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Department of Climate Change

National Green Cooling Program

In-depth study and survey to develop the National Green Cooling Program

Final Report - Executive Summary

March 2024

Energy Environment Climate VNEEC

perspectives climate group

EPRO Consulting

FINAL REPORT- Executive Summary
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EXECUTIVE SUMMARY

Surging cooling demand and the contribution to meet the national commitment to reduce GHG emissions

Viet Nam aims at an annual GDP growth of 7% during the 2021-2030 period and aspires to become an upper-middle income country by 2030 with GDP per capita reaching 7,500 USD. Beyond that date, the vision for 2050 is to become a developed high income country with a per capita GDP around 30,000 USD. In that context, Viet Nam is currently rapidly shifting from a rural-agrarian society to an urban-industrial and services-based economy, with urbanisation reaching 38.1% in 2022 which will result in increasing high demands for new buildings, infrastructure and vehicles.

Viet Nam is a country with high temperatures and humidity, covering both subtropical and tropical zones. In rural areas in Viet Nam, lack of access to cooling infrastructure leads to a loss of productivity and exacerbates health risks, particularly in heatwave conditions that are likely to become more severe with climate change. 80% of Viet Nam's population currently are at risk from extreme heat. Adequate cooling is particularly lacking for low-income households, vulnerable groups, such as the elderly and infants. Predictions suggest that heat-related deaths could triple by 2050.

Tackling this surging cooling demand sustainably is extremely important to fulfil Viet Nam's Nationally Determined Contribution (NDC) climate change mitigation targets. Therefore, it is crucial to assess the growing cooling demand in the country and mitigate related greenhouse gas (GHG) emissions through solutions such as passive building designs, energy efficient active cooling using best available technology, phasing out of high global warming potential (GWP) refrigerants, use of green refrigerants, and recycling and safe disposal of refrigerants among others. To tackle this challenge, the Southeast Asia Energy Transition Partnership (ETP) has taken a significant step forward in supporting the Technical Assistance (TA) initiative titled "National Green Cooling Program In-depth study and survey to develop the National Green Cooling Program" undertaken in collaboration with Department of Climate Change (DCC), and the Ministry of Natural Resources and Environment (MONRE). The primary objective of this TA is to formulate a National Green Cooling Program (NGCP) for Viet Nam. Throughout the implementation of the TA, regular consultations with the DCC, MONRE and other key relevant stakeholders from other line ministries, governmental agencies, associations, research institutes and cooling industries were undertaken in order to seek the feedback/recommendations as well as to ensure the consistency of the outcomes, findings and deliverables under the TA with the existing and planning policies and practices.

The National Green Cooling Action Plan (NGCAP) consists of passive cooling and active cooling approaches. The active cooling component is elaborated by the consortium of Perspectives Climate Group (PCG), VNEEC and EPRO whereas the passive cooling segment is developed by the United Nations Environment Programme (UNEP). It will address challenges faced by the cooling sector, strategies to promote the adoption of the state-of-the-art sustainable cooling practices. Ultimately, it will directly contribute to Viet Nam's NDC and its commitment to achieve Viet Nam's Net Zero Target (NZT) by 2050.

Viet Nam's international commitments to mitigate climate change

The Government of Viet Nam has demonstrated a proactive engagement in the international treaties addressing climate change and the destruction of the ozone layer. Viet Nam ratified the Montreal Protocol and its Amendments with a commitment to freeze consumption of hydrochlorofluorocarbons (HCFCs) in 2013 and will reduce HCFC consumption, except for servicing, by 100% by 2030. Accordingly, Viet Nam has set targets to gradually reduce and cease the import of HCFCs entirely by the year 2040. In 2019 it

ratified the Kigali Amendment to phase down hydrofluorocarbon (HFC) refrigerants. Over the period 2024-2029, Viet Nam will freeze the production and consumption of HFCs and then reduce them progressively to 20% of this value by 2045. At the 26th Conference of Parties to the UN Framework Convention on Climate Change (UNFCCC) (COP26), Viet Nam pledged to achieve net-zero greenhouse gas (GHG) emissions by 2050. Its current NDC under the Paris Agreement has an unconditional commitment of 15.8% and a conditional contribution of 43.5% emission reduction compared to the baseline in 2030. At COP28 in 2023, Viet Nam signed a Global Cooling Pledge, along with other 63 nations which commit to a 68% reduction in cooling related GHG emissions by 2050.

