ESMAP
Energy Sector Management Assistance Program

THE WORLD BANK
IBRD • IDA

2023

ACCELERATING DECARBONIZATION
In times of crisis

Fuel shortages and inflation driving up demand for energy efficiency

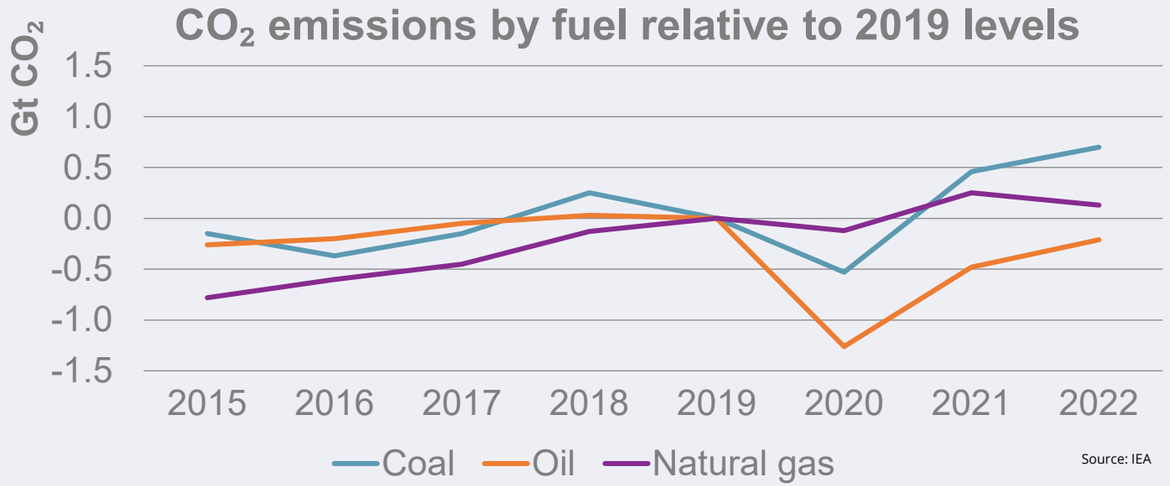
CONTENTS

UPHEAVEL IN THE ENERGY SECTOR

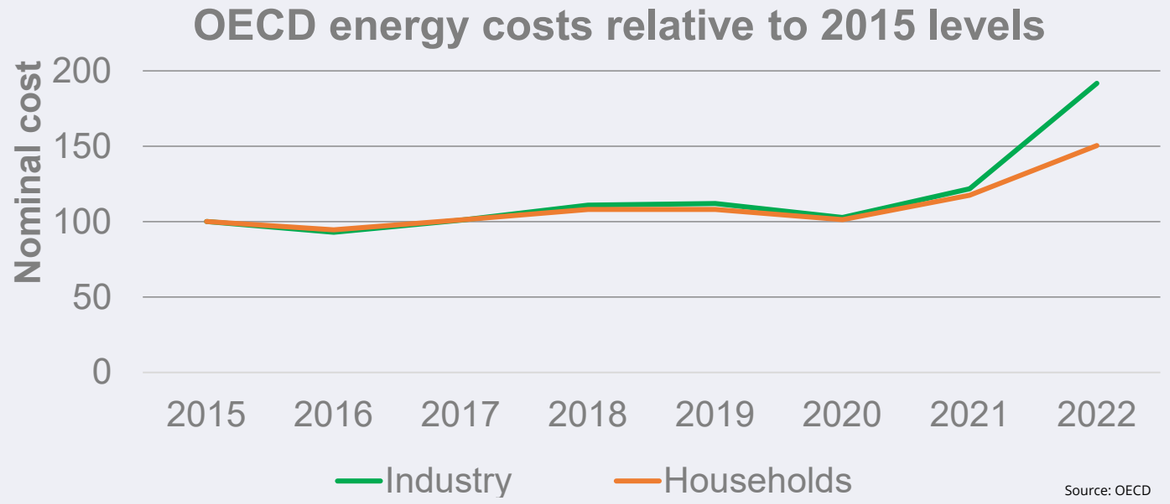
COVID-19, War on Ukraine, and fuel supply shortages have led to increased volatility in the energy sector

In 2021 and 2022 emissions rebounded to above pre-COVID level:

- **Emissions from coal grew** due to the supply squeeze on natural gas and extreme weather
- **Energy prices sharply increased** driving inflation, increasing poverty and raising manufacturing costs
- **Renewable energy penetration increased** but not to a level sufficient to offset gas-to-coal switching
- **Energy intensity** has improved only 1-2% annually, but annual gains ~4% are needed



Source: IEA

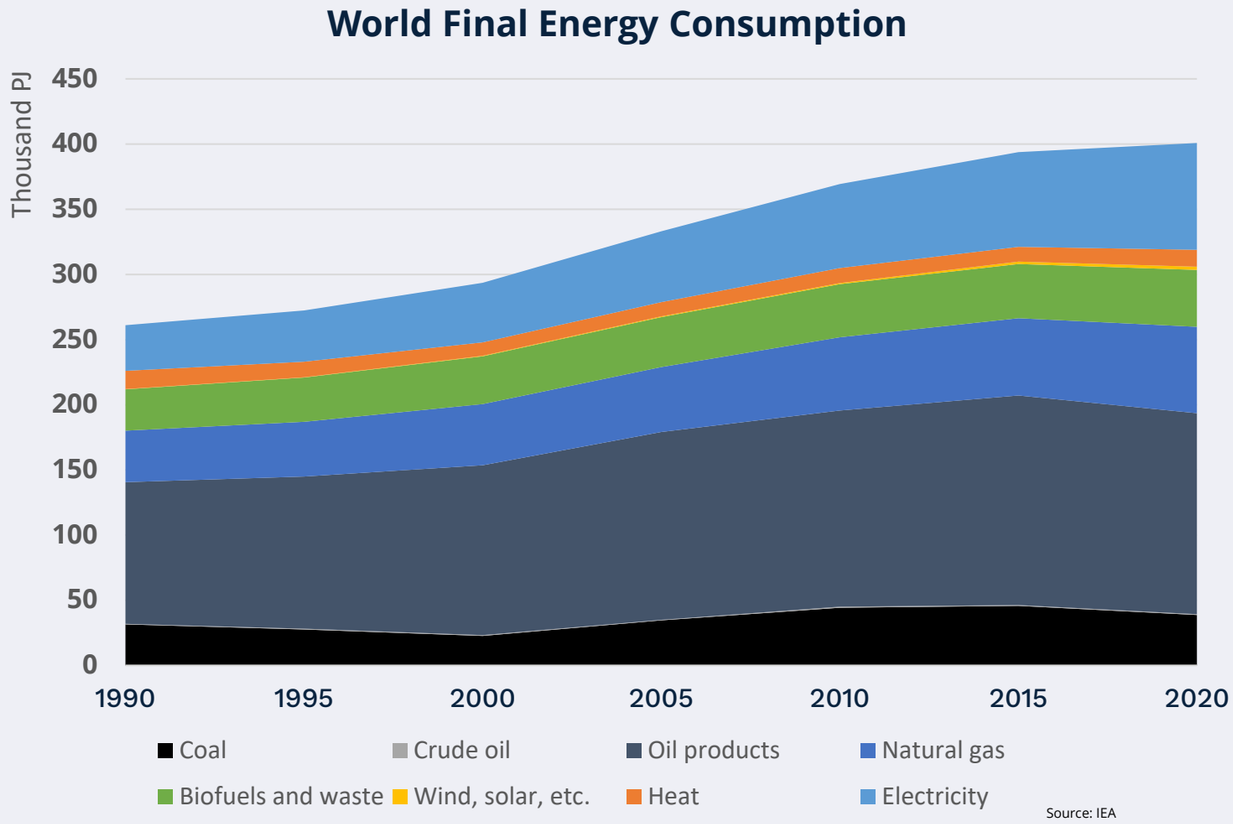


Source: OECD

URGENCY TO DECARBONIZE

2/3 of end-use sectors' consumption is fossil fuel and urgent action is needed to reduce end-use greenhouse gas emissions

- **Save** end-use energy and scale up energy efficiency in buildings, industries and transport and bring down the energy intensity to provide for service needs. Demand reductions and control to support variable renewable energy.
- **Shift** to sustainable energy sources and electrification of end-uses through heat pumps, EVs and displace fossil fuel by sustainable bio-energy and green hydrogen.
- **Adopt** circular economy principles and improve material efficiency to reduce demand for raw materials and reduce embedded carbon in supply chains
- **Manage** residual emissions through carbon capture, utilization and storage.



