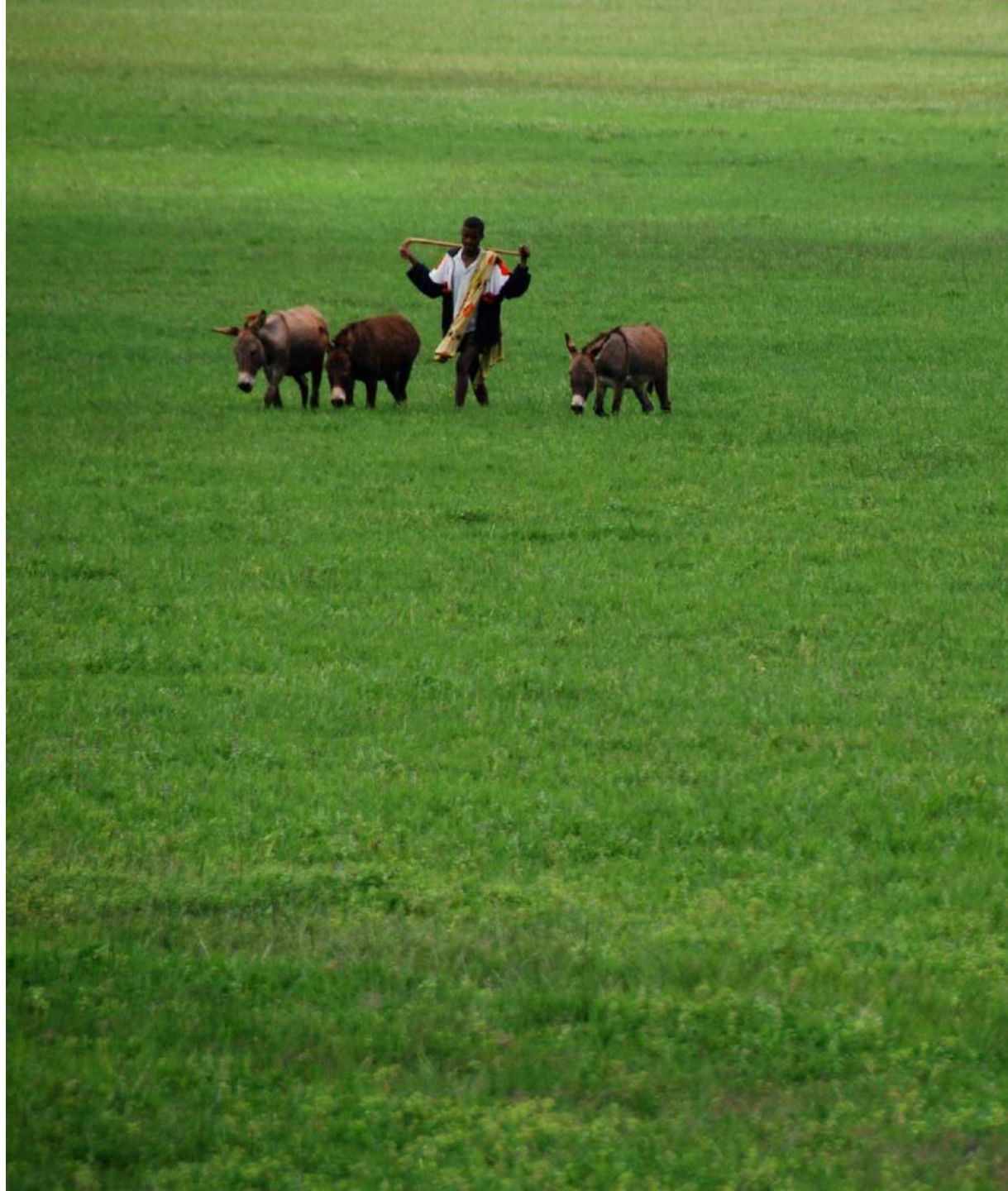
Green Growth Innovations to Achieve Sustainable Development Under Climate Change

Frank Rijsberman, Director General

Bonn, November 14, 2019

Content

- We are in the midst of an unprecedented ***sustainability crisis***
- Past successes
- The drive for economic growth
- Green Growth innovations
- The Green Transition: What will it take?
- GGGI's support for the green transition



Unpacking the sustainability crisis:

- Climate Change
- Mass species extinction crisis
- Deforestation
- Plastic ocean – dead zones
- Chronic diseases
- Air pollution
- Indoor air pollution

Climate Change:
heat waves, fires, floods, droughts intensify

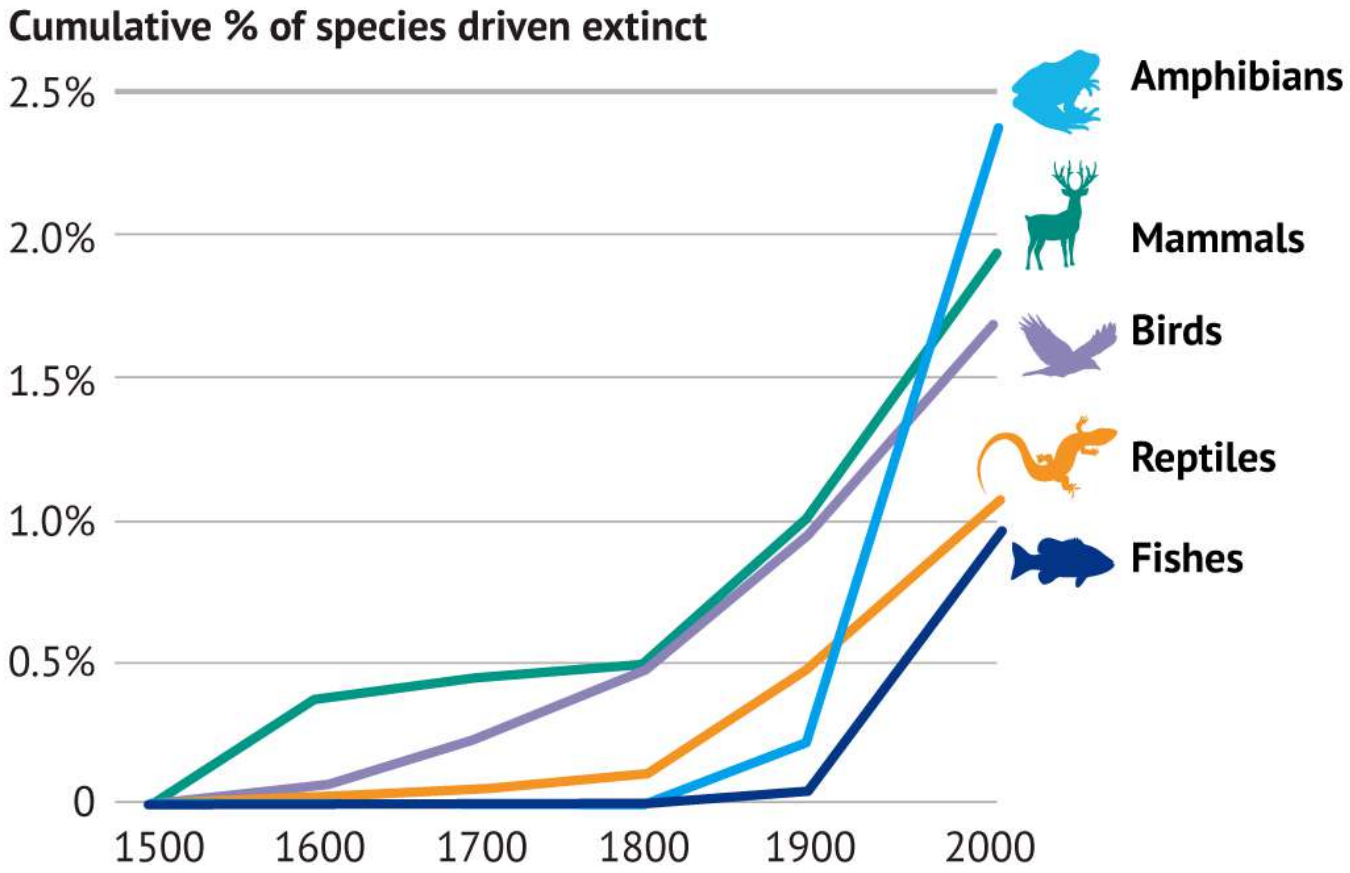
2018: Floods in Kerala worst in a hundred years

2018: Republic of Korea sets all-time record high temperature amid deadly heat wave

2018: Massive forest fires and intense droughts affecting millions of people

The Holocene or 6th mass species extinction

- Estimates range between 24 (MEA) and 150 (CBD) species lost every day.
- Extinction Rebellion protests climate change and linked fear of mass species extinction



Source: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

Global deforestation is rising

- Global tree cover loss has grown from 13 million hectares per year at the turn of the century, to nearly 28 million hectares per year today.
- “What really concerns those of us working on the role of forests in climate change is that global tree cover loss is increasing,” said Christopher Martius, managing director of CIFOR’s office in Bonn, Germany.

Fires burning on the South American continent 27 August 2019, Photo: NASA/FIRMS

Plastic pollution in the oceans

- Only 9% of all plastic waste ever produced has been recycled. About 12% has been incinerated, while the rest — 79% — has accumulated in landfills, dumps or the natural environment.
- **10 rivers** alone carry more than **90% of the plastic waste** that ends up in the oceans

Great Pacific Garbage Patch

Source: UN Environment

Poor diets damaging children's health worldwide, warns UNICEF

Poor diets are now the #1 cause of ill health globally, overtaking smoking, with 800 million hungry people, 2 billion malnourished people, 159 million stunted children and 2 billion people overweight or obese, causing rapid increases in diabetes in India and heart disease in China. Three quarters of all overweight children live in Africa and Asia.

The State of the World's Children 2019: Children, food and nutrition finds that at least 1 in 3 children under five – or over 200 million – is either undernourished or overweight. Almost 2 in 3 children between six months and two years of age are not fed food that supports their rapidly growing bodies and brains. This puts them at risk of poor brain development, weak learning, low immunity, increased infections and, in many cases, death.

Poverty, urbanization, climate change and poor eating choices driving unhealthy diets

Air Pollution in the Asia Pacific

- In the Republic of Korea, Air Pollution was declared a social disaster to be tackled through emergency laws.
- 92% of Asia and the Pacific's population – about 4 billion people – are exposed to levels of air pollution that pose a significant risk to their health.
- Blue skies are the top priority throughout Asia, from Mongolia to China to Bangkok – but blue skies will also help address the climate crisis.