The Ministry of Natural Resources and Environment (MONRE) is the focal point for implementation of these international commitments. Viet Nam has developed a legal and institutional framework and strategies for phasing out ODS and reduction of GHG emissions, most recently through the 2020 Law on Environmental Protection and Government's Decree 06/2022/ND-CP on mitigation of GHG emissions and protection of ozone layer. The National Climate Change Strategy and NDC, updated in 2022, underscore Viet Nam's dedication to reducing ODSs and HFCs. The Just Energy Transition Partnership (JETP) signed between the Government of Viet Nam and International Partners Group in 2022 aims to mobilise significant funding over the next three to five years, to enable accelerated closure of coal power plants through an increase of energy efficiency (EE) and renewable energy generation. In parallel, Viet Nam has implemented several policies to enhance EE in the cooling sector, through the implementation of policies such as the Law on Economical and Efficient Use of Energy, Viet Nam's National EE Programme (VNEEP) and public procurement regulations that promote the economical and efficient use of energy generally and in the cooling sector particularly, challenges persist, including gaps in enforcement and outdated standards as well as a lack of comprehensive disposal and recycling systems.

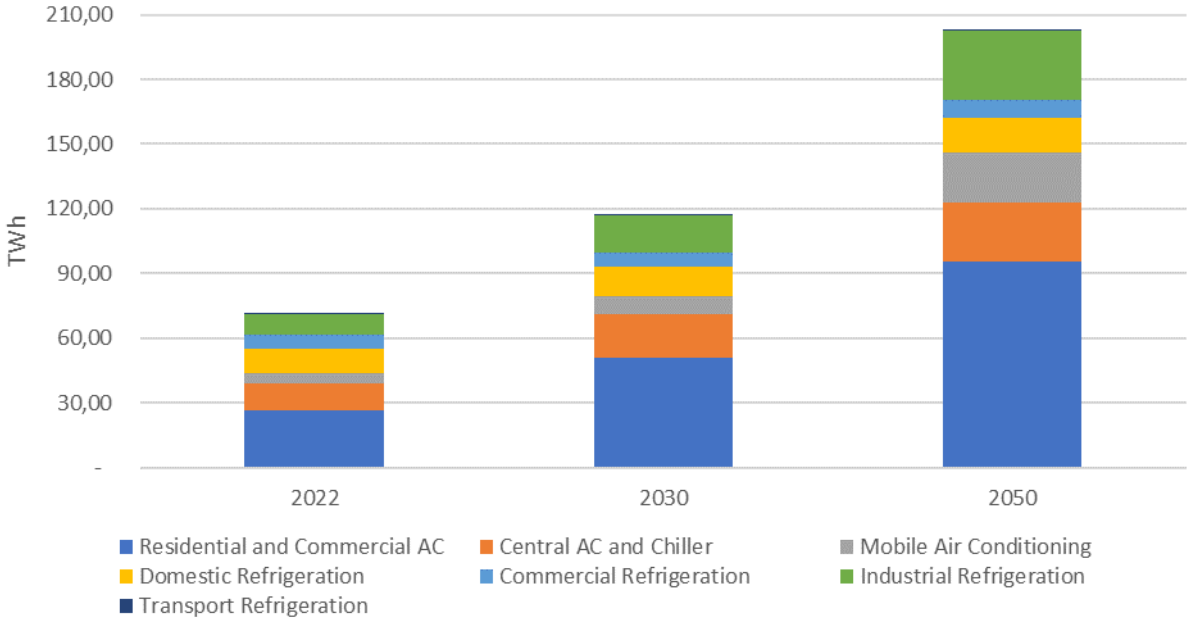
Establishing the energy and emissions baseline scenarios for Viet Nam's cooling sector in 2030 and 2050

