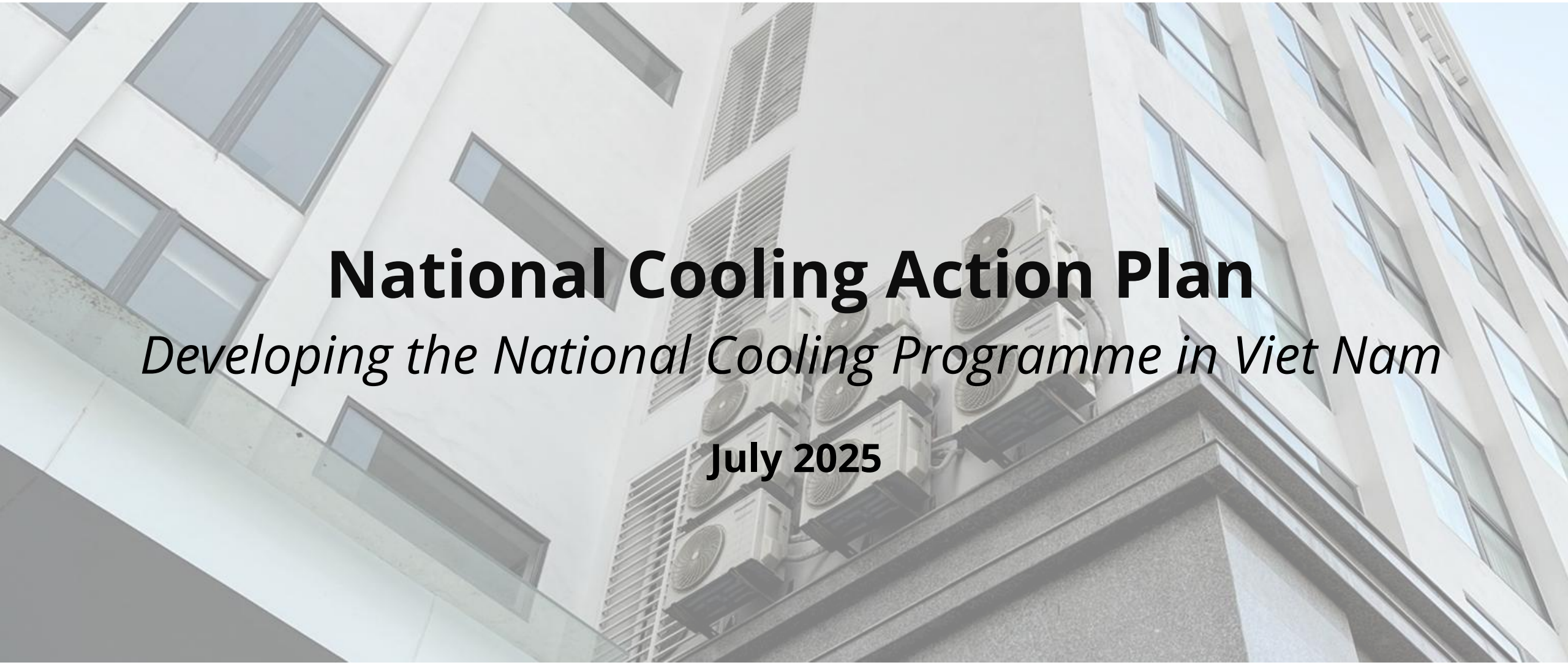


National Cooling Action Plan

Developing the National Cooling Programme in Viet Nam

July 2025

Contents

Rationales (1)

The Global Imperative: Cooling is essential for health, productivity, and economic growth, but it's a significant contributor to global electricity consumption (20%) and GHG emissions.

Vietnam's Context:

- Rapidly rising cooling demand due to urbanization, increased incomes, and more frequent, intense heatwaves.
- Projected to account for nearly 10% of national GHG emissions by 2030 if unchecked.

Our Commitment: Vietnam has committed to sustainable cooling through various international agreements:

- Montreal Protocol & Kigali Amendment
- 2030 NDC Target under Paris Agreement & 2050 Net-Zero Target (COP26)
- Global Cooling Pledge (COP28)

Purpose of NCAP: To provide a comprehensive roadmap for Vietnam's transition to sustainable, climate-resilient cooling.

Technical Assistant overview

“Developing the National Cooling Programme in Vietnam”

This Technical Assistance is a key activity within the framework of cooperation in energy transition and greenhouse gas (GHG) reduction in Viet Nam with the South East Asia Energy Transition Partnership (ETP) that has been indicated in the Memorandum of Understanding (MOU) between the Department of Climate Change (DCC), Ministry of Agricultural and Environment (MAE) and the United Nations Office for Project Services (UNOPS) on 21 June 2022.

- **Consultant:** Energy and Environment Consultancy Joint Stock Company (VNEEC)
- **Implementation time:** 04/12/2024 to 30/06/2025
- **Objective:** Conduct an analysis and consolidate outputs from previous initiatives to develop an integrated National Cooling Action Plan (NCAP) for Viet Nam, aiming to:
    - Assess the current status of the cooling sector in Viet Nam, including technologies in use, market trends, regulatory framework, and refrigerant management;
    - Promote the adoption of sustainable cooling solutions, combining high energy-efficiency (EE), low-carbon technologies, and passive cooling measures to reduce overall cooling demand;
    - Support the government in developing an integrated, climate-resilient cooling strategy aligned with national and international climate commitments.

Rationales (2)

Methodology: Structured, data-driven, consolidating analytical work from two key initiatives:

- **ETP/UNOPS Support:**

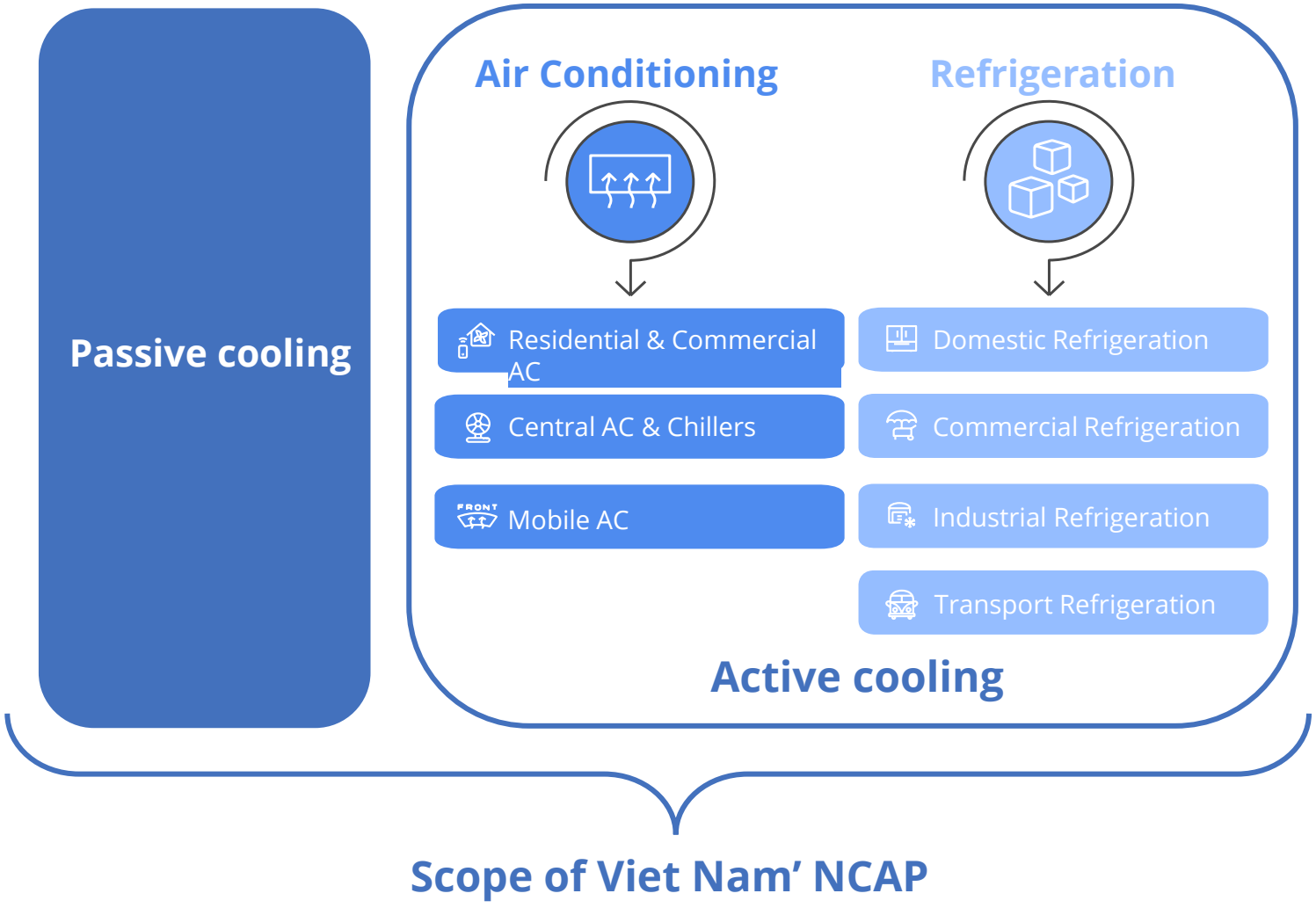
  Developed the National Green Cooling Programme (NGCP), focusing on improving the energy efficiency of active cooling technologies and enhancing refrigerant management.

- **UN ESCAP and UNEP Passive Cooling and Cold Chain Support:**

  This initiative of the United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP) and the United Nations Environment Programme (UNEP) Cool Coalition promotes the adoption of cold chain and passive cooling solutions to inherently reduce cooling demand. Key strategies include climate-responsive building design, nature-based solutions, and effective urban planning.