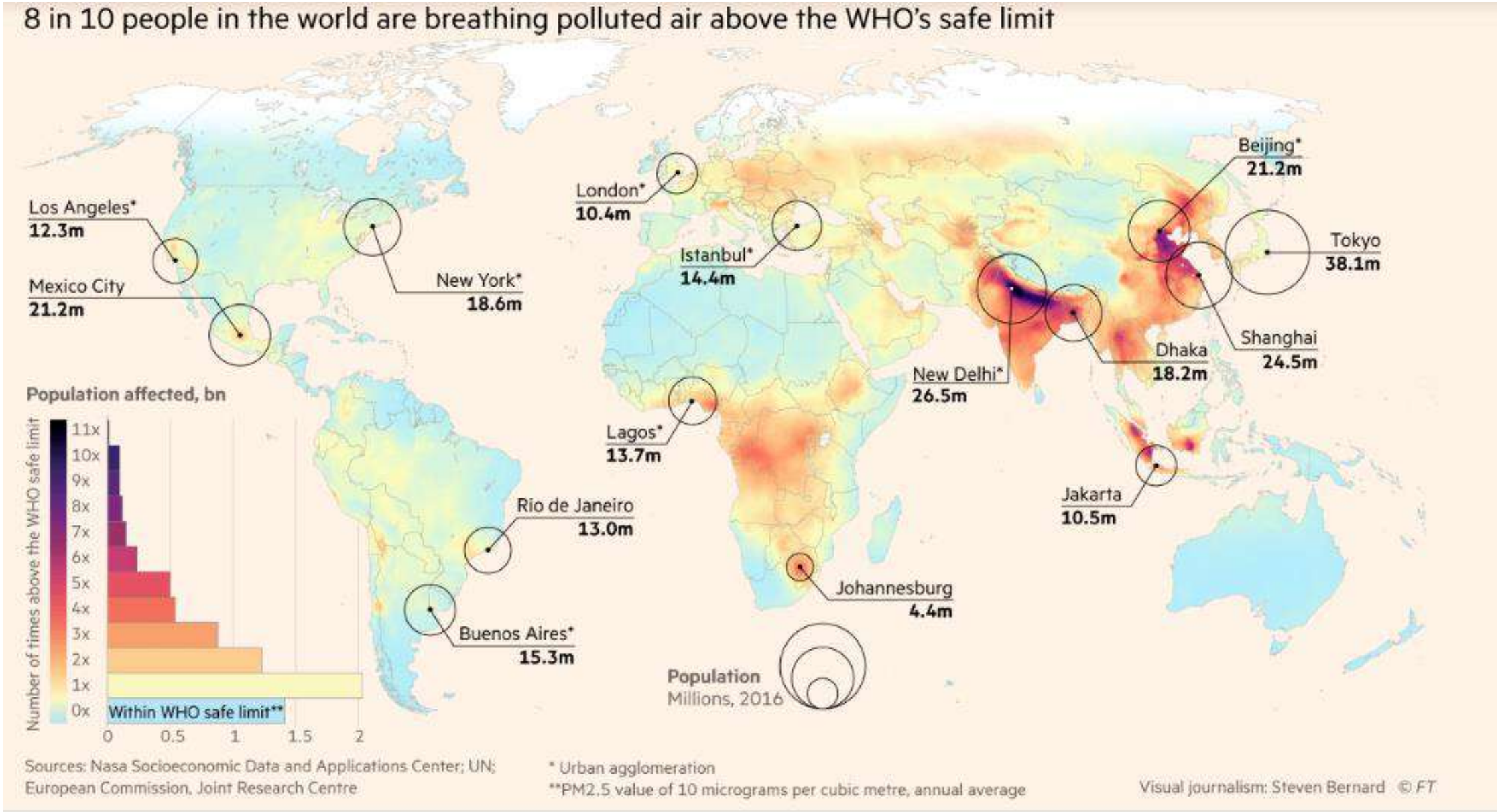
Statistics source: UN Environment

The Air Pollution Crisis

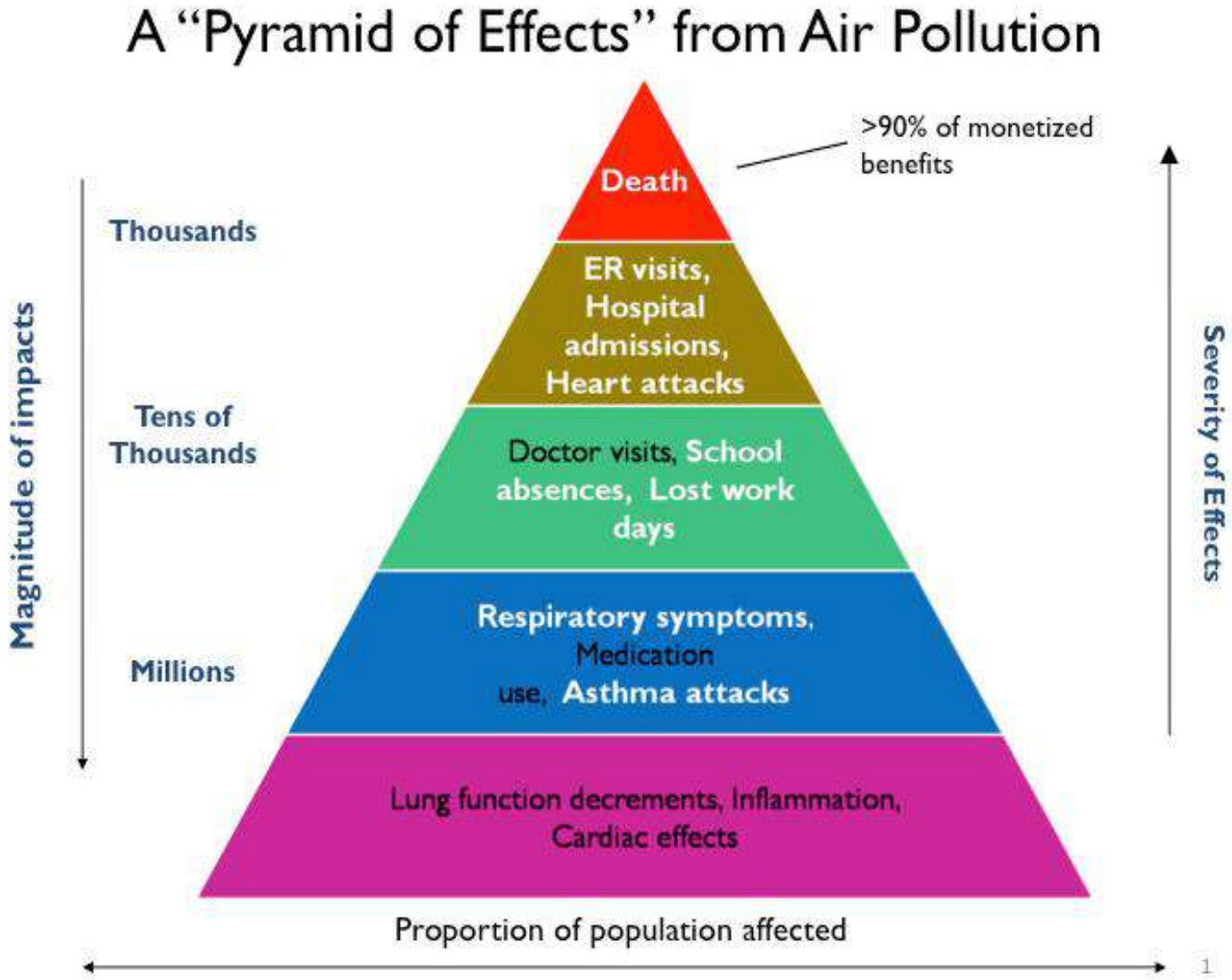
- Every year, an estimated 7 million people die from illnesses attributable to air pollution.
- Blue skies are the top priority throughout Asia, from Mongolia to China to Bangkok – but blue skies will also help address the climate crisis.
- Combating climate change and meeting the goals of the Paris Agreement could save around a million lives a year worldwide by 2050 solely through reductions in air pollution.

GGGI

With incumbent growth models, air quality is worsening in most Asian cities in the past decade



The result is reduced standard of living, reduced productivity and deaths with long-term impacts



Source of pollution differ by cities and countries

Pollution sources of Delhi

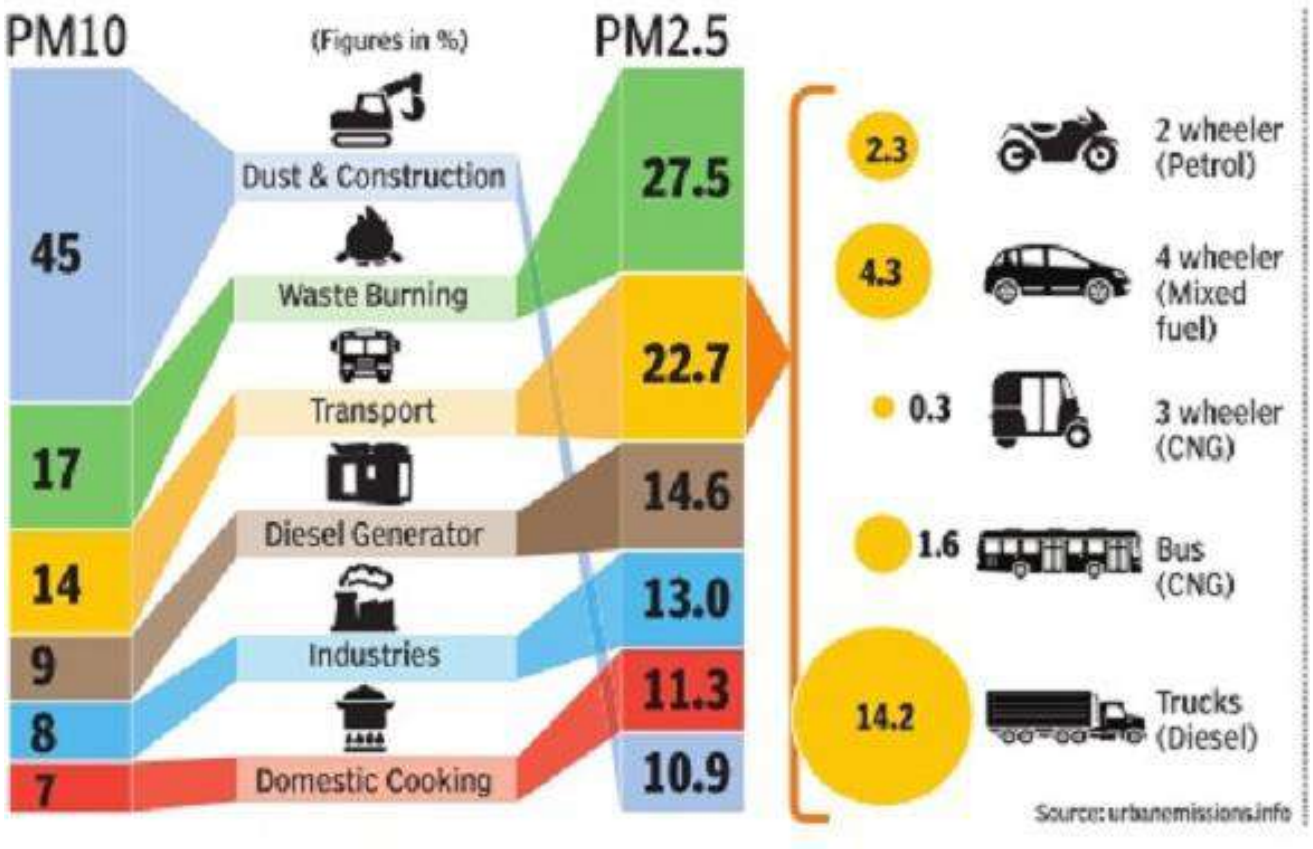


Figure 16. Source contributions to deaths attributable to $PM_{2.5}$ in India in 2015.

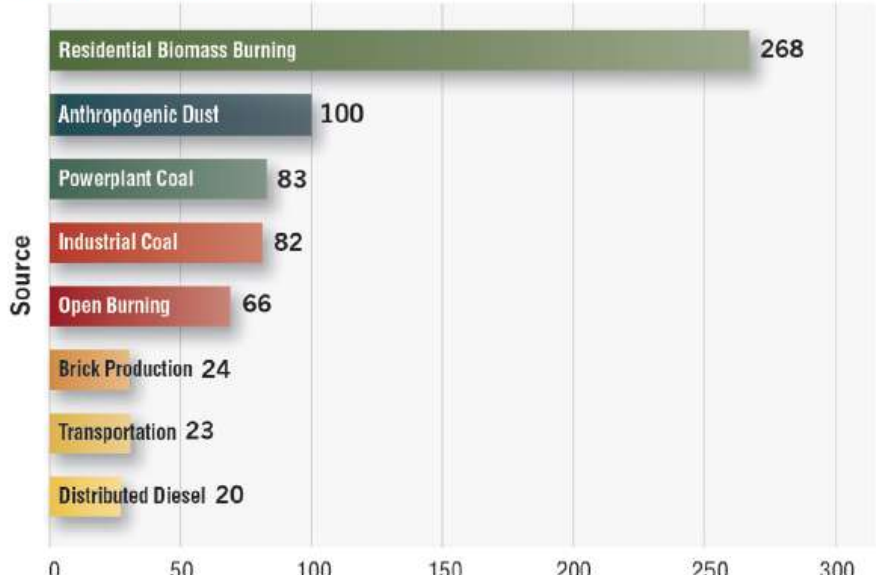
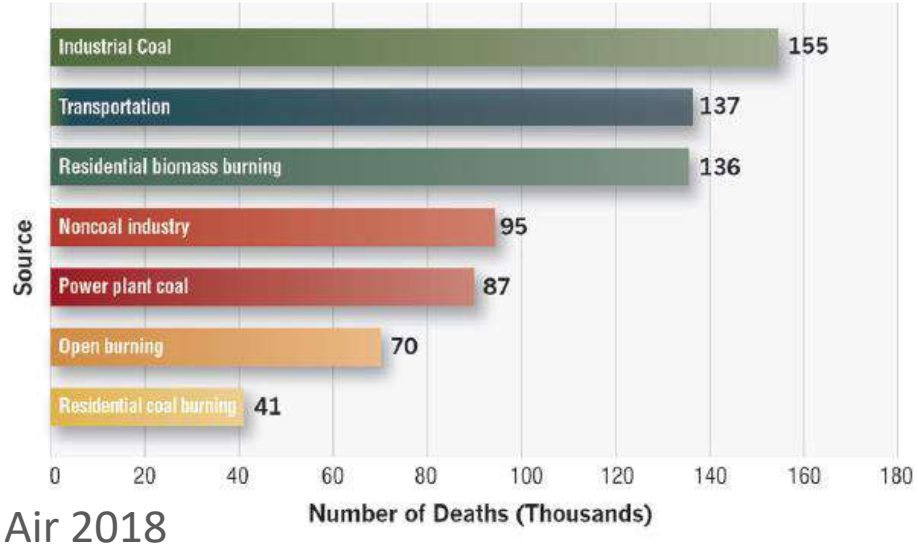


Figure 15. Source contributions to deaths attributable to $PM_{2.5}$ in China in 2013.