Source: IEA

NEED TO SCALE-UP INVESTMENT

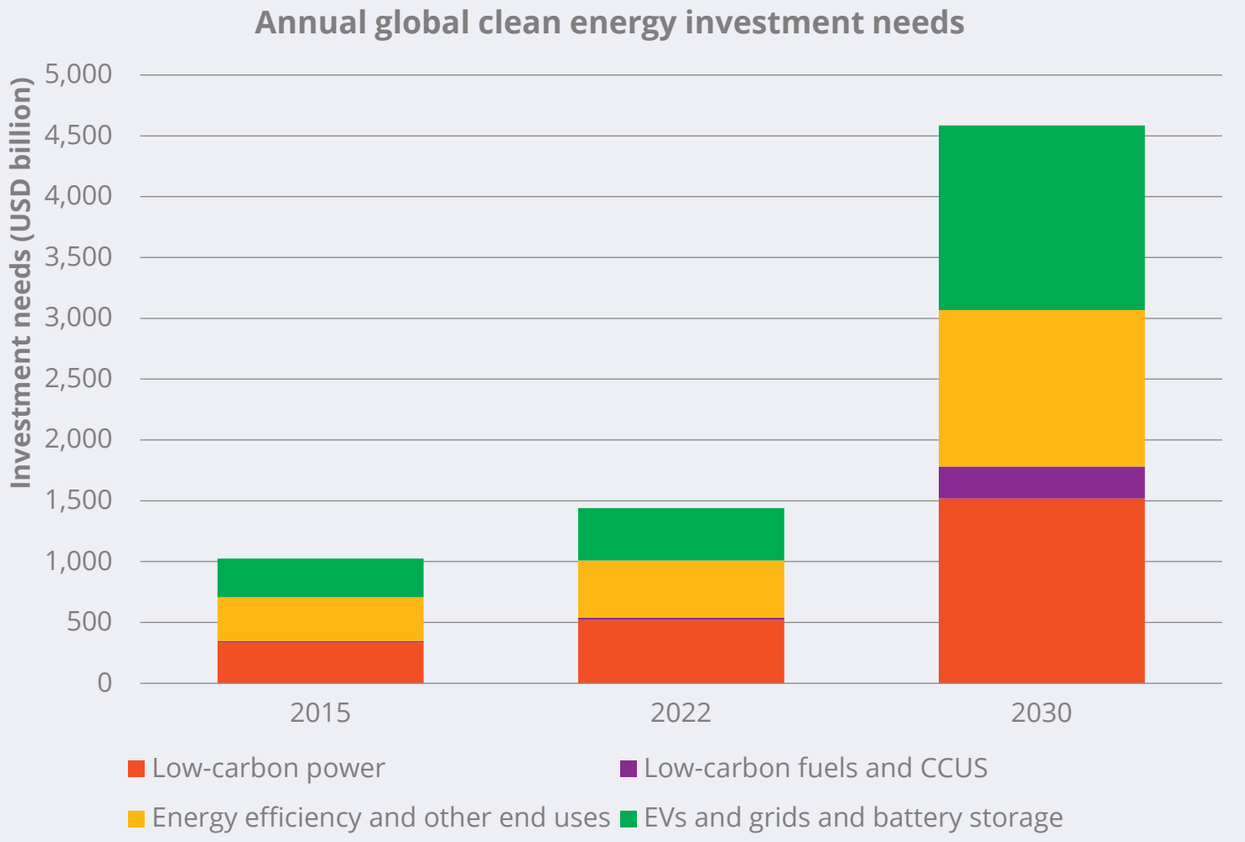
More than $4.5 trillion of annual investment is needed by 2030, of that more than half must go to demand side actions

Investment needs to flow to measures that:

- **Save** energy
  - Zero carbon buildings via updates to codes, certifications and renovation programs
  - Energy and material efficiency
  - Waste heat recycling
- **Shift** to sustainable energy sources
  - Electric vehicles and sustainable fuels for transport
  - Sustainable cooling and low GWP refrigerants
  - Heat pumps and geothermal direct use for heating
  - Distributed renewable energy generation
  - Low-carbon hydrogen, and sustainable bioenergy for combustion
- **Control and reduce** demand with circular economy principles, recycling, and efficiency measures
- **Address** residual emissions with carbon capture, utilization and storage

Investment is also needed into the infrastructure that underpins end-use decarbonization including:

- Energy transmission and storage (electricity and hydrogen)
- CO_2 transport and storage



Source: IEA

FUNDAMENTAL CHALLENGES

Technological solutions exist but deployment is hampered by the lack of an enabling environment

End-use sector decarbonization levers

Infrastructure

Legal and regulatory frameworks

Innovation

Policy

Investment

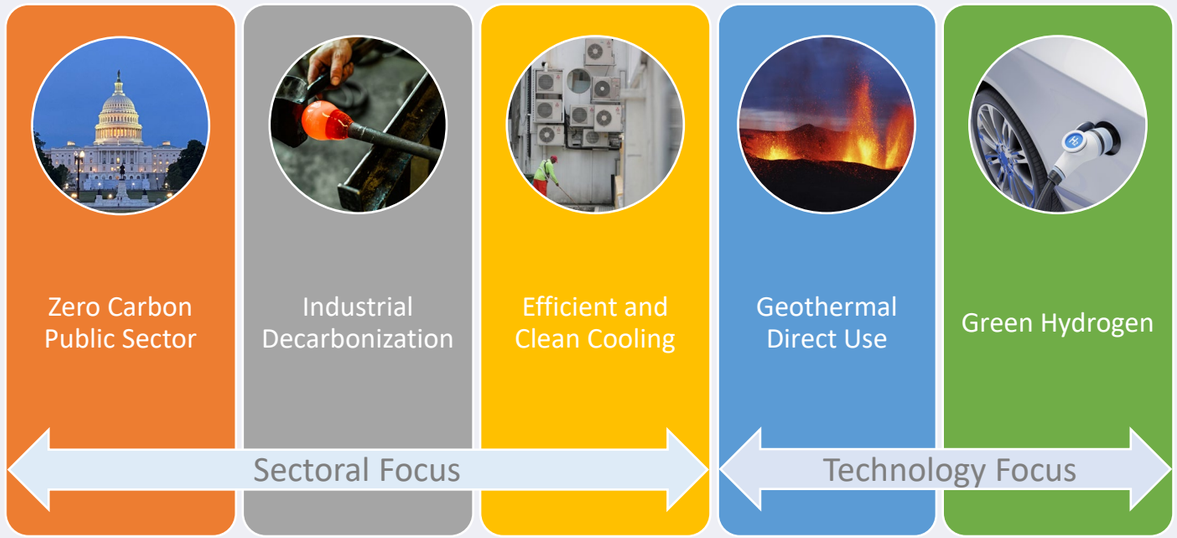
Human Capital

PILLARS and Achievements SNAPSHOT

FOCAL AREAS

Five windows targeting the demand-side of the energy system and end-use sectors or services

- **Zero Carbon Public Sector** supports energy efficiency and decarbonization of buildings, transport and public utilities such as streetlighting, district energy, water treatment and supply, and waste management
- **Efficient and Clean Cooling Program** aims to scale-up investments in the deployment of affordable, efficient and sustainable cooling solutions. The program supports cold chains for health facilities and farmers and efficient and clean space cooling in buildings and urban areas.
- **Industrial Decarbonization** supports decarbonization of industrial sectors by accelerating the adoption of innovative solutions and driving the advancement of new technologies.
- **Geothermal Direct Use** aims to raise awareness of the value of utilizing geothermal energy directly for e.g. agriculture, tourism, heating, and to build the enabling environment necessary to scale up its uses.
- **Green Hydrogen** supports the successful development of first-of-a-kind hydrogen projects and raises awareness of the value of green hydrogen.



