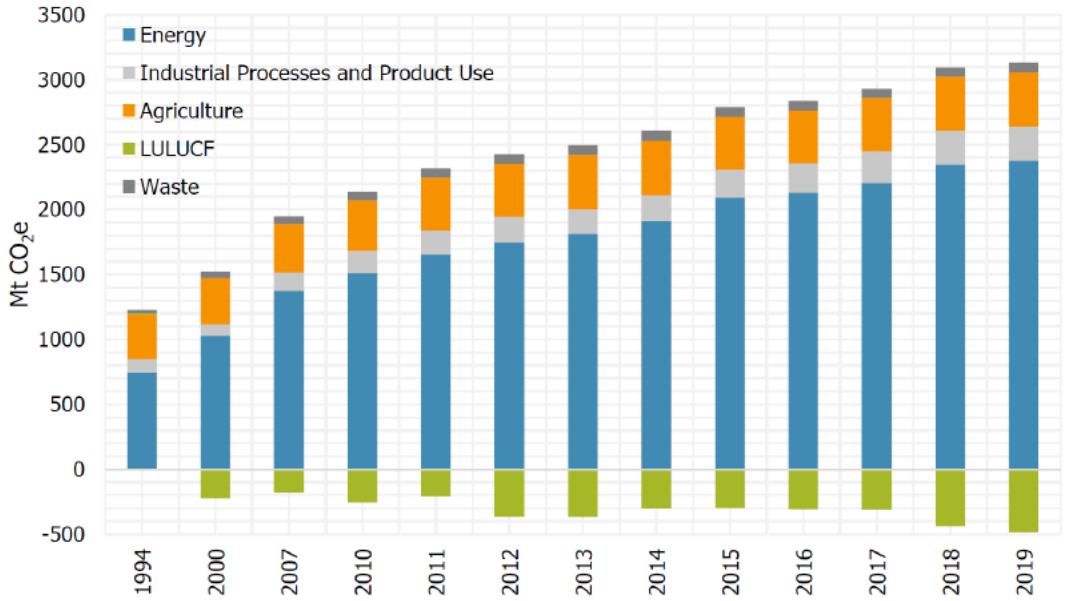
Energy intensity and per capita consumption trend

Sources: Ministry of Power and Bureau of Energy Efficiency, Government of India. 2023; COP28 National Statement by Union Minister for Environment, Forest and Climate Change, Shri Bhupender Yadav

GHG EMISSIONS

As per India's Third National Communication to UNFCCC

- In 2019, India's total GHG emissions, excluding LULUCF was **3,132 $MtCO_2e$,** and **2,647 $MtCO_2e$** including LULUCF
- Total national emissions (including LULUCF) increased by **4.56%** with respect to the total national emissions of **2016,** and by **115.42% since 1994**
- From **1994 to 2019**, total CO_2e emissions (without LULUCF) increased by **158%**
- The **energy sector** had the highest emissions growth of **219%** due to continuous increase of fossil fuel combustion



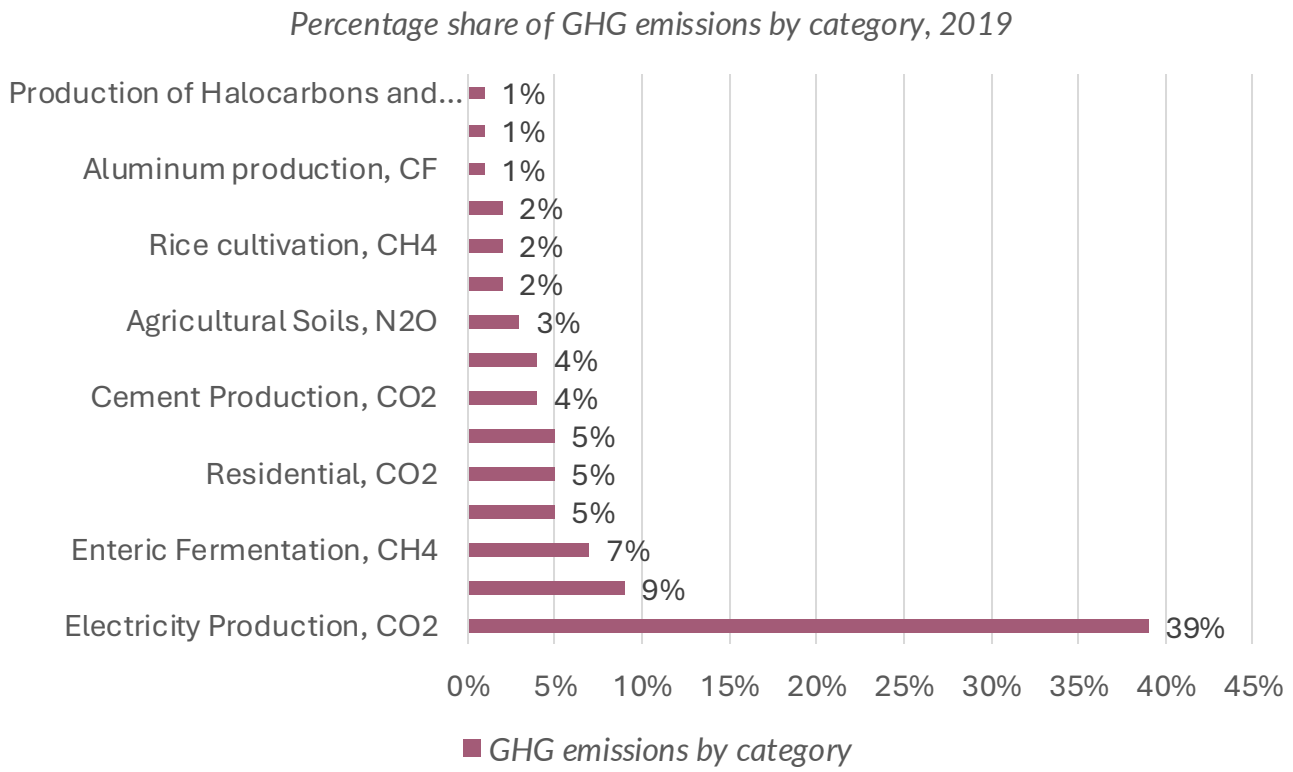
Sector-wise national GHG emissions in $MtCO_2e$ (1994–2019)

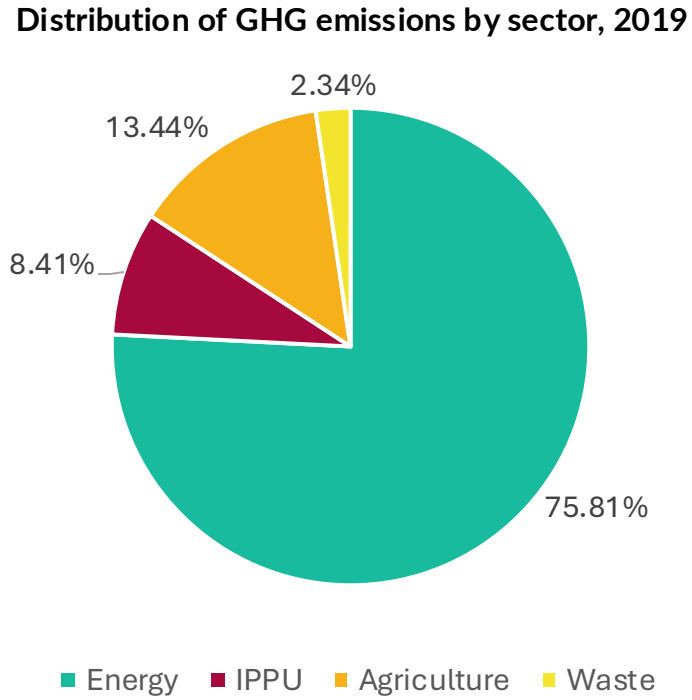
Sources: MoEF, 2004; MoEF, 2010; MoEF, 2012; MoEFCC, 2016; MoEFCC, 2018; MoEFCC, 2021

Source: MoEFCC, 2023b

GHG EMISSIONS

As per India's Third National Communication to UNFCCC





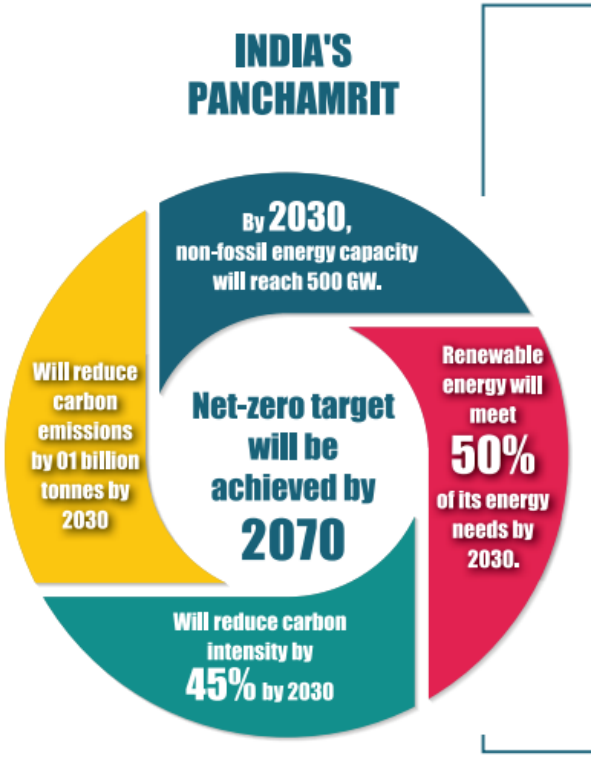
The energy sector is the major contributor to emissions at 75.81%, followed by agriculture sector (13.44%), IPPU sector (8.41%) and waste sector (2.34%)

Source: MoEFCC, 2023b

UPDATED NDCs

India's updated NDCs under Paris Agreement (2021–2030)

- Put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through ***a mass movement for 'Lifestyle for Environment' (LIFE) as a key to combating climate change***
- ***Adopt a climate friendly and a cleaner path*** than the one followed by others at corresponding level of economic development
- ***Reduce emissions intensity of its GDP by 45% by 2030***, from 2005 level
- ***Achieve about 50%*** cumulative electric power installed capacity from non-fossil-fuel-based energy resources by 2030, with the help of technology transfer and low-cost international finance, including from Green Climate Fund
- ***Create an additional carbon sink of 2.5 to 3 billion tons of CO_2*** equivalent through additional forest and tree cover by 2030
- Better adapt to climate change by ***enhancing investments in development programs*** in sectors vulnerable to climate change
- ***Mobilize domestic funds, as well as new and additional funds*** from developed countries to implement mitigation and adaptation actions in view of the resource required and the resource gap
- ***Build capacities***, and create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative research and development for such future technologies



India's announcement at COP26, Glasgow
Source: Central Bureau of Communication

Source: MoEFCC, 2022b

LT-LEDS

India's Long Term – Low Emission Development Strategy

At COP26 in 2021, India announced its target to ***achieve net zero by 2070***

India formulated and submitted its ***Long-term Low Greenhouse Gas Emission Development Strategies (LT-LEDS)*** to the UNFCCC in November 2022

India's LT-LEDS involves seven key strategic transitions, namely:

(i) ***Low carbon development of electricity systems*** consistent with development

(ii) Developing an ***integrated, efficient, inclusive low carbon transport system***

(iii) Promoting ***adaptation in urban design, energy and material-efficiency in buildings, and sustainable urbanization***

(iv) Promoting economy-wide ***decoupling of growth from emissions and development*** of an efficient, innovative low-emissions industrial system

(v) ***CO_2 removal*** and related engineering solutions

(vi) ***Enhancing forest and vegetation cover*** consistent with socio-economic and ecological considerations

(vii) ***Economic and financial aspects of low carbon development*** and long-term transition to net zero by 2070

NDC MITIGATION

National action plans on climate change: Eight missions

National Solar Mission

To enhance solar electricity generation

National Mission for Green India

Afforestation to increase carbon sinks

National Mission for Sustainable Habitats

To reduce emissions in cities

National Mission on Enhanced Energy Efficiency

To improve energy efficiency in all sectors

National Mission for Sustainable Agriculture

To enhance agricultural productivity

National Cooling Plan

Reduction in cooling demand, refrigerant transition, enhancing energy efficiency and better technology

National Water Mission

To evolve strategies for climate resilience in agriculture through new and traditional technology amalgamation, and deploying climate finance and insurance

National Mission for Sustaining the Himalayan Ecosystem

To suggest management measures and bridge gaps for sustaining and safeguarding the Himalayan glaciers and ecosystem

National Mission for Strategic Knowledge on Climate Change

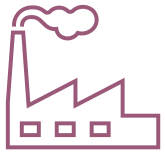
To address the challenges of climate change through knowledge exchange and technology development

GHG MITIGATION

Overview of mitigation measures across emission-intensive sectors

Power Sector

- Renewable Purchase Obligations (RPOs) and Renewable Energy Certificates (RECs)
- Green Power Access Policy (2022)
- National Mission for Highly-efficient Photovoltaic Modules
- Development of Mega and Ultra Mega and Solar Parks

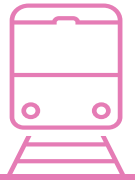


Industrial Sector

- Perform, Achieve and Trade (PAT) Scheme
- National Motor Replacement Program (NMRP)
- Green Hydrogen Mission

Residential Sector

- Standards and Labeling (S&L)
- UJALA and Street Light National Program (SLNP)
- Eco Niwas Samhita
- Municipal Energy Efficient Program (MEEP)
- Building Energy Efficiency Project (BEEP) and ESEAP
- PM Surya Ghar Yojana



Transport Sector

- Faster Adoption and Manufacturing of Electric Vehicles (FAME 1.0 and 2.0)
- Corporate Average Fuel Economy Norms
- 100% Railways Electrification
- Emission Norms PLI for Automotives
- Advanced Chemistry Cells

Commercial Sector

- Energy Conservation Building Code (ECBC)
- National Cooling Action Plan

Agricultural Sector

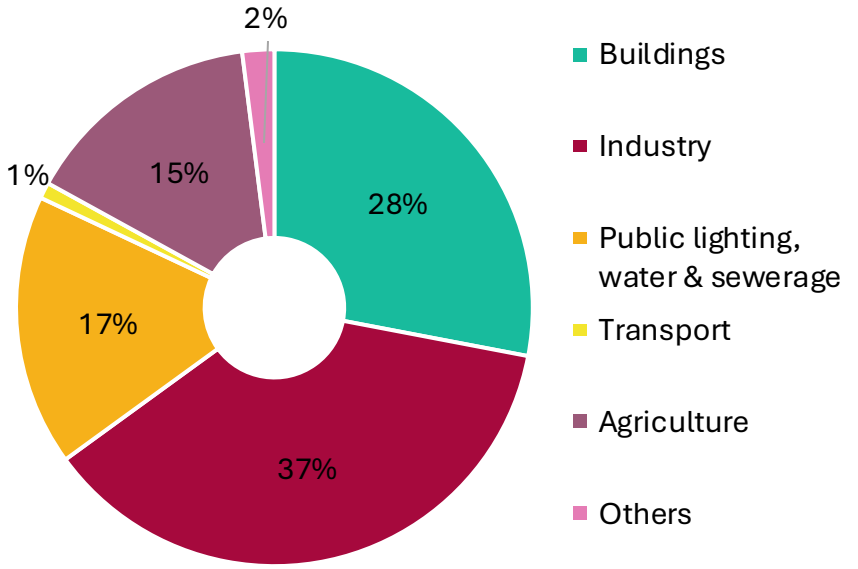
- PM KUSUM (Solar Power)
- SAMARTH (Skills Development)
- National Livestock Mission

ELECTRICITY DEMAND

Sectoral demand

- The share of industrial electrical energy demand increased from 37% in FY 2020–2021 to 40% in FY 2023–2024
- Electricity is the major source of energy for buildings. Electrical energy demand of the building sector increased from 28% in FY 2020–2021 to 33% in FY 2023–2024
- ***By 2030, the energy consumption in the building sector is expected to surpass that in the industrial sector***