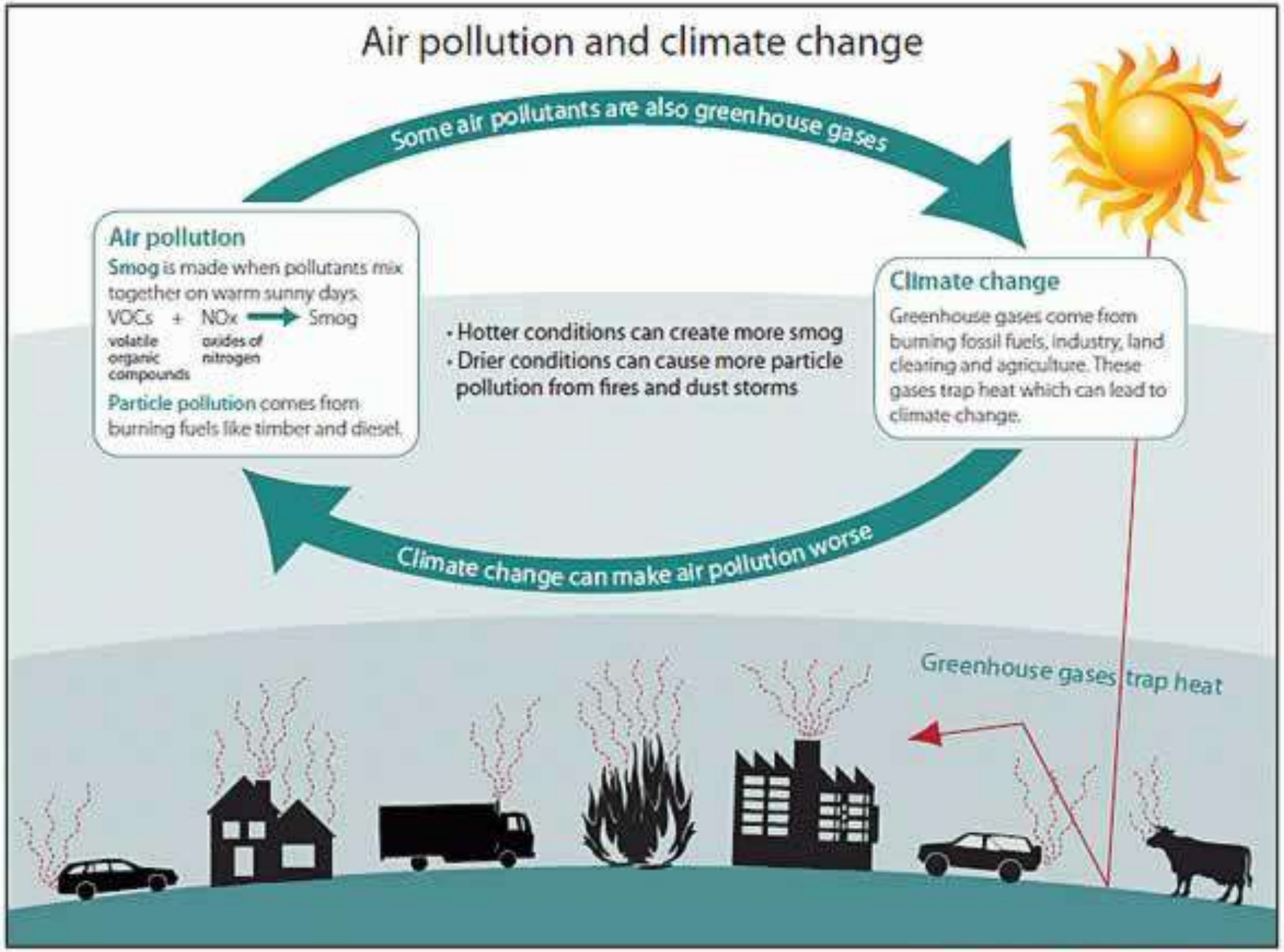
Source: State of the Air 2018

Statistics Source: World Health Organization; & Our World in Data

Indoor Air Pollution - Causes

- Inefficient use of solid fuels for heating and cooking.
- Low-income households have a higher dependence on solid fuels for their basic needs.
- More than two billion people worldwide are dependent on polluting fuels for energy needs.

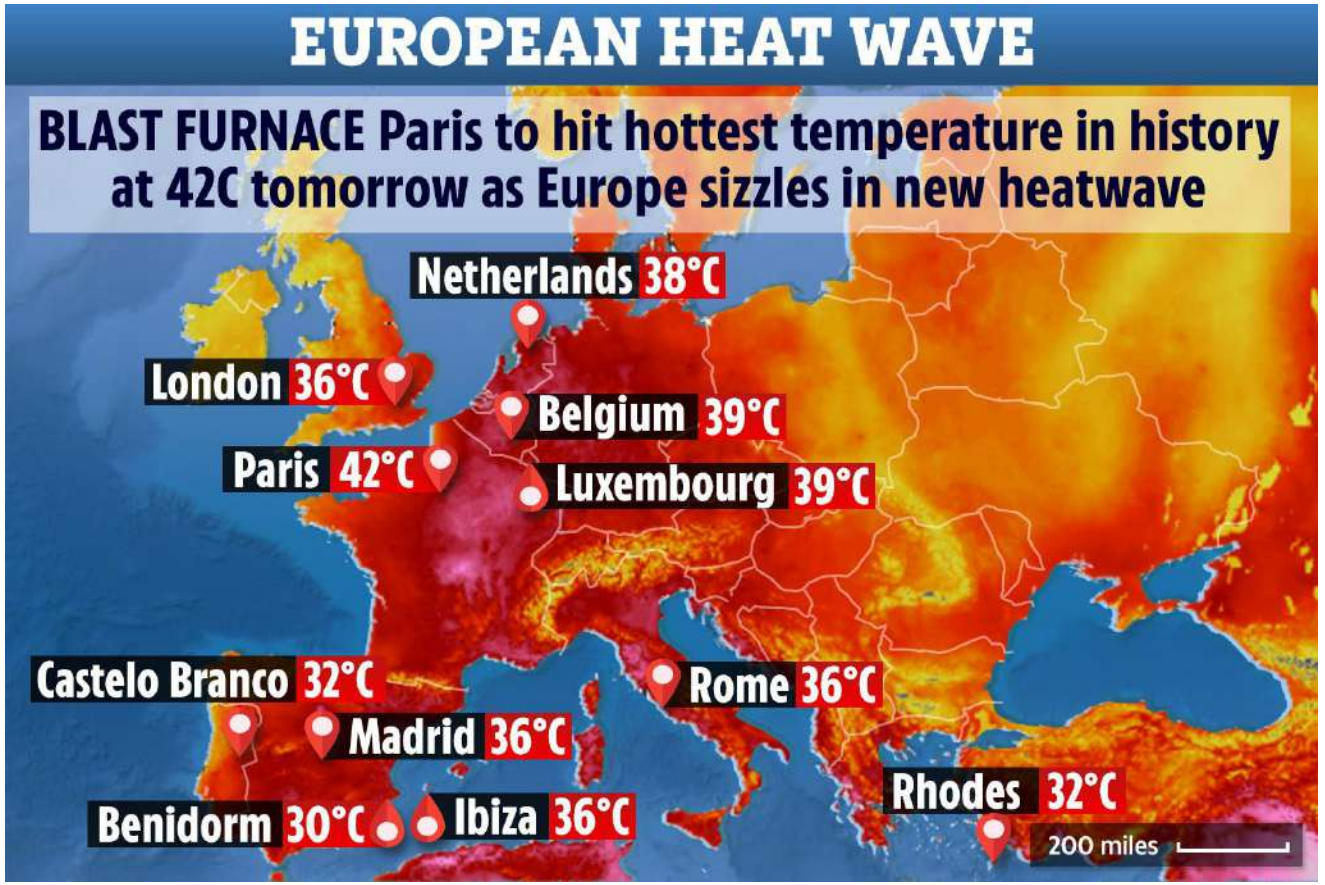
Maintaining good air quality in the longer-term is inextricably linked to ambitious climate action



Adapted from State of the Environment NSW 2000

Impacts of climate change today

- European heatwave 2019
- California forest fires in both 2018 and 2019, bankrupting PG&E
- Australia battles catastrophic bush fires



Also in 2019: Cyclone Idai hit Mozambique

- Over 1000 deaths
- Over 110 thousand displaced in camps
- Over 1.5 million children affected
- Over $2Bn in damages
- Mozambique's GBP is around $12Bn

Climate Change: the defining threat of our time

Glasgow COP26 in 2020: the moment of truth for the Paris Agreement as countries submit their new Nationally Determined Contributions – they need to be more solid and more ambitious

Past successes

The 1956 Clean Air Act, London, UK

- On December 4th, 1952, a thick fog, known as *the Great London Smog* covered London.
- Led to 4,000 deaths above the usual average.
- The first Clean Air Act was introduced in 1956 to control domestic sources of smoke pollution by introducing smokeless zones where only smokeless fuels could be used.

Source: http://www.air-quality.org.uk/

Results of the 1956 Clean Air Act?

- The smoke control areas helped to reduce domestic emissions
- Electric and gas usage increased
- The use of solid fuels decreased
- Relocation of power stations to more rural areas
- Continued decline in heavy industry

Source: http://www.air-quality.org.uk/

Clean Air Act USA, 1970

- Since passing the US economy has tripled but air pollution, measured as emissions of 6 key pollutant gases, has come down 73% in absolute terms
- Strong evidence that growth can be green, that growth and pollution can be decoupled

Every $1 spent to reduce emissions

FROM MOBILE SOURCES

UNDER THE CLEAN AIR ACT

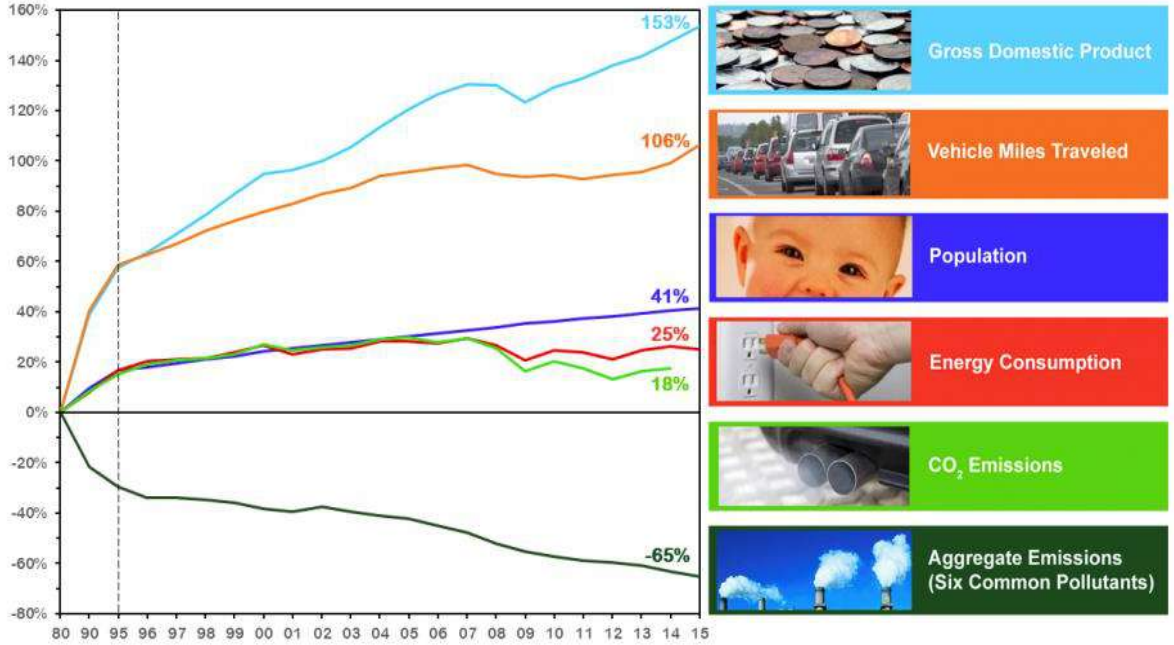
US Clean Air Act passed in 1970

Results in $9 of benefits

TO PUBLIC HEALTH, THE ENVIRONMENT,

PRODUCTIVITY, AND CONSUMER SAVINGS

Comparison of Growth Areas and Emissions, 1980-2015



New York City: 1973 vs. 2013

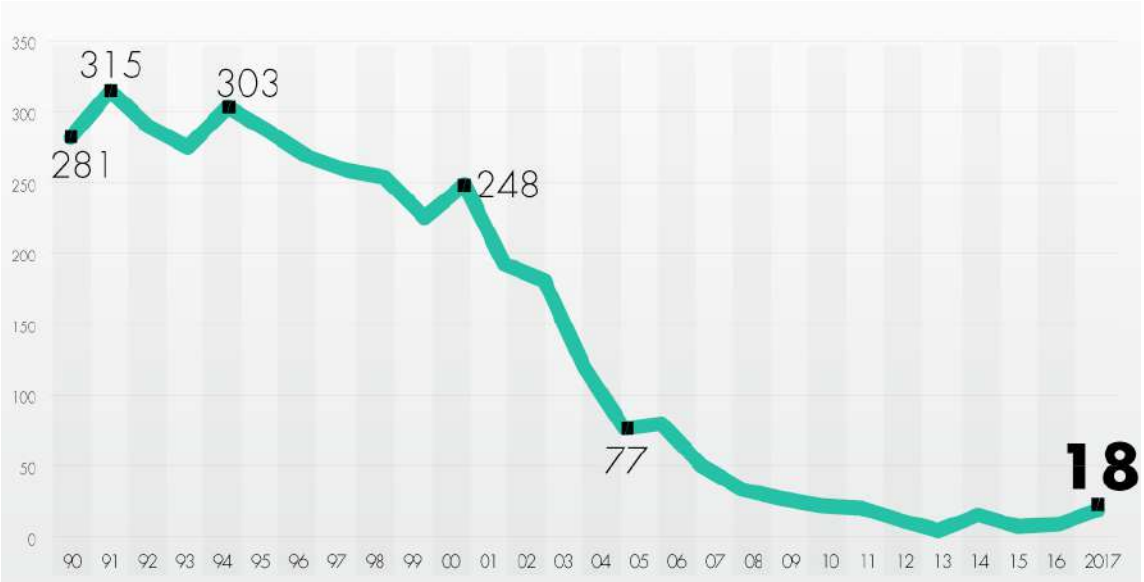
Source: EPA Documerica "Then and Now Challenge"