Building on a cooling sector database, covering the period 2018-2022, sourced from extensive data and analysis obtained through national and sectoral surveys conducted within the TA framework a baseline scenario and growth forecast for Viet Nam's energy consumption and emissions from cooling equipment has been established for the period 2022 and 2050. It covers seven sub-sectors: Residential and Commercial Air Conditioning (AC), Central AC and Chillers, Mobile AC (MAC), Domestic Refrigeration, Commercial Refrigeration, Industrial Refrigeration, and Transport Refrigeration.

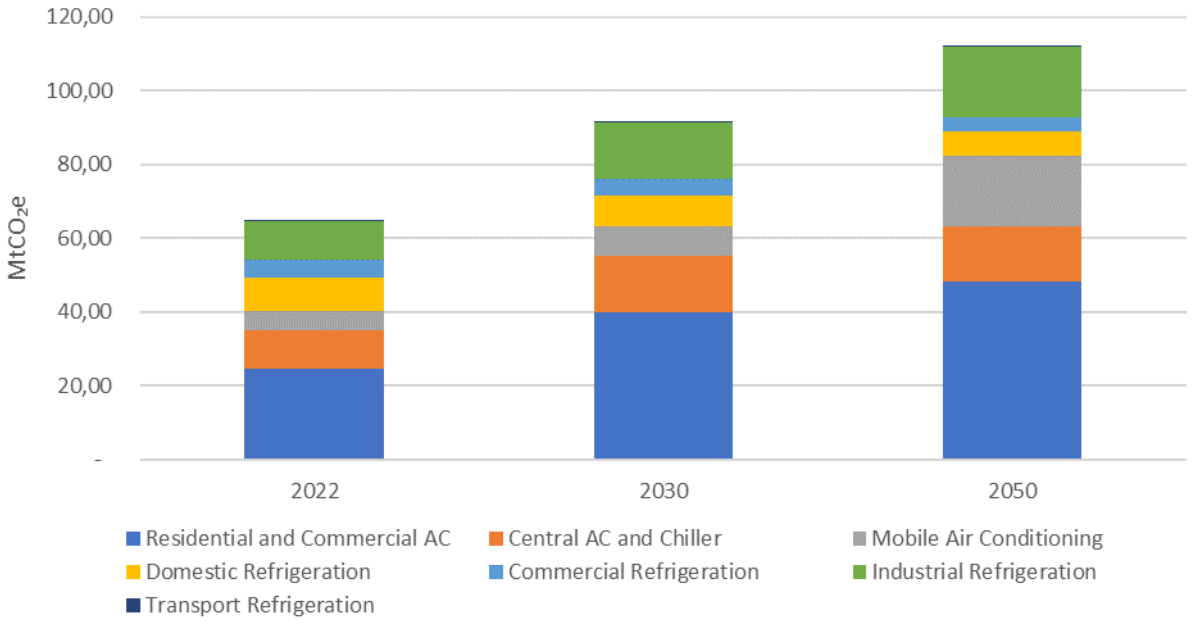
The cooling sector was responsible for 25.2% of total electricity (generated and imported) of Viet Nam and 64.7 $MtCO_2e$ emissions in 2022. Direct emissions were responsible for 15.7%, indirect emissions for 84.3% of the total in 2022. The The high level of the latter is due to Viet Nam's high grid emission factor, which reached 0.7221 tCO_2/MWh in 2021. Total emissions are projected to rise to 91.7 $MtCO_2e$ in 2030 (accounting for 9.9% of total national emissions) as per the NDC business-as-usual (BAU) scenario.