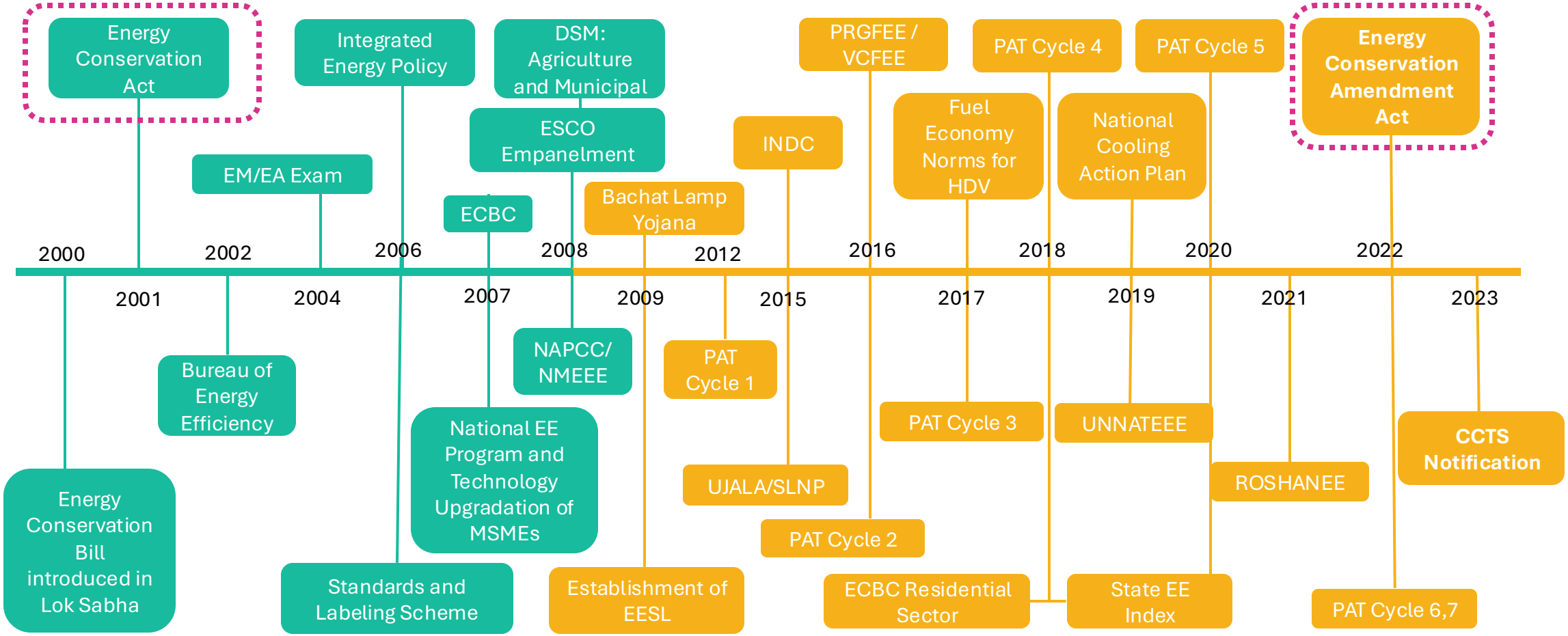
Electricity consumption in India by sector (FY 2020–2021)



Source: Central Electricity Authority, Government of India, 2023

INDIA INITIATIVES

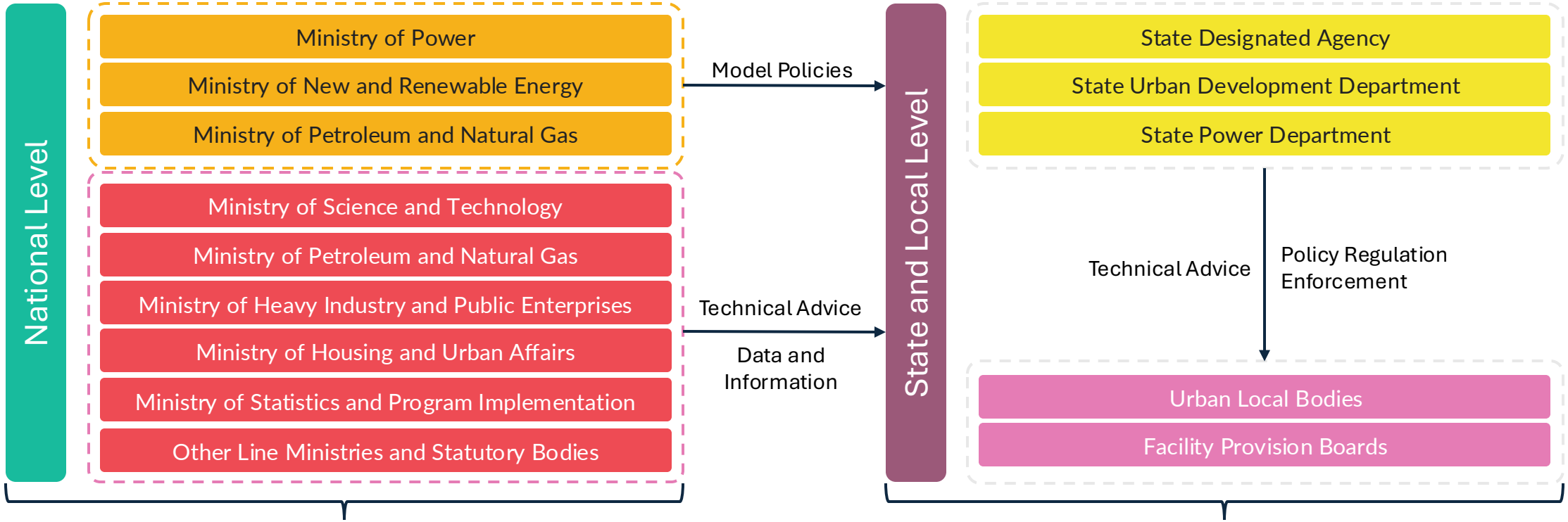
Timeline since the Energy Conservation Act 2001



Source: Ministry of New and Renewable Energy, Government of India, 2023

INSTITUTIONAL STRUCTURE

For energy efficiency policy-making at national, state and local levels



Roles and Responsibilities

- Formulate policies
- Allocate funds
- Determine national goals
- Guide states and national bodies

Roles and Responsibilities

- Develop masterplans
- Adapt and amend laws and regulations

Source: Green Building Performance Network, 2022

ENERGY CONSERVATION ACT 2001

Landmark legislation for energy efficiency

This Act provides a legal framework, institutional arrangement and enforcement mechanisms at central and state levels. The landmark interventions through this Act include:

Designated Agencies

Establishment of the Bureau of Energy Efficiency and State Designated Agencies

Mandatory Norms

Energy Consumption Targets for Energy Intensive Industries and Commercial Buildings (Designated Consumers)

Codes

Energy Conservation Building Code Prescribing Energy Performance Indices for Buildings

★★☆

Appliances: Energy Performance Standards (STAR Ratings)

Capacity Building: Certification Examinations for Energy Professionals (Energy Auditors and Energy Managers)

Research and Development

Promotion of Research and Development and Innovative Financing

Empowerment of State Governments – Enforcement, Levies and Promotion

Source: Ministry of New and Renewable Energy, Government of India, 2023

ENERGY CONSERVATION ACT 2001

Amendments in 2022

This Act was amended in 2022 to include new emerging areas and concerns:

Buildings

Enhanced ECBC Code to Include Sustainability Features

Carbon Trading

Formulation of Carbon Trading Scheme

Transport

Minimum Energy Performance Standards

Non-fossil Fuel

Norms for Hydrogen, Renewable Energy and Other Non-fossil Sources

Regulatory Affairs

Strengthening of the State Electricity Regulatory Commissions

Source: Ministry of New and Renewable Energy, Government of India, 2023

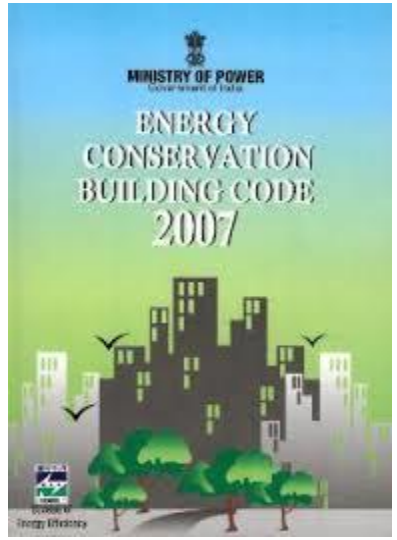
ENERGY CONSERVATION BUILDING CODE

Salient aspects

ENERGY CONSERVATION ACT 2001

HOSPITALITY	HEALTHCARE	ASSEMBLY	BUSINESS	EDUCATION	RETAIL
No star Resorts Star Hotels	Hospitals Out-patient Care	Theatres Transport Service Facilities Multiplexes	Small Offices < 10,000 sqm Medium Offices 10,000–30,000 sqm Large Offices > 30,000 sqm	Schools Colleges Universities Training Institutions	Shopping Malls Stand-alone Retails Open Gallery Malls Supermarkets

ECBC BUILDING CLASSIFICATIONS



- New buildings with connected load of 100kW and more or contract load of 120kVA
- Includes passive design features like daylighting and shading
- Includes integration of renewable energy systems
- Minimum energy efficiency standards for design and construction level
- Pathway toward net zero energy buildings

EE PROGRAMS

Mitigation measures for emission-intensive sectors

India's emissions mitigation strategy can be mapped to five highest emission-intensive sectors:

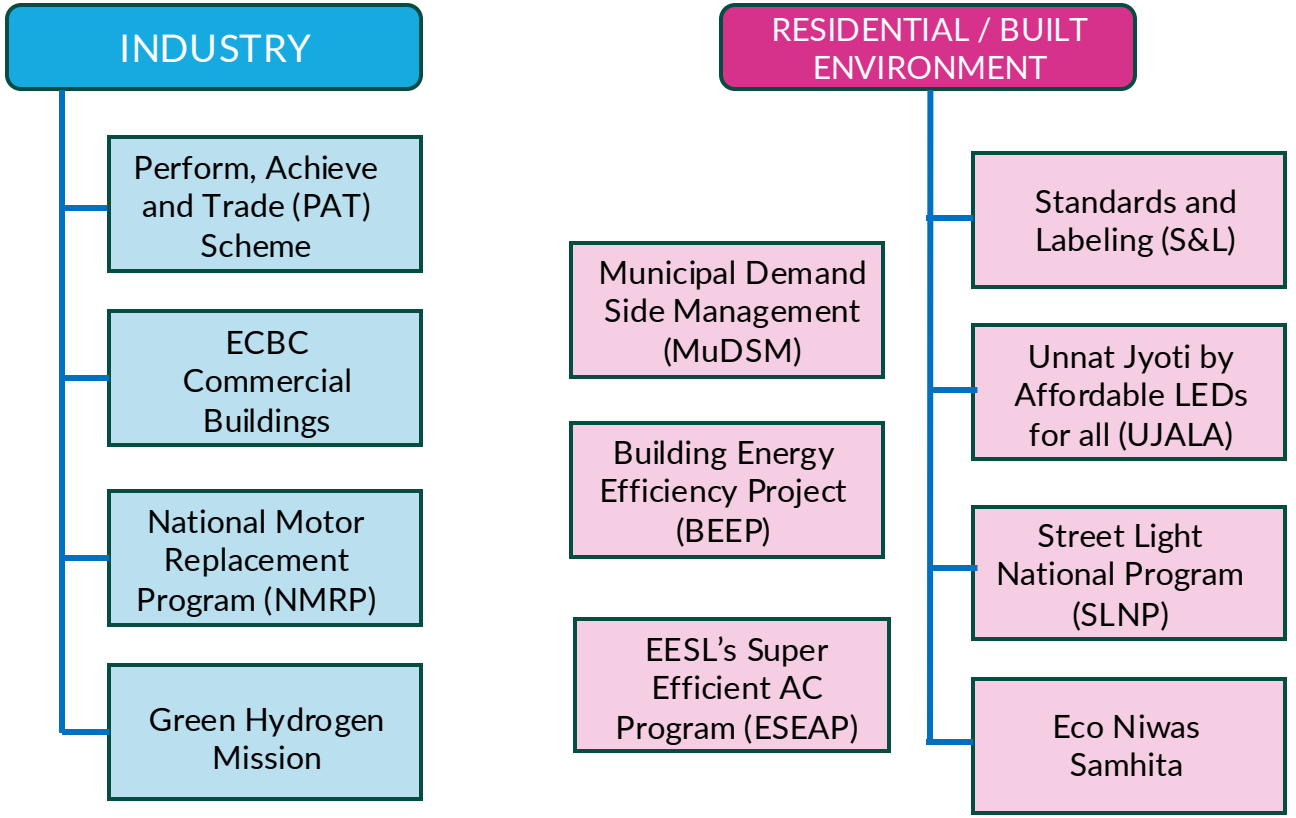
POWER

INDUSTRY

RESIDENTIAL

AGRICULTURE

TRANSPORT



Source: Chateau. J. et al., 2023

EE IN THE BUILDING SECTOR

Initiatives for improving energy efficiency

Programs and schemes for the building sector by government and industry

GUIDELINES, CODES AND STANDARDS

- Energy Conservation Building Code **(ECBC) for commercial buildings**
- Eco Niwas Samhita – **ECBC for residential buildings (Parts 1 and 2)**
- Eco Niwas Samhita Tool
- Residential Labeling Program focusing on energy efficiency

ENERGY EFFICIENCY IN EXISTING BUILDINGS

- PAT scheme for hotel buildings
- Nearly net zero in existing buildings
- Shunya labeling for net zero energy buildings and net positive energy buildings
- EESL Building Energy Efficiency Program
- BEE star rating for existing buildings

VOLUNTARY RATING SYSTEMS

- GRIHA national rating system for new and existing buildings and large developments
- LEED and IGBC rating systems for new and existing buildings
- GEM rating for buildings
- CPWD rating 'GHAR'

Source: Ministry of Power and Bureau of Energy Efficiency, Government of India, 2023

BEEP PROGRAMS

Building energy efficiency programs funded by multilateral and bilateral agencies

Indo-German Collaborations

PAT Program
Norms for industry

IGEN-EERB
Energy efficiency in residential buildings

EE – COOL
Promoting energy efficient cooling in India

EE in Finance
For MSMEs

EE Lines of Credit
Finance for EE

IGEN Energy Forum
Energy efficiency in residential buildings

DSM
Flexibilization of the Indian electricity system with demand side management (DSM)

Indo-US Collaborations

ECO Program (since 2000)
Energy conservation and commercialization

ECO II and III
- Support to BEE
- Support to Maharashtra for energy conservation and DSM
- Support to Karnataka in energy efficient lighting

PACE
Partnership to advance clean energy deployment

MAITREE
- EE in buildings
- Sustainable cooling
- Training on consumer engagement and outreach

BEEP PROGRAMS

Building energy efficiency programs funded by multilateral and bilateral agencies

Indo-UK Collaboration

IEA CETP + BEE
IEA Clean Energy Transition Program

- Cooling
- Industrial EE
- Buildings
- Energy services
- Leveraging private investment

SEAD
Super-efficient Equipment and Appliance Deployment Initiative

Indo-Swiss Collaboration

BEEP
Indo-Swiss Building Energy Efficiency Program

Integrated design process, energy efficiency and thermal comfort

LOW CARBON CEMENT

Multilateral Programs and Partnerships

GEF
Global Environment Facility

FLCTD
Facility for Low Carbon Technology Deployment

IPEEC
International Partnership for Energy Efficiency Cooperation

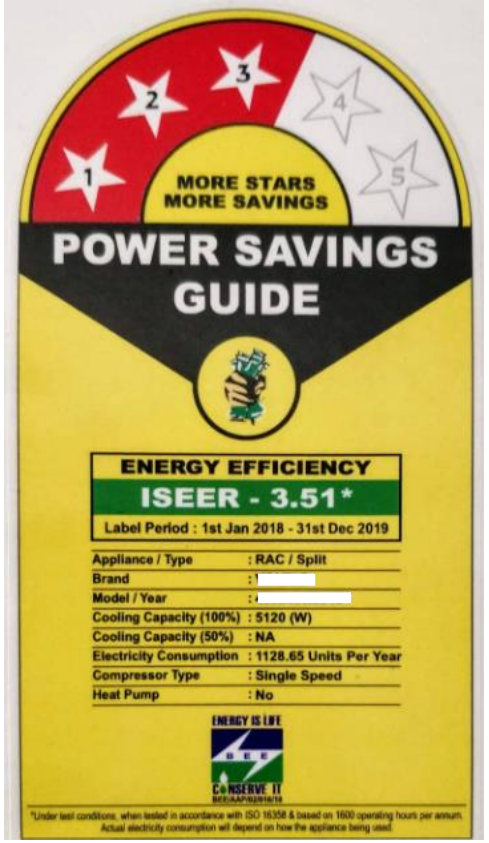
CEM
Clean Energy Ministerial

STANDARDS AND LABELING

BEE's S&L programs

Objectives

- Reduce end-use consumption of appliances without diminishing service levels
- Create awareness among consumers in making informed decision based on cost effectiveness and energy performance while purchasing appliances
- Total production for the appliances during 2022–2023 ~ 550 million.
  - Total brands registered = 3,126
  - Total models registered = 22,192
- 15,000 retailers trained under the Retailers Training Program
- Reduced 57 million tons of CO_2 emissions



S&L

Appliances covered – mandatory and voluntary

S NO	MANDATORY
1	Frost Free Refrigerator
2	Direct Cool Refrigerator
3	Deep Freezer
4	Room AC (Variable Speed)
5	Room AC (Fixed Speed)
6	RAC (Cassette, Floor Standing Tower, Ceiling Corner AC)
7	Light Commercial AC (Fixed Speed)
8	Stationary Storage Type Electric Water Heater
9	Tubular Fluorescent Lamp
10	LED Lamp
11	Ultra High Definition Television
12	Colour Television
13	Distribution Transformer
14	Ceiling Fan
15	Chiller
16	Washing Machine