Measures against air pollution in Mexico City

Tackle 20% of sources that produce 80% pollution

Number of days per year with Environmental Contingency in Mexico City

Days with more than 150 points in the air quality index (IMECAS) in Mexico City (1990- 2017)

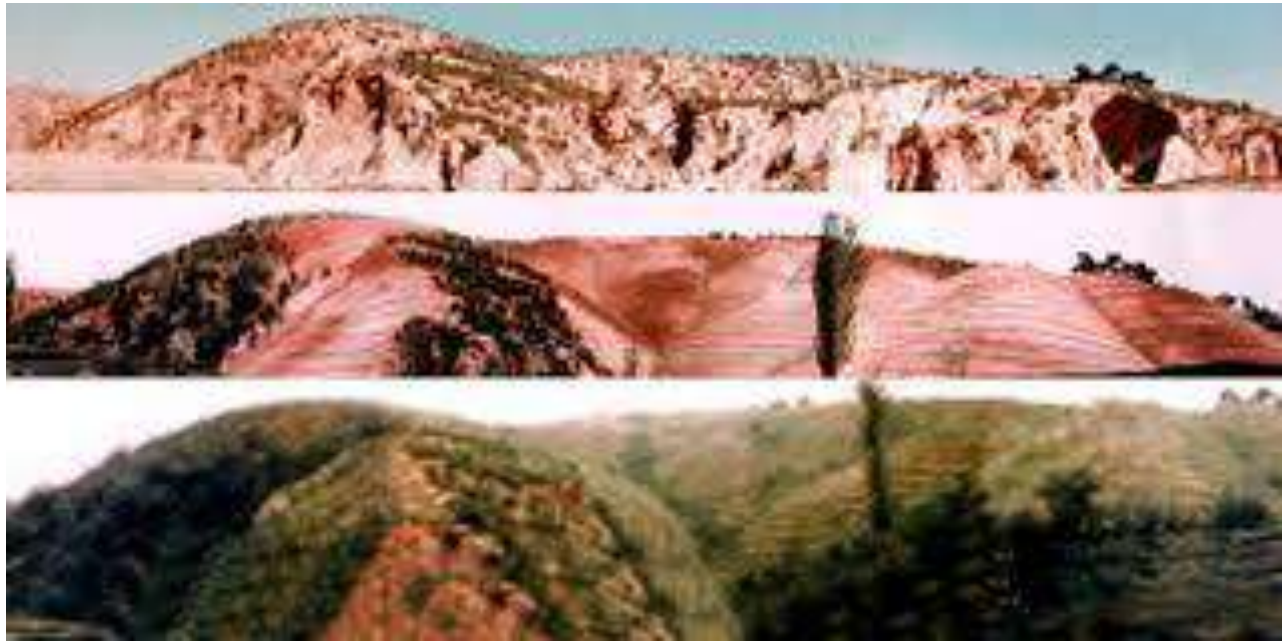


- 1985- Development of Metropolitan Quality Air Index (IMECA)
- 1988 – general law on eco balance and environ protection, application of 21 measures identified
- 1990 – "Cars don't circulate"
- 2014- Strengthening of PM10, PM2.5, CO,O_3,NO_2 and SO_2 and limits
- 2015 – New vehicle emissions verification system. Enhancement of "Programa Hoy no Circula"
- 2015 – Fines to polluting companies
- 2017 – APP "AIRE" and analytical tool to forecast quality air (up to 24hr.) and monitor air quality in real-time (AQI)
- 2018 – Join the program "Respira la vida" – To promote low carbon mobility

Source: Sistema de Monitoreo Atmosferico de Ciudad de Mexico.

Successful reforestation in South Korea

- Korea successfully reforested a completely denuded landscape after the Korean war to one of the highest levels of forest cover today – 64%
- Reforestation efforts focused on mass community tree planting, starting 1973, 11 billion trees were planted



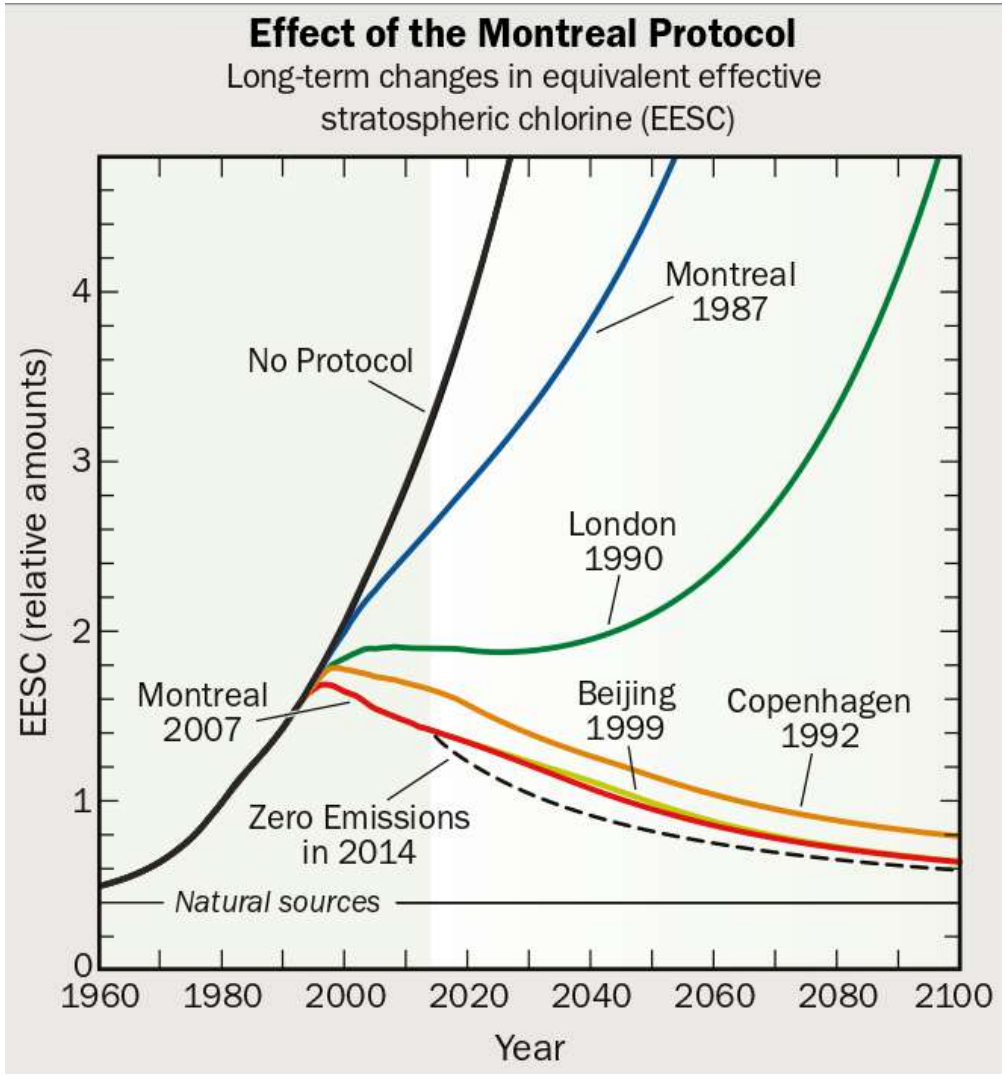
Cleaning up rivers such as the Rhine

- In 1986, a fire broke out in a production plant storage room at the pharmaceutical company Sandoz in the Swiss city of Basel. As a result, huge amounts of pesticides were released into the Upper Rhine, killing a multitude of fish and micro-organisms.
- Since then, investments in industrial and public water purification plants have amounted to 60 billion euros (over $75 billion), with local governments investing a yearly amount of one billion euros in water purification.

source: http://news.nationalgeographic.com/news/2010/09/photogalleries/100921-toxic-foam-river-brazil-science-environment-pictures/

30 years old, the Montreal protocol saved the ozone layer

- The **Protocol** now has 197 countries participating and resulted in the phase-out of 99 percent of nearly 100 ozone-depleting chemicals. It's often considered the most **successful** international environmental treaty in history.



Drive for economic growth

The Quality of Economic Growth Really Matters:

Clear Need for "Green Growth"

... a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive.

The green growth model **seeks opportunities for economic growth** that are:

- low-carbon and climate resilient
- prevent or remediate pollution
- maintain health natural ecosystems
- create green jobs
- reduce poverty
- enhance inclusion

Need for Green Growth: Air pollution

- Data from the Hyundai Research Institute indicated that air pollution costs South Korea around 4 trillion won ($3.4 billion) in 2018.
- South Korea has now committed to increasing the country's share of renewable energy from 7% to 20% by 2030 and other measures to reduce emissions.

Source: KEIA; YNA

A more sustainable basis for the economy..

"…the concepts of Circular Economy, Green Economy and Bioeconomy are joined by the common ideal to reconcile economic, environmental and social goals."

- ***Bioeconomy***: bio-based substitutes for non-renewables from agriculture and forest industry, biotechnology
- ***Circular Economy***: industrial ecology, cleaner production, materials flows
- ***Green Economy***: environmental and ecological economics, natural resources management, more socially inclusive
- ***Green Growth***: economic growth that is environmentally sustainable and socially inclusive, growth and sustainability can have mutual positive feedback

D'Amato et al. (2017) Green, circular, bio economies: a comparative analysis of sustainability avenues. Journal of Clean Production. https://doi.org/10.1016/j.jclepro.2017.09.053

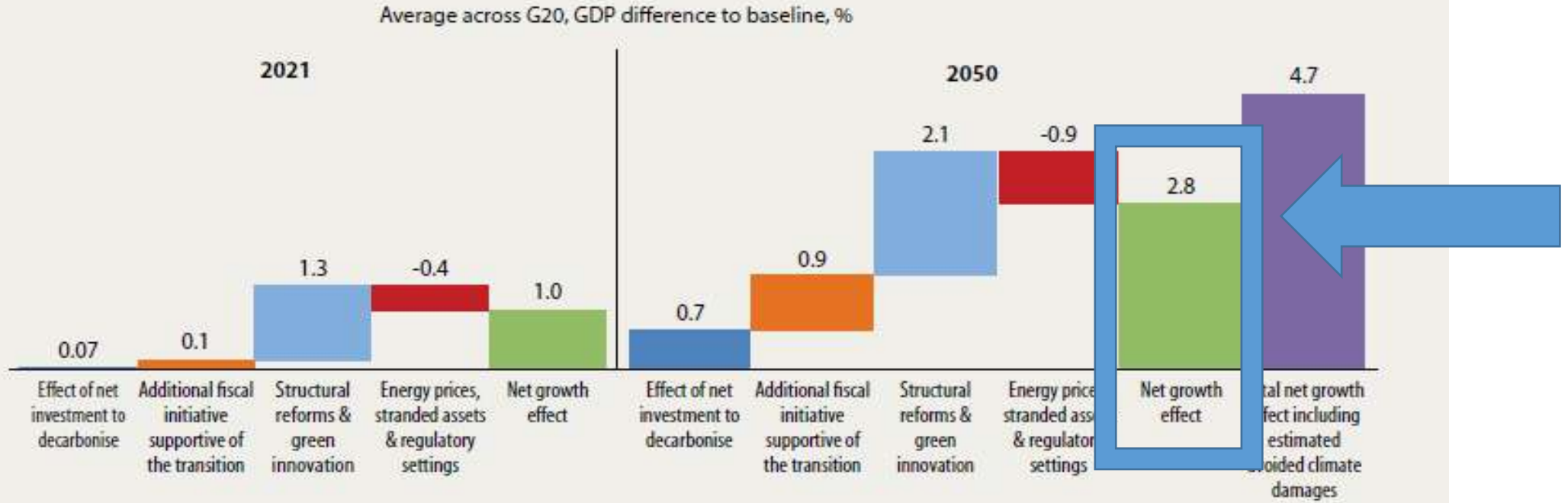
Source: The Borgen Project; & The World Bank

Numerous benefits for green growth

- Ending poverty needs more than solely economic growth, pro-poor policies are essential for growth to be sustainable.
- Creation of green jobs
- Countries have to opportunity to develop the infrastructure of the future.
- Renewable energy, energy conservation, and energy efficiency help to lower costs while also improving the environment.