ACHIEVEMENTS

Global reach and impacts from FY21-FY23

Impact FY21 to FY23 (as of April 2023)

- Four countries have approved Green Hydrogen Strategies
- 46 WB Board Approved projects
  - $6.7 billion leveraged and estimated
  - 49.2 million metric tCO2e reduced
- 7 Projects with focus on woman enhancement and empowerment

Study tours & Capacity building in FY23

- Geothermal Direct Use: **Study tour** in November 2022 to Iceland, with over 40 delegates from 15 countries.
- Geothermal **Conference** in Türkiye, both direct use and electricity
- Green Hydrogen, **Roundtable** on sharing business models and technology from Dutch firms, participants from over 30 countries
- Three Green Hydrogen **webinars** on: Standards and Certification, business model and financing structure

Knowledge in FY23

- Three Reports finalized in FY23
  - Direct Utilization of Geothermal Resources
  - Sufficiency, sustainability, and circularity of critical materials for clean hydrogen (see deep dive)
  - Electric Mobility and Power Systems - Impacts and Mitigation Strategies in Developing Countries
- Two other publications in FY23
  - Paper: Ammonia Production from Clean Hydrogen
  - Live wire: Opportunities for Direct Uses of Geothermal Energy in Türkiye

$$ Climate finance fundraising

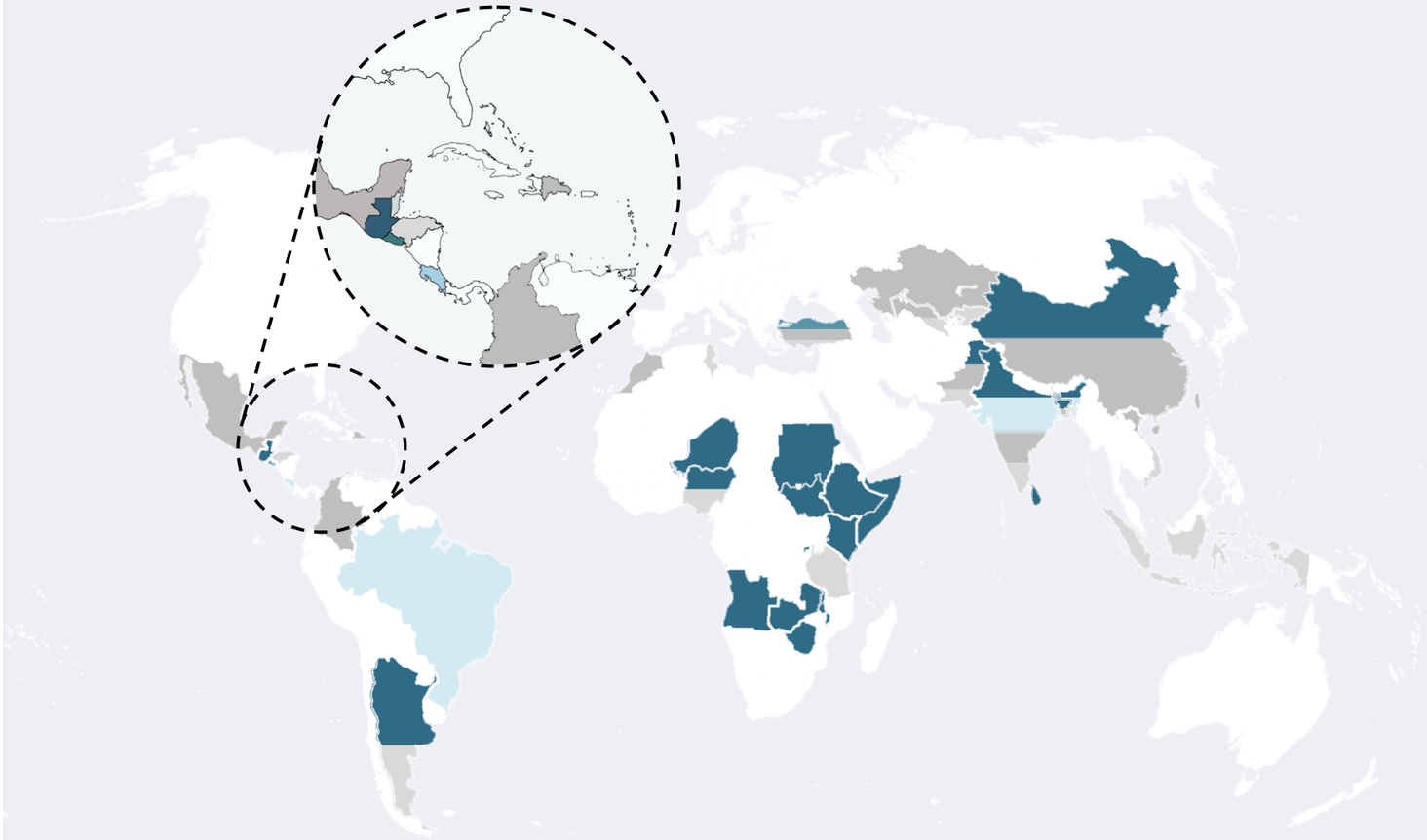
- Efficient and Clean cooling mobilized **$157 m from GCF** to create the Cooling Facility which became effective in July 2022.
- Support investments in sustainable cooling in 9 countries across the health, agriculture and energy sectors.
- The Somalia and São Tomé & Príncipe health projects expected to be approved by Aug- Sept 2023.

GREEN CLIMATE FUND

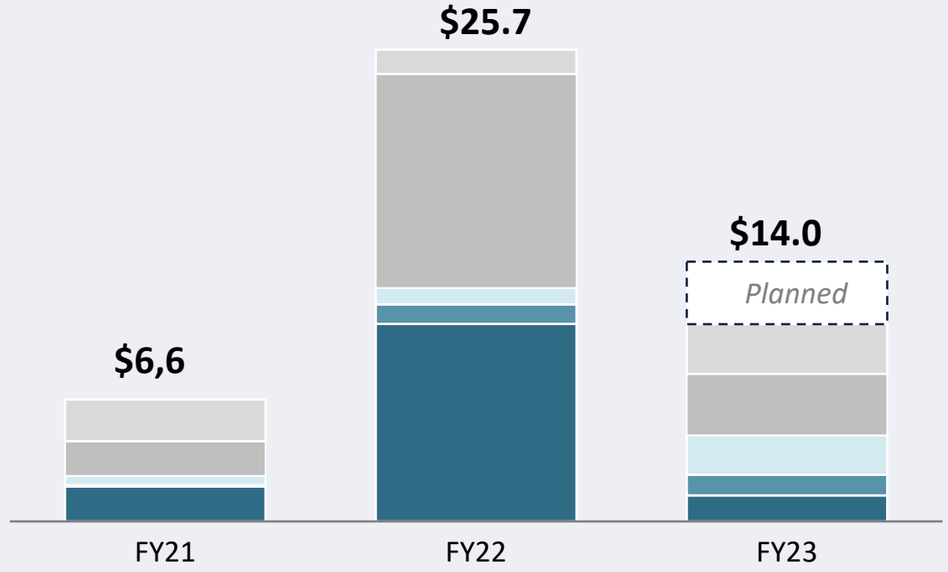
GROWING DEMAND

The reach of the pillar has expanded to 55 countries in addition to regional requests

Global Footprint (Countries where the Accelerating Decarbonization has provided grants, FY21-23)



Annual Grant Allocation (million USD)



US$ 43.3 million already allocated in **55+ countries over FY21-23**

The allocation for **FY23** amounts to **US$ 12.3 million** as of April 30th

Legend:
- Zero Carbon Public Sector
- Industrial Decarbonization
- Green Hydrogen
- Geothermal Direct Use
- Efficient and Clean Cooling

Partnerships and collaboration

AD team continues to have good collaboration with other ESMAP teams, WB global units (Health, Urban, Agriculture, Transport), IFC and international organizations (IEA, IRENA, ..)