Rationales (3)

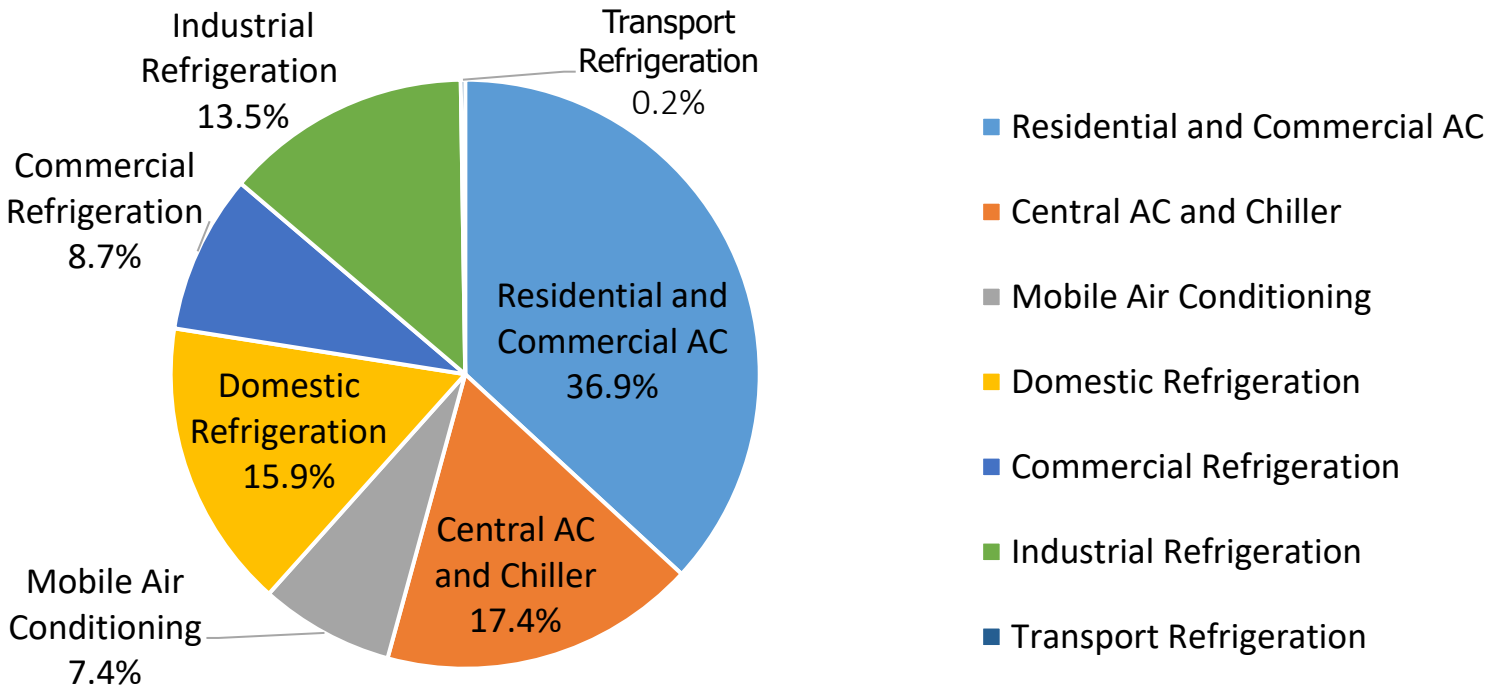
The NCAP covers passive cooling and active cooling (seven sub-sectors)



National Cooling Profile (1)

Current Status (2018-2022):

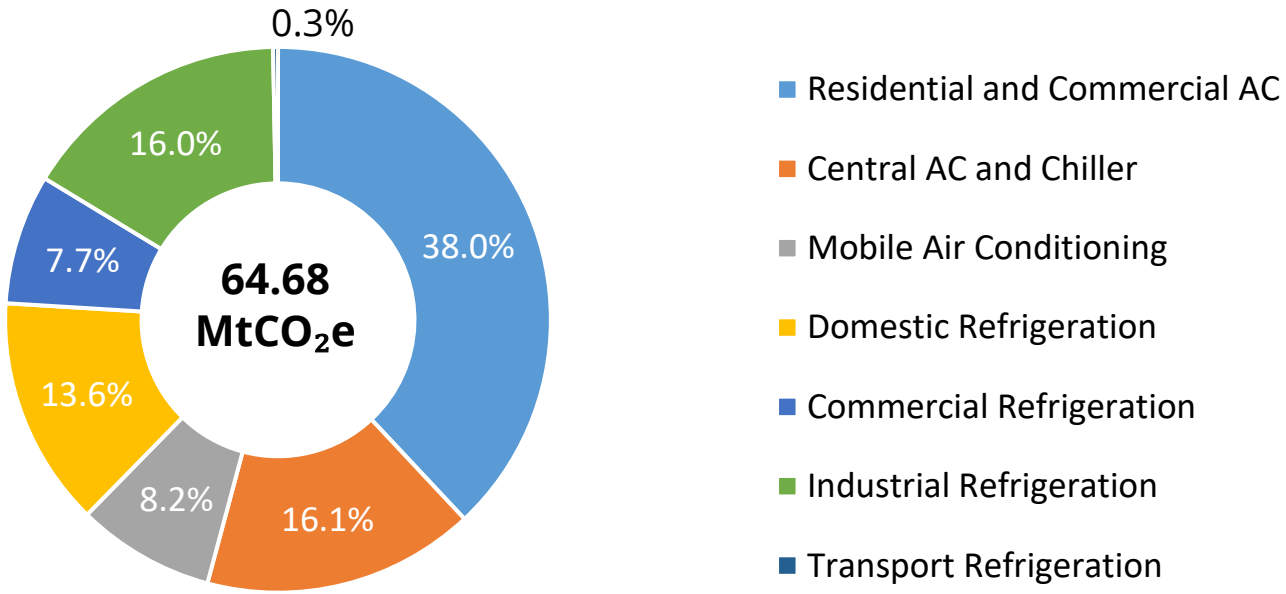
- **Cooling Sector Growth:** Expanded at an average of 2.3% per year between 2018-2022, led by Residential and Commercial AC (7.6% annually).
- **Energy Consumption:** 71.38 TWh (65.95 TWh electricity + fuel), representing 25.2% of Vietnam's total generated and purchased power.
- Proportion of energy consumption of cooling sub-sectors in 2022:



National Cooling Profile (2)

Current Status (2018-2022):

- **GHG Emissions:** 64.68 $MtCO_2e$, accounting for ~14% of national projected emissions.
  - **Indirect Emissions (Electricity):** 84.3% (54.52 $MtCO_2e$)
  - **Direct Emissions (Refrigerants):** 15.7% (10.16 $MtCO_2e$)
- Total BAU GHG emission from the cooling sector and contribution by sub-sectors in 2022



National Cooling Profile (3)

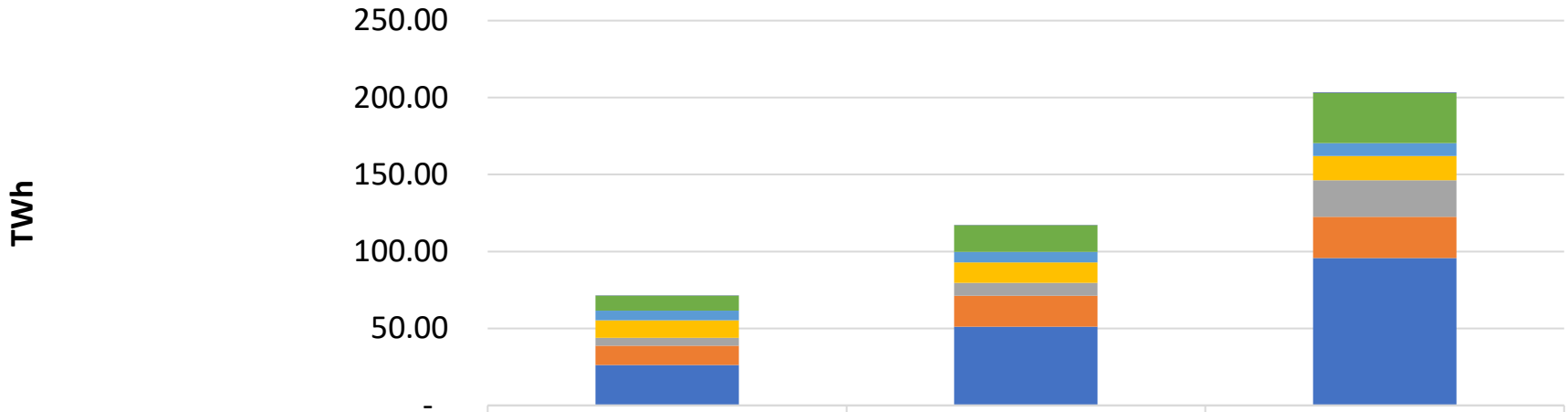
Current Status (2018-2022):

- **Energy Efficiency (EE) Status:**
  - Room AC stock already operates above current Minimum Energy Performance Standards (MEPS).
  - 72% of new residential and commercial units use inverter drives.
- **Refrigerant Use:**
  - HCFCs nearly phased out in new sales, scheduled for full elimination by 2040.
  - Current market dominated by HFCs (R-32, R-410A, R-134a).
  - Natural refrigerants (R-600a, R-290, R-717) gaining traction in domestic and industrial refrigeration.
- **Passive Cooling:**
  - Largely overlooked in current building practices.98% of structures built without insulation, 75% use single-layer glass.
  - Rapid urbanization exacerbates Urban Heat Island Effect (UHIE).

Active Cooling Demand Projections – BAU scenario (1)

Two active cooling scenarios developed for the NCAP including **Business-as-Usual (BAU) and Net-zero target (NZT)** scenarios.