Green growth approach brings positive economic growth effects in countries

Figure 1. **Positive growth effects for the G20 by combining climate action with economic reforms in a decisive transition (50% probability of achieving 2°C)***



(Source: OECD, 2017)

Collective "decisive transition" can increase the net growth effect by 2.8% on average across the G20 (when comparing a current policies trajectory to a pathway set to hold warming below 2 degree Celsius with a probability of 50%)

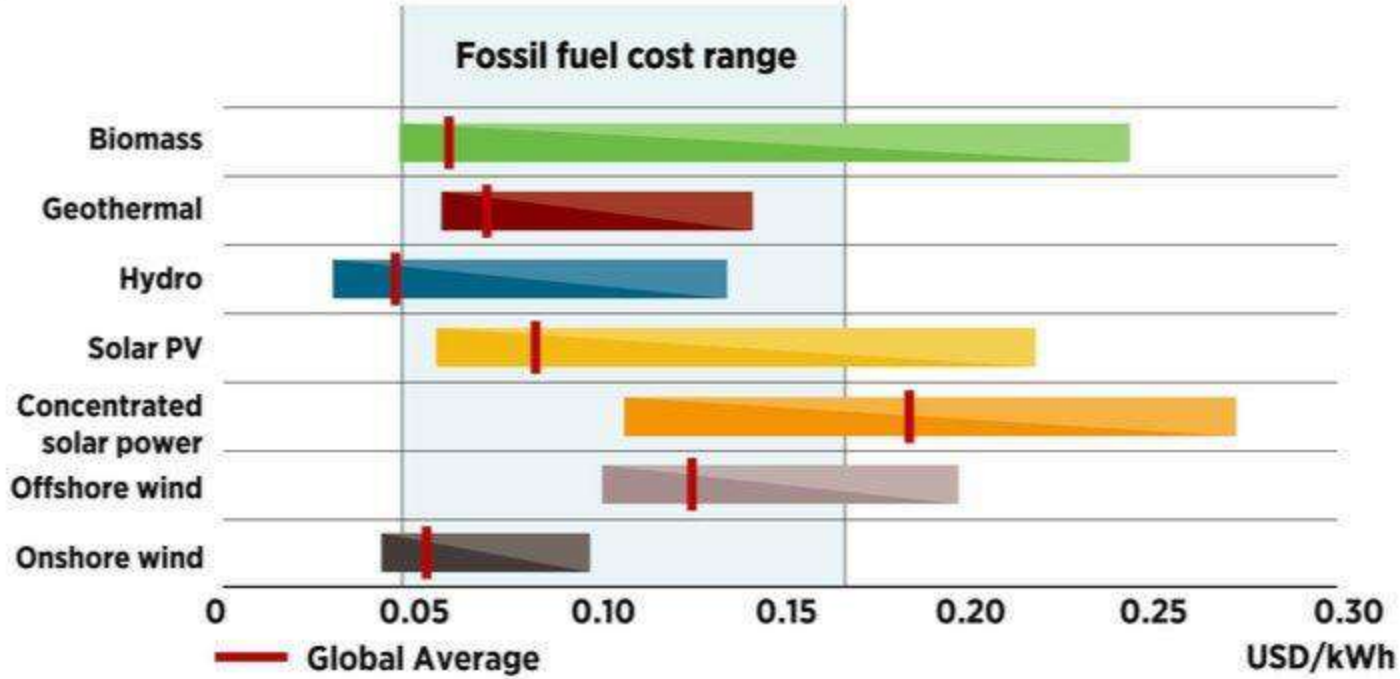
Green growth innovations

- Renewable energy
- Energy storage
- E-Mobility
- Energy efficiency: buildings
- Nature based solutions
- Regenerative & climate smart agriculture; real food
- Functional medicine

Disruption: Renewable Energy

- Investment opportunity in renewable energy.
- Renewable energy is disrupting the energy market.
- Wind and solar energy, in many regions, are now cheaper than fossil fuels.
- Costs of renewable energy technologies, generally, continuing to fall.

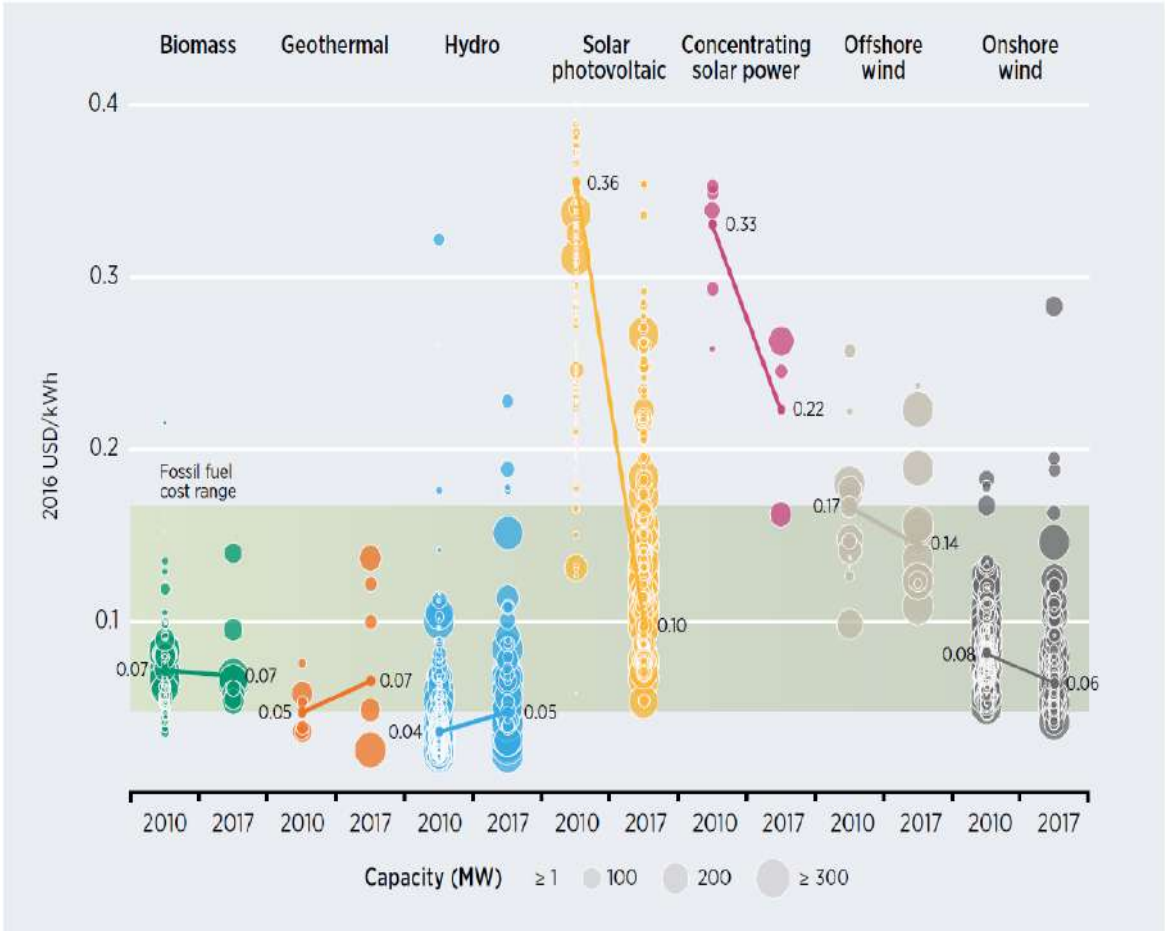
Today, the cost of electricity from renewables is cheaper or within the range of fossil fuels



Some good news, all in May 2019:

- ***IRENA*: falling renewable energy costs will drive global climate action**

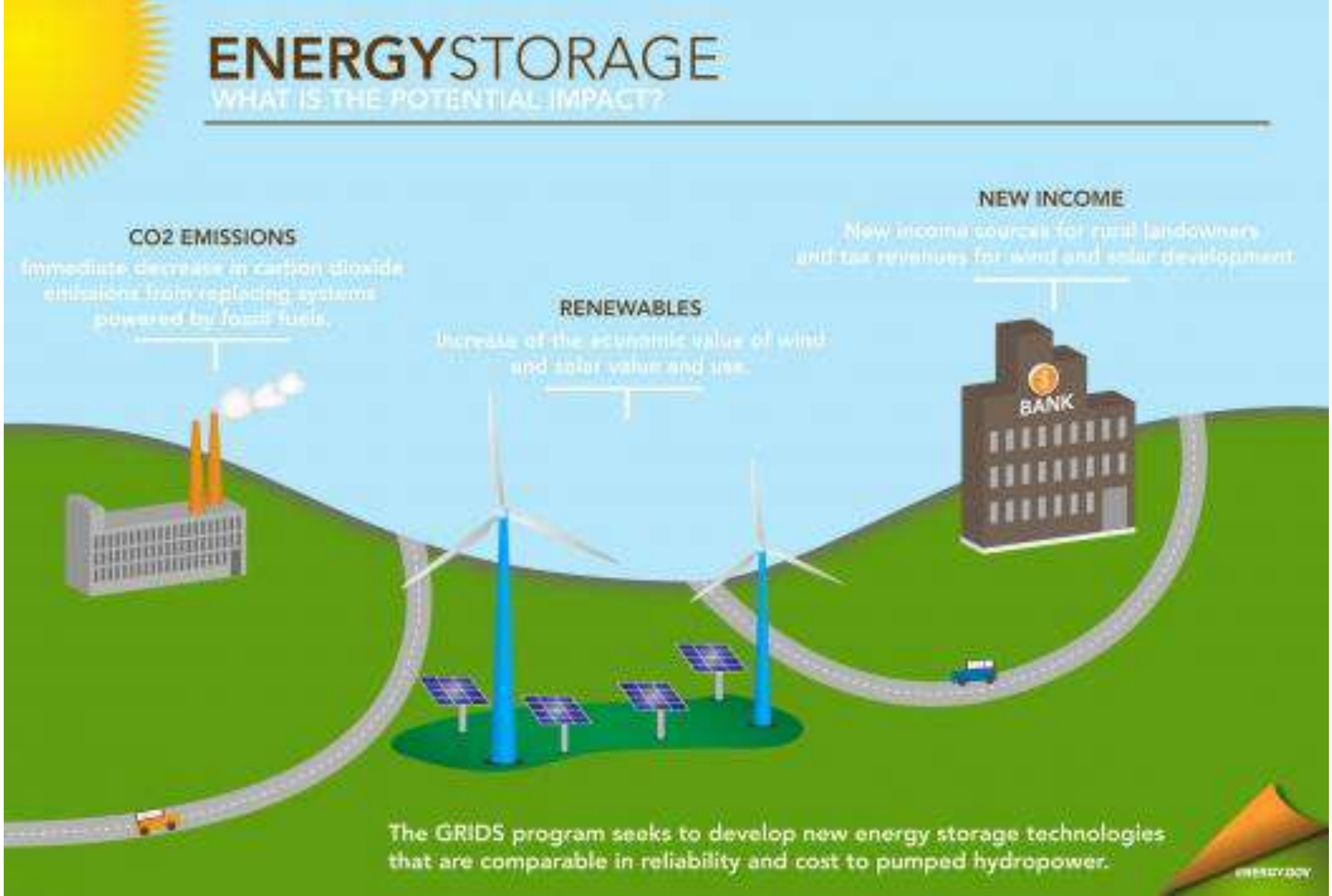
- *Longi Green Energy Technology*: record low solar energy price USD 1.7 cent per Kilowatt hour – cheapest form of energy
- *IEA*: Solar, EVs and energy storage are 3 of 45 energy technologies keeping pace with energy transition goals