Efficient and Clean Cooling Program
- Example of external partnership and collaboration

Member of Steering Committee; exchange with network of experts/key stakeholders

Joint publication on nexus between sustainable cooling and energy access;

Development of vaccine cold chain assessment tool & piloting
Development of Quality Assurance framework for off-grid cooling appliances

Seed funding for ESMAP Cooling program; network of cooling stakeholders and experts;

Climate finance for Cooling Facility

COVID-19 Response and Strengthening of health systems with reliable, climate friendly vaccine cold chains
Guidance Notes on Vaccine Cold Chains

Hydrogen For Development Partnership

Foster developing country participation in the growing hydrogen economy across the value chain

Partnership between 26 partners

ACCELARING DECARBONIZATION ALIGNS WITH THE WBG'S EVOLUTION ROADMAP OBJECTIVES

Scaling up and optimizing for impact	Supporting good country outcomes while addressing global challenges	Engaging at regional and global level to complement country engagement	Facilitating private capital
AD programs pool resources and scale up investments by leveraging public and private financing and focusing on impacts	AD programs focus on end use sector in countries and reducing GHGs, reducing cost of the energy transition, improving health, and supporting gender equality	AD programs collaborate with other bi-lateral and multi-lateral agencies on country, regional, and global level to leverage expertise and resources	AD programs support market development to mobilize private capital by improving enabling environment and risk mitigation

IMPACT STORIES

DEVELOPING SUSTAINABLE INDUSTRY IN VIETNAM

Challenges: Industrial facilities, with their long lifespan, process emissions unrelated to combustion, and need for high temperature heat are a challenge to decarbonize.

ESMAP Response: A set of studies on the technological options to decarbonize hard to abate industries in Vietnam. These studies will support an RETF project that has three components:

- Promoting innovative and low-carbon technologies
- Knowledge products and capacity building
- Improvement of readiness for sectoral carbon crediting in selected sectors

Results: A market study for decarbonization feeding into a public knowledge sharing workshop on decarbonizing hard to abate industries. This work is also supporting IFC dialogue with select private sector cement and steel firms to do in depth sectoral assessments.

SHIFT TO ELECTRIC MOBILITY
MENA Region

Challenges: E-Mobility is being considered as part of the solutions to address air pollution and climate change. However, this transition is not without its own challenges, including the impact on the grid and utilities, exacerbated by local conditions, esp. the high demand for mobile air cooling.

ESMAP Response: A regional study on the challenges and opportunities, incl. in-depth analyses of Morocco, Egypt, and Jordan, with policy recommendations and roadmap of actions.

Results: The results from the ESMAP study are informing the procurement of electric buses in Cairo as part of "Egypt Greater Cairo Air Pollution Management and Climate Change Project" (component budget: US$40 mio). In Morocco and Jordan, the clients have requested further technical assistance to deep dive into the implications on electricity tariffs, charging infrastructure deployment, and role of utilities.

DEVELOPING SUSTAINABLE COLD CHAINS for health facilities in Africa

Challenges: Lack of reliable power supply and cold storage at health facilities damages and hinders access to critical care, medicine and vaccines with a negative impact on population health and human capital development.

ESMAP Response: Supporting investment in sustainable cold chains to effectively transport, store, and administer vaccines and medications, through technical assistance, sharing of good practice and lessons learned, grants and mobilizing of climate financing. ESMAP is providing this support in close collaboration with external partners, including SEforALL and the Cool Coalition.

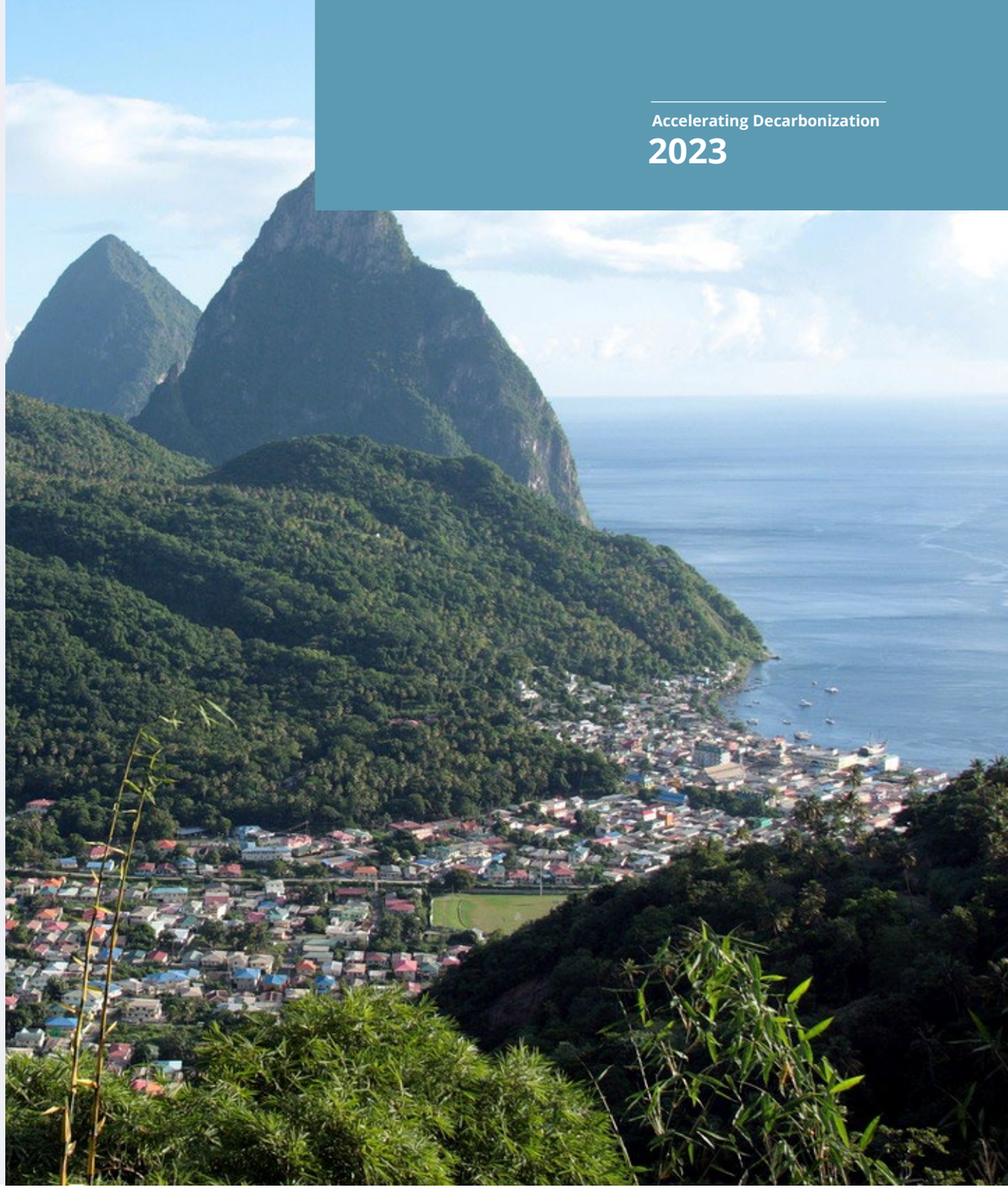
Results: Over **US$9 million** grant financing (for investments and TA) has been allocated to support sustainable cooling and cold chains for health facilities in 20 countries, with over 500 solar direct drive refrigerators, cold rooms and climate-friendly cold storage vehicle being installed.

SAVE END-USE ENERGY WASTE
The Caribbeans

Challenges: Island states are suffering from expensive fuel imports and little self-sufficiency in renewable energy generation. Low availability of energy efficient equipment and lack of knowledge and experience among local companies.

ESMAP Response: Support energy efficiency renovations of public buildings and distributed solar PV generation. Support the development of building energy codes and Energy Efficiency and renewable energy legislation and regulation. Joined effort for CARICOM region on market development for EE products and expertise.

Results: Preparation of the Caribbean Efficient and Green Energy Buildings Project ($60 million IDA, $1.25 million TF) for Grenada, St. Lucia, and the OECS. Exp. Board approval Sept. 2023.