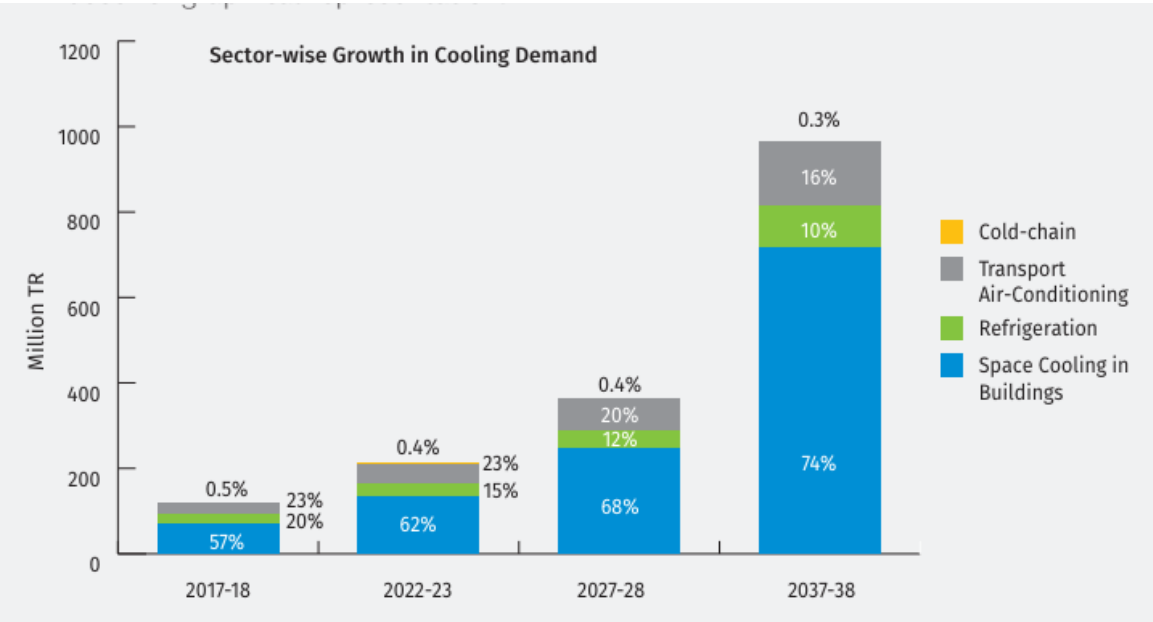
S NO	VOLUNTARY
1	General Purpose Industrial Motor
2	Submersible Pump Set
3	Domestic Gas Stove
4	Computer
5	Ballast
6	Office Automation Product
7	Diesel Engine Driven Monoset Pump for Agricultural Purposes
8	Solid State Inverter
9	Diesel Generator Set
10	Microwave Oven
11	Solar Water Heater
12	Air Compressor
13	High Energy Li-Battery
14	Tyre
15	Multi Door Refrigerator
16	Pedestal Fan, Table Fan, Wall Fan
17	Induction Hob
18	Solar Photovoltaic

INDIA COOLING ACTION PLAN

Focus areas

India is the first country to develop a comprehensive cooling action plan launched in March 2019 that focuses on:

- A long-term integrated vision to address cooling requirements in the country with the focus on urban cooling, thermal comfort and cold chains
- Reduction in cooling and refrigerant demand
- Enhancing energy efficiency



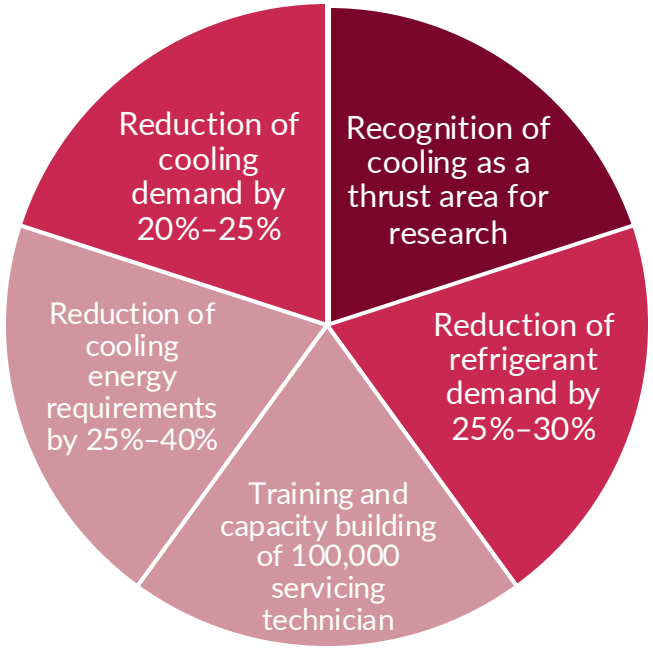
India's cooling demand across sectors

Source: Ministry of Environment, Forest and Climate Change, Government of India, 2019

INDIA COOLING ACTION PLAN

Goals

- ***Building cooling energy consumption*** is likely to ***double in the next decade*** and increase by ***nearly four times in the next two decades (over the 2017–2018 baseline)***
- ***Building cooling energy consumption can be reduced by around 15%*** in the next decade and by around 30% in the next two decades
- Room air conditioner constitutes a dominant share of the building sector's cooling energy consumption – at around 40% in 2017–2018, and expected to grow to around 50% in 2027–2028 and 2037–2038
- Significant presence of non-refrigerant-based cooling from fans and air coolers at around 40% makes a strong case for realigning focus on fans and air coolers that will continue to be very pervasive, particularly in the residential sector, to provide thermal comfort to all



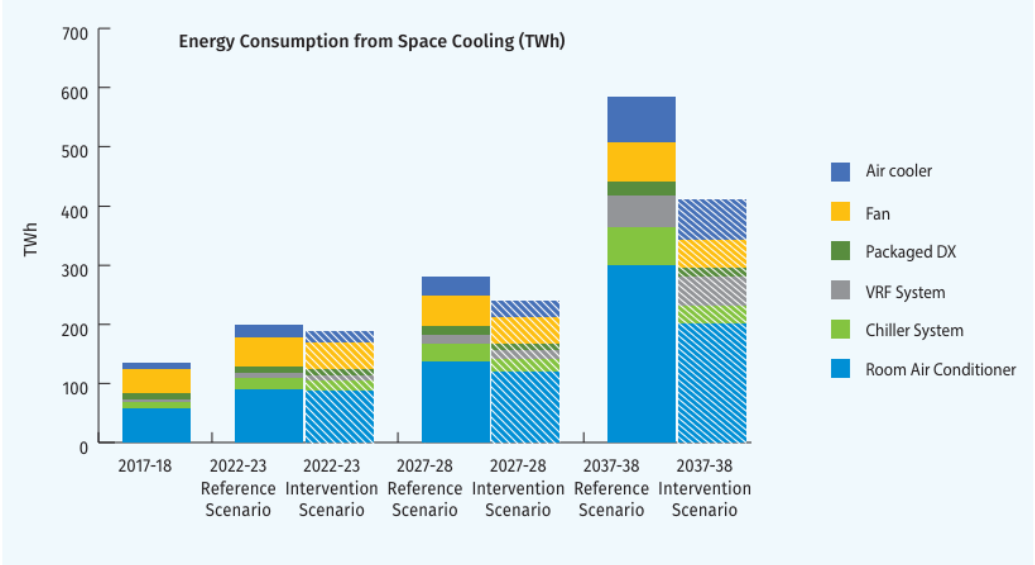
ICAP Goals by 2037–2038

Source: Ministry of Environment, Forest and Climate Change, Government of India, 2019

INDIA COOLING ACTION PLAN

Recommendations

1. Promote wider penetration of climate-responsive built spaces to bring indoor temperatures within acceptable thermal comfort band through passive cooling, thus reducing cooling load
2. Leverage existing levels of technology to make it available for wider market adoption
3. Adopt adaptive thermal comfort-based set-point for air conditioner operation
4. Enhance operational efficiency of cooling systems
5. Develop DSM and demand response programs for enhancing energy efficiency of cooling equipment
6. Formulate and implement policies at the state level



Annual energy consumption in space cooling in buildings

Source: Ministry of Environment, Forest and Climate Change, Government of India, 2019

INDIA COOLING ACTION PLAN

Recommendations (continued)

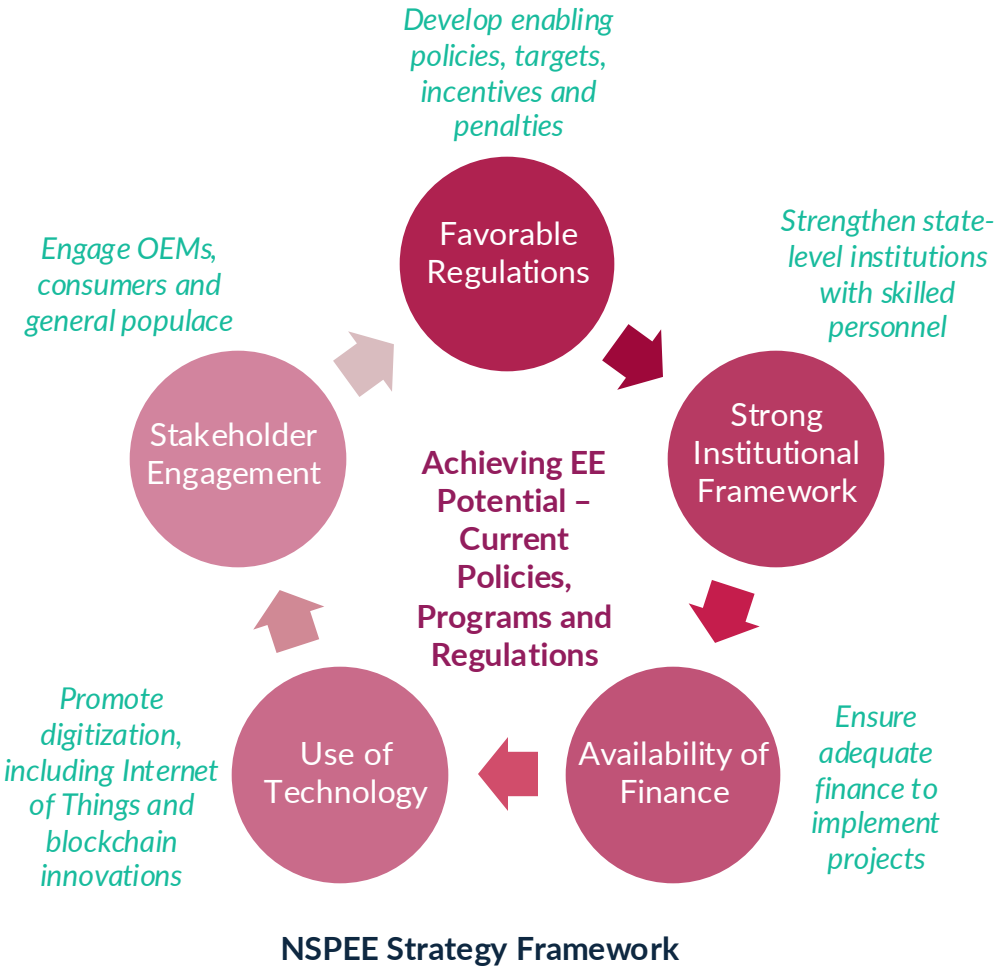
7. Form a **robust research and development team** that leverages global best practices in space cooling and existing knowledge by closely monitoring pertinent policies and technology pathways
8. **Build energy data collection** and reporting systems
9. Implement **eco-labeling program** for cooling appliances
10. Institutionalize **holistic and integrated approach for energy efficient building design of commercial buildings** with the mandate to minimize cooling needs as a condition under the environmental clearance policy
11. Encourage **development of urban heat action plans** for all cities with a population of 2.5 million or more
12. Promote use of not-in-kind technologies including trigeneration system, district cooling, thermal energy storage etc.
13. **Institutionalize installation of thermal storage with cooling systems and differential (time of day) power tariffs to minimize peak power requirements**
14. **Ensure all new constructions – both residential and commercial – are 100% ECBC compliant**
15. Periodically revise the minimum stringency levels of ECBC compliance to ECBC+ and super ECBC requirements
16. Make mandatory building automation and management systems for all new constructions with a connected load of 100 kW or greater

Source: Ministry of Environment, Forest and Climate Change, Government of India, 2019

WAY FORWARD

Addressing challenges

- Promote awareness and knowledge about energy efficiency measures among consumers and businesses. People are not aware of the benefits of energy efficiency, and there is a lack of incentives to adopt energy efficient measures
- Promote financing for energy efficiency projects, especially upfront investments
- Enforce energy efficiency regulations
- Develop authenticated information and standard monitoring and verification protocols



NSPEE Strategy Framework

Source: Bureau of Energy Efficiency, Government of India, 2019

OPPORTUNITIES

For low carbon and green growth

Buildings:

- India's buildings and construction sector is highly carbon-intensive, contributing around one-sixth of the nation's total GHG emissions

Implementation of new building codes:

- While the ECBC 2017 and the EE label for residential buildings have been launched and notified, there is an urgent need for these programs to be implemented and enforced by the states. Processes for ECBC applications for new buildings, and monitoring after building construction, need to be developed by the states
- There is an urgent need to take action to improve the energy efficiency of the existing stock of buildings that are 30–40 years or older

Thermal comfort for all:

- India's demand for space cooling is rapidly moving away from ceiling fans to air-conditioners. India is among the first countries to launch an India Cooling Action Plan, which is now in the implementation phase

OPPORTUNITIES

For low carbon and green growth

Push for higher appliance efficiencies:

- India has made great strides in introducing energy efficiency labels for large number of appliances. The focus should now be on improving the standards and pushing for the manufacture and sale of higher star-rated appliances through appropriate incentive schemes

Promotion of net zero initiatives:

- The future of the built environment must focus on net zero in energy, water, waste and carbon
- It is important to bring net zero into policies and implementation frameworks and consider incentives for the first entrants
- Net zero must happen not just for buildings and habitats, but at an ecosystem level, so that policies, technologies, business models, skilling and green jobs creation happen in coordination
- Energy efficiency can help India become a global leader in sustainable economic development

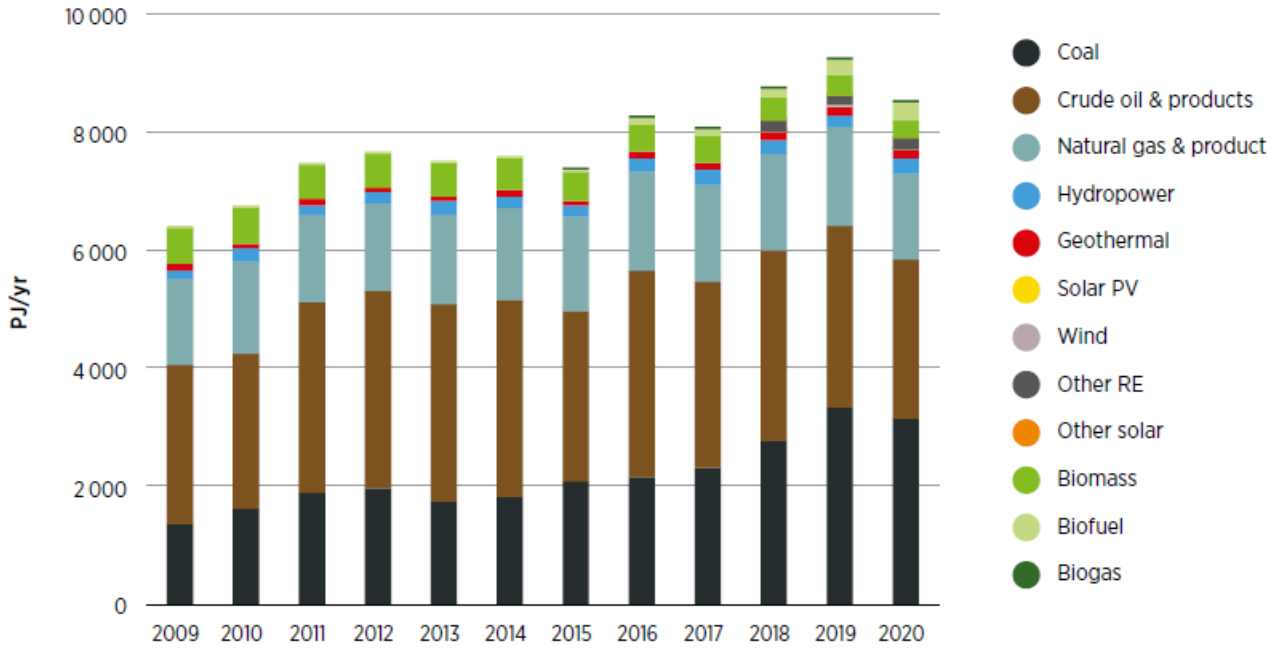
3. Indonesia

Image source: https://www.archdaily.com/1003506/indonesia-plans-to-build-its-new-capital-from-the-ground-up-to-replace-the-sinking-city-of-

ENERGY SCENARIO

Primary energy supply and consumption

- Indonesia's energy supply is still heavily **dominated by fossil fuels**
- Indonesia's historical maximum coal consumption was in 2019. **80% of the total consumption were by power plants**
- Industry is the second largest user of coal, by industries like iron, steel, metallurgy, cement, textile and fertilizer
- Indonesia has the **largest energy consumption** among ASEAN member states



Note: PJ = petajoule; RE = renewable energy.
Source: (MEMR, 2021a).