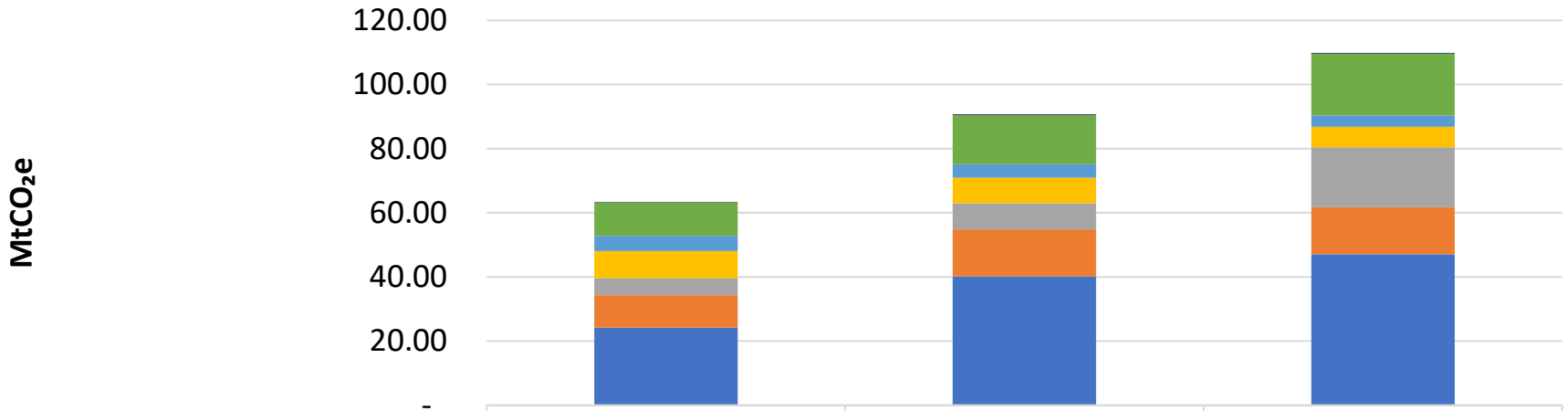
BAU Scenario - Electricity Consumption: Triple from 65.95 TWh (2022) to ~200 TWh by 2050



	2022	2030	2050
Transport Refrigeration	0.17	0.22	0.30
Industrial Refrigeration	9.67	17.37	32.41
Commercial Refrigeration	6.23	6.81	8.52
Domestic Refrigeration	11.33	13.19	15.74
Mobile Air Conditioning	5.26	8.37	23.64
Central AC and Chiller	12.41	20.19	26.91
Residential and Commercial AC	26.31	51.12	95.69

Active Cooling Demand Projections – BAU scenario (2)

BAU Scenario - GHG Emissions: Projected to peak at 116.38 $MtCO_2e$ in 2045, contributed primarily by Residential & Commercial AC; the grid decarbonizes after 2030 will reduce indirect emissions considerably



	2022	2030	2050
Transport Refrigeration	0.19	0.24	0.33
Industrial Refrigeration	10.36	15.27	19.22
Commercial Refrigeration	4.78	4.21	3.53
Domestic Refrigeration	8.44	8.05	6.42
Mobile Air Conditioning	5.28	8.13	18.65
Central AC and Chiller	10.14	14.60	14.67
Residential and Commercial AC	24.19	40.21	47.09

Active Cooling Demand Projections – BAU scenario summary (3)

Emissions Trends

- Total cooling sector emissions in 2022: **64.68 $MtCO_2e$**
- Direct emissions contribute **15.7%**, while indirect emissions contribute **84.3%** in 2022
- Doubling of emissions expected by 2050, **peaking in 2045**
- Residential and Commercial AC sub-sector is the major contributor

Emission Composition

- 84.3% of 2022 emissions were indirect due to higher emission factors
- Emissions to double by 2050, with direct emissions reaching 93.24 $MtCO_2e$ and indirect 19.06 $MtCO_2e$

Energy Consumption

- 2022, cooling sector consumed 65.95 TWh of electricity
- Expected threefold increase in energy consumption by 2050 due to rising demand
- Contributed 25.2% EVN's total electricity generation in 2022

Refrigerant Trends

- HFCs dominate the sector, especially in Air Conditioning sector.
- HCFCs like R-22 and R-123 in Industrial Refrigeration and servicing are to phase out by 2040.
- Natural alternatives (R-600a, R-290) are dominant in Domestic and Commercial Refrigeration.
- R-717 (NH_3) utilised in large Industrial Refrigeration systems
- HFO of R-1234yf slowly penetrating the MAC sub-sector

Strategic Interventions & Targets for Active Cooling (1)

NZT Scenario - Energy Efficiency Enhancement

Cooling Sub-sector	Period	Target for EE Improvement	Average Growth Rate/Year
Residential & Commercial AC	2022–2030	+50%	~6.25%
	2031–2050	+30%	~1.5%
Central AC & Chiller	2022–2030	+20%	~2.5%
	2031–2050	+30%	~1.5%
Mobile AC	2022–2030	+15%	~1.8%
	2031–2050	+30%	~1.5%
Domestic Refrigeration	2022–2030	+50%	~6.25%
	2031–2050	+30%	~1.5%

Cooling Sub-sector	Period	Target for EE Improvement	Average Growth Rate/Year
Commercial Refrigeration	2022–2030	+20%	~2.5%
	2031–2050	+30%	~1.5%
Industrial Refrigeration	2022–2030	+15%	~1.8%
	2031–2050	+25%	~1.3%
Transport Refrigeration	2022–2030	+10%	~1.2%
	2031–2050	+20%	~1.0%

Strategic Interventions & Targets for Active Cooling (2)

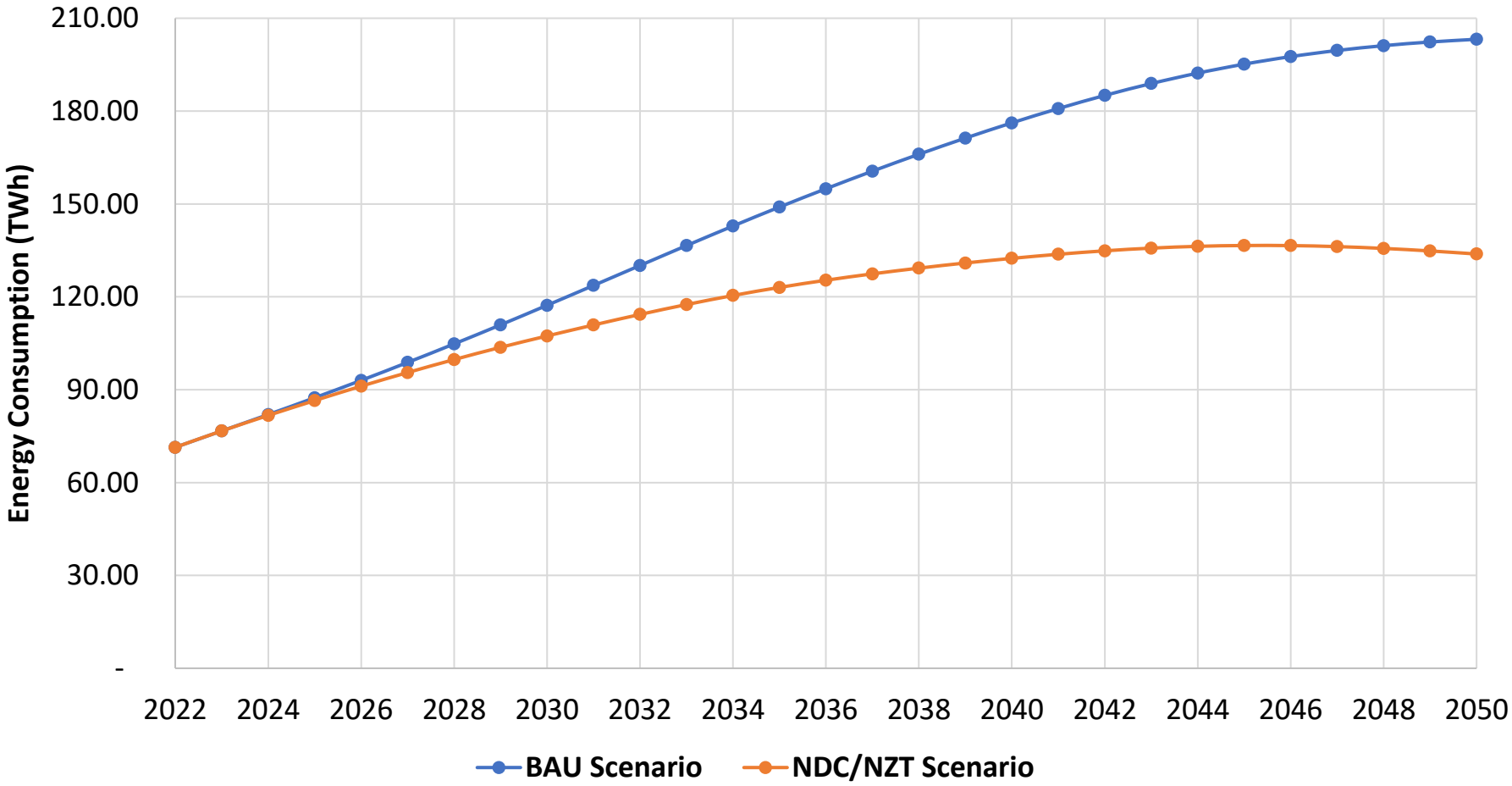
Climate-Friendly Refrigerants Targets

Cooling Sub-sector	NZT (Target Interventions)
General	Recovery, recycling, reuse, disposal: **20% by 2030; 100% by 2050**. Leakage reduction through enhanced O&M.
Residential & Commercial AC	Introduction of **R-290 by 2025**. Penetration targets: **5% by 2030, 80% by 2050**. Low-GWP adoption by 2030: **90% (Res), 50% (Com)**.
Central AC & Chiller	Chiller: Transition to **R-717, R-1234ze, R-1233zd, R-290**. Central AC: Transition to **R-1234yf, R-1234ze, HFOs/ HFCs blends**. Low-GWP conversion by 2030: **50%**.
MAC	Accelerated transition to **R-1234yf**. Penetration targets: **25% by 2030, 100% by 2050**.
Domestic Refrigeration	Full conversion to **R-600a by 2029**. Low-GWP adoption by 2030: **60%**.

Cooling Sub-sector	NZT (Target Interventions)
Commercial Refrigeration	Standalone/Small remote: **R-290/R-600a transition by 2030**. Large systems: Transition to **HFOs/blends; eliminate HFCs by 2045**. Low-GWP conversion by 2030: **60%**.
Industrial Refrigeration	Phase out high-GWP HFCs (R-404A, R-507A, R-410A) from 2029 & R-134a from 2035. Low-GWP conversion by 2030: **80%**.
Transport Refrigeration	Phase out new **R-404A from 2029 & R-134a from 2035**. Transition to **R-1234yf/blends GWP < 750**.