SHIFT TO SUSTAINABLE FUELS
Biogas in India

Challenges: Being the World's 3rd largest consumer of energy but having a per capita consumption less than half of global average India faces great challenges of securing energy resources and become less reliant of fossil fuel imports. The country is also the fourth largest emitter of methane with the largest emissions from agriculture, solid waste and wastewater. Biogas generation is typically small scale and investors as the market for distributing and selling the gas is immature and uncertain.

ESMAP Response: Supporting a road map to scale up biogas generation from organic agricultural waste, municipal waste and industrial waste streams to produce compressed biogas to displace natural gas and for automotive fuels. Crucial for the investments in biogas plants is the off-take security, so the program is part of the Government's SATAT (Sustainable Alternative Towards Affordable Transportation) scheme where oil marketing companies provide assurance for off-take.

Results: The SATAT target is to increase the production of compressed biogas by 600%, which will **displace 1/3 of the current natural gas consumption or 2/3 of the natural gas import**. Preparation of a MPA for development of renewable biogas in India with a guarantee mechanism in the amount of $170 million and a $95 million PforR for infrastructure development. Expected board approval in July 2023.

ESMAP SUPPORTS SCALE-UP

Through development of knowledge, innovation, collaboration and grant support to World Bank operations

- **Innovation:** Cooling Facility, pilots on innovative technologies, Net Zero Energy and Carbon Buildings, Hydrogen for Development

- **Implementation:** Procurement policies for energy efficiency technologies and services, ESCO development, revolving funds, support to project preparation, strategies and action plans. Increased focus on vertical and horizontal scaling up through regulation and innovative financing models

- **Frontier Technologies:** Clean industrial technology pilots, heat pump and geo-thermal technologies, Sea water air conditioning (SWAC), e-mobility and charging infrastructure.

- **Knowledge Product & Tools**: Innovative industrial technologies, E-Mobility & power systems, Clean cooling guidelines, Zero carbon buildings

- **Collaboration:** Support WB teams on Paris Alignment, Mission Efficiency, Mission Innovation, GCF Cooling Facility, Cool Coalition, H4D, GlobalABC

Source: IEA

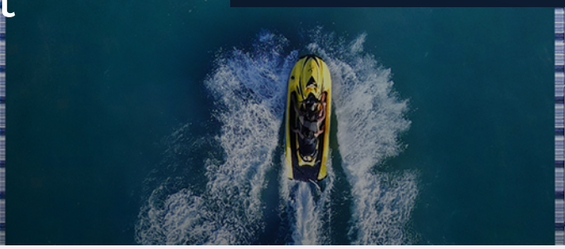

ESMAP
Energy Sector Management Assistance Program
THE WORLD BANK
IBRD • IDA
Accelerating Decarbonization
2023
THANK YOU

Accelerating Decarbonization
2023

ANNEXES

FUNDAMENTAL CHALLENGES

Technological solutions for end-user decarbonization exist but deployment is hampered by the lack of an enabling environment



Levers for decarbonization of end-use sectors

Policy

- National or regional or sectoral decarbonization strategy
- Carbon market and/or price
- Subsidies supporting deployment of technologies

Legal and regulatory frameworks

- Fit-for-purpose framework for technology deployment
- Regulatory capacity
- Clear and efficient permitting process
- Emissions regulations
- Pollution regulations

Infrastructure

- Transmission lines or pathways in place to move electricity, hydrogen and CO_2
- Energy storage infrastructure
- CO_2 storage infrastructure

Innovation

- Scale-up and commercialization of existing technologies
- Continued R&D to improve technological solutions and increase efficiencies
- Novel applications of existing mature technologies

Investment

- Maturation of or development of clear business models
- Private sector engagement
- Novel financial instruments

Human capital

- Development and reinforcement of needed skills and expertise
- Clean energy technology training programs and workshops
- Stakeholder engagement and dialogue

Geothermal Direct Use

ABOUT Geothermal Direct use

Geothermal Direct Use
2023

- **Objective** To raise awareness of the value of direct use geothermal in creating and decarbonizing economic activity and to build the enabling environment necessary to scale-up its use

- **Outcome** Two WB lending projects approved in Turkiye.
  - Utilizing geothermal energy to heat greenhouses in "**Greenhouse industrial zone**" (30 mUSD IBRD lending). Implementation started.
  - **Financing** for geothermal direct use projects (30 mUSD IBRD lending). Lending available for private sector.

- Supporting 9 countries since 2020: Dominica, St. Lucia, Turkiye, Kazakhstan, El Salvador, Indonesia, Guatemala, Honduras, Costa Rica

- New countries to be added next FY: Papua New Guinea, Georgia

- Activities have focused on **raising awareness and creating a pipeline** of projects

- **Further BETF** is needed to engage and initiate studies
  - to **screen** countries and sites for geothermal direct use potential
  - Identify **focus areas** for geothermal heat
  - Identify **gaps** in legal, regulatory and institutional framework

- Further **RETF** will be needed to support feasibility studies and to **realize the pipeline of projects**.

Achievements

Study tours & Capacity building

- **Study tour** in 2022 in cooperation with Icelandic MFA, with over **40** delegates from **15** countries. The tour spanned two days. Companies visited
  - Blue Lagoon (spa),
  - Haustak (fish drying),
  - Friðheimar (green house and restaurant),
  - Ölverk (beer brewery and pizzeria) ,
  - GeoSilica (food supplement)
  - Hydrogen pilot facility
  - Stolt Sea farm (fish farming)
  - Fluðir (municipality),
  - Varmaokra (low temperature mini power plants)

- **Conference in** Türkiye with the country team, 186 participants to launch the WB approved projects. The conference spanned two days and included 38 speakers.

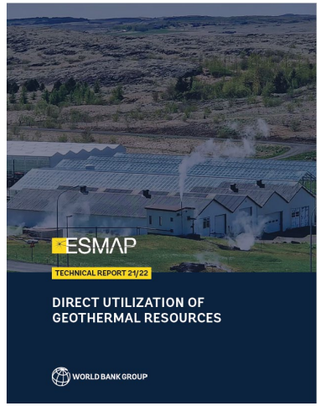
Technical assistance by ESMAP team and leveraging of additional financing

- **Dominica, El Salvador, Turkiye, :**
  - Legal and Regulatory gap analysis
  - Demand analysis for geothermal heat
  - Five Prefeasibility studies
  - Feasibility study for a greenhouse industrial zone

  Of those **Icelandic Government** also provided and paid for rooster of consultants to conduct the five prefeasibility studies.

Knowledge products

- Report: **Direct Utilization of Geothermal Resources,** the objective of the study is to brings awareness to the concept of GDU, with a particular emphasis on how it can bring economic and social benefits. Icelandic Government paid and provided rooster of consultant to provide input to the study
- Live wire: **Opportunities for Direct Uses of Geothermal Energy in Türkiye**