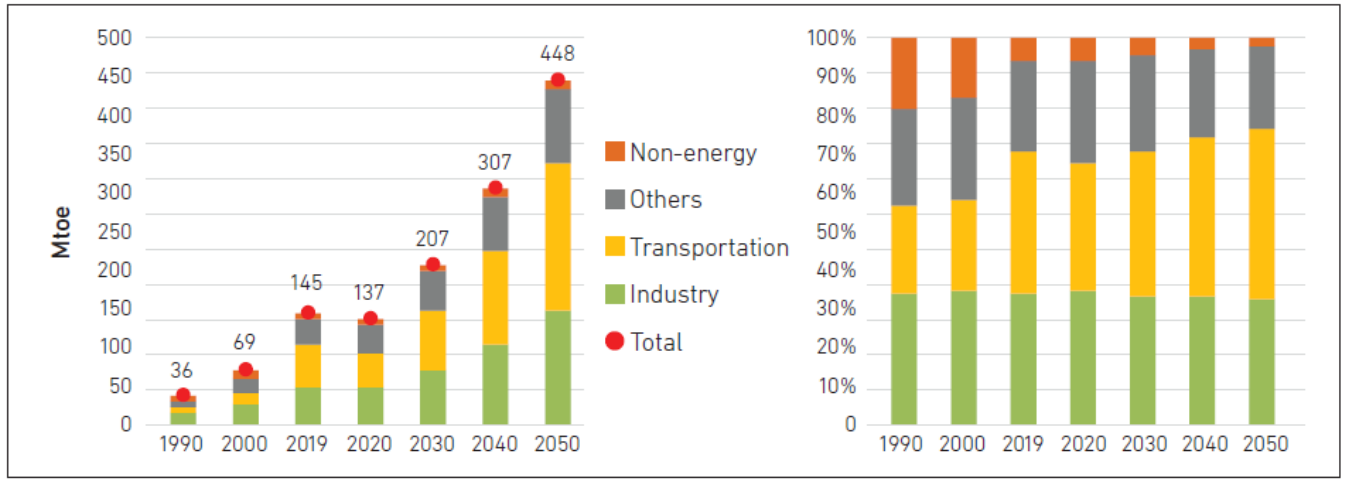
Breakdown of Indonesia's total primary energy supply, 2009–2020

Source: International Renewable Energy Agency, 2022

ENERGY SCENARIO

Total final energy consumption

- The growth in total final energy consumption (TFEC) is mainly due to the rapid increase of energy consumed by **transport and industry**
- Transport's share in TFEC increased from **22.6% in 1990 to 36.9% in 2019**. The share is expected to continue to increase to **45.9% in 2050**
- Industry had the highest share in TFEC in 1990–2005, which was then overtaken by transport
- The share of 'others' (mainly residential and commercial) in TFEC in 1990 was about 25.2% and is **expected to decrease to 21.6% in 2050**



Mtoe = million tonnes of oil equivalent.

Source: Author's calculations.

Note: Others = residential and commercial

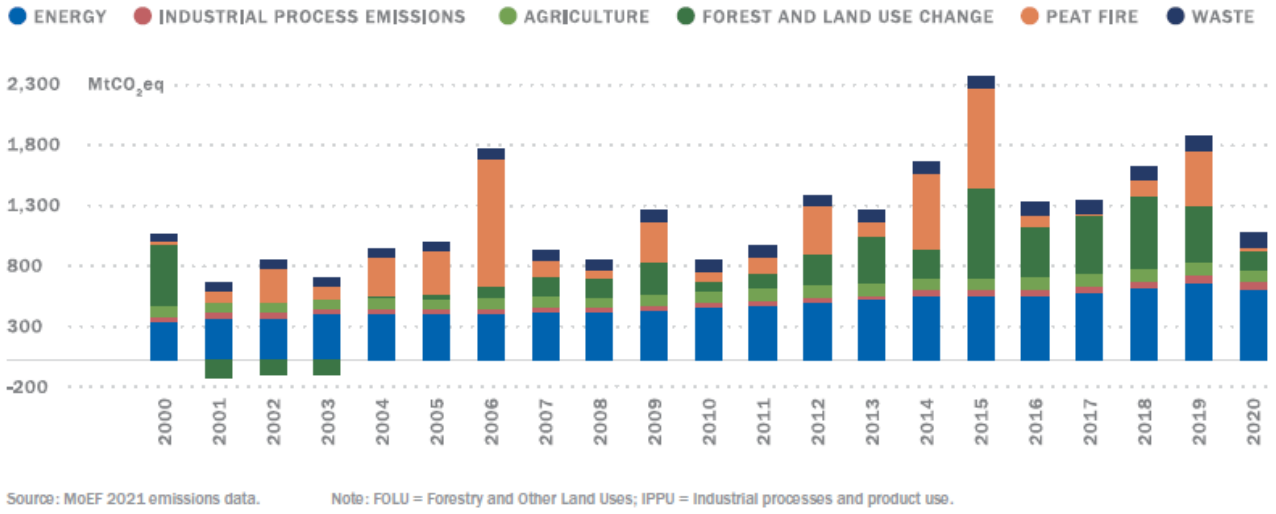
Indonesia's final energy consumption by sector, 2019–2050 (Mtoe)

Source: Kimura. S. et al., 2023

GHG EMISSIONS

By sector

- About 93% of the energy supply comes from fossil fuels, namely coal (43%), oil (31%) and gas (19%). It is the second largest source of carbon emissions
- Energy accounts for approximately 39% of GHG emissions in Indonesia in 2000–2020
- **The demand for primary energy has been driven by the electricity sector,** which has been the largest contributor to emissions from energy use
- **Building sector emissions will be dominated by space cooling and will peak by 2030 due to economic growth and urbanization**



Indonesia's GHG emissions by sector, 2000–2020 (million tCO_2eq)

Source: World Bank, 2023b

GHG EMISSIONS

Building sector in Indonesia

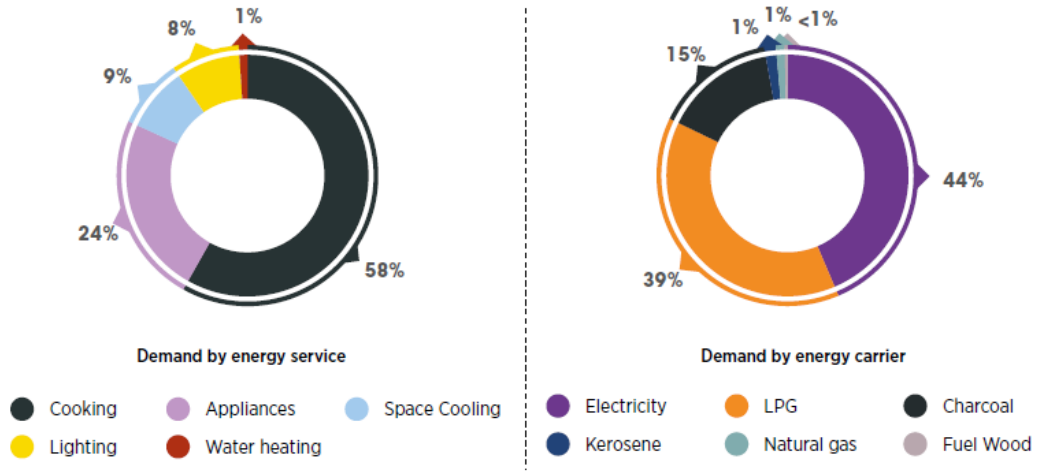
The building sector's final energy consumption is expected to **more than triple by 2050 in BAU case.** Growth in the population, economy and floor area is the main driver of building sector energy demand growth. Electrification and stringent energy efficiency implementation can lower energy demand growth

RESIDENTIAL

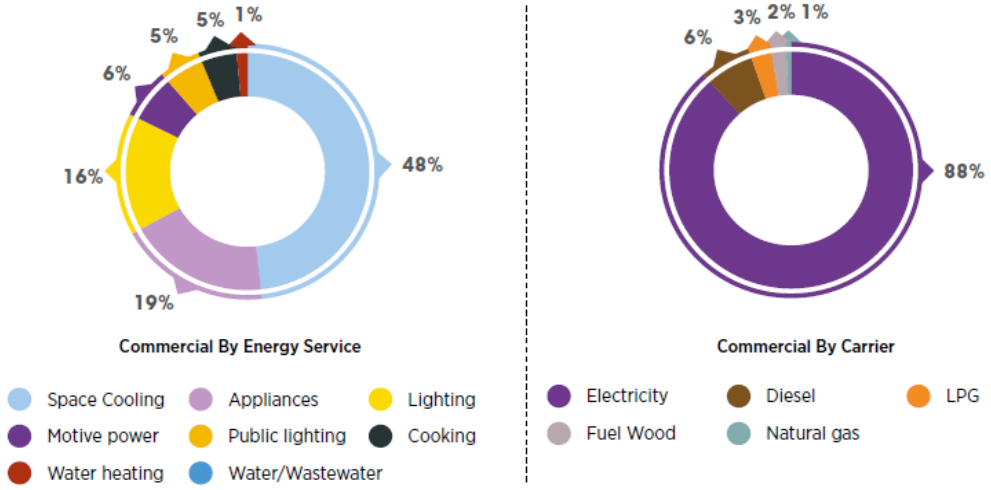
Even when the minimum energy performance standard (MEPS) of residential air conditioners and other household equipment is mandated, by 2050, space cooling is expected to dominate energy consumption in the residential subsector, comprising over **41% of total residential energy demand**, while **appliances is expected to comprise 35%**

COMMERCIAL

The demand is projected to expand almost sixfold over the next 30 years. **Cooling may consume 48%** of this electricity, and **appliances and lighting may consume 34%**



Residential buildings' energy demand, 2018

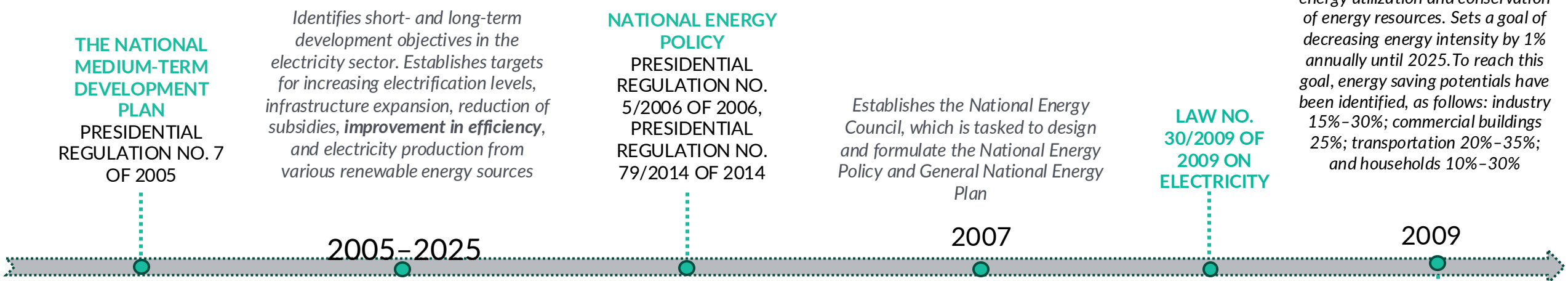


Commercial buildings' energy demand, 2018

Source: International Renewable Energy Agency, 2022

INDONESIA INITIATIVES

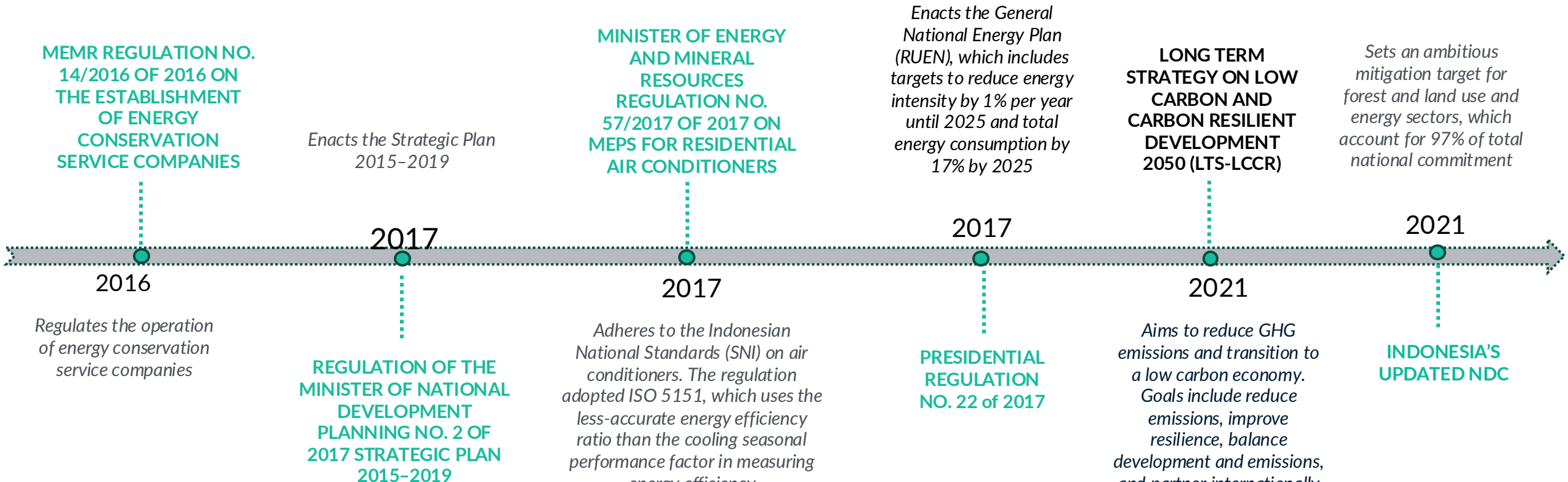
Timeline of policies in climate and energy



Sources: https://asiapacificenergy.org/apef/index.html#main/lang/en/time/[2018,2024]/geo/[]/search; Climate Action Tracker; NDC, 2022

INDONESIA INITIATIVES

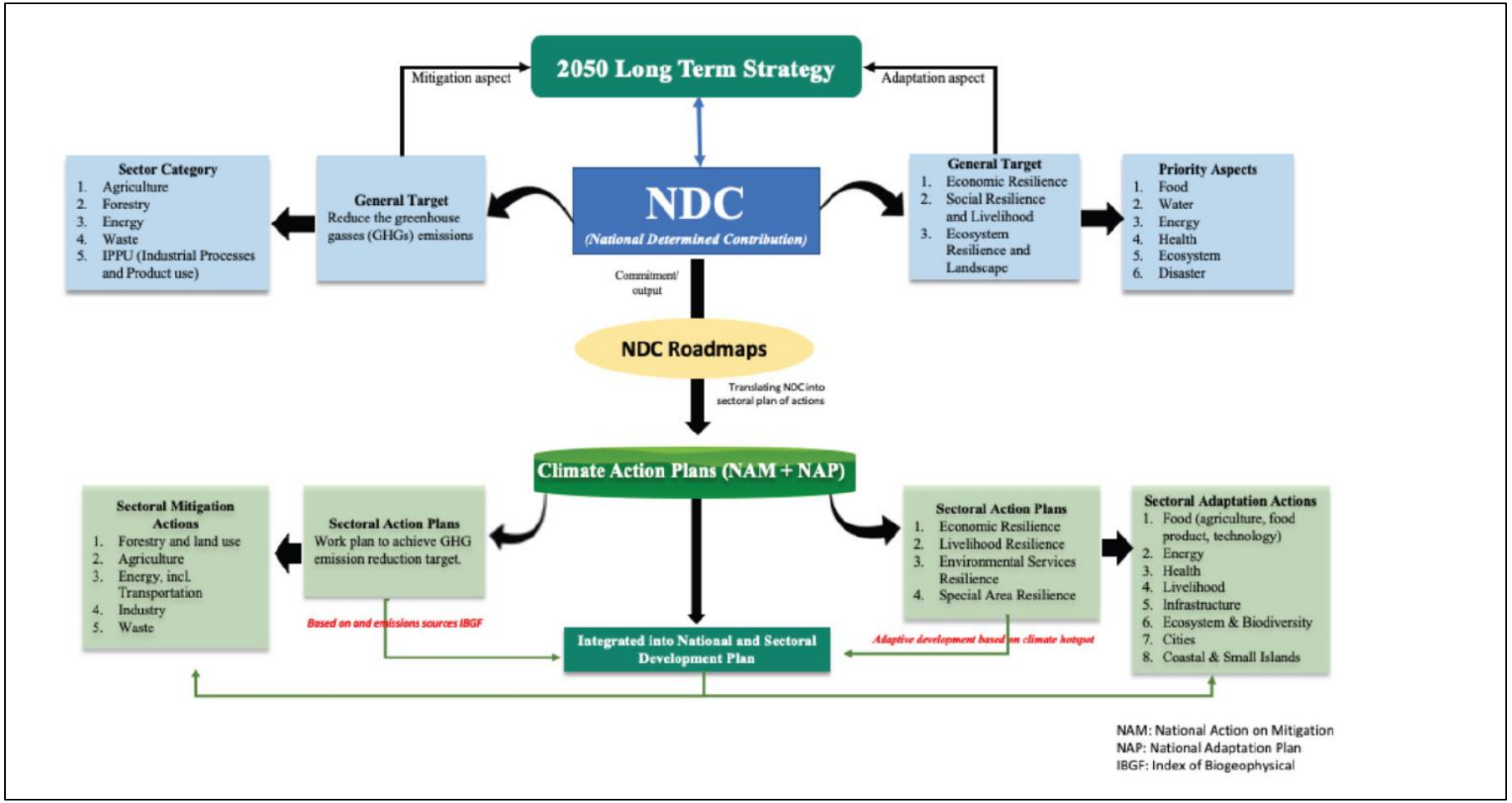
Timeline of policies in climate and energy