Active Cooling Demand Projections - NZT Scenario (1)

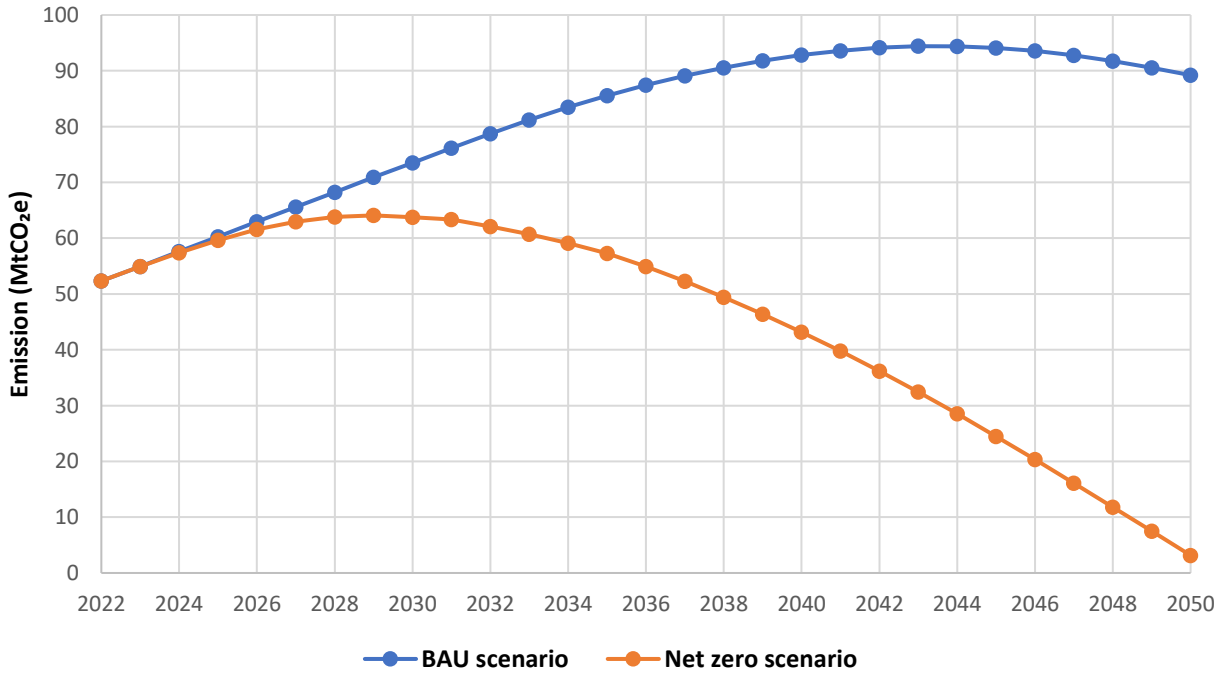
NZT Scenario - Energy Savings: achieve significant electricity savings of 9.91 TWh by 2030 and 69.37 TWh by 2050 (66.12% and 55.97% from Residential & Commercial AC, respectively).

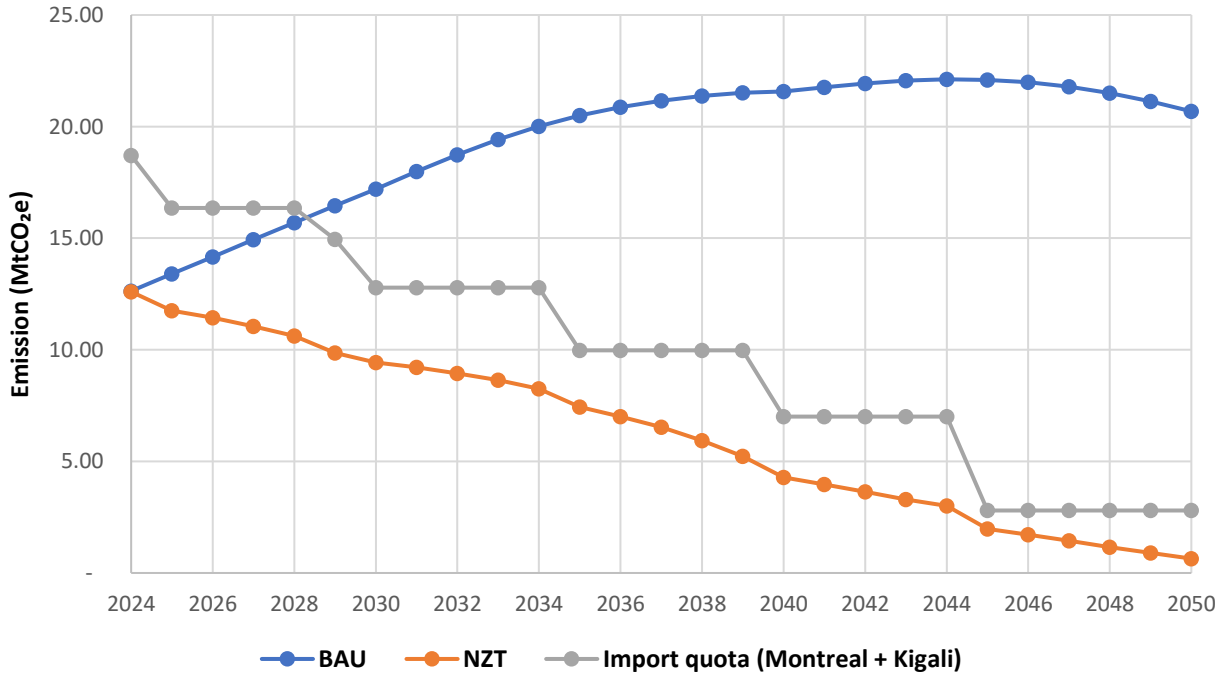


Active Cooling Demand Projections - NZT Scenario (2)

NZT Scenario - Emission Reductions:

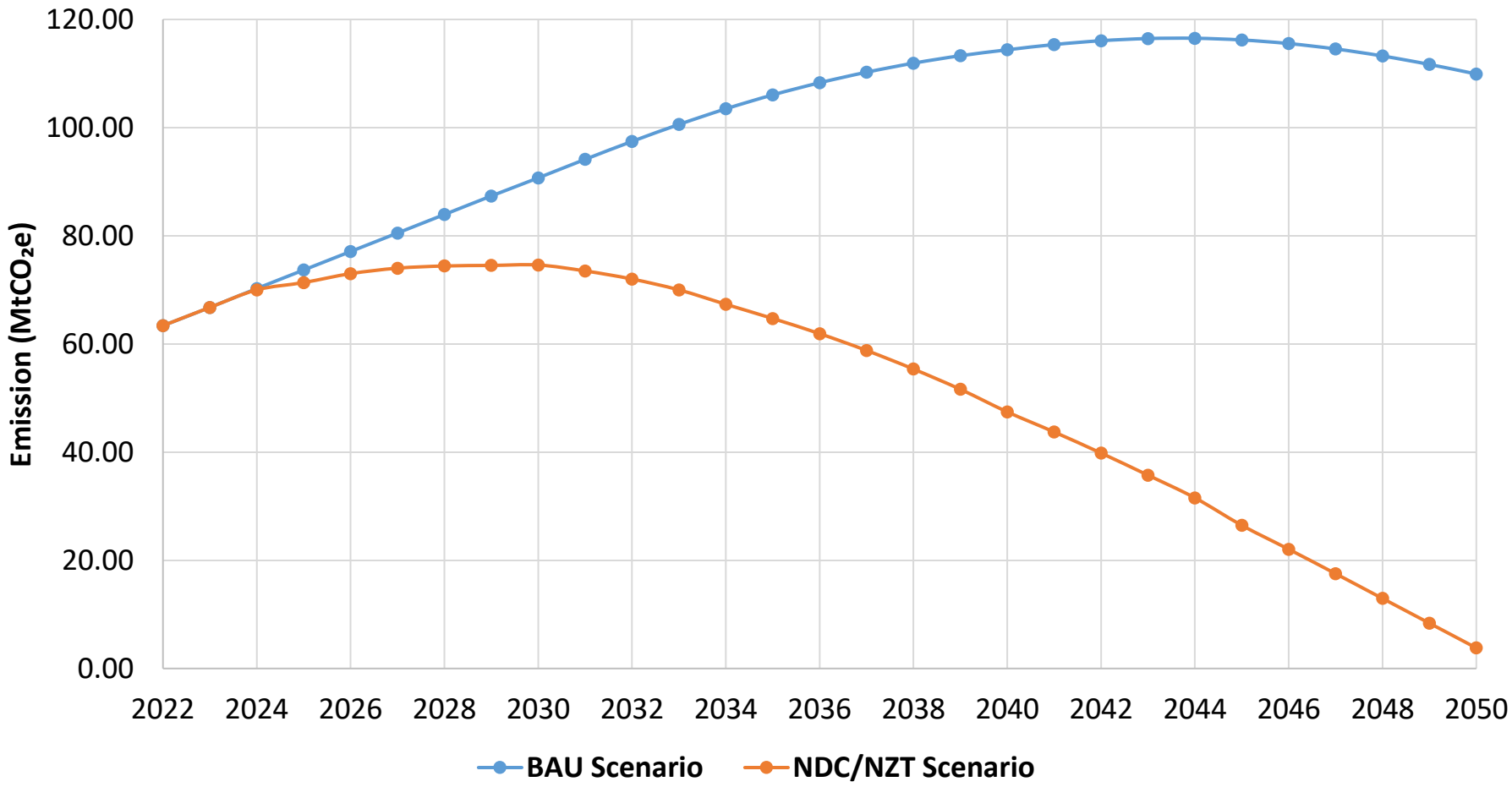
- **Indirect Emissions (energy use):** Drastically reduce to 3.16 $MtCO_2e$ by 2050 (from 54.52 $MtCO_2e$ in 2022) due to EE improvements and grid decarbonization.
- **Direct Emissions (refrigerants):** 7.77 $MtCO_2e$ reduction by 2030; 20.04 $MtCO_2e$ reduction by 2050. Residential & Commercial AC offers the largest potential reduction.