Industrial Decarbonization

INDUSTRIAL DECARBONIZATION

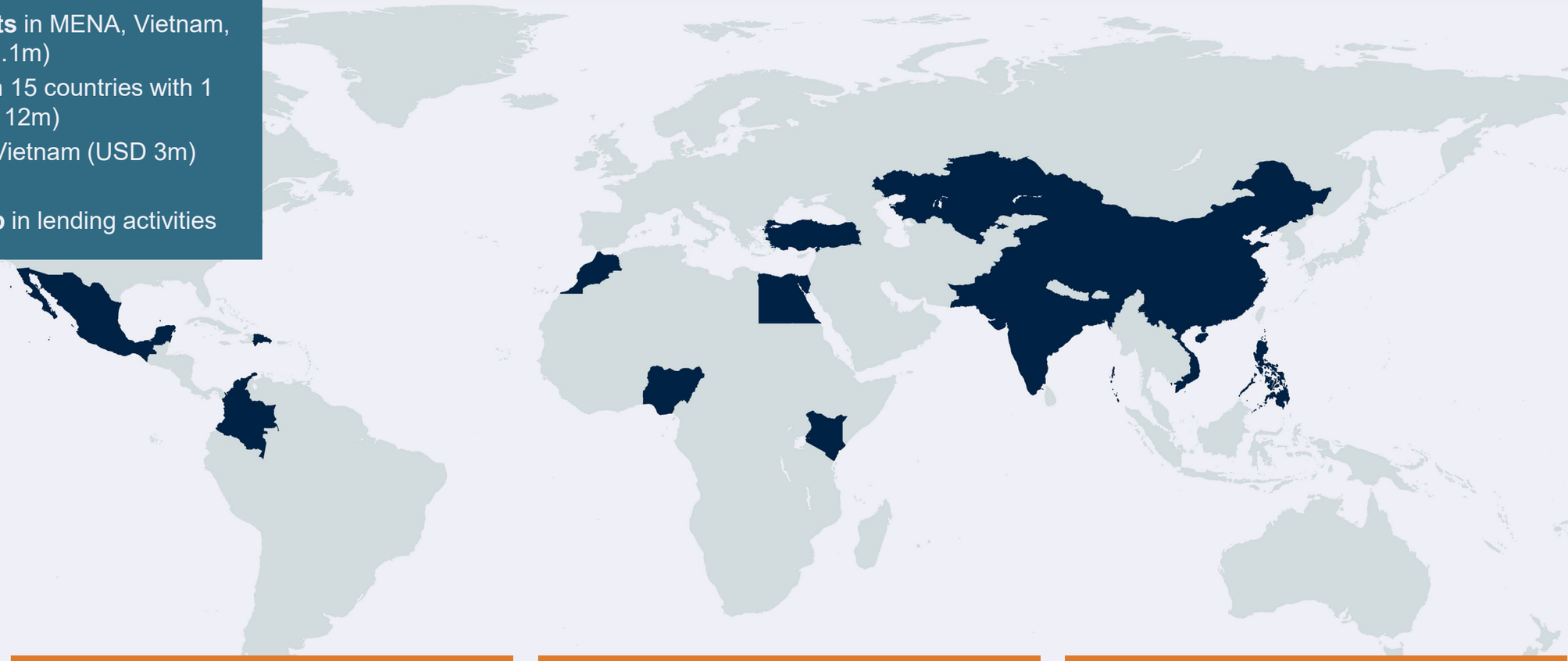
- **Objective:** To support decarbonization of industrial sectors by accelerating the adoption of innovative solutions and driving the advancement of new technologies to prevent carbon emissions lock in. With a focus on:
  - Reducing the demand for carbon-intensive products
  - Improving energy efficiency
  - Deploying decarbonization technologies
- **Activities** have focused on:
  - Production of green ammonia
  - Industrial applications of green hydrogen
  - Decarbonization options and pathways for industry
  - Circular economy solutions

FY23 Highlights

- **4 new projects launched:**
  - Colombia (USD 810k)
  - Dominican Republic (USD 300k)
  - Mexico (USD 900k)
  - Türkiye (USD 450k)
- Previously Mexico and Colombia had only been a part of multi-country projects

FOOTPRINT

- **21 Activities** (USD 16.2m):
  - **3 completed projects** in MENA, Vietnam, and Morocco (USD 1.1m)
  - **17 active projects** in 15 countries with 1 global projects (USD 12m)
  - **1 pending RETF** in Vietnam (USD 3m)
- **Pipeline of USD >10m**
- **Supported over USD 3.3b** in lending activities



Demand reduction (3)
Global advisory with the IFC
Projects in: Pakistan, and Morocco

Energy Efficiency (7)
Global advisory with the IFC
Projects in: Bangladesh, China, Kazakhstan, Morocco, Türkiye, Dominican Republic

Technology deployment (12)
Global advisory with the IFC
Projects in: China, Kazakhstan, Türkiye, Uzbekistan, Vietnam, India, and Mexico

Zero Carbon Public Sector
2023

ZERO CARBON PUBLIC SECTOR

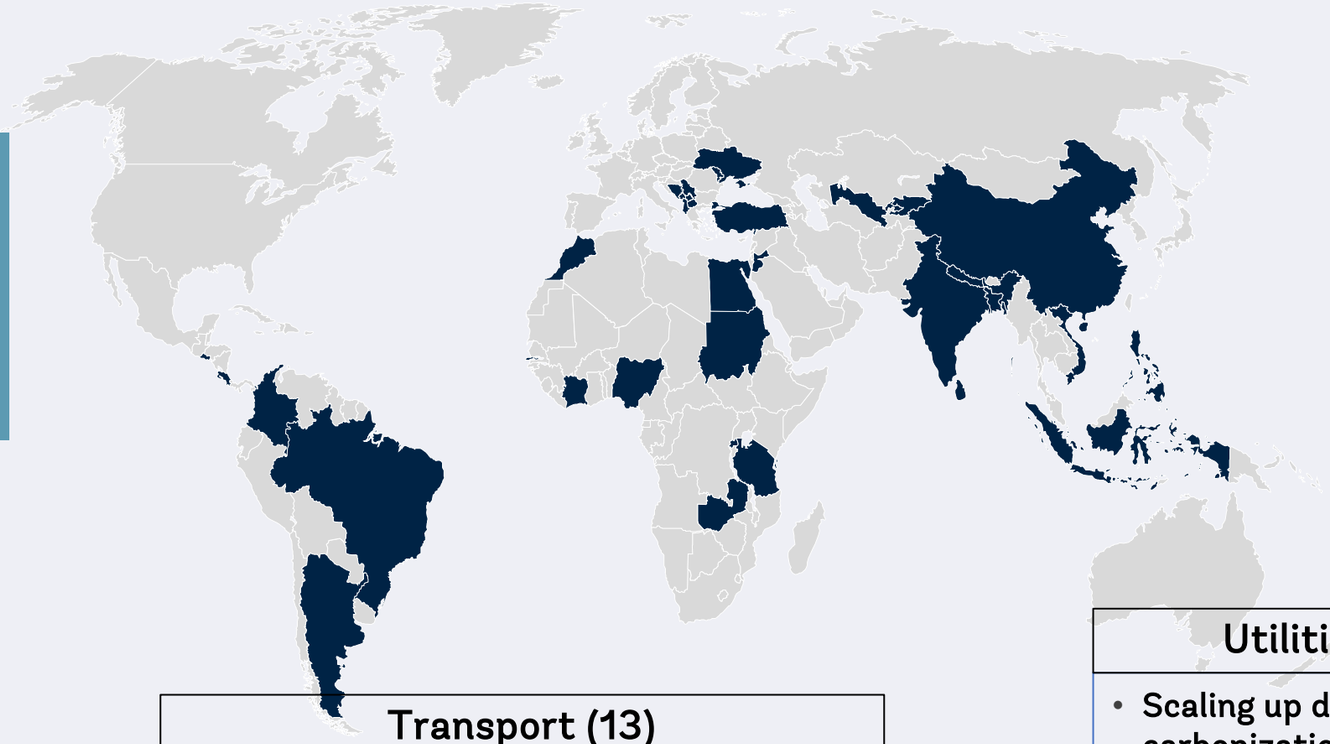
ZERO CARBON PUBLIC SECTOR

- **Objective**
- The public sector has the potential to provide leadership for a net zero carbon future: its institutions and their extensions, such as public buildings, public utilities, and transportation facilities, typically consume up to 20 percent of an average country's energy resources.
- Promote the adoption of energy-efficient and low-carbon solutions by public entities in developing countries by providing technical assistance to governments to prioritize zero carbon pathways and low carbon and energy efficiency activities for the public sector in namely public buildings; street lighting; public transport and e-mobility; water treatment and supply, waste management; and district heating and cooling.

- **The support for program includes:**
- **Technical assistance:** Decarbonization of buildings, transport, and utilities. Support energy efficiency retrofits of public buildings and streetlighting; promote public transport and scaling up e-mobility; scaling up district heating; energy efficiency and biogas generation in water and waste sectors.
- **Generate comprehensive global knowledge** on energy efficient and zero carbon buildings; energy efficiency in water sector; e-mobility and power system integration; electrification of space and water heating.