Source: https://asiapacificenergy.org/apef/index.html#main/lang/en/time/[2018,2024]/geo/[]/search

NDC ROADMAP

Long-Term Strategy for Low Carbon and Climate Resilience 2050



Source: Government of Indonesia, 2021

NDCs AND THE BUILDING SECTOR

Challenges

The construction and operation of buildings accounted for 21.6% of total annual energy consumption (electricity, gas and liquefied petroleum gas) in 2015

Direct emissions from Indonesia's building sector constitute 4% of energy-related CO_2 emissions

Major barriers in the implementation of GHG-reducing technologies are:

- Lack of energy efficiency policies and incentives for potential investors
- Lack of technical expertise and capacity to plan and design energy efficient construction projects, and financial issues for these projects
- Lack of financing opportunities

Source: Global Alliance for Buildings and Construction and Danish Energy Agency, 2022

INSTITUTIONAL MECHANISMS

For energy efficiency

- Ministry of Public Works and Housing (MPWH)

Responsible for policy formulation, spatial planning and public infrastructure, among others. Standards for building construction, including the regulation on green building guideline, are under the supervision of the MPWH

- Ministry of Energy and Mineral Resources (MEMR)

Responsible for administering government affairs in the fields of energy and mineral resources. The MEMR's main functions consist of formulating, determining and implementing policies and technical guidance in the training, controlling and supervising of oil and gas, electricity, minerals and coal, new energy, renewable energy, energy conservation, and geology. The MEMR also provides support and implementation of research and development in energy and mineral resources

- Green Building Council of Indonesia (GBC Indonesia)

An independent and private organization established in 2009 by professionals in the design and construction industries. GBC Indonesia collaborates with stakeholders such as architects, buildings designers, building professionals, governments and the private sector. GBC Indonesia has four main programs: market transformation, training and education, green building certification, and stakeholder engagement

Source: ASEAN Centre for Energy and Deutsche Gesellschaft für Internationale Zusammenarbeit, 2018

REGULATIONS

For energy efficiency

The following regulations are relevant to the building and construction sector in Indonesia:

- Presidential Regulation No. 22 of 2017 concerning the General National Energy Plan
- Minister of Energy and Mineral Resources Regulation No. 14 of 2012 concerning Energy Management Regulation No. 70 of 2009: End users with an annual consumption of over 6,000 TOE must implement energy management, e.g., regular energy audit, preparation of an energy plan and implementation of energy saving measures
- MEMR Regulation No. 13: Public facilities must implement EE measures to achieve a 20% reduction target
- MEMR Regulation No. 7: Minimum energy performance standards and labeling are required for air conditioning systems
- Governmental Regulation No.16/2021 on buildings
- Governmental Regulation No. 21/2021 on the assessment of green building performance
- Minister of Energy and Mineral Resources Regulation No. 18 of 2014 concerning minimum performance standards and energy saving label of self-based lamps
- Minister of Energy and Mineral Resources Regulation No. 57 of 2017 concerning minimum performance standards and energy saving label of air conditioners

Source: Global Alliance for Buildings and Construction and Danish Energy Agency, 2022

REGULATIONS

National energy efficiency standards for buildings

Indonesia has four energy standards for buildings:

- SNI 6196:2011 Energy audit procedure for building
- SNI 6197:2020 Energy conservation for lighting system in building
- SNI 6389:2020 Energy conservation for building envelope
- SNI 6390:2020 Energy conservation for air conditioning system in building

Other relevant standards include:

- SNI ISO 50001:2018 Energy management system – Requirements with usage guidelines
- SNI ISO 50002:2014 Energy audit – Requirements with guidelines for use
- SNI ISO 50006:2014 Energy management system – Measuring energy performance using energy baseline (EnB) and energy performance indicator (EnPI) – General principles and guidelines
- SNI ISO 50015:2014 Energy management system – Measurement and verification of an organization's energy performance – General principles and guidelines
- SNI ISO 50021:2019 Energy management and energy saving – General guidelines for choosing an evaluator
- SNI ISO 50046:2019 General method for predicting energy saving
- SNI 6500:2018 Fixed installation refrigeration system – Safety and environmental requirements
- SNI ISO 817:2018 Refrigerant naming and safety classification
- SNI 8476:2018 Method of assessment and testing on the performance of cool water coolers with vapor compression systems

REGULATIONS

For energy efficiency

- The Ministry of Energy and Mineral Resources released a set of Energy Efficiency Guidelines for Building Design in Indonesia, which is divided into three separate guidelines:

  i. For Developer and Building Owner
  i. Energy Efficiency Technical Guidelines
  ii. Case Study

- GREENSHIP Certification by the Green Building Council of Indonesia, introduced in 2010, is a voluntary rating tool based on rating systems widely used around the world. The GREENSHIP criteria considers five types of certification:

  i. New Building
  ii. Existing Building
  iii. Interior Space
  iv. Homes
  v. Neighborhood

GREENSHIP Certification includes four recognition achievements, namely, (i) Platinum, (ii)Gold, (iii) Silver and (iv) Bronze During its launch, 14 buildings in Indonesia were rated under GREENSHIP

REGULATIONS

For energy efficiency

- **Government Regulation No. 70 of 2009** regarding **energy conservation** is a legally-binding regulation explanatory of the Energy Law on matters of energy conservation. The regulation elucidates mandates of the Energy Law, specifically on policy and obligatory programs
  - *"By law, energy conservation is obligatory"*
  - Specific regulation for the largest energy users at above 6,000 TOE annually; they are **obliged to implement energy conservation through energy management law**
  - Easiness, incentive and disincentive:
    - Easiness in the access to information regarding energy efficient technology, their specifications and energy efficient measures; and consultation services regarding energy efficient measures
    - Government and/or regional government shall provide incentive to those that can implement and produce energy saving within a certain period
    - Disincentive will be given to those who fail to implement energy conservation through energy management

REGULATIONS

For energy efficiency

- **National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK) Presidential Regulation No. 61/2011**
  - Mandates Indonesia's provinces to develop and submit a local action plan (RAD-GRK). RAN-GRK provides capacity building, budget, and potential participation in domestic and international markets to local governments to incentivize them to contribute to RAN-GRK's goals. This regulation is not limited to buildings but across all areas
- **MEMR Regulation No. 14/2012 on Energy Management**
  - Regulates the authority to implement energy management at the province and regency/city levels
- **MEMR Regulation No. 18/2014 on Energy Saving Label for Compact Fluorescent Lamp**
  - Obligations on energy saving labeling as described in Indonesia Standard Number 04-6958-2003 concerning *use of electric power for household needs*
- **Presidential Regulation No. 38/2015 on Government Cooperation with Business Entities in Infrastructure Procurement** (including infrastructure on energy conservation)
  - Provides additional incentives such as the availability of payment mechanism, which allows the government to commit to long-term payments for infrastructure services provided by business entities

REGULATIONS

For energy efficiency

- **Minister of Public Works and Housing Regulation No. 02/PRT/M/2015 on Green Building**
  - Aims to promote sustainability in the construction of buildings and imposes green building requirements
  - There are three compliance levels of green building requirements for new and existing buildings, that are mandatory, recommended and voluntary
- **Law No.16 of 2016 Confirmation of Paris Agreement UNFCCC**
  - Confirms the ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change, which Indonesia signed on 22 April 2016
- **MEMR Regulation No. 57/2017 Minimum Energy Performance Standards (MEPS) Implementation and Energy Saving Label for AC**
  - Stipulates that domestic producers and importers must apply MEPS and Save Energy Sign Label on air conditioning instruments that will be marketed in Indonesia *(refer to International Energy Agency and ASEAN, 2022b, pp. 32–35)*

REGULATIONS

For energy efficiency

- **Green City Action Plans (2014–2017)**
  - Outlines investment plans and policy development, institutional restructuring, capacity development and training, technical studies, and actions related to funding, financing and implementing projects *(refer to International Energy Agency and ASEAN, 2022a)*
- **Regulation of Ministry of Public Works and Housing 21/2021**
  - Regulates the administration of spatial development regulations, including the design and fixing of a guide comprising spatial development standards, processes and criteria *(refer to International Energy Agency and ASEAN, 2022a)*
- **Energy Conservation Program – Implementation based on Government Regulation No. 33 of 2023**
  - Revisions include regulations on energy audits for factory and energy efficiency labeling

POLICIES

For energy efficiency

Implementation of Mandatory Energy Management for Large Energy Users

- Energy management involves integrated activities to control energy consumption. This is undertaken to achieve effective and efficient energy utilization (maximize output in a structured and economic fashion that minimizes consumption of raw and supporting materials)
- **As a follow up to Government Regulation No. 70/2009 on Energy Conservation**, which stipulates that industries and buildings that consume greater than 6,000 TOE of energy per year should conduct energy management programs and activities, that is:
  - Appoint an energy manager
  - Prepare an energy conservation program
  - Conduct energy audits regularly
  - Implement audit result recommendations
  - Report energy conservation planning and measures to government
- **In 2019, 148 companies implemented energy management systems**

NATIONAL COOLING ACTION PLAN

Development timeline

- In 2020, the Directorate General of New Renewable Energy and Energy Conservation, with ESCAP and UNEP, started to develop the first National Cooling Action Plan (NCAP). The study conducted resulted in identification of requirements to build capacity of related stakeholders in developing recommendations, increase the engagement of related governmental bodies and ministries, and enhance commitment to implement NCAP
- Through NCAP, an initial mapping on the cooling sector, such as building space cooling, food cold chain, vaccine cold chain, cooling system for industrial process and mobile air conditioning, was conducted
- In December 2022, Indonesia ratified the Kigali Amendment to the Montreal Protocol. By 2045, it is hoped that Indonesia will succeed in reducing hydrofluorocarbon emissions by 80%
- In February 2024, a focus group discussion on NCAP was held in Jakarta to review the plan and discuss the roles of each stakeholder. It is hoped that the plan will guide climate change mitigation in the cooling sector. The plan is currently being finalized after receiving valuable inputs from the focus group discussion

CODES

For energy efficiency

Indonesia has four energy standards for buildings (Standar Nasional Indonesia/SNI):

i. Energy conservation for building envelope – SNI 03-6389-2011
ii. Energy conservation for air conditioning system in building – SNI 03-6390-2011
iii. Energy conservation for lighting system in building – SNI 03-6197-2011
iv. Energy audit procedure for building – SNI 03-6196-2011

The MEMR released a set of Energy Efficiency Guidelines for Building Design in Indonesia, which is divided into three separate guidelines, namely for Developer and Building Owner, Energy Efficiency Technical Guidelines, and Case Study

GREENSHIP Certification by the Green Building Council of Indonesia, introduced in 2010, is a voluntary rating tool based on rating systems widely used around the world. The GREENSHIP criteria considers five types of certification: (i) New Building, (ii) Existing Building, (iii) Interior Space, (iv) Homes, and (v) Neighborhood, and includes four recognition achievements namely (i) Platinum, (ii)Gold, (iii) Silver and (iv) Bronze. During its launch, 14 buildings in Indonesia were rated under GREENSHIP

BUILDING EE PROGRAMS

Creating public awareness

- Public awareness on energy conservation is promoted by MEMR, regional governments, the state-owned energy/electricity company, private companies and non-governmental organizations
- Public awareness is raised through advertisement, printed materials and the internet, and through seminars and workshop. The activities carried out so far include:
  - **Energy awards for the building and industrial sector**, including participation in the ASEAN Energy Awards
  - **Energy calculator**, a web-based application used to calculate the energy cost of household electrical appliances and provide energy saving recommendations. The benefits of an energy calculator include knowing energy use, implementing energy conservation and saving electricity bills
  - **Kampanye Potong 10% (10% Cut of Energy Use Campaign)** targets all stakeholders in the energy sector, including governmental and non-governmental organizations, industries and the public to reduce energy consumption by 10%. The program was launched in May 2016 and is funded by MEMR
  - **Konservasi Energi Goes to Campus (Energy Conservation Goes to Campuses)** aims to introduce university students to the basic principles of energy efficiency, the ISO 50001: energy management systems, and job opportunities for energy auditors and energy managers. The program is managed and funded by MEMR

WAY FORWARD

Key actions for policy, investment and design

- Improve existing building energy standards. Ensure that building standards are periodically enhanced to improve performance requirements every five years with the expectation of moving toward zero-emissions and zero-energy standards over the period of 2040–2050
- Encourage developers to use the building codes. A new building code was introduced in 2021 but it is still not fully implemented. Priority should be given to the adaption and enforcement of the code, and incentivizing building owners and developers to use it e.g., by giving advantages to developers that comply with the building code
- Encourage the use of green rating tools. Reward outstanding buildings and developers going significantly beyond the building code
- Government should ensure that all new public buildings follow the building code and targets are set to go beyond the code e.g., nearly-zero energy buildings
- Ensure funding for sustainable construction, including access to and use of financial resources to encourage private investment in sustainable buildings. Link these efforts to new and emerging consumer loan models

Source: Global Alliance for Buildings and Construction and Danish Energy Agency, 2022

WAY FORWARD

Key actions for policy, investment and design

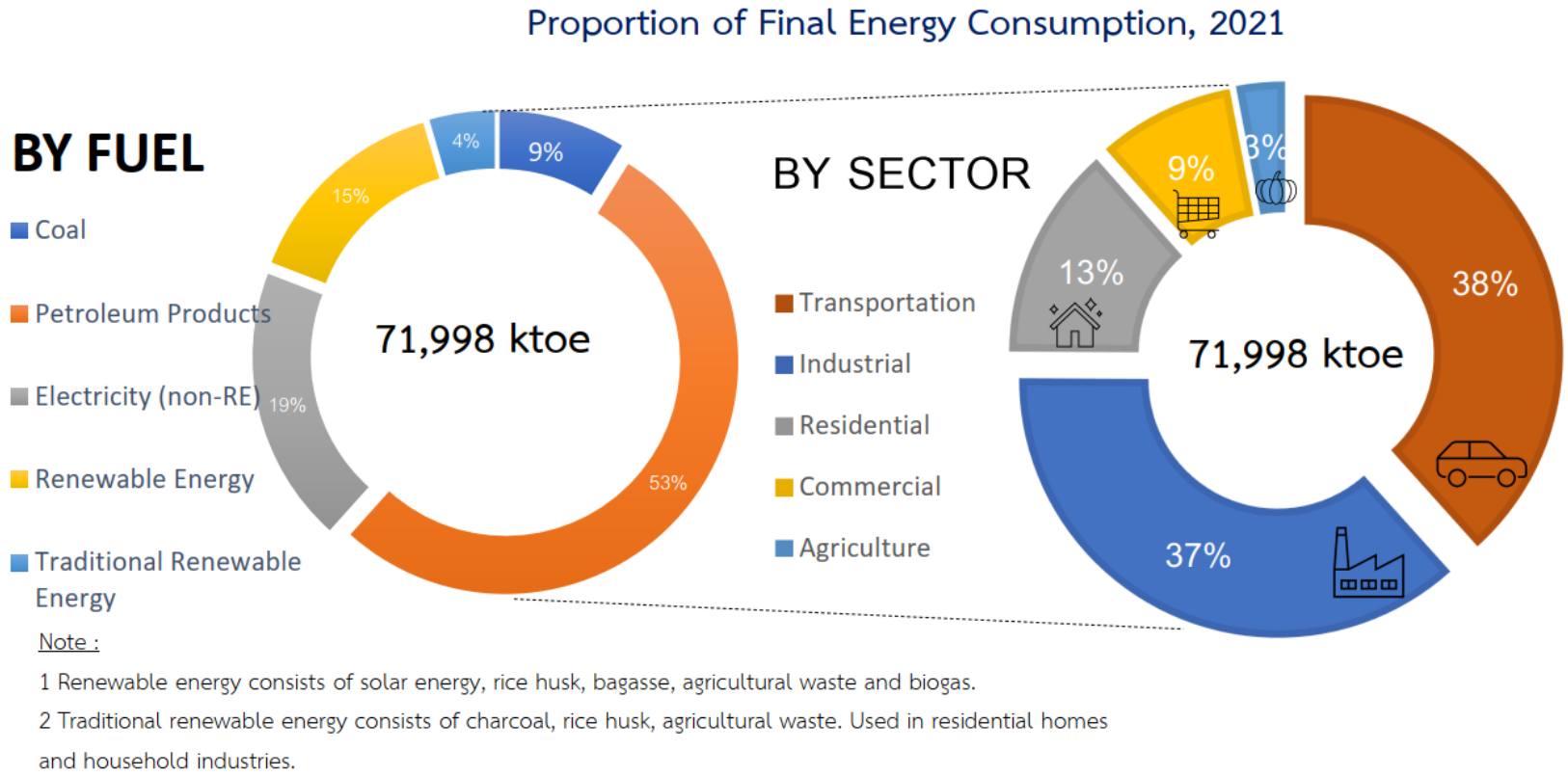
- Increase use of building design tools. Use integrated design processes and simulation or modeling tools such as building information modeling (BIM) and energy models for ensuring high performance and cost savings. For new buildings, use of BIM and energy models may be required in the design task
- Reduce embodied carbon in building materials. Include requirements for low carbon materials in building regulations. Focus on design that uses suitable materials. Reduce the amount of carbon in building operations through the use of renewable energy
- Increase awareness and information. Increase the understanding of the benefits of sustainable buildings among consumers. Use the labeling system to promote energy efficient properties