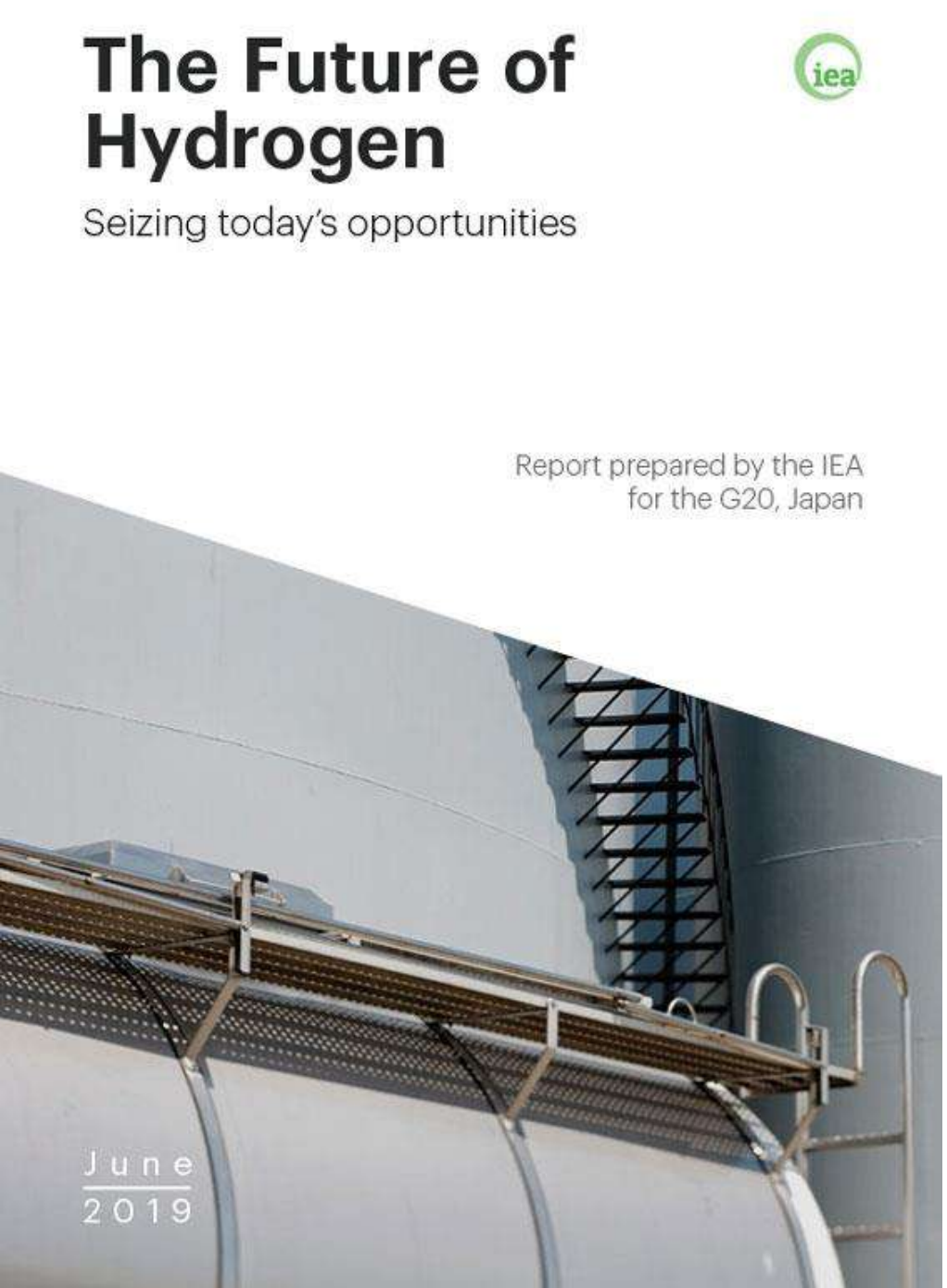
Falling costs of energy storage

- Storage prices are falling quicker than originally anticipated , partially due to the increasing demand for electric vehicles (EVs).
- With lower prices, storage will be able to play an increasingly larger role in energy markets, such as replacing conventional power generators for reliability, providing power-quality services, and supporting renewables integration.

Source: McKinsey & Company



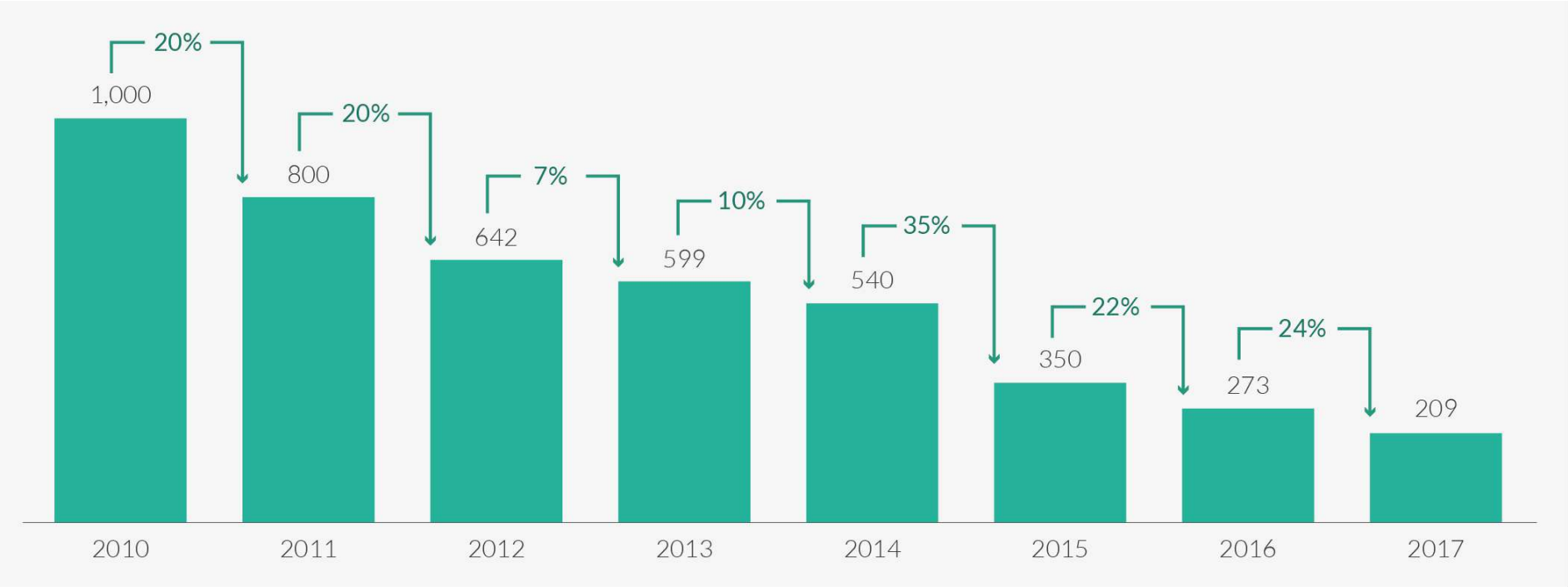
Source: energy.gov



"Hydrogen is today enjoying unprecedented momentum. The world should not miss this unique chance to make hydrogen an **important part of our clean and secure energy future**."
Fatih Birol, Executive Director, IEA

- Dedicated electricity generation from renewables or nuclear power offers an alternative to the use of grid electricity for hydrogen production.
- With declining costs for renewable electricity, in particular from solar PV and wind, interest is growing in electrolytic hydrogen

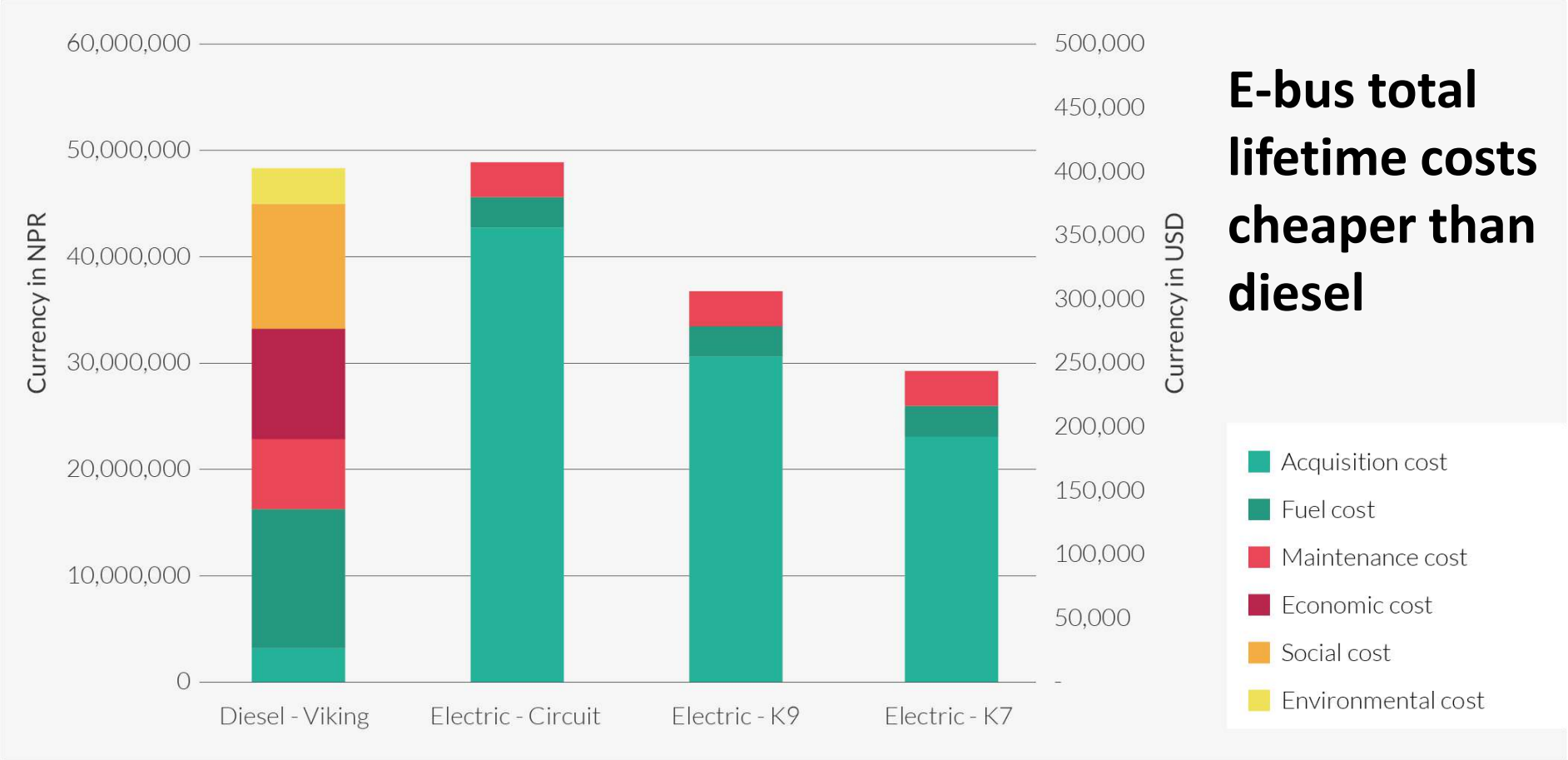
Figure 4. Lithium-ion battery pack price (USD/kWh)



RE Transformation plus plummeting battery prices can drive electrification of transportation

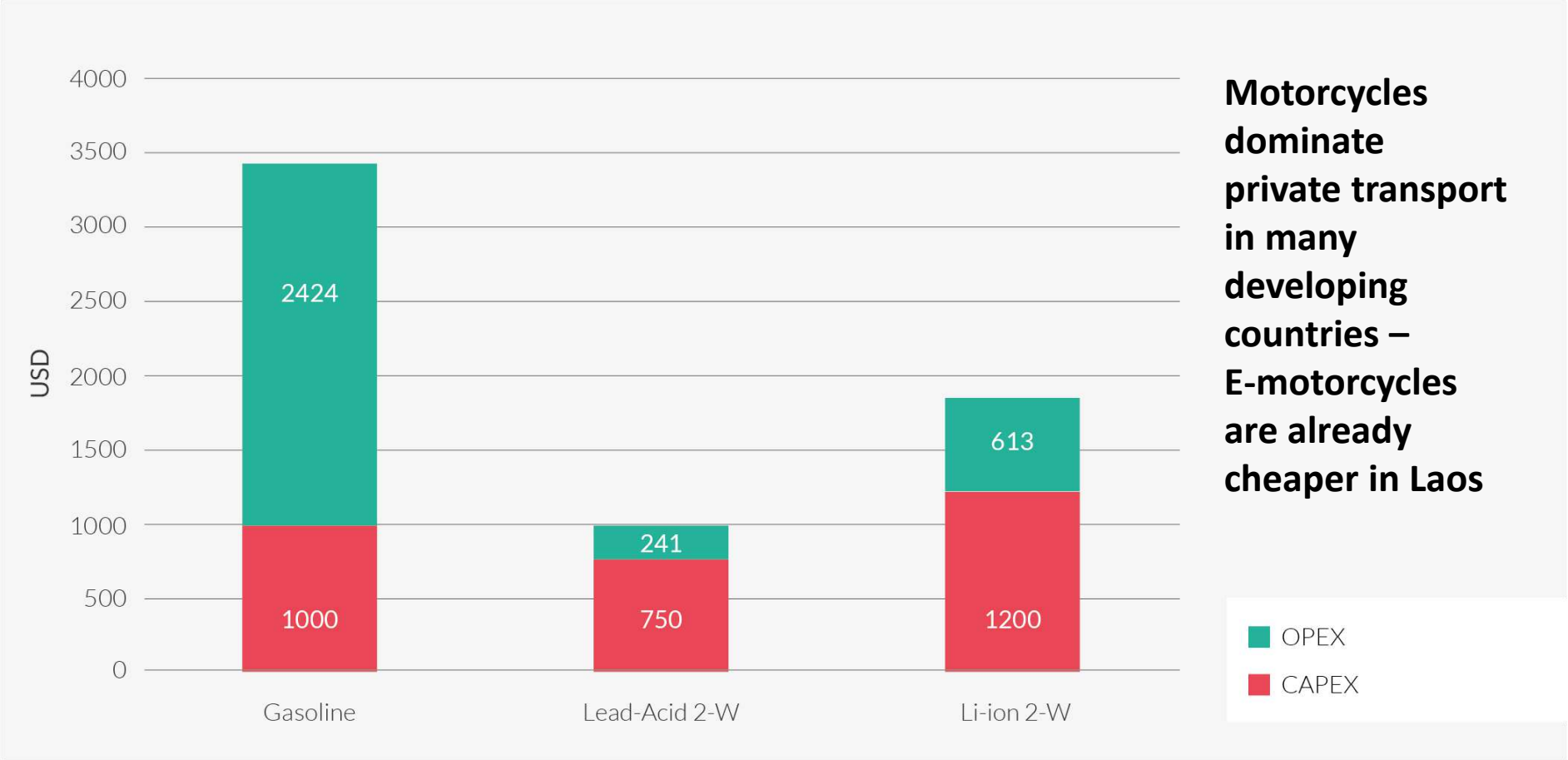
Source: Bloomberg New Energy Finance, 2018.