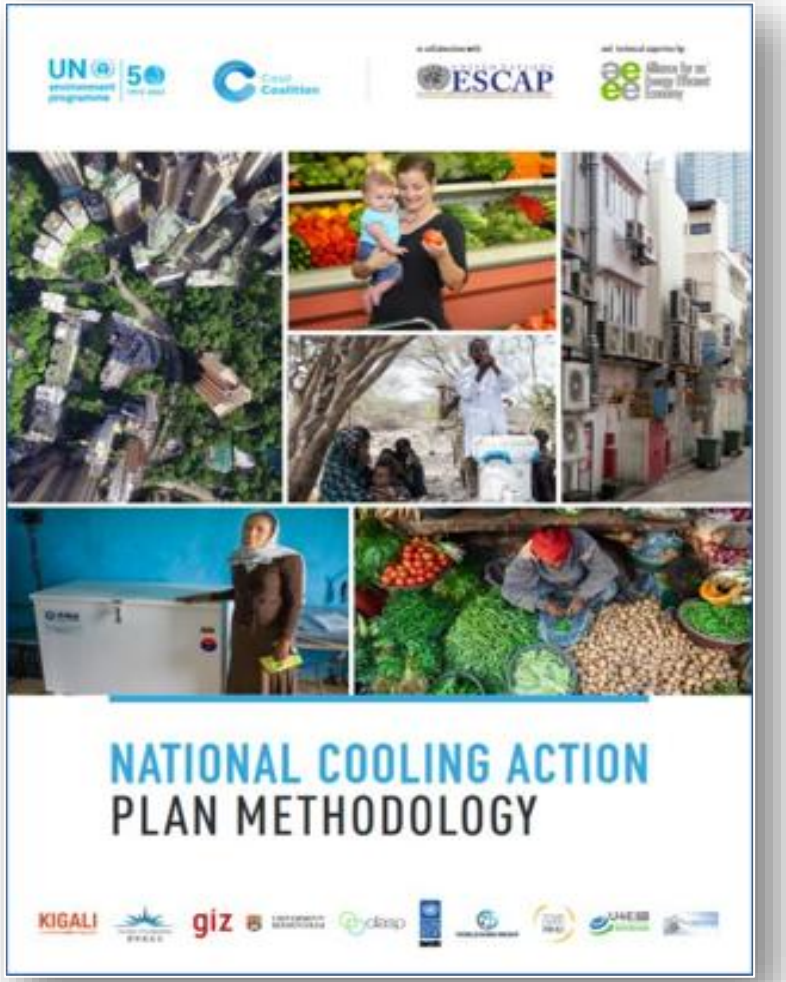


Active Cooling Demand Projections - NZT Scenario (3)

NZT Scenario - Total GHG Emissions: peak in 2030 and decrease to 3.80 $MtCO_2e$ by 2050 (a 97% reduction relative to BAU).



Methodology and Modeling of passive cooling demand



Collect data and prepare model inputs

Policy targets
Codes and standards
Consultations
Building stock dataset
- Footprints
- Building types
- Climate zones

Establish baseline models

Run simulations

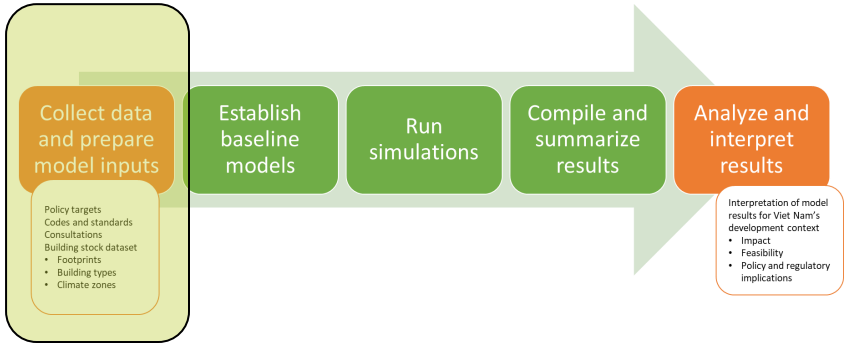
Compile and summarize results

Analyze and interpret results

Interpretation of model results for Viet Nam's development context
- Impact
- Feasibility
- Policy and regulatory implications

Modeling of passive cooling demand (1)

Specific quotas to be met	By 2025	By 2030
Urbanization rate	Equal to or more than or 45%	More than 50%
Ratio of urban construction land area over natural land area	1.5% to 1.9%	1.9% to 2.3%
The number of urban areas across the country	950 to 1000	1000 to 1200
Ratio between land area use for transport to urban construction land	11% to 16%	16% to 26%
The average green coverage per capita in urban areas	$6m^2$ to $8m^2$	$8m^2$ to $10m^2$
Average floor space per capita in urban areas	Equal to or more than $28m^2$	Equal to or more than $32m^2$
Contribution from the urban economy to the national GDP	75%	85%
The proportion of the municipalities' GRDP taken up by the digital economy	25% to 30%	35% to 40%
The proportion of the urban adult population in possession of an Electronic Payment (E-payment) account	More than 50%	More than 80%

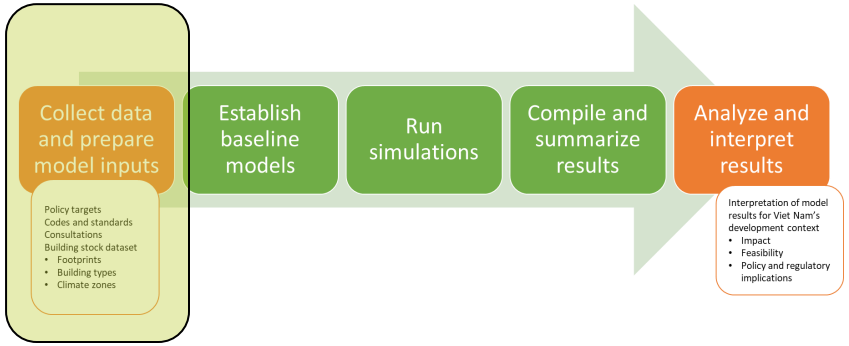


No.	Issuing agency	Year	Title
15	**Prime Minister**	**2021**	**Decision 2161/QD-TTg approves the National Housing Development Strategy for 2021-2030, with a vision towards 2045**
16	Ministry of Construction	2022	Decision 910/QD-BXD 2022 on the Implementation Plan of the Project "Development of Vietnamese Urban Areas in Response to Climate Change for the period 2021-2030" issued by the Minister of Construction
17	Prime Minister	2022	Decision 896/QĐ-TTg approving the National Climate Change Strategy until 2050
18	Prime Minister	2022	Decision 569/QD-TTg establishes the Science, Technology, and Innovation Development Strategy until 2030
19	Prime Minister	2022	Decision 882/QD-TTg approving the National Action Plan on Green Growth
20	**Central Executive Committee**	**2022**	**Resolution 06-NQ/TW on planning, construction, management and sustainable development of urban areas in Vietnam until 2030, vision 2045**
21	Ministry of Construction	2023	Decision 11/QD-BXD establishes the Science, Technology, and Innovation Development Strategy for the construction sector until 2030
22	**National Assembly**	**2023**	**Resolution 81/2023/QH15 on National Master Plan for the period 2021-2030, vision to 2050**
23	**MoNRE**	**2023**	**Decision No. 719/QD-BTNMT approving and announcing the results of land area statistics in 2023**

Modeling of passive cooling demand (2)

- Building stock dataset
- Footprints
- Building types
- Climate zones

- GSO



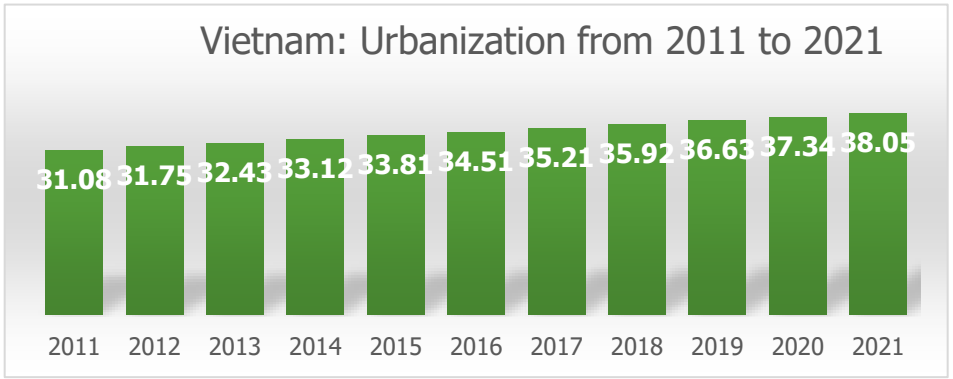


Table 50. PROPORTION OF HOUSEHOLDS WITH HOUSING BY NUMBER OF SEPARATE BEDROOMS, URBAN, RURAL, SOCIO-ECONOMIC REGION AND PROVINCE AND CITY, April 1, 2019

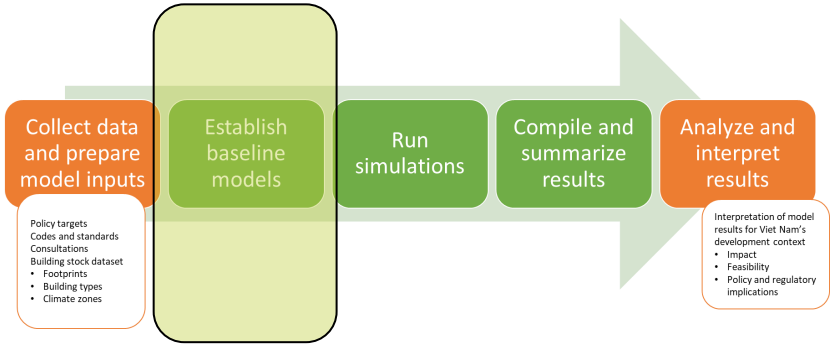
Unit: %

	Total	There are no bedrooms	1 bedroom	2 bedrooms	3 bedrooms	4 bedrooms	There are 5 bedrooms or more
NATIONWIDE	100.0	8.6	27.2	37.9	18.9	5.9	1.5
City	100.0	9.9	25.3	34.9	20.5	7.2	2.2
Countryside	100.0	7.9	28.2	39.6	18.0	5.2	1.1

- Estimations based on reports published by CBRE, Colliers and Savills….
- EE and sustainable project: EECB-UNDP, Building Energy Performance Survey Data-USAID Vietnam,…

Modeling of passive cooling demand (3)

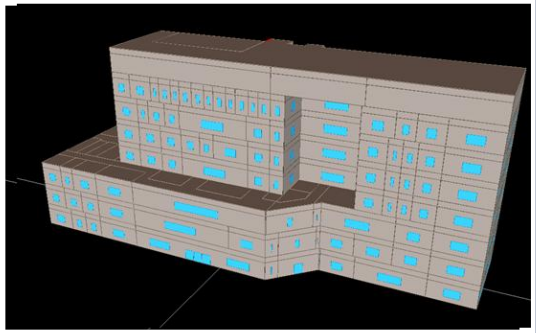
- Typical Building Plan
  - Residential Builds.
  - Commercial Buildings
  - Hospital, data center
  - Gov. Office
- Climate
  - Hanoi
  - Danang
  - HCMC
- Buidling Envelope
  - Typical Envelope
  - Passive design
  - Improvement Envelope