Source: Global Alliance for Buildings and Construction and Danish Energy Agency, 2022

4. Thailand

ENERGY SCENARIO

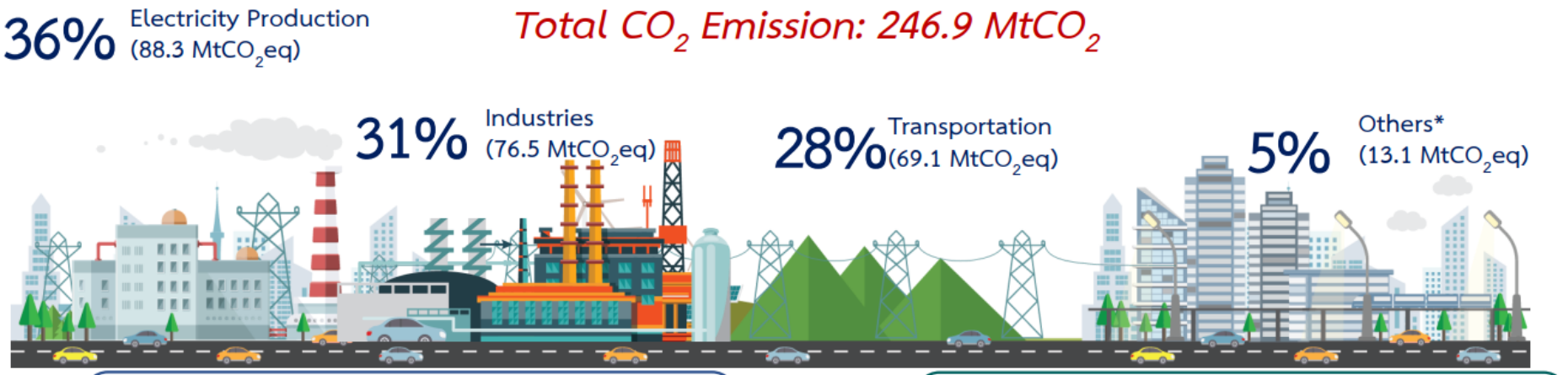
By fuel and sector, 2021



Source: Division of Energy Efficiency Promotion, Department of Alternative Energy Development and Efficiency, Ministry of Energy, Government of Thailand, 2023

CO_2 EMISSIONS

2021



2.04 $MtCO_2$/ktoe

CO_2 emission per energy consumption

Lower than global average as well as Asia, US, China, and Europe's average

3.69 tCO_2/capita

CO_2 emission per capita

Higher than Asia's average

Others* includes residential, agricultural, commercial, etc.

23.50 $kgCO_2$/MBaht

CO_2 emission per GDP

Higher than US, Europe, and global average

0.42 $kgCO_2$/kWh

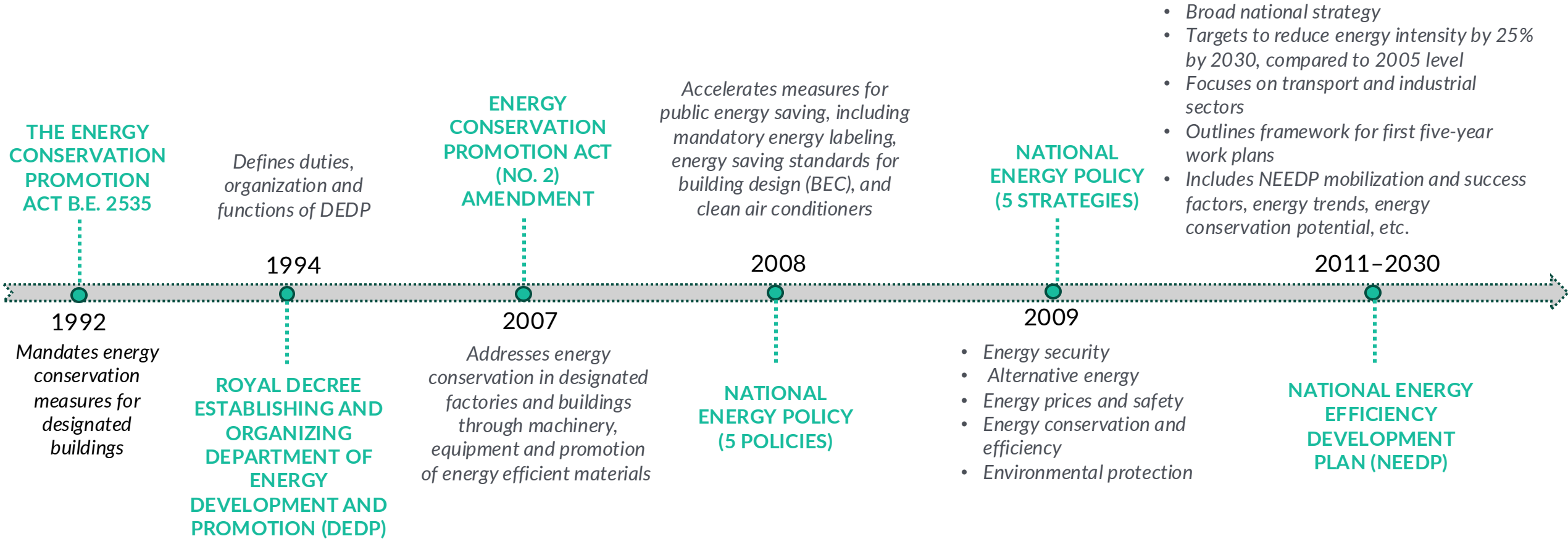
CO_2 emission per electricity production

Higher than Europe's and developed countries in America

Source: Division of Energy Efficiency Promotion, Department of Alternative Energy Development and Efficiency, Ministry of Energy, Government of Thailand, 2023

THAILAND INITIATIVES

Timeline for policies in climate and energy



Source: https://asiapacificenergy.org/apef/index.html#main/lang/en/time/[2018,2024]/geo/[]/search

THAILAND INITIATIVES

Timeline for policies in climate and energy

ENERGY EFFICIENCY PLAN (EEP)

2015–2036
Updated 2018

- Targets 36% reduction in energy intensity by 2037 compared to a baseline year of 2010
- Includes sector-specific goals across various industries, including residential, commercial and industrial sectors
- Outlines compulsory measures such as energy management standards and building codes
- Outlines voluntary measures such as labeling for energy efficient equipment and financial incentives for adopting energy-saving technologies
- Promotes integration of innovative technologies to enhance energy efficiency

CLIMATE CHANGE MASTER PLAN (CCMP)

2015–2050

Focuses on:

- *Carbon neutrality by 2050*
- *Building climate resilience*
- Reducing greenhouse gas emissions (net zero GHG emissions by 2065)
- Capacity building
- Data collection, knowledge sharing and technological development

NATIONAL ENERGY PLAN (NEP)

September 2024
Expected Launch

Integrates five key energy-related plans:

i. Power Development Plan (PDP) 2024–2037
ii. Alternative Energy Development Plan (AEDP)
iii. Energy Efficiency Plan (EEP)
iv. Gas Plan
v. Oil Plan

Aims to increase the share of renewable energy in Thailand's power generation from 36% (as of June 2024) to 51% by 2037

Sources: https://asiapacificenergy.org/apef/index.html#main/lang/en/time/[2018,2024]/geo/[]/search; https://www.preventionweb.net/publication/thailand-climate-change-master-plan-ccmp

INSTITUTIONAL MECHANISMS

National Committee on Climate Change Policy

Chairperson	Prime Minister
1st Vice Chairperson	Minister of Natural Resources and Environment (DEQP, ONEP and NCCO)
2nd Vice Chairperson	Minister of Foreign Affairs
Committee members, Permanent Secretaries of:	
1. Prime Minister's Office	15. Ministry of Higher Education, Science, Research and Innovation
2. Ministry of Finance	
3. Ministry of Foreign Affairs	16. Bangkok Metropolitan Administration
4. Ministry of Tourism and Sports	17. Office of the National Economic and Social Development Council
5. Ministry of Transport	
6. Ministry of Digital Economy and Society	18. Office of the National Water Resources
7. Ministry of Energy (DEDE and EGAT)	19. Bureau of Budget
8. Ministry of Commerce	20. 5–9 experts on law, economics, environment, science and technology, energy, or climate change
9. Ministry of Interior	
11. Ministry of Education	21. One expert from the private sector
12. Ministry of Public Health	Other invitees may include the Thailand Greenhouse Gas Management Organization (TGO), Office of Natural Resources and Environmental Policy and Planning (ONEP), and Chiang Mai University
13. Ministry of Industry	
14. Ministry of Agriculture and Cooperatives	

Source: Adapted from Office of Natural Resources and Environmental Policy and Planning, Government of Thailand, 2022a

INSTITUTIONAL MECHANISMS

Structure of the National Committee on Climate Change Policy

Secretariat: Permanent Secretary, MONRE

Assistant Secretary: Secretary-General of ONEP

Assistant Secretary: Director of Thailand Greenhouse Gas Management Organization (TGO)

Subcommittee on Climate Change Policy and Planning Integration	Subcommittee on Climate Change Knowledge and Database	Subcommittee on Climate Change Negotiation and International Cooperation	Subcommittee on Action for Climate Empowerments and Public Relations	Subcommittee on Climate Law	Subcommittee on the Mobilization of GHG Mitigation with Carbon Sequestration in LULUCF Sector	Subcommittee on the Mobilization of GHG Mitigation with CCUS Technology Implication
Working Group on GHG Mitigation Policy and Planning	Working Group on GHG Inventory and Mitigation Measures	Working Group on Climate Change Convention Conference and Negotiation				
Working Group on National Climate Change Adaptation Implementation Integration	Working Group on Climate Change Data and Modeling					
Ad-Hoc Working Group on REDD+						

Source: Office of Natural Resources and Environmental Policy and Planning, Government of Thailand, 2022a

THAILAND'S NDCs

Overview

- Thailand submitted its **second NDC in 2022**. It covers the energy, industrial processes and product use, agriculture, and waste sectors
- GHG target (**unconditional**): Reduce GHG emissions by **30%** from the projected BAU level by 2030
- GHG target (**conditional**): The level of contribution could increase up to **40%**, subject to adequate and enhanced access to technology development and transfer, financial resources, and capacity building support
- Thailand submitted a revised Long Term – Low Emission Development Strategy (**LT-LEDS**) in 2022, which aims to achieve **carbon neutrality by 2050** and **net zero GHG emissions by 2065**

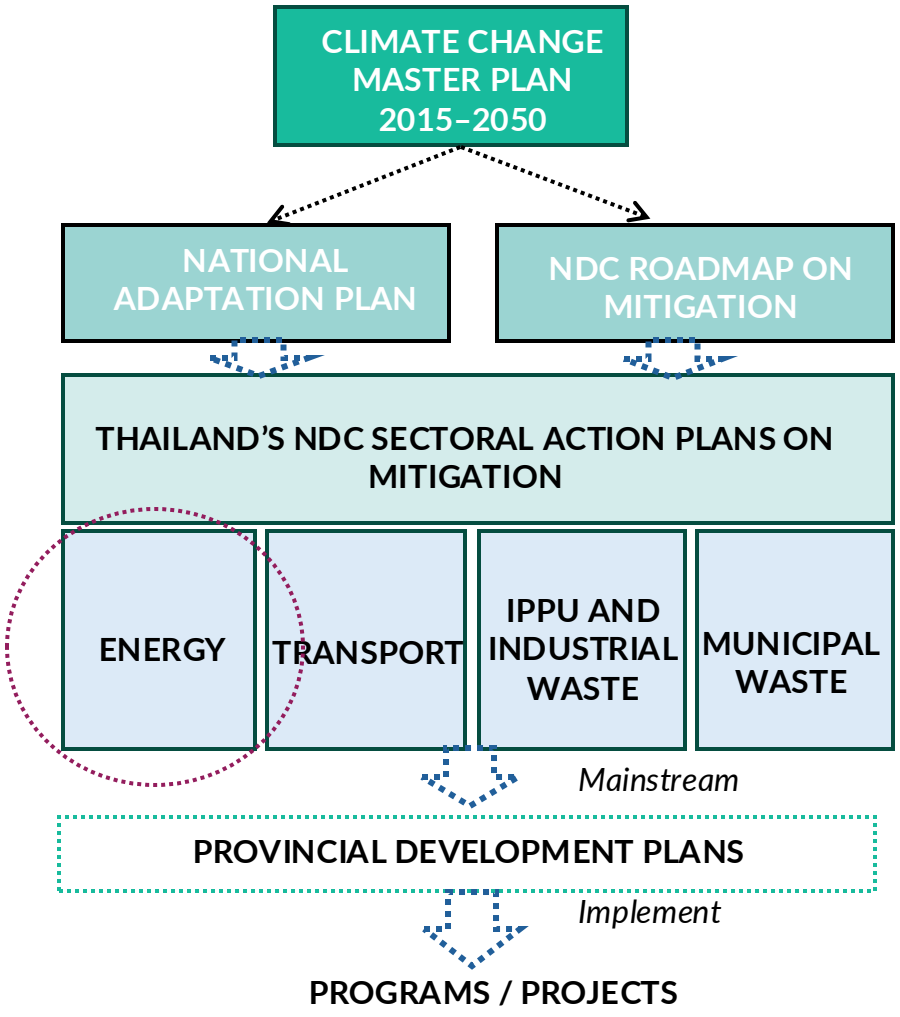
Source: https://ndcpartnership.org/country-action

NDC ROADMAP (2021–2030)

Implementation mechanisms, policies and plans

NATIONAL PLANS TO MEET MITIGATION TARGET IN NDC:

i. 12th National Economic and Social Development Plan 2017–2021
ii. Climate Change Master Plan 2015–2050
iii. Power Development Plan (PDP) 2015–2036, (2018 edition)
iv. Energy Efficiency Plan (EEP) 2015–2036, (2018 edition)
v. Alternative Energy Development Plan (AEDP) 2015–2036 (2018 edition)
vi. Thailand Smart Grid Development Master Plan 2015–2036
vii. Environmentally Sustainable Transport System Plan 2013–2030
viii. National Industrial Development Master Plan 2012–2031
ix. Waste Management Roadmap
x. Long Term Low Greenhouse Gas Emission Development Strategy



NDC Implementation of Mitigation Measures

Source: Supirak, 2021

LT-LEDS

Long Term – Low Emission Development Strategy

Building sector-related plans in the LT-LEDS include:

POWER DEVELOPMENT PLAN (PDP)

Includes developing an energy management system and energy forecast system, liberalizing the energy business, creating the wheeling charge system, and ***promoting an EV and EV charging station production and purchasing system***

ALTERNATIVE ENERGY DEVELOPMENT PLAN (AEDP)

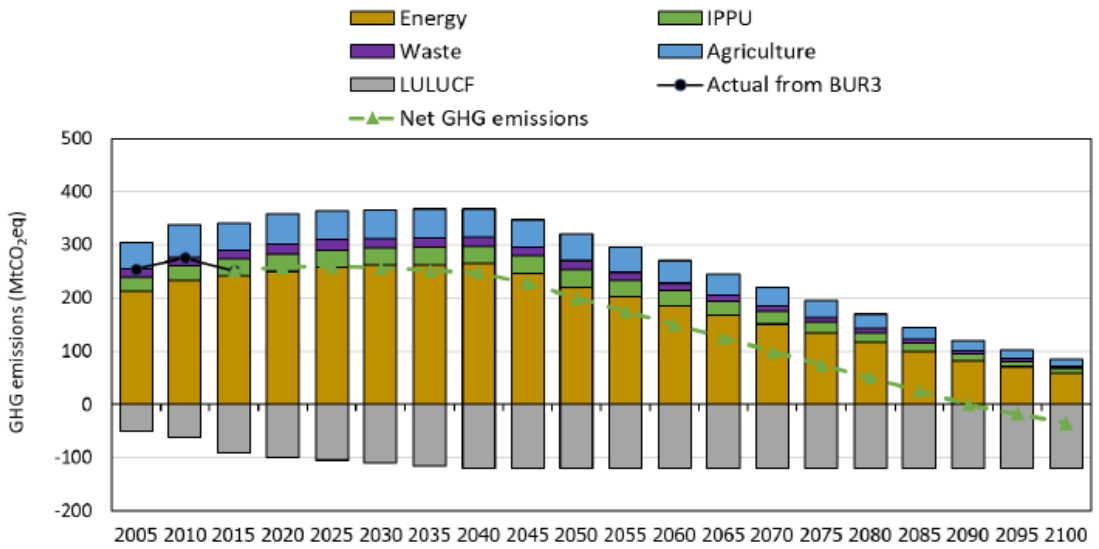
Includes developing a biocircular economy, ***carbon credits mechanism and renewable energy certificates***

ENERGY EFFICIENCY PLAN (EEP)

Seeks to ***enhance energy efficiency in buildings, industries and households, promote green industries and smart energy management***, and develop digital and EV data platforms and ***charging stations to promote electric vehicle utilization***