Figure ES-1 below projects Viet Nam's energy consumption for the cooling sector which is expected to triple in 2050. It is evident that the Residential and Commercial AC sub-sector will be the most energy intensive sub-sector in 2050.

Figure ES-1: Energy consumption and GHG emissions from cooling in Viet Nam by sub-sectors



Energy consumption



GHG emissions

Source: Compiled from the database of the survey

Viet Nam's total cooling sector emissions are estimated to double from 2022 to 2050, peaking in 2045, considering the current trend of electricity grid emission factor reduction as well as the effect of current policies on refrigerants.

Key highlights of the NGCP analysis and the roadmap

The NGCP has been developed focusing on the following four pillars: 1) the strengthening, expansion and enforcement of Minimum Energy Performance Standards (MEPS) in line with the targets set out under the NDC and the Kigali Amendment, 2) harnessing of domestic and international financing sources for the improvement of cooling equipment production and use while minimising foreign debt burden, 3) capacity building of key actors to ensure proper handling, usage, O&M of cooling equipment with high efficiency and low GHG refrigerant, and 4) awareness raising on climate-friendly cooling equipment.

To achieve the NDC and NZT, it is imperative to address indirect emissions by upgrading EE levels for Residential and Commercial AC, Domestic Refrigeration, and the adoption of MEPS in sub-sectors such as Industrial Refrigeration, Mobile Air Conditioning (MAC), Commercial Refrigeration and Transport Refrigeration. Direct emissions are addressed by policy instruments to transition towards natural refrigerants with zero GWP. Setting up waste recycling centres, disposal emissions can be minimised through recycling of the refrigerants, and safe disposal of refrigerants and e-waste. There is a strong need for awareness raising of users and market participants through organized and targeted capacity building, and certification of the technicians.

The utilisation of HCFCs such as R-22 and R-123, primarily in Industrial Refrigeration, is on track for complete phase out by 2040, with the increased use of HFCs and natural refrigerants. Natural alternatives like R-600a (Isobutane) and R-290 (Propane) would be used in Domestic and Commercial Refrigeration, while R-717 (NH_3) finds application in large-scale Industrial Refrigeration systems. As for MAC, the HFO of R-1234yf is penetrating the market of automobiles.

Viet Nam needs bold and strategic policy interventions to achieve both its NDC target and the overarching NZT. This includes strong EE standards for RAC products, harnessing climate finance judiciously, capitalising on the carbon market, and deploying robust policy incentives to facilitate the seamless transition toward low-GWP refrigerants and efficient RACs. A resolute commitment to rigorous recovery of refrigerants, recycling of e-waste, and disposal systems underpins realising the national green cooling aspirations. This is not merely a call to action; it is developing consensus on a sustainable and efficient cooling paradigm that befits the aspirations of a progressive Viet Nam.

National Green Cooling Program: Targets, actions and recommendations

The NGCP should primarily focus on Residential and Commercial AC, Central AC and chillers and MAC as well as domestic, commercial, industrial and transport refrigeration. MEPS are to be established and regularly updated as well as energy labelling. EE improvements and low GWP refrigerant adoption is to be incentivized in order to achieve NDC targets and progress towards the NZT. Furthermore, policies should target the disparities in cooling access between urban/high-income and rural/low-income groups. This can be achieved by implementing measures that remove financial constraints for low-income groups by introducing affordable, and simple procedure to avail financing. Expanding guarantee programs for commercial loans provided by domestic banks and concessional loan programs for private companies, which have shown moderate success in the past, is also essential.