Internal Load

Envelope

Schedule



Room	Total Area (sf)	Percent (%)	Design Area (sf/person)	Fresh air (CFM/preson)
Living room	31,39	26,16	624	10
Kitchen	17,12	14,27	14	15
Toilet	11,9	9,92	50	0
Bed room	32	26,67	624	20,6
Stair	11,1	9,25	50	0
lobby	16,49	13,74	100	0

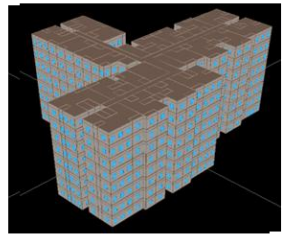


Figure A1. Typical Apartment

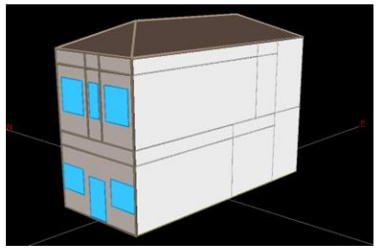


Figure A2. Typical private house

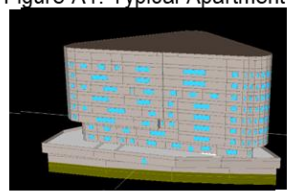


Figure A3. Typical Office 1

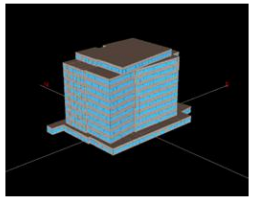


Figure A4. Typical Office 2

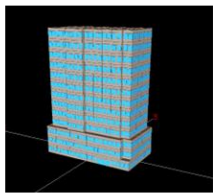


Figure A5. Typical Hotel

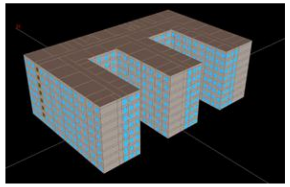


Figure A8. Typical University

Modeling of passive cooling demand (4)

- $Total\ Cooling\ demand_{Nation} = \sum_i^n CD_i = CD_{Urban} + CD_{Rural}$ (1)

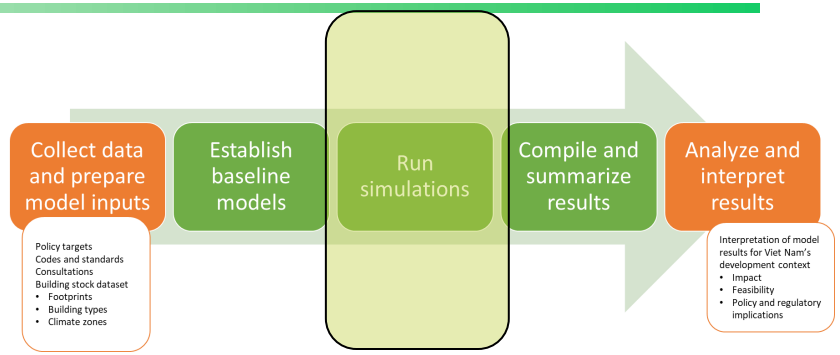
Wherein:

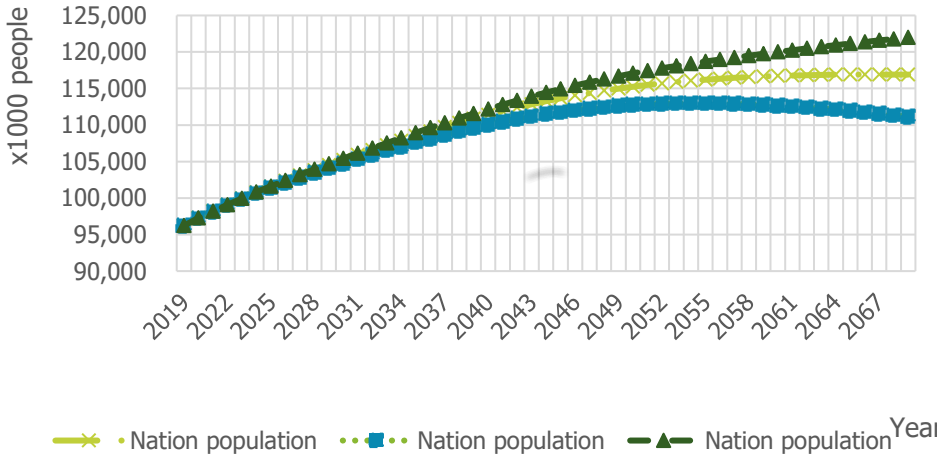
- CD_i is the cooling demand of each building category (kw/year), and i denotes whether the area being considered is urban or rural

- $CD_i = TA_{Area_i} * SCD_{Avr_i}$ (2)

Wherein:

- T_{Area_i} is the total area of urban or rural construction areafor each building category
- SCD_{Avr_i} is the average specific cooling demand per square meter of each building category (kW/m2/year).
- AH_{Aver-j} is the average housing area per capita by urban, rural areas

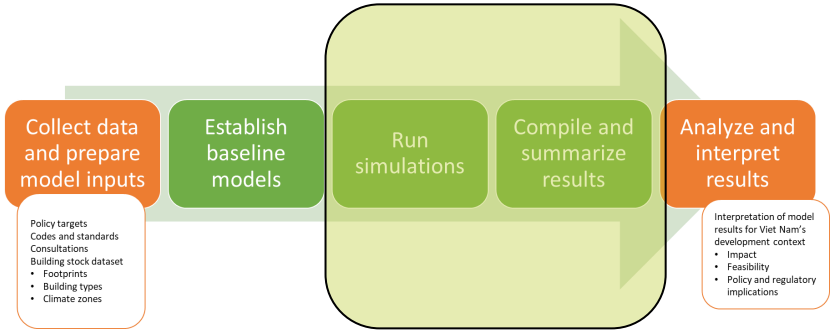




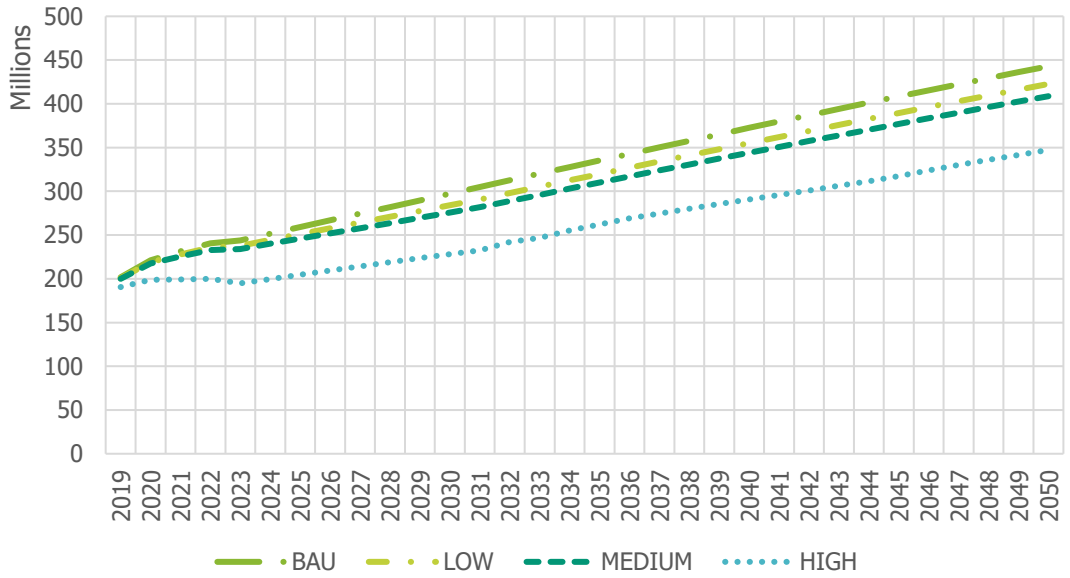
Population growth in period 2019 to 2067 with data of GSO report

Modeling of passive cooling demand (5)

Year	BAU scenario, kWh	LOW scenario, kWh	MEDIUM scenario, kWh	HIGH scenario, kWh
2019	201,702,627	200,634,159	199,973,577	190,507,031
2020	221,267,606	218,972,284	217,565,973	198,745,384
2021	231,368,706	227,855,094	225,704,711	199,125,590
2022	240,514,007	235,790,931	232,906,464	199,879,766
2023	243,811,419	237,641,567	234,059,546	194,837,619
2024	251,373,461	244,405,381	240,065,333	199,616,763
2025	259,044,205	250,967,546	245,935,219	204,612,738
2030	297,312,306	284,023,340	275,678,929	228,162,862
2035	335,236,236	319,718,040	309,965,666	262,201,828
2040	372,440,081	355,182,412	344,153,118	290,627,316
2045	408,459,014	389,502,877	376,957,807	317,450,182
2050	442,816,369	422,689,595	408,689,839	347,283,379