EEP 2018 + AEDP 2018 + PDP 2018 Rev 1 = 117.66 $MtCO_2eq$ by 2030

Including guidelines for promotion of electric vehicles (EV) as per 30@30 policy



Thailand's long term low greenhouse gas emissions scenario

Sources: Office of Natural Resources and Environmental Policy and Planning, Government of Thailand, 2022a and 2022b

NATIONAL ENERGY PLAN

Toward carbon neutrality and net zero

Mitigation targets in the National Energy Plan for the building sector

RESIDENTIAL SECTOR

- Electricity accounts for the highest energy consumption in the residential sector. ***Household air conditioners are one of the key drivers of electricity demand in Thailand. The energy efficiency improvement of energy devices*** in the residential sector will have to increase to 29% of total final energy consumption in 2050
- The ***share of renewable energy use in households*** will have to increase to ***49% of total final energy consumption in 2050***

COMMERCIAL BUILDINGS

- The ***energy efficiency improvement of energy devices*** in commercial buildings will have to ***increase to 33% of total final energy consumption in 2050***
- ***Solar water heating devices*** have to be promoted to produce hot water in hotels, condominiums and hospitals
- The share of solar water heating will have to increase to 5% of total final energy consumption in 2050

Increase renewable energy use to 50%

EV 30@30
30% of passenger cars and pickup trucks by 2030

Increase EE by 30% through use of technology and energy management

4D1E
Decarbonization, Digitalization, Decentralization, Deregulation, Electrification

Policy direction for the National Energy Plan 2024 (under consideration)

Sources: Office of Natural Resources and Environmental Policy and Planning, Government of Thailand, 2022a and 2022b

NDC SECTORAL PLAN

Energy sector (2021–2030)

- **National Climate Change Policy Committee (NCCC)** assigned the ***Energy Policy and Planning Office (EPPO)*** as the responsible agency to prepare the national greenhouse gas reduction plan 2021–2030
- **EPPO**, with Office of Natural Resources and Environmental Policy and Planning ***(ONEP)*** and Greenhouse Gas Management Organization ***(TGO)***, *identifies potential mitigation measures such as increasing energy efficiency and promoting renewable energy*
- They coordinate with the following agencies to prepare the ***action plan on national GHG emissions*** in the energy sector:
  - Department of Alternative Energy Development and Efficiency **(DEDE)**
  - Electricity Generating Authority of Thailand **(EGAT)**
  - Office of Energy Regulatory Commission **(OEC)**
  - Office of Transport Policy and Planning and Traffic **(OTP)**
  - Chiang Mai University
  - Private power producers

Overview of Thailand's NDC Roadmap and Action Plan and reduction potential

Sources: Office of Natural Resources and Environmental Policy and Planning, Government of Thailand, 2022a; Supirak, 2021

BUILDING ENERGY EFFICIENCY PROGRAMS

Implemented through energy efficiency plans in Thailand

THAI'S RATING OF ENERGY AND ENVIRONMENTAL SUSTAINABILITY (TREES)

- Developed by the Thai Green Building Institute and the Engineering Institute of Thailand
- Purpose is to elevate Thailand's construction sector to international standards

HIGH ENERGY PERFORMANCE STANDARD AND LABELING (DEDE)

- Voluntary program for rating the energy efficiency of appliances
- Provide customers with enhanced awareness on energy efficient appliances and equipment
- Voluntary labeling program to include glazing, three-phase motors, variable speed drives, and diesel and gasoline engines

ENERGY MANAGEMENT SYSTEM

- Requires designated buildings to conduct energy management and assign an energy manager, with reports to be submitted to DEDE yearly

FINANCIAL SUPPORT FOR BUILDING RETROFITS

- In 2019, DEDE set up a subsidy program for retrofitting nine types of buildings, subsidizing the cost of improving the building envelope and the roof to comply with the Building Energy Code

Thailand

Way Forward

Image source: https://ips-cambodia.com/cambodia-encourages-more-green-building

WAY FORWARD

Implementing building EE policies

- Thailand needs further support in terms **of finance, technical expertise, technology transfer and capacity building** to ensure the achievement of its Long-term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) in the short-term (2025–2035), medium-term (2040–2050) and long-term (2050–2065) periods
- To ***enhance the enabling environment***, support is needed for ***developing and strengthening mechanisms, instruments and policy implementation, such as financial instruments and incentives*** to engage private sector in green investment, and ***capacity building for all stakeholders*** to ***integrate climate actions into their respective practice and plans***
- ***Build capacity*** in the public and private sectors to integrate mitigation action into their respective plans or enterprises
- ***Raise awareness on climate change,*** Thailand's LT-LEDS and NDCs among relevant stakeholders and the public at large

OPPORTUNITIES

For low carbon and green growth

Green low carbon growth in Thailand could focus on the following:

- Adjust the economic structure toward a less energy- and carbon-intensive economy
- **Transform urban areas into green livable low carbon cities through multi-sector approaches**

  The speed and scale of urbanization in Thailand presents an opportunity to build low carbon cities and attract the best talent and long-term investments needed to create new jobs in higher-value-added and less-resource-intensive industries

  Some of the key principles include ***compact urban form, efficient and clean energy, renewable energy generation, green buildings, sustainable urban transport, and efficient water and waste management***

- **Tap the energy efficiency potential through energy plans, especially in the transport, industry and building sectors**

  This includes strengthening policies and regulations, and increasing the use of fiscal measures to complement existing voluntary measures

*The Department of Climate Change and Environment (DCCE) with support from the Climate, Coastal and Marine Biodiversity (CCMB) project implemented by GIZ Thailand, has drafted **Thailand's first climate legislation**, namely the **Climate Change Act***

*The draft Climate Change Act establishes various **carbon pricing instruments, including Thailand's emissions trading system, carbon tax and carbon credit, and the National Climate Change Fund.** The draft Act also establishes mandates on climate adaptation, green taxonomy and mandatory greenhouse gas reporting*

5. Vietnam

Energy Scenario, Emissions, NDCs and BEEP

ENERGY SCENARIO

Overview

- Vietnam has transformed into one of the most dynamic economies in the world with the energy sector playing a vital role
- Vietnam has large reserves of primary energy resources and the **primary energy supply** in Vietnam is evolving and dominated by about 49% coal and 24% oil

Vietnam experienced GDP growth of 6.8% in 2017

Improved Life

Reduced Poverty

In 2015, Vietnam became a net energy importer

with energy share at 5%

and is expected to grow

PRIMARY ENERGY SUPPLY

1990–2050

1990 — One of the poorest nations in Asia

Significant role played by energy sector

Rapid growth

2019 — One of the most dynamic economies in the world

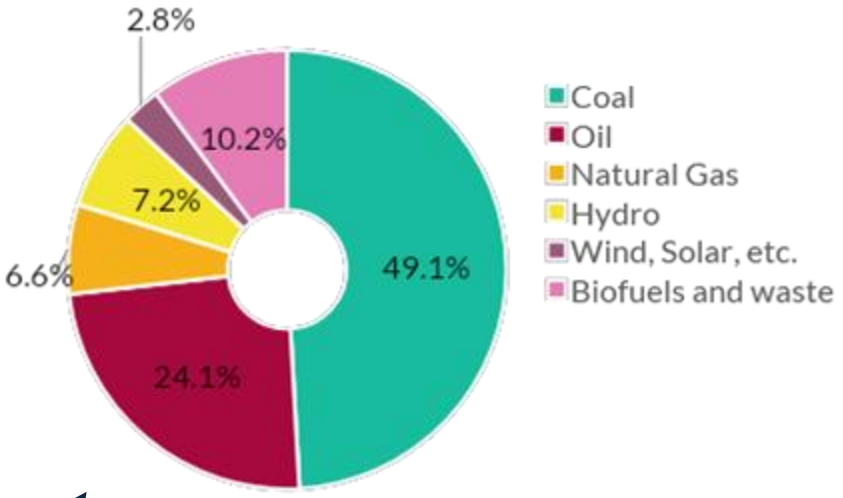
Vietnam has large reserves of primary energy resources

Primary energy supply in Vietnam is dominated by about

49% Coal | 24% Oil

of the total energy supply

Total energy supply, Vietnam, 2021

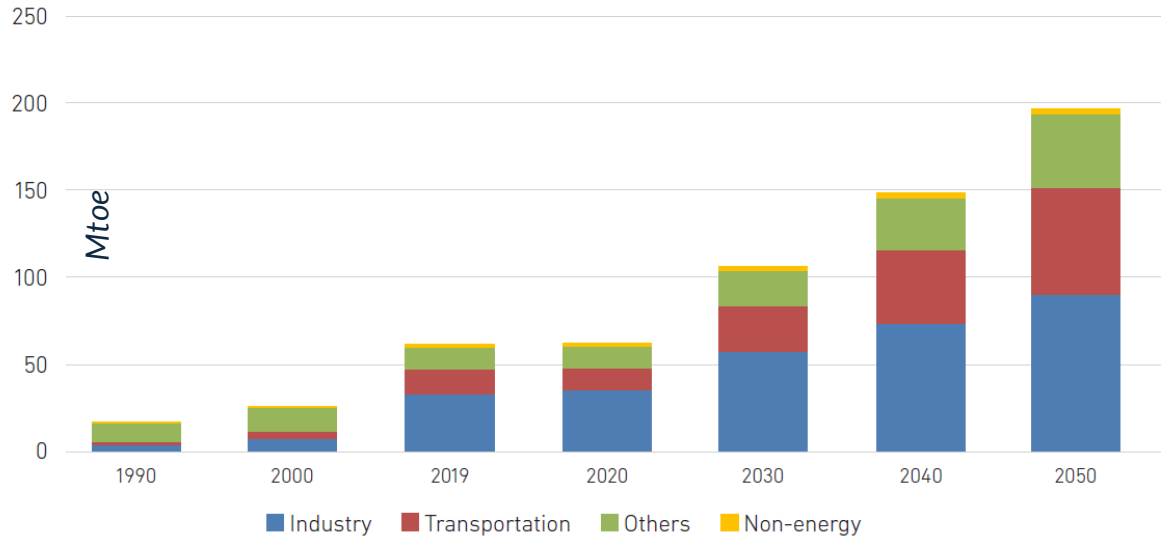


Source: International Energy Agency, 2022

ENERGY CONSUMPTION

Projected trend, business as usual

- Industry, followed by transportation, account for significant portion of total energy consumption
- This trend is expected to continue in the business-as-usual scenario



Final energy consumption by sector in the business-as-usual scenario, 1990–2050

Notes: Mtoe = Million Tons of Oil Equivalent; Others = residential and commercial sectors

Source: Kimura. S. et al., 2023

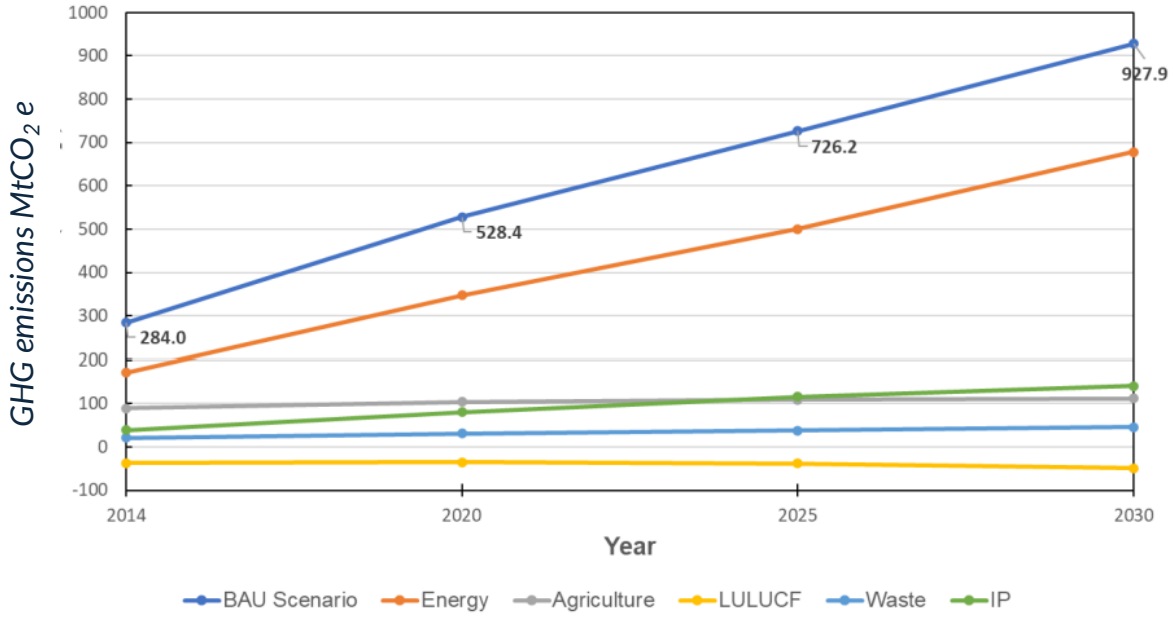
GHG EMISSIONS

Projected trend, business as usual

National measures to reduce GHG emissions for 2021–2030 have been identified for the agriculture, energy, industrial processes, LULUCF and waste sectors

Measures to reduce GHG emissions in the energy sector include:

- Use of high-efficiency air conditioning and refrigeration equipment in commercial and residential services
- Use of energy-saving lighting
- Use of solar water heaters
- Use of high-performance electrical equipment
- Use of high-efficiency refrigeration equipment in services, commerce and trade
- Improvement, development and application of technology in the production of building materials



GHG emissions in the business-as-usual scenario

Note: $MtCO_2e$ = million tons of carbon dioxide equivalent

Sources: Government of Vietnam, 2020 and 2022

CO_2 EMISSIONS

By sector

Rank of Vietnam in Asia-Pacific region

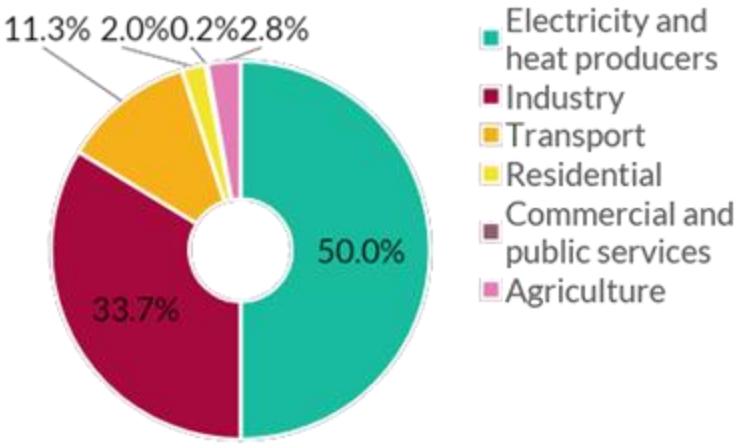
7th
for CO_2 emissions of fuel combustion

13th
for CO_2 emissions per capita

Dominant sectors for CO_2 emissions

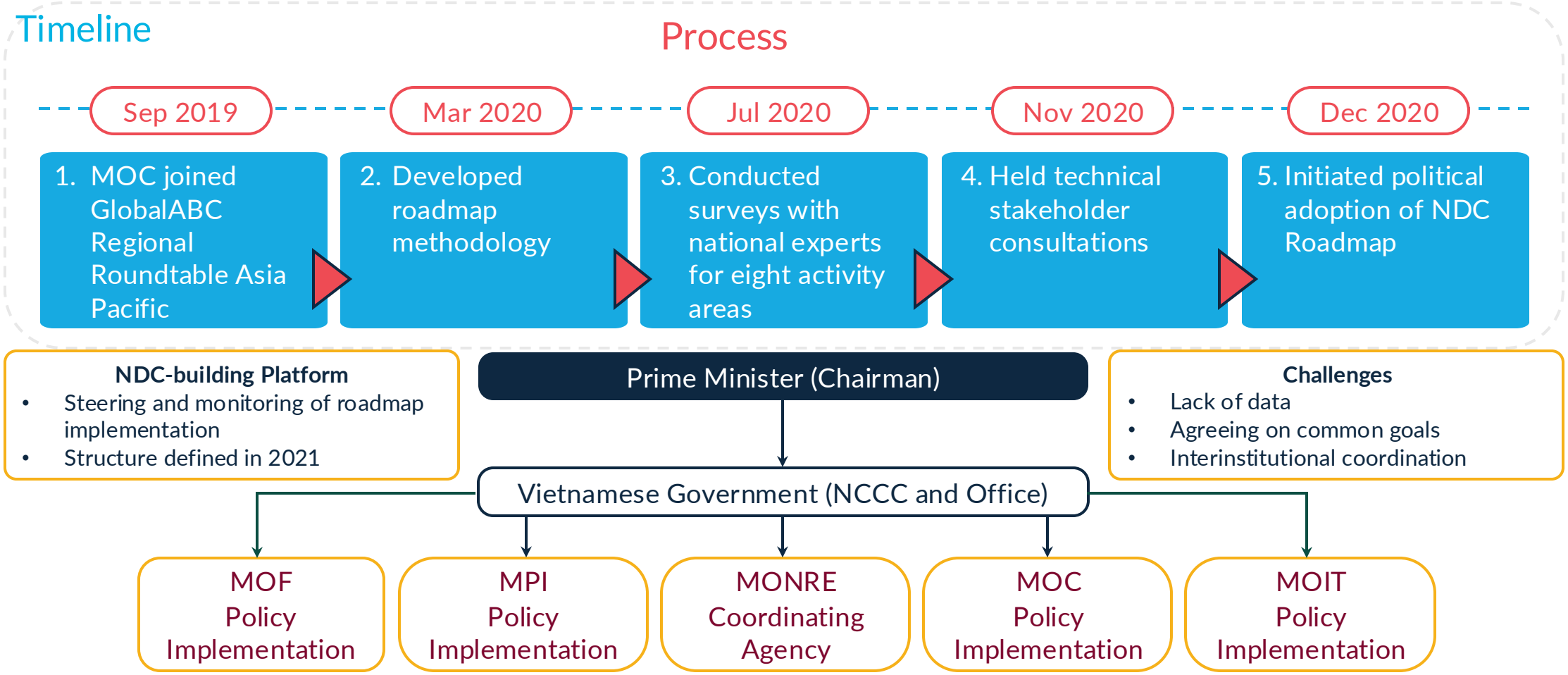
50% Electricity and Heat | 33% Industry | 11% Transport