FOOTPRINT

- Supporting 44 project activities
- Allocated $4.6M grants (FY21-23)
- 20+ countries (+global and regional)
- $1.7b of WBG financing informed
- Pipeline of $16.7M



Buildings (23)

- Sustainable and Energy Efficient Social Housing in Buenos Aires and Indonesia
- Decarbonization of heating and cooling systems in buildings in Uzbekistan
- **Energy Efficiency Strategies and Action Plans for Turkey and Gambia**

Transport (13)

- **Unlocking the Electric Mobility Development Potential in MENA**
- Electric Mobility Adoption Strategies for the Indonesian Mass Transit Program
- Supporting the Development of Electric Mobility in the Maldives

Utilities (8)

- **Scaling up de-carbonization in water utilities (global)**
- ECA Sustainable Heating Program
- Developing a Compressed Bio-Gas roadmap in India

EFFICIENT AND CLEAN COOLING

OVERVIEW

The purpose of the program is to:

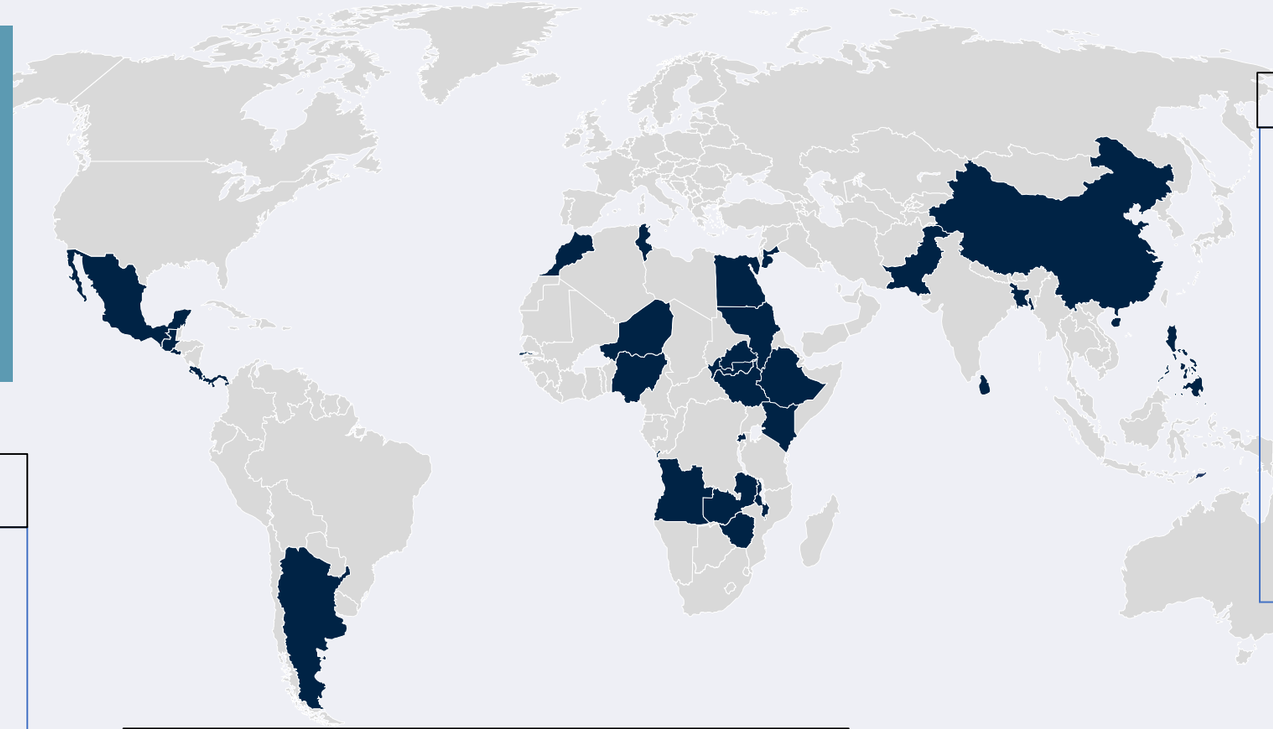
- Respond to the development challenge of over 1.2 billion people globally, currently at risk due to lack of access to cooling and the 2.3 billion people that could be exposed and vulnerable to heat waves by 2030
- Enhance access to affordable sustainable cooling solutions across key cooling sectors, such as buildings and cities (space cooling), health (vaccine cold chains) and agriculture and fisheries (food cold chain), thus contributing to SDG 7 (energy), SDG 2 (hunger), SDG 3 (health), and SDG 13 (climate)

The support for program includes:

- **Technical assistance**: Provide expertise, strategic advice & technical assistance to identify solutions, assess business and financial models and to design and implement investments in the deployment of affordable, efficient, and sustainable cooling solutions support across sectors, adapted to local context.
- **Generate comprehensive global knowledge** on space cooling, cool cities, passive solution and urban planning, less harmful refrigerants, sustainable vaccine and food cold chains, seawater cooling.
- **Mobilize financing**, including World Bank and IFC lending, investment, and concessional climate finance

FOOTPRINT

- Supporting 40+ TA activities
- 30+ countries (+global and regional)
- Allocated $10M+ grants (FY21-23)
- $4.2b of WBG financing informed
- 24 million tCO2e CO2 savings (FY21-23) from informed operations



Energy (8)

- **Mobilizing private finance to accelerate commercial and industrial buildings energy efficiency and space cooling** in Panama, Costa Rica, El Salvador, Sri Lanka, India, Bangladesh and Pakistan
- Gambia: Energy Efficiency Strategy
- India: Support for Next Generation of Policy and Regulation and Sustainable Cooling
- Caribbean: Seawater cooling

Agriculture (9)

- **Energy Efficient Cold-Chain for Agriculture**: Malawi, Rwanda, Kenya, Mexico, Argentina, Guatemala
- Bangladesh: cold chain infrastructure in the livestock value chain
- India: Assessing energy efficient and low GWP refrigerants in cold chain for fishery
- World: Develop Climate Smart Cold Chain Solutions with IFC Clients

Health (19)

- **COVID 19 Response operations**: Climate friendly vaccine cold chains for health facilities in Nigeria, Comoros, Ethiopia, South Sudan, Sudan, Malawi, Zimbabwe, Somalia, Niger, Sao Tome & Principe, Angola, Cabo Verde, Zambia, Mongolia, Philippines, Tunisia, Timor Leste and Pacific Island Countries

Urban/Transport/other (5+)

- Egypt, Jordan, Morocco: Electric Mobility and Cooling
- China: Nature Based Urban Cooling Solutions
- Argentina: Promoting sustainable and energy efficient social housing in Buenos Aires

GCF Cooling Facility

- **Objective:** to scale up sustainable cooling solutions across key sectors
- **Financing mobilization**: $157 M GCF Climate finance to co-finance $722.8 M IBRD/IDA
- **Cross-sectoral:** address key cooling areas such as space cooling (building) and refrigeration and cold chain (healthcare and agriculture)
- **Programmatic:** Support investments in cooling across 9 countries
- **Expected lifetime tCO2e reduced/avoided:** 16.2 Mt CO_{2e}

Cooling Facility Structure

- Component 1: Policy, regulatory and enabling environment support
- Component 2: Financing for cooling investments-
- Component 3: Project management

Eligibility Criteria

- Investment in space cooling, refrigeration and cold chains
- World Bank operation linkage
- Alignment with transition to low GWP
- Country ownership & alignment with climate change/cooling action plans

Status

- Facility approved in Oct 2021,
- Effective in July 2022
- The Somalia and São Tomé & Príncipe health projects are under preparation and expected to be approved by Aug- Sept 2023

GCF Cooling Facility – Portfolio

Efficient and Clean Cooling
2023

El Salvador (Health – COVID response)
- Refrigeration & space cooling
- Contribute to mitigation (74.9ktCO2e) & adaptation targets (1.3 M beneficiaries)
- Implementation model: PPC
- *Planned* financing: $6M GCF + $70 WB