With regard to international cooperation, revenues from the sale of internationally transferred mitigation outcomes (ITMOs) through international carbon markets under Article 6 of the Paris Agreement could lead to a rapid upscaling of EE and refrigerant replacement which would otherwise not be financially feasible. Internationally, several governments have already engaged with MONRE to acquire ITMOs under Article 6.2, while the government of Viet Nam still has to set up its specific institutional and legal frameworks for such cooperation. Revenues from ITMO sales could overcome the challenge related to the

Government of Viet Nam being very reluctant to accept international concessional loans in order not to increase international debt beyond a manageable threshold. In other countries, Article 6.2 cooling sector projects are already moving ahead, inter alia in Ghana and Morocco. Additional capacity building is needed in Viet Nam to properly take advantage of international carbon market opportunities.

Impact of the NGCP on energy use and emissions in 2030 and 2050

The Best Available Technology (BAT) scenario projects savings of 10.57 TWh in 2030 and 62.09 TWh in 2050 compared to the BAU scenario, with the Residential and Commercial AC sub-sector achieving savings of 7.48 TWh in 2030 and 43.76 TWh in 2050. The somewhat less ambitious NZT by 2050 scenario, aiming for a 50% increase in AC efficiency by 2050, would achieve savings of 9.03 TWh in 2030 and 54.48 TWh in 2050.

The NGCP has the following objectives (see Table ES-1 below): a 50% increase in the average efficiency rating of new ACs by 2030 and an 80% increase by 2050, a 7%-30% increase in the efficiency of non-AC cooling equipment by 2030, and 10%-35% by 2050, with reference to 2022; and recovery of all refrigerants from cooling equipment at its end of life by 2050.

Table ES-1: Targets and actions of the NGCP

Cooling sub-sector	Target for EE improvement to achieve NDC/NZT scenario	Target for EE improvement to achieve BAT scenario	Action to achieve targets
Residential and Commercial AC	**50%** higher EE compared to the current level in 2030. **80%** higher EE compared to the current level in 2050.	**60%** higher EE compared to the current level in 2030. **100%** compared to the current level in 2050.	Increase MEPS, rising star level, and incentive for buyers to buy highly efficient ACs. Market transformation through demand aggregation and targeted rollout in government and private/retail sectors. Sustainable Public Procurement. Buyback of old and used cooling equipment and safe disposal/end of life.
Central AC and Chiller	**15%** higher EE than the current level in 2030. **20%** higher EE compared to the current level in 2050.	• Chillers: **18%** higher EE than the current level in 2030. **25%** higher EE compared to the current level in 2050. • Central AC: **20%** higher EE compared to the current level in 2030. **30%** higher EE compared to the current level in 2050.	Including in the building EE policies (QCVN) which are not only limited to EE buildings (QCVN 09:2013/BXD). Implement a specific MEPS for VRV/VRF and other types of multi-split ACs. Develop new TCVN for chiller which included MEPS. Standards for chillers operation and maintenance (O&M) through recognised and accredited experts and a mechanism to monitor. An incentive to use higher efficiency types of equipment.
MAC	**30%** of cars in 2030 are Electric Vehicles (EVs).	**30%** of cars in 2030 are EVs. **100%** of cars in 2050 are EVs.	Develop TCVN for MAC or vehicles with MAC which includes MEPS. (MEPS for MAC or

Cooling sub-sector	Target for EE improvement to achieve NDC/NZT scenario	Target for EE improvement to achieve BAT scenario	Action to achieve targets
	100% of cars in 2050 are EVs. **30%** increase in the EE for MAC in 2030. **35%** increase in the EE for MAC in 2050.	**30%** increase in the EE for MAC in 2030. **35%** increase in the EE for MAC in 2050.	control via fuel efficiency MEPS of vehicles with MAC) Restrict importing old MAC equipment. Training and capacity building of technicians for the O&M of vehicles with MACs. Incentive buying EVs.
Domestic and Commercial Refrigeration	**15%** higher EE compared to the current level in 2030. **30%** higher EE compared to the current level in 2050.	**20%** higher EE compared to the current level in 2030. **35%** higher EE compared to the current level in 2050.	Rising MEPS, rising star level. Support or incentive of buying high efficiency equipment, especially in rural areas. Energy labelling for commercial equipment. (specify the type of equipment and EE according to TCVN 10289:2014)
Industrial and Transport Refrigeration	**7%** higher EE compared to the current level in 2030. **10%** higher EE compared to the current level in 2050.	**10%** higher EE compared to the current level in 2030. **15%** higher EE compared to the current level in 2050.	Develop TCVN and MEPS for equipment. Standards for O&M through recognised and accredited experts and a mechanism to monitor the performance of the industrial system.