CO2 emissions by sector, Vietnam, 2021



Source: International Energy Agency, 2022

NDC ROADMAP DEVELOPMENT



Sources: Climate Action Tracker, 2023; NDC Partnership

RESPONSE TO CLIMATE CHANGE

Overview

Implementation of energy policy in Vietnam, reinforced through National Energy Development Strategies

In February 2020, the Political Bureau issued the Orientation of Vietnam's National Energy Development Strategy to 2030 and Outlook to 2045

Three climate targets:

- Reduce greenhouse gas emissions
- Increase energy efficiency in total final energy consumption compared to the business-as-usual scenario
- Increase proportion of renewables in the energy mix

Source: PwC, 2024

RESPONSE TO CLIMATE CHANGE

Aspirations and commitments

UN Sustainable Development Goals

By 2030

Universal access to energy services

At least **32.3%** renewable energy share

Maintain at least **6% GDP** growth per annum

Vietnam's Aspiration

By 2045

High-income status country

Net Zero Commitments (COP26)

By 2040

Phase out coal

By 2050

Net zero

Revised Nationally Determined Contribution (NDC)

By 2030

Conditional NDC:
With international support:
43.5% GHG reduction compared to BAU

Unconditional NDC:
Using domestic resources:
15.8% GHG reduction compared to BAU

Source: PwC, 2024

NDC COMMITMENTS

Crucial GHG mitigation strategies

- Energy efficiency is recognized as an important mitigation strategy, covering the areas of energy production, transmission and distribution (especially for large production facilities), residential sector, trade and services, and transport

- **Vietnam's Nationally Determined Contributions (NDC)** commitments include:

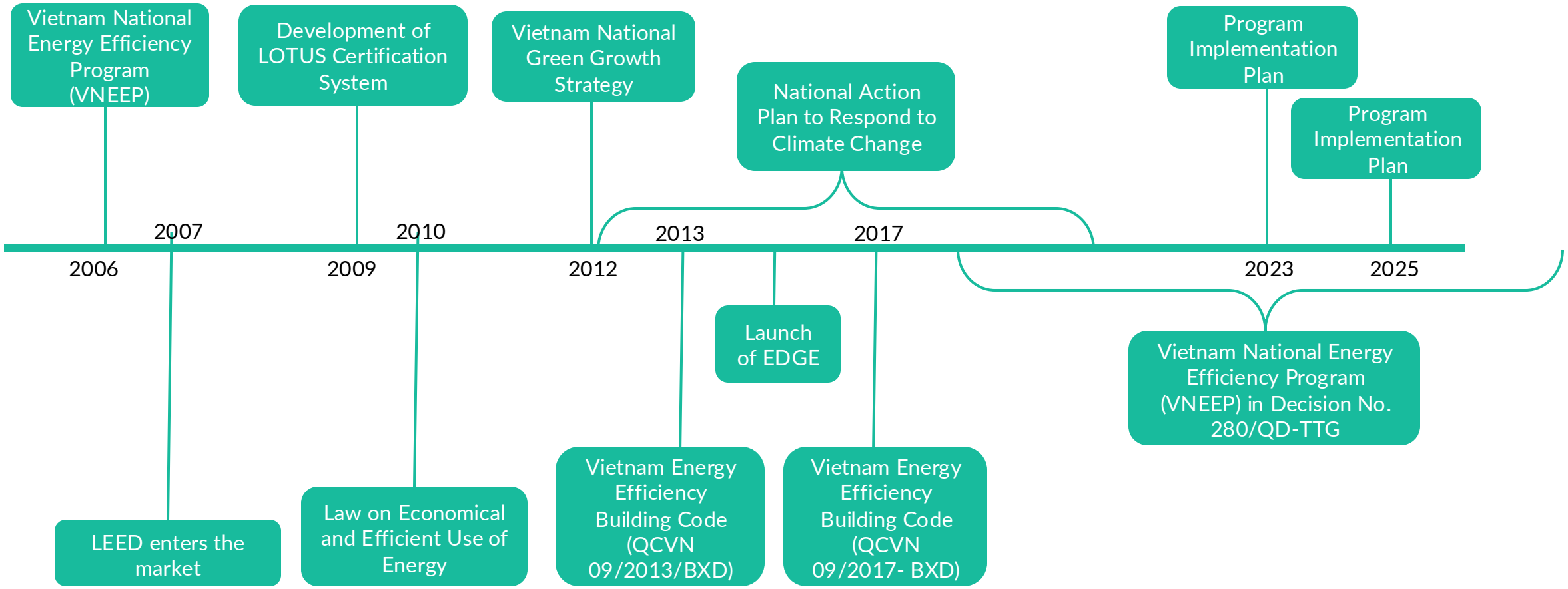
  - In 2020, the commitment was to reduce GHG emissions by 8% (11.84 $MtCO_2e$) and unconditionally by 25.7% (37.83 $MtCO_2e$) through international support by 2030, compared to the business-as-usual scenario, with utilization of domestic resources
  - In 2022, the NDC commitment was updated to reduce GHG emissions by 15.8% using domestic resources and by 43.5% through bilateral and multilateral support and financing by 2030
  - Vision for 2031 to 2050 is to achieve zero emissions from the construction industry by 2050

Image source: https://climatepromise.undp.org/news-and-stories/NDCs-nationally-determined-contributions-climate-change-what-you-need-to-know

Source: PwC, 2024

VIETNAM'S INITIATIVES

Energy efficiency initiatives 2006 – present



Sources: Climate Action Tracker, 2023; NDC Partnership

UPDATED NDC TARGETS

Key mitigation and adaptation measures

Urban development and housing, and energy sector

- Climate monitoring and early warning of natural disaster to adapt to climate change
- Natural disaster response and flood prevention for major cities

Creating awareness and community engagement

- Building climate-resilient communities to promote the use of local knowledge in responding to climate change

Urban planning tools for climate mitigation

- Upgrading and renovating the infrastructure of sectors in association with synchronous implementation of measures to protect the environment and adapt to climate change
- Upgrading transport facilities in areas with high disaster risk and vulnerability to climate change
- Building and upgrading water drainage systems, preventing floods caused by heavy rains, floods, spring tides and storms

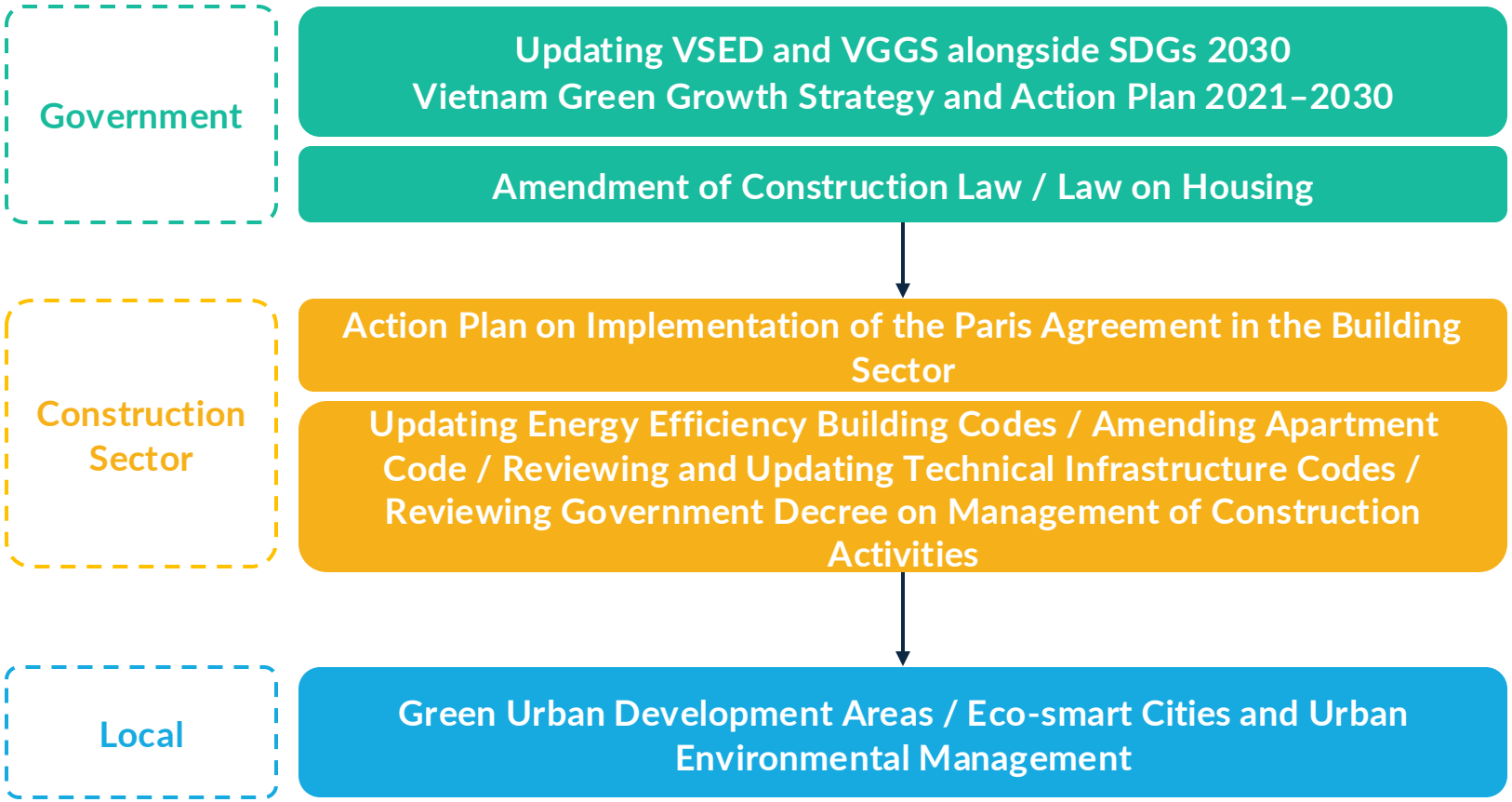
Energy usage

- Residential sector accounted for 18% of total final energy consumption in 2017
- Strong demand for increase in new social housing and affordable mid-income housing due to a growing middle-class population
- Strong projection in non-residential sector
- Vietnam's successful implementation of universal electrification and increase in use of electrical home appliances has led to energy demand in building sector

Sources: Climate Action Tracker, 2023; NDC Partnership

INSTITUTIONAL MECHANISM

Roles of stakeholders



Sources: Climate Action Tracker, 2023; NDC Partnership

INSTITUTIONAL MECHANISM

Responsible authorities

Name of institution for improving building energy efficiency	Responsibility
Ministry of Industry and Trade	Activities related to the energy sector and other industries
Ministry of Construction	Development of general construction plans and related coordination
Ministry of Planning and Investment	Sets the socio-economic development strategy and plan
The Ministry of Finance	Jurisdiction over tariffs and taxation related to energy activities
The Ministry of Natural Resources and Environment	Research and development in the fields of energy and environmental protection
Local Authorities	Construction activities within their territory

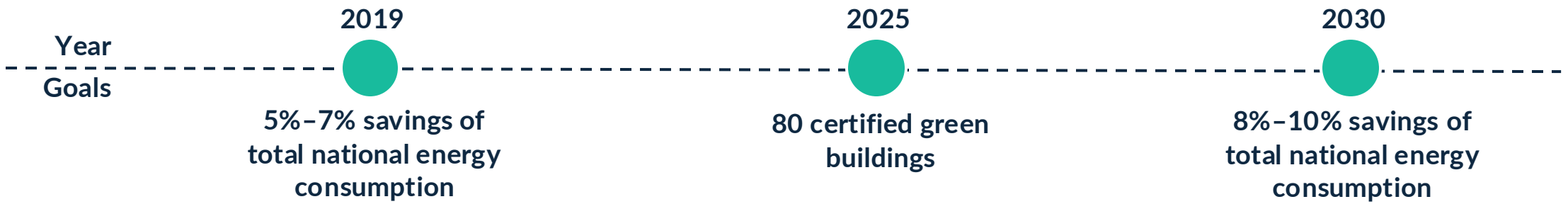
Source: Copenhagen Centre on Energy Efficiency, 2018

ENERGY EFFICIENCY IN BUILDINGS

Initiative: Vietnam National Energy Efficiency Program

Vietnam National Energy Efficiency Program (VNEEP)

- All buildings must comply with the mandatory requirements set by the National Technical Building Code on Energy Efficiency (VEEBC)
- 80 certified green buildings by 2025
- Mandatory energy labeling
- Minimum energy efficiency standards roadmap for equipment and appliances



Sources: Climate Action Tracker, 2023; NDC Partnership

ENERGY EFFICIENCY IN BUILDINGS

Initiative: National Green Growth Strategy

2012 — **National Green Growth Strategy (NGGS)**

- Includes strategies for green construction and sustainable urbanization, and is linked to the national climate change and economic policy agendas
- In the 2016 Plan for Implementation of the Paris Agreement, the government defined various mitigation actions for the construction sector in 2021–2030

Key Targets

	Reduction in intensity of GHG emissions per unit of GDP	Primary energy consumption per unit of GDP	Proportion of renewable energy over total primary energy supply
By 2030	At least 15% compared to 2014 levels	1%–1.5% per year	15-20%
By 2050	At least 30% compared to 2014 levels	1% per year	25-30%

Sources: Climate Action Tracker, 2023; NDC Partnership

BUILDING ENERGY EFFICIENCY PROGRAMS

Decisions and implementation plans

2019–2023 — **Vietnam National Energy Efficiency Program (VNEEP) in Decision No. 280/QD-TTG**

Aims to achieve 8%–10% energy savings in the building sector by 2030. It promotes various strategies, including:

- **Encouraging energy efficient technologies:** Financial incentives provided for using high-performance appliances and building materials
- **Building capacity and awareness:** Focus on training architects, engineers and the public on energy efficient design and practices

2023 — **Program Implementation Plan**

Pushes the promulgation and implementation of the provincial directives on energy efficiency (2020–2025)

- **Directives:** Strengthening inspection and supervision, capacity building, and pushing the implementation of applicable regulations on energy efficiency

2025 — **Program Implementation Plan**

Aims to achieve building efficiency goals by 2025

- Save 5%–7% of total end consumption nationwide under normal economic development scenario

Sources: Climate Action Tracker, 2023; NDC Partnership

Vietnam

Way Forward

Image source: https://ips-cambodia.com/cambodia-encourages-more-green-buildings/

WAY FORWARD

Addressing challenges and barriers in the financing of green buildings

- Consolidate incentives in the building market
- Address developer hesitance to absorb additional up-front costs of green building design, when cost savings will only accrue for future owners
- Address mismatch between building longevity and the relatively short holding periods for real estate assets in investment portfolios
- Provide landlord incentives to invest in energy efficient equipment because the tenant is paying the utility bill
- Address subsidized or government-controlled energy prices
- Increase awareness, information and education on the benefits of green buildings to private owners and the public
- Promote access to design, construction material and skilled workers
- Develop guidelines and policies promoting green buildings

Source: Azhgaliyeva, D. and Rahut, D. B., 2022

WAY FORWARD

Opportunities and potential measures

Opportunities

- Country-level initiatives and EE system in place but there is a need for financing large-scale deployments
- Need for EE with increasing competition in the market (particularly for export-oriented units)
- Need for training and capacity building for auditors, systems optimization experts, SMEs, industry owners, ESCOs and other stakeholders in the ecosystem
- ESCO market is not developed so far and there is need for technology standardization and local technology suppliers

Potential Measures

- De-risk energy efficiency project-based lending
- Raise awareness and build capacity
- Engage the private sector and unlock private investments
- Implement EE standards and technical guidelines for appliances and equipment for reductions in energy consumption and GHG emissions in selected sectors
- Demonstrate demand aggregation and ESCO financing-based models in selected sectors

Source: Institute for Sustainable Communities et al., 2021

Thank you!

For more information, visit us at https://ALCBT.GGGI.ORG or scan the QR code below

IKI Independent Complaint Mechanism

Any person who believes they may be harmed by an IKI project or who wish to report corruption or the misuse of funds, can lodge a complaint to the IKI Independent Complaint Mechanism at IKI-complaints@z-u-g.org. The IKI complaint mechanism has a panel of independent experts who will investigate the complaint. In the course of the investigation, we will consult with the complainant so as to avoid unnecessary risks for the complainant. More information can be found at https://www.international-climate-initiative.com/en/about-iki/values-responsibility/independent-complaint-mechanism/.

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