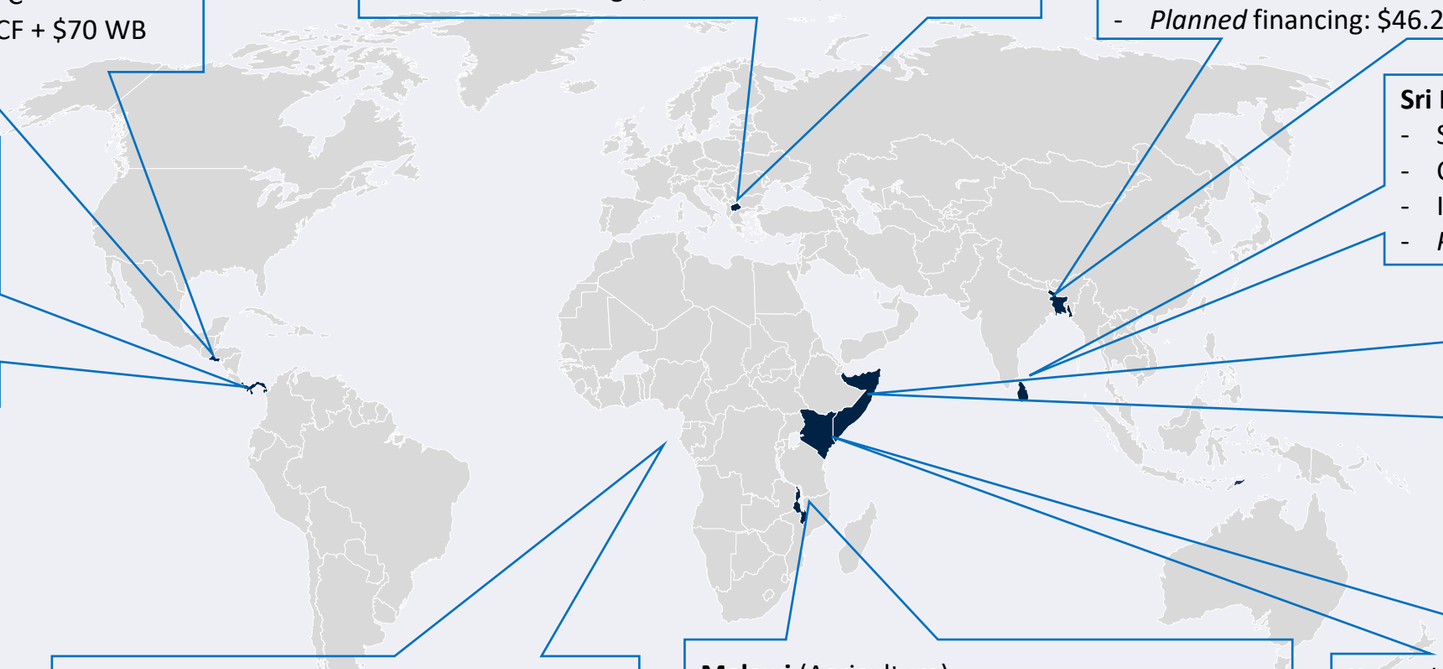
North Macedonia (Buildings)
- Space cooling
- Contribute to mitigation targets (0.5 MtCO2e)
- Implementation model: PPC; EEFF
- *Planned* financing: $10.5M GCF + $27.4 WB

Bangladesh (Buildings)
- Space cooling
- Contributes to mitigation (3.8 MtCO2e) & adaptation targets (441k beneficiaries)
- Implementation model: PPC; CL; EEFF
- *Planned* financing: $46.2M GCF + $150M WB

Sri Lanka (Buildings)
- Space cooling
- Contributes to mitigation (5.6 MtCO2e)
- Implementation model: PPC; CL; EEFF
- *Planned* financing: $36M + $80M WB

Panama (Buildings & appliances)
- Space Cooling
- Contribution to mitigation targets
- Implementation model: PPC; CL
- *Planned* financing: $7M GCF + $50M WB

Somalia (Health-Covid response)
- Refrigeration & space cooling
- Contributes to mitigation (71.6k tCO2e) & adaptation targets (2.2 M beneficiaries)
- Implementation model: PPC
- *Planned* financing: $4.2M GCF + $100M WB



Indicative implementation models:*

***PPC**: Public procurement & contracting*
***CL**: Credit lines*
***EEFF**: Energy Eff. Financing facility (incl., public ESCO and revolving fund)*
**model(s) not yet selected for all countries*

Sao Tome & Principe (Health-Covid response)
- Refrigeration & space cooling
- Contributes to mitigation (24.1k tCO2e)
- Implementation model: PPC
- *Planned* financing: $1M GCF + $9.4 M WB

Malawi (Agriculture)
- Refrigeration
- Contribution to mitigation (0.6 MtCO2e) & adaptation targets (560k beneficiaries)
- Implementation model: PPC; CL; EEFF
- *Planned* financing: $16M GCF + $86M WB

Kenya (Agriculture/energy)
- Refrigeration
- Contributes to mitigation targets (3.5 MtCO2e)
- Implementation model: PPC; EEFF
- *Planned* financing: $30M GCF + $150M WB

Green Hydrogen Support Program
2023

Green Hydrogen Support Program

IMPACT OF GHSP

- **4 countries** have released their **Green Hydrogen Strategies** based on analytical work funded by the GHSP (Namibia, Costa Rica, India, and Morocco)
- **1 in-person country engagement** to catalyze the operationalization of India's Green Hydrogen Mission → TA prompted the request for a lending operation
- **25 partners** supporting and operationalizing the Hydrogen for Development (H4D) initiative
- **1 report** on Sufficiency, sustainability, and circularity of critical materials for clean hydrogen and **1 paper** on Ammonia Production from Clean Hydrogen
- **3 online sessions** with government officials, private sector and research institutions from +10 developing countries to discuss **socioeconomic befits** of GH
- **1 roundtable** sharing **business models** and **technologies from Dutch firms** with participants from over 30 developing countries (MENA, LAC, SA, SSA)
- **3 capacity building webinars**: on standards and certification, business models and financing structures for Brazil, Namibia, and South Africa

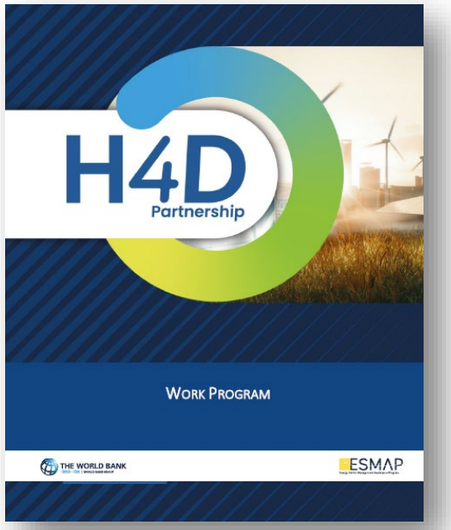
Green Hydrogen Support Program
2023

INDIA

Analytical work supported by ESMAP:
-Inputs to the Roadmap for Green Hydrogen Adoption in India, five key sectors have been identified (Fertilizer, Refineries, Steel, Methanol and Transport).
-Mapping of Demand and Supply Centers.
-Bridging the Cost Gap between Grey and Green Hydrogen.

HYDROGEN FOR DEVELOPMENT (H4D) PARTNERSHIP

Workstream	Topic
WS1	Clean hydrogen technologies, infrastructure, and systems integration
WS2	Enabling policy and regulatory frameworks
WS3	Investment, financing, business models, and procurement
WS4	Socioeconomics and sustainability



BARRIERS, RISKS, AND CHALLENGES THAT ESMAP CAN SUPPORT FOR H2

Requirements	Solutions though Technical Assistance
Demand uncertainty	Secure contracts that guarantee volume and price
Definition for clean hydrogen	Develop clean hydrogen standards and regulations
Upscaling and deployment	Mature and proven technologies
Government support	Global: USD 100 billion (i.e., US IRA, EU IPCEI, etc.)
Renewable power supply	Finance power generation and secure green PPAs
Enabling infrastructure	Construct pipelines, transmission lines, ports, etc.
High capital cost	Governments → Cover initial project development cost MDBs → Risk guarantees and blended finance in developing countries
Price gap with fossil fuels	Design adequate price carbon policies
Socioeconomics	Job creation, local content, social licenses, environmental permits, sustainable use of water