Source: Developed by consultant

Phasing out of HCFCs and HFCs would be done as follows under the NGCP:

Table ES-2: HCFC and HFC reduction targets under the NGCP

Refrigerant	Elimination Roadmap	Implementation period	Quota
HCFCs	Reduce 67.5% HCFCs	2025-2019	1,300 t per year
	Reduce 97.5% HCFCs	2030-2039	100 t per year
	Reduce 100% HCFCs	From 2040	0 t per year
HFCs	Fixed emission at baseline	2024-2028	14.0 $MtCO_2e$ emission from HFCs
	Reduce 10%	2029-2034	12.6 $MtCO_2e$ emission from HFCs
	Reduce 30%	2035-2039	9.8 $MtCO_2e$ emission from HFCs
	Reduce 50%	2040-2044	7.0 $MtCO_2e$ emission from HFCs
	Reduce 80%	From 2045	2.8 $MtCO_2e$ emission from HFCs

Source: Developed by consultant

The NGCP action plan enhances MEPS and Energy labelling requirements over time while enforcing and monitoring, harnesses technical and financial resources from domestic and international sources, includes capacity building to eventually have 100% of technicians and management officers certified, and creates community awareness. The Ministry of Industry and Trade (MOIT) would spearhead implementation, collaborating with various ministries and stakeholders. The program emphasises gender equality and considerations regarding vulnerable groups that do not have access to modern cooling solutions.

The NGCP uses grants, concessional loans and revenues from international and domestic carbon markets to overcome barriers including lack of incentives to promote EE projects, limited commercial financing, requirement for high collateral, complicated documentation and limited know-how and capacity to access finances. Instruments include tax exemptions, preferential tax grants/subsidies (Green Credit Trust Fund, Green Investment Facility, Viet Nam Scaling up EE for Industrial Enterprise), loans (Viet Nam RE Development Project, blended finance program, special finance for industries, Sustainable Use of Natural Resources and Energy Finance, concessional and commercial loans). Revenues from sales of ITMOs and energy saving certificates complement these instruments. Mixed financing models such as Cooling as a Service, and Green on a wage (like the one used in Ghana to promote eco-friendly fridges) should also be explored and adopted in national context.

Key recommendations for moving forward with the NGCP

In order to move towards achievement of the objectives in the NGCP, the following activities should be implemented:

1. Implementation of the Prime Minister's Decision on the Management Plan for phasing out Ozone Depleting Substances and controlled GHGs: The finalization of the draft Decision is currently underway by the DCC, MONRE to be submitted for approval and promulgation by the Prime Minister. Following this, DCC will be responsible for developing guidelines to implement the Decision. Continuous technical support will be essential to aid DCC in the formulation of the guidelines, facilitating events and training sessions for relevant stakeholders. This ongoing support is crucial for ensuring the successful short and long-term implementation of the Decision.
2. Mobilization of technical assistance/support to implement the Viet Nam’s commitments under the Global Cooling Pledge.
3. Support for implementation of the pilots of investment projects in the green cooling: three financing models that seem to be most suitable for Viet Nam, under the different phases of the cooling value chain are recommended to be considered further for pilot activities as the following up activities after closing this TA, namely i) Cooling as a service ii) Trade in and iii) Generation and sale of ITMOs under Article 6.2 of the Paris Agreement.