Figure 5. Total lifetime costs of bus options



Source: GGGI Analysis.

Figure 7. Total costs of ownership of gasoline and electric motorcycles in Laos



Source: GGGI Analysis.

Smart cooking technology

- Around 3 billion people every day cook using open fires or rudimentary cookstoves fueled by coal or solid fuels, which hinders the health of the population, air quality, and environment.
- Research estimates that the adoption of advanced biomass cookstoves could have an impact equivalent to lowering CO2 emissions by approximately 25–50%.

Source: Global Alliance for Clean Cookstoves

Energy Efficiency: Green Buildings

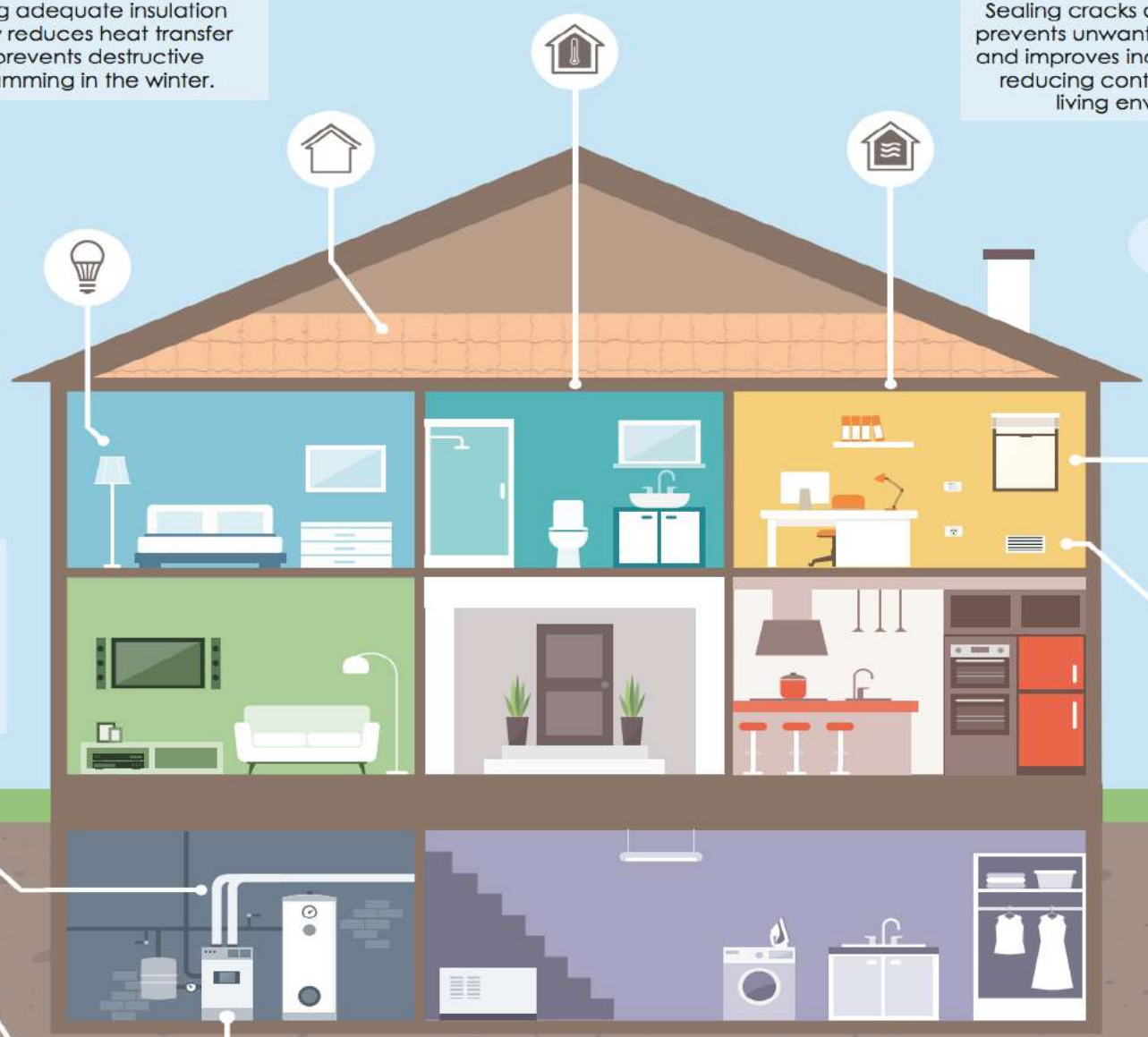
- Buildings are responsible for an estimated 32% of global energy use and almost 30% of total GHG emissions.
- Heating and cooling energy requirements can be lowered by 50-90% through retrofitted buildings.
- New, energy-efficient buildings, in many cases, use almost zero energy for heating and cooling.

THERMAL BARRIER
Installing adequate insulation on all sides of the home improves occupant comfort and reduces the heating and cooling load.

CEILING INSULATION
Installing adequate insulation properly reduces heat transfer and prevents destructive ice-damming in the winter.

AIR BARRIER
Sealing cracks and penetrations prevents unwanted air movement and improves indoor air quality by reducing contaminants in the living environment.

EFFICIENT LIGHTING
Installing LEDs or CFLs dramatically lowers electricity usage and reduces unwanted heat in the home.



EFFICIENT WINDOWS
It is critical that windows be well insulated and well-sealed to prevent unwanted heat transfer and moisture infiltration.

DUCT SEALING
Sealing all components of the HVAC system, and testing to verify, improves indoor air quality, system efficiency, and increases occupant comfort by ensuring air is evenly distributed to all rooms in the home.

MECHANICAL VENTILATION
Installing a dedicated exhaust, supply or balanced ventilation system improves indoor air quality by guaranteeing source-controlled fresh air is being supplied to the home.

HVAC SYSTEM SIZING
Properly sizing the HVAC system reduces capital costs, prolongs the life of the system, and improves system efficiency.

Created by

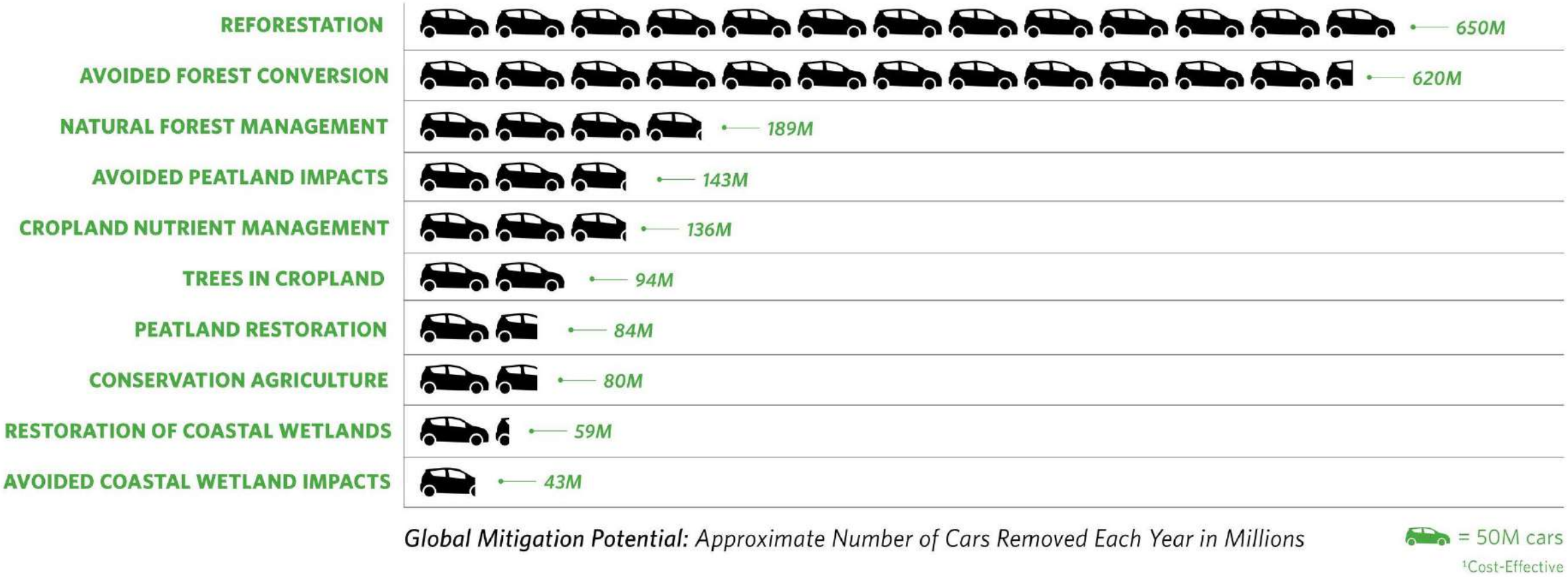
MEEA
MIDWEST ENERGY EFFICIENCY ALLIANCE

NATURAL CLIMATE SOLUTIONS

The Nature Conservancy

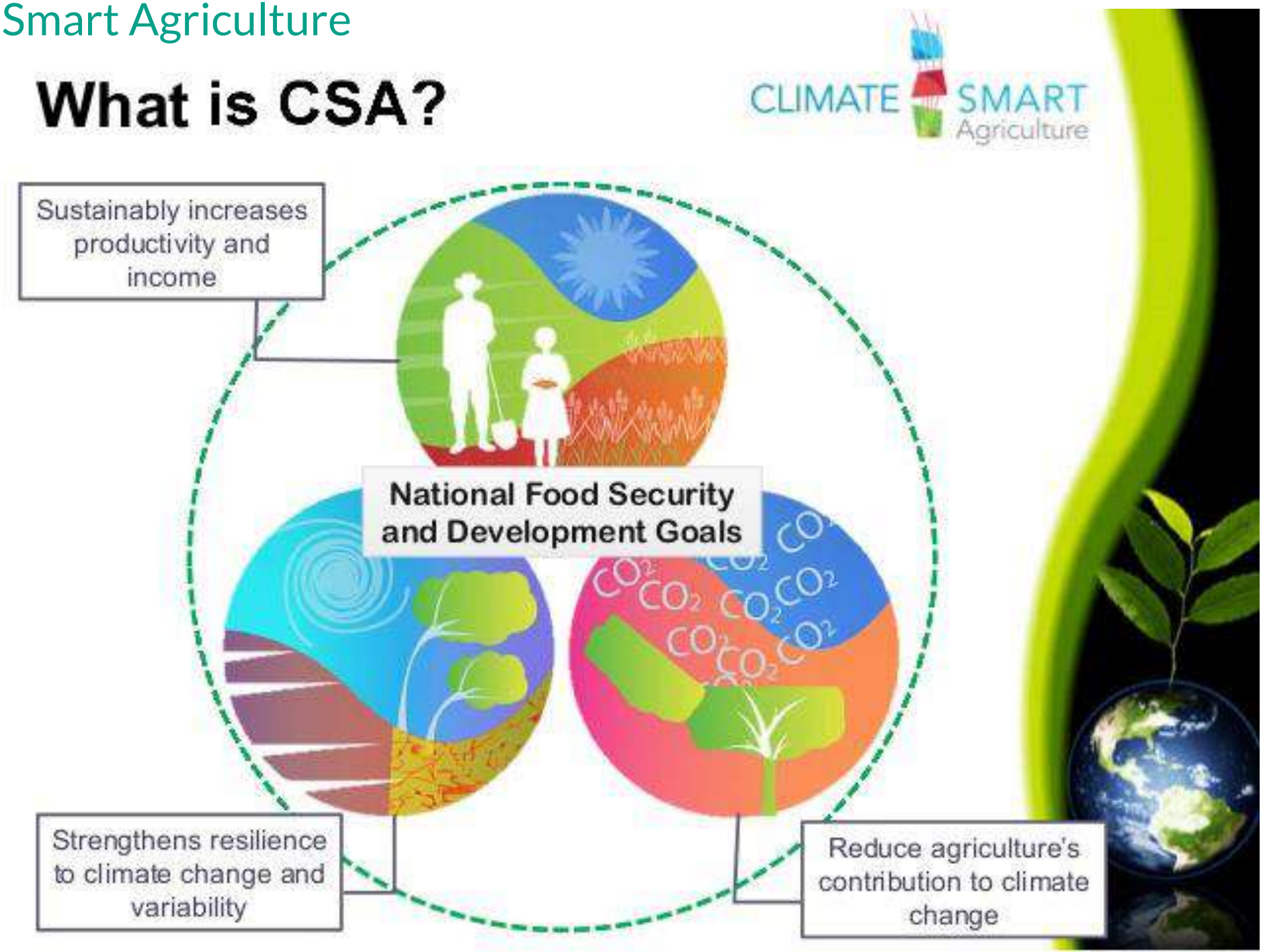
TOP 10 MITIGATION PATHWAYS[1] WITH CO-BENEFITS