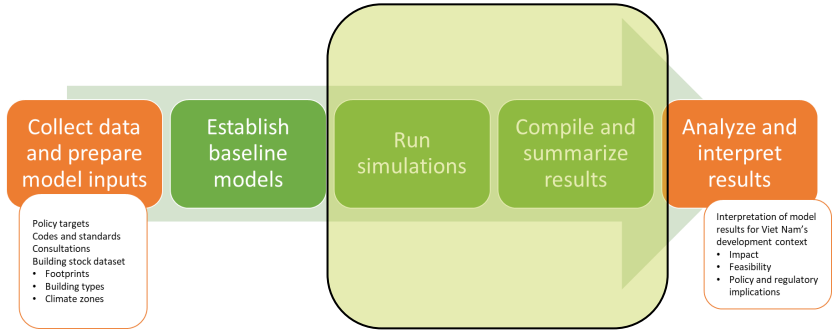


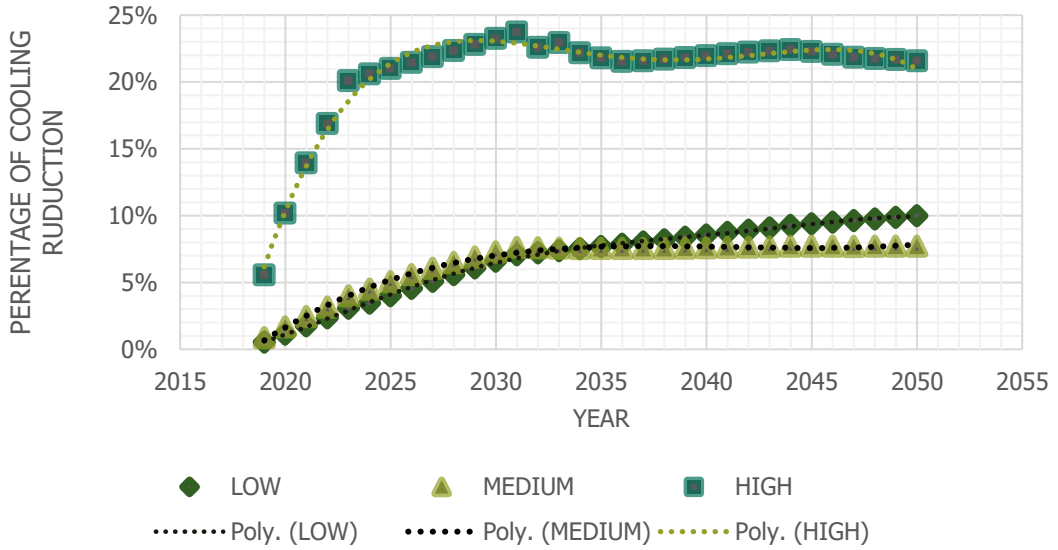
Modeling of passive cooling demand (6)



Cooling demand under different passive and urban design adoption scenarios in 2020-2050

- In low scenarios, the potential of **cooling demand reduction** is **10%** until 2050.
- In high scenarios, the peak percentage of cooling demand reduction is about **23%** by 2030





Comparison of low cooling demand scenario with BAU over the period of 2019-2050

Proposed Implementation Roadmap (1)

I. Management and Phasing Down of Controlled Substances

Objective: Align with Montreal Protocol, Kigali Amendment, and national commitments, ie. Prime Minister's Decision No. 496/QD-TTg to control and phase down high-GWP refrigerants.

1. HCFC Phase-down Schedule (Prime Minister's Decision No. 496/QD-TTg):

- By 2024: 35% reduction from baseline (Cap: 2,600 tons/year).
- 2025-2030: 67.5% reduction (Cap: 1,300 tons/year).
- 2030-2040: 97.5% reduction (Cap: 100 tons/year).
- From 2040: 100% phase-out.

2. HFC Phasedown Schedule (Prime Minister's Decision No. 496/QD-TTg):

- 2024-2028: Freeze at baseline (Cap: 14.0 $MtCO_2e$).
- 2029-2035: 10% reduction (Cap: 12.6 $MtCO_2e$).
- 2035-2040: 30% reduction (Cap: 9.8 $MtCO_2e$).2040-2045: 50% reduction (Cap: 7.0 $MtCO_2e$).
- From 2045: 80% reduction (Cap: 2.8 $MtCO_2e$).

Proposed Implementation Roadmap (2)

I. Management and Phasing Down of Controlled Substances

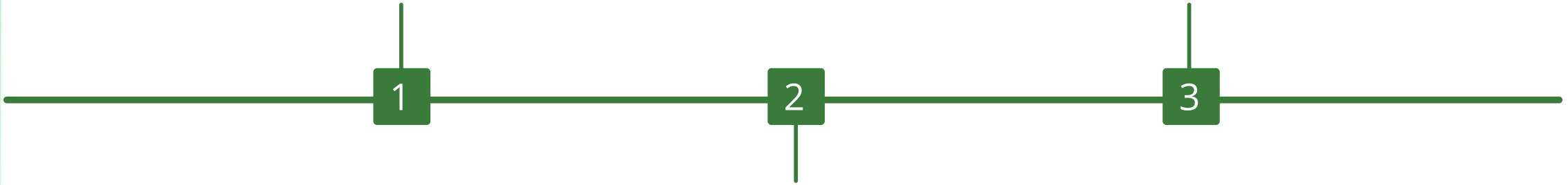
3. Managing Products & Equipment:

Initial Restrictions (2025, 2029)

Restrictions on transport refrigeration, commercial/industrial refrigeration, heat pumps, portable ACs, household ACs (GWP > 750/1,500/1,800/2,100), and household refrigeration (GWP > 3).

Long-term (by 2045)

Comprehensive restrictions ensuring nearly all new cooling equipment uses very low- or zero-GWP alternatives (GWP > 150/3).



Mid-term (2035) & Further (2040) Restrictions

Tightening controls on a broader range of equipment, pushing towards lower-GWP solutions.

Proposed Implementation Roadmap (3)

I. Management and Phasing Down of Controlled Substances

4. Lifecycle Management

Phase 1 (2024-2028)

Building foundational capacity & infrastructure (training, regional collection/ recycling facilities).

Phase 2 (2029-2034)

Scaling up certification & recovery efforts (8,000 certified technicians, 100% collection from large AC/ industrial refrigeration, HCFC-22 reuse/recycling).

Phase 3 (2035-2039)

Enhancing technician proficiency & end-of-life management (70% certified technicians, 100% collection from household equipment, destruction of non-reusable substances).

Phase 4 (2040-2044)

Achieving comprehensive management & circularity (100% certified technicians, maximized recycling, carbon credit mechanisms).

Proposed Implementation Roadmap (4)

II. Promoting and Applying Sustainable Cooling Solutions

Objective: Reduce overall cooling demand and environmental impact through passive design, EE, and innovative service models.

Key Action Areas

1

Phase 1 (2024-2028)

Capacity building, research, policy integration (training for architects/planners, awareness campaigns, integrating UHI mitigation into urban plans, updating technical guidelines).

2

Phase 2 (2029-2034)

Piloting & regulatory development (energy consumption benchmarks, public procurement guidelines, Net-Zero Energy Building (NZEB) certification schemes, demonstration projects, Cooling-as-a-Service (CaaS) pilots).

3

Phase 3 (2035-2039)

Scaling up & mainstreaming (mandating energy benchmarks, 50% new constructions achieving green certification, replicating successful models, scaling CaaS).

4

Phase 4 (2040-2044)

Achieving widespread sustainable cooling & resilience (comprehensive implementation, UHI reduction/ resilience in all major cities, 100% new constructions green/EE certified, NZEB design where feasible).

Implementation and Governance Framework (1)

I. Institutional Framework & Coordination

Active Stakeholder Engagement: Crucial for coordinated, multi-dimensional approach.

Overall Coordination: Led by MAE as the focal point for climate action and environmental protection. Involves inter-ministerial dialogues, joint planning, technical working groups.

Roles & Responsibilities of Key Government Ministries:

- **MAE:** National climate/ozone focal point, GHG/ODS mitigation strategies, sustainable refrigeration in agriculture/seafood; promote green finance and climate finance.
- **MOIT:** EE programs, refrigerant licensing, MEPS/energy labelling development/enforcement.
- **MOF:** Public financial resources, incentives for EE/sustainable cooling.
- **MOST:** Research, standardization, technological innovations.
- **MOC:** Building codes, urban planning for EE, passive cooling, UHI management and transportation sector management .
- **MOET:** Vocational training, technician certification for cooling equipment.
- **MOHA:** develop and issue national technical regulations on labour safety for RAC systems

Implementation and Governance Framework (2)

II. Engagement of Non-Governmental Stakeholders

Technical Organizations

Testing centers, industry associations (VISRAE, VAMA, VASEP), research institutions, universities, colleges – fostering innovation, setting standards, advancing expertise.

Industry & Private Sector

Manufacturers, importers, distributors, retailers, service providers, ESCOs, building owners/managers, real estate developers – adopting new technologies, market insights, implementing best practices.

Financial Institutions

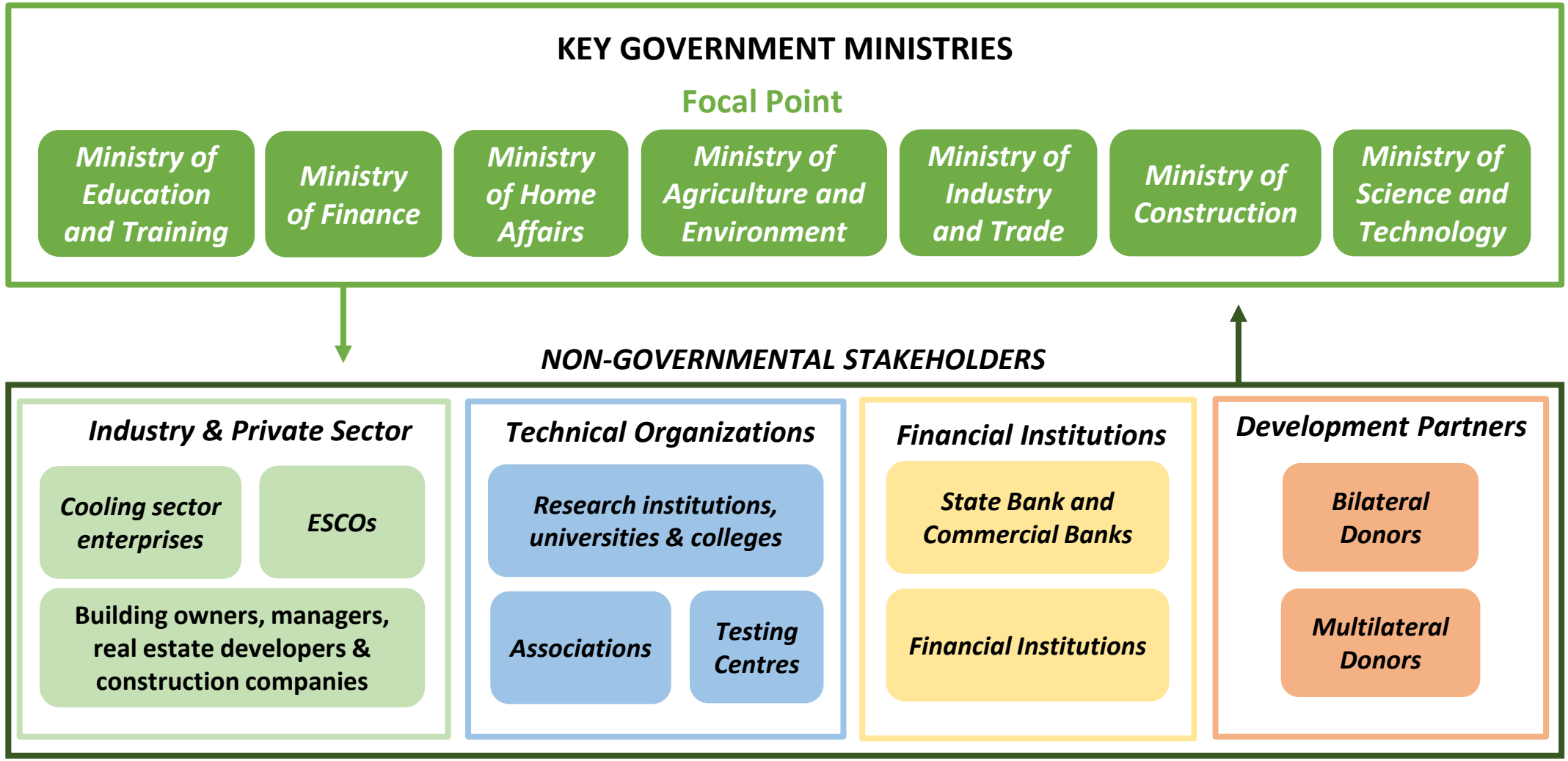
State/commercial banks, investment funds, microfinance institutions – providing capital for green loans, credit lines, tailored financial products.

Development Partners

Bilateral and multilateral donors – funding, technical assistance, capacity building, expertise.

Implementation and Governance Framework (3)

III. Institutional framework and stakeholder coordination for the cooling sector



Implementation and Governance Framework (4)

IV. Mainstreaming Gender Equality Issues and Alleviation of Impacts on Vulnerable Groups

- Disseminate heatwave warnings, restrict outdoor work during peak heat.
- Introduce financial support programs for informal workers (e.g., extreme heat income insurance).
- Offer incentives for EE cooling systems for low-income/female-led households.
- Address disparities in cooling access between urban/high-income and rural/low-income groups.

Key Barriers and Challenges (1)

Regulatory & Policy Challenges:

- **Outdated Legal Framework:** The 2010 Law on Economical and Efficient Use of Energy and associated MEPS lag behind current technology **(Just updated in 06/2025)**
- **Limited Scope of Standards:** Many high-growth cooling segments (e.g., VRF systems, commercial display freezers) are not yet covered by mandatory standards.
- **Implementation Lag & Enforcement:** Significant delays between standard issuance and implementation, and limited market surveillance for non-compliant products.

Refrigerant Use Challenges:

- **Nascent Support Infrastructure:** New quota system for HCFC/HFC imports is in place, but recovery, recycling, and safe destruction infrastructure is still developing.
- **Industry Concerns:** Slow transition to low-GWP alternatives (hydrocarbons, HFOs) due to concerns over flammability, toxicity, and higher upfront costs.
- **Lack of Clear Standards & Incentives**: Insufficient safety standards, technician training, and incentives for retrofitting or replacing high-GWP systems.

Key Barriers and Challenges (2)

Quality and Knowledge in Operating & Servicing:

- Limited Certification: Most of Vietnam's ~200,000 RAC technicians lack formal credentials and modern tools.
- Hidden Losses: Poor charge control and casual handling of refrigerants lead to leakages, premature failures, and increased emissions.

Financial Barriers:

- Price Premium: High-efficiency equipment and safer refrigerants have 15-40% higher upfront costs, with long payback periods.
- Tough Lending Terms: Banks demand high collateral and charge double-digit interest rates, deterring SMEs and low-income households.
- Fragmented Support: Green credit lines and other financing pilots are small-scale and do not adequately address the capital needs for widespread adoption.

Investment needed and resources

- **Estimated need:** Upgrading equipment, building recovery infrastructure, training technicians, and scaling passive-cooling measures will require **several billion USD by 2030**.
- **Blended-Finance Strategy:** urban cooling and sustainable cooling initiatives, de-risked by tax incentives and credit guarantees.
  - Domestic public funds
  - Green credit lines
  - Public-Private Partnerships (PPP)
  - Private investment
  - International support
  - Innovative models: Cooling-as-a-Service (CaaS), Trade-in schemes, Article 6 mitigation outcomes (ITMOs).

Business models

- Suitable business models have been identified as immediately actionable under Vietnamese market conditions:
  - Cooling-as-a-Service (CaaS) – energy-service companies fund equipment and are repaid from shared energy savings.
  - Trade-in/recycling schemes – scrap collection integrated into formal recovery channels, supported by concessional loans and producer-responsibility levies.
  - ITMO generation – a pilot of 100,000 high-efficiency room ACs yields about 0.135 $MtCO_2e$ of credits; at USD 40 tCO_2e, this raises roughly USD 5.4 million for consumer rebates. End-of-life R-22 recovery adds additional revenue streams.
- Role of International Climate Finance:
  - To cover high upfront costs, with revenues from energy savings and carbon markets repaying investors.
  - Mobilizing this capital and tracking its impact through the MRV system.

Expected impacts

NCAP is expected to result in positive and quantifiable impacts by 2050 that will transform Vietnam's climate commitments into a clear, step-by-step path towards a climate-smart cooling economy by mid-century.

- Energy – electricity use by ~10 TWh in 2030 and ~69 TWh in 2050 (equivalent to annual output of four large power plants). Cumulative electricity savings exceeding 800 TWh.
- Emissions – A 97 % reduction in cooling-sector GHGs relative to BAU by 2050 (Fall by 7.8 $MtCO_2e$ in 2030 and 20 $MtCO_2e$ in 2050).
- Health – Reduced heat-wave hospitalisations and protection for vulnerable groups.
- Industry competitiveness – Clear demand signals spur domestic manufacturing and certified service exports.
- Climate finance inflows – Scaled ITMO sales and green-bond issuance attract foreign capital.
- **Overall Impact:** Combined with a greener power grid, total cooling-sector emissions will drop considerably from today's level, safeguarding Vietnam's NDC and net-zero goals.

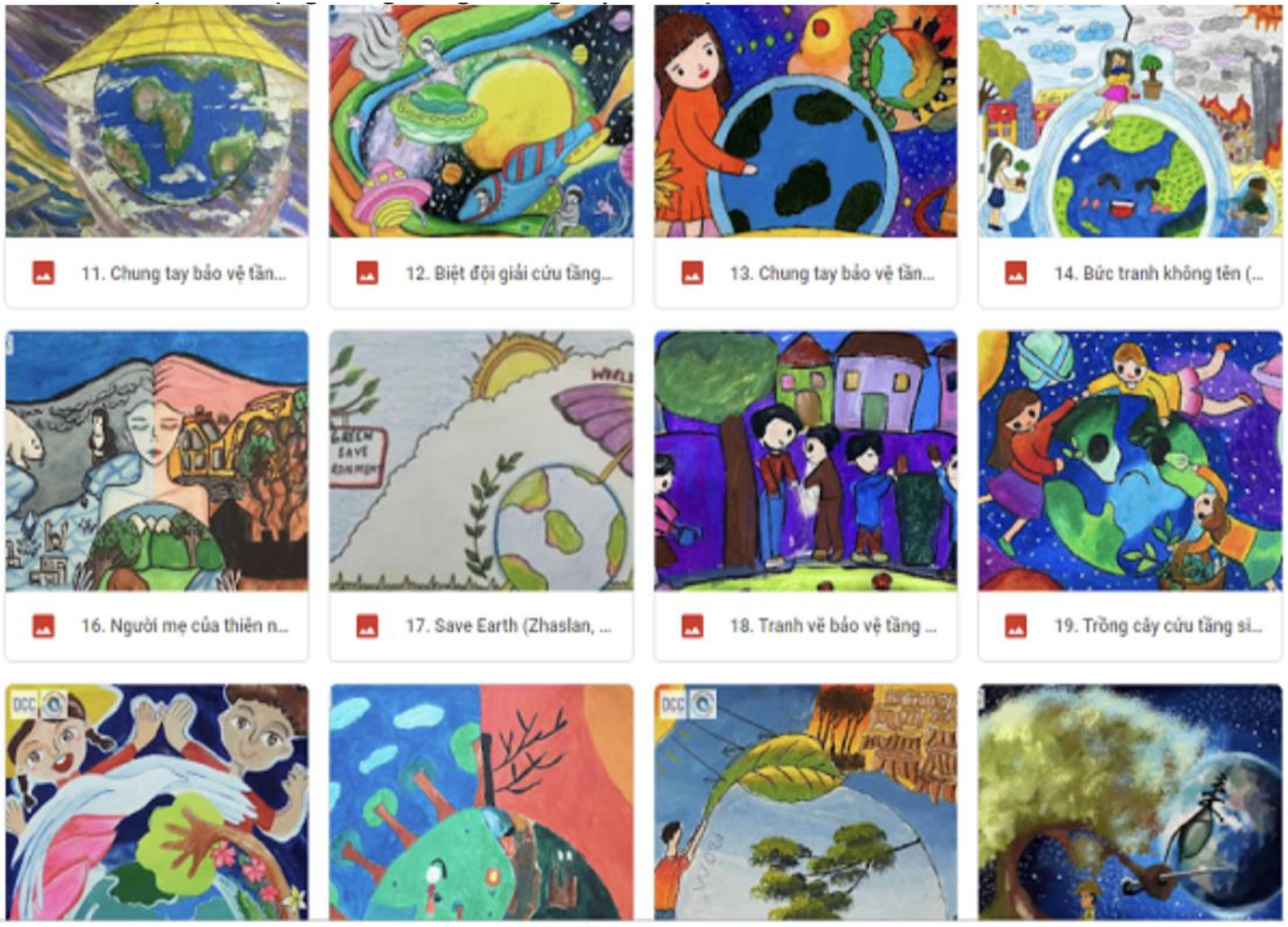
Final Outlook

Beyond emissions cuts: Achieving NCAP milestones will deliver significant co-benefits:

- Free up gigawatts of electricity for new economic activity.
- Shield vulnerable communities from extreme heat.
- Open regional export opportunities for high-efficiency, climate-friendly cooling technologies.

Vietnam's leadership:

- Vietnam can transform cooling from a rapidly growing source of emissions into a flagship of green growth.
- Demonstrating that development, resilience, and net-zero ambition can move forward together.



Thank you!

Source: http://www.dcc.gov.vn