Natural Climate Solutions have the same impact on emissions as taking millions of cars off the road



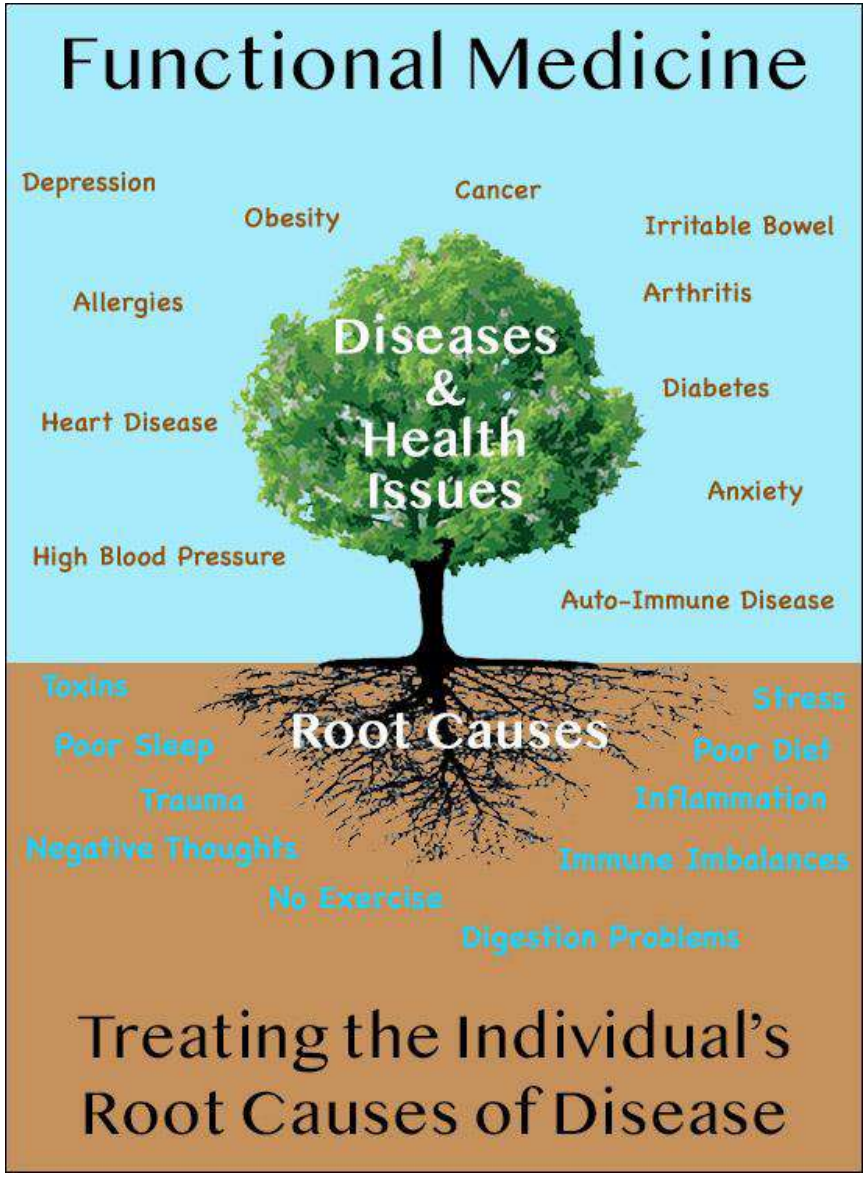
Bronson W. Griscom el al., "Natural climate solutions," *PNAS* (2017). www.pnas.org/cgi/doi/10.1073/pnas.1710465114

Climate Smart Agriculture



Functional Medicine

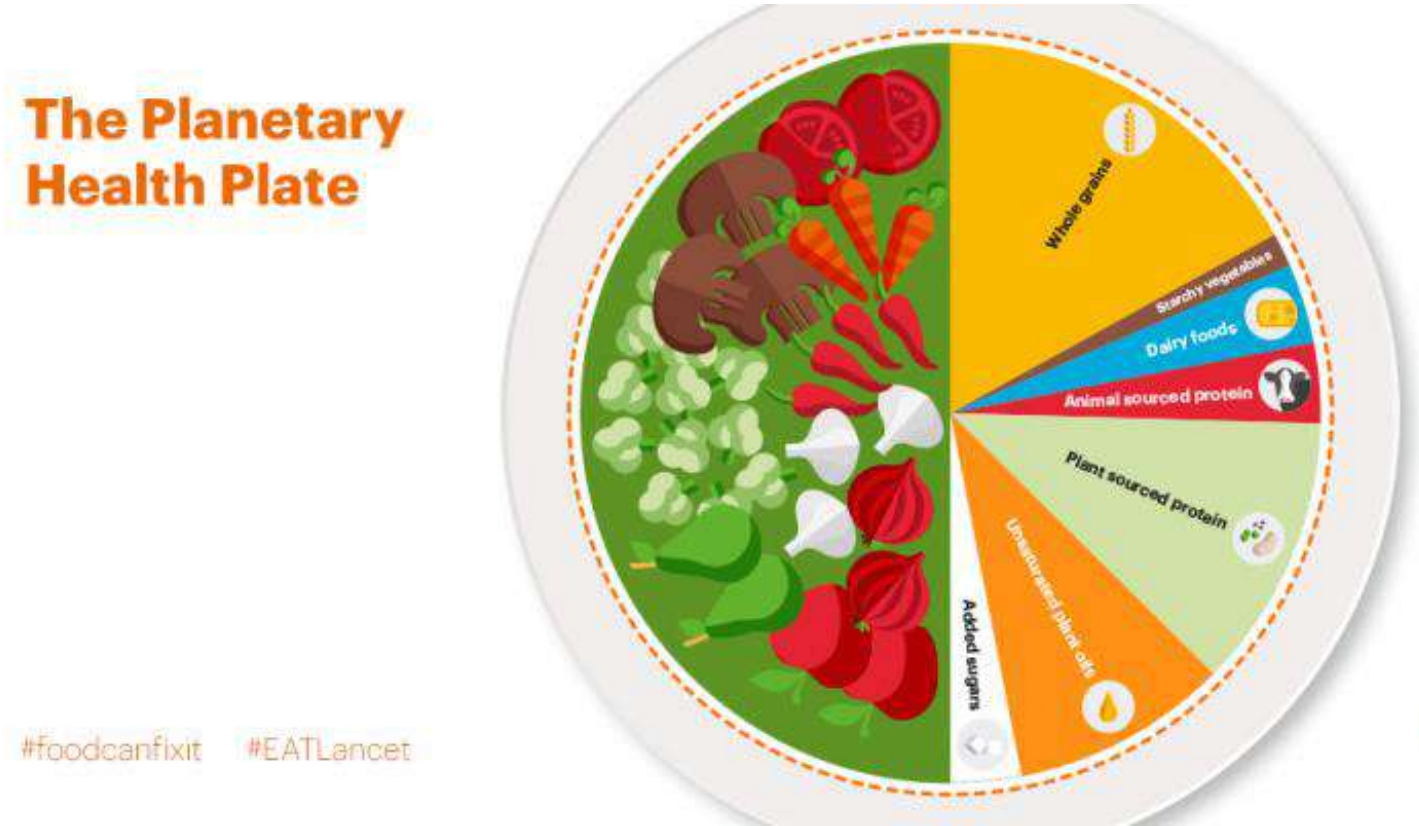
- **Functional Medicine** is a systems biology–based approach that focuses on identifying and addressing the root cause of disease. Each symptom or differential diagnosis may be one of many contributing to an individual's illness.
- Increasing attention for the human micro-biome: The **microbiome** is **defined** as the collective genomes of the microbes (composed of bacteria, bacteriophage, fungi, protozoa and viruses) that live inside and on the **human** body. We have about 10 times as many microbial cells as **human** cells.



The EAT-Lancet Commission on Food, Planet, Health

- The **EAT-Lancet report** is the first full scientific review of what constitutes a healthy diet from a sustainable food system, and which actions can support and speed up food system transformation.

"Eat real food, not too much, mostly plants"



The green transition

What will it take?

Public awareness

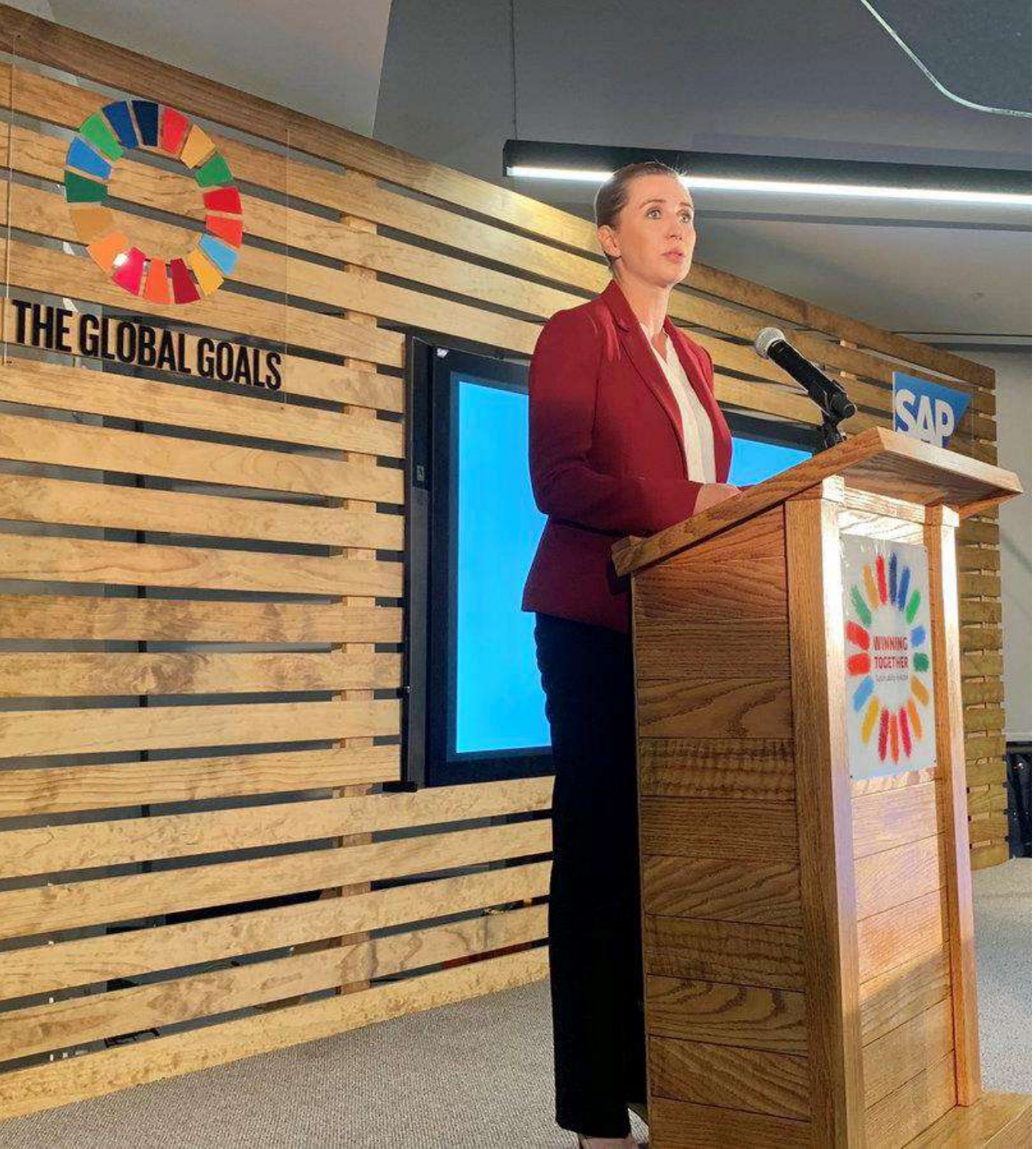
Global School Climate Strike

Doctors protesting in support of Extinction Rebellion in London to highlight deaths caused by air pollution. Photograph: Dominic Lipinski/PA

Leadership


Speech 10 of
Jason Walls
@Jasonwalls92
Green MP @_chloeswarbrick was heckled by a National MP during her speech on the Zero Carbon Bill.
She fired back with "okay boomer" but the captions on Parliament TV clearly have not yet got the memo on millennial slang:
TE CHANGE RESPONSE (ZERO CARBON) AMENDMENT BIL


"WE WILL REDUCE GREENHOUSE GAS EMISSIONS BY 70% IN 2030. AND DANISH BUSINESSES AND INDUSTRY SEE THE POTENTIAL."
METTE FREDERIKSEN
PRIME MINISTER OF DENMARK



Leadership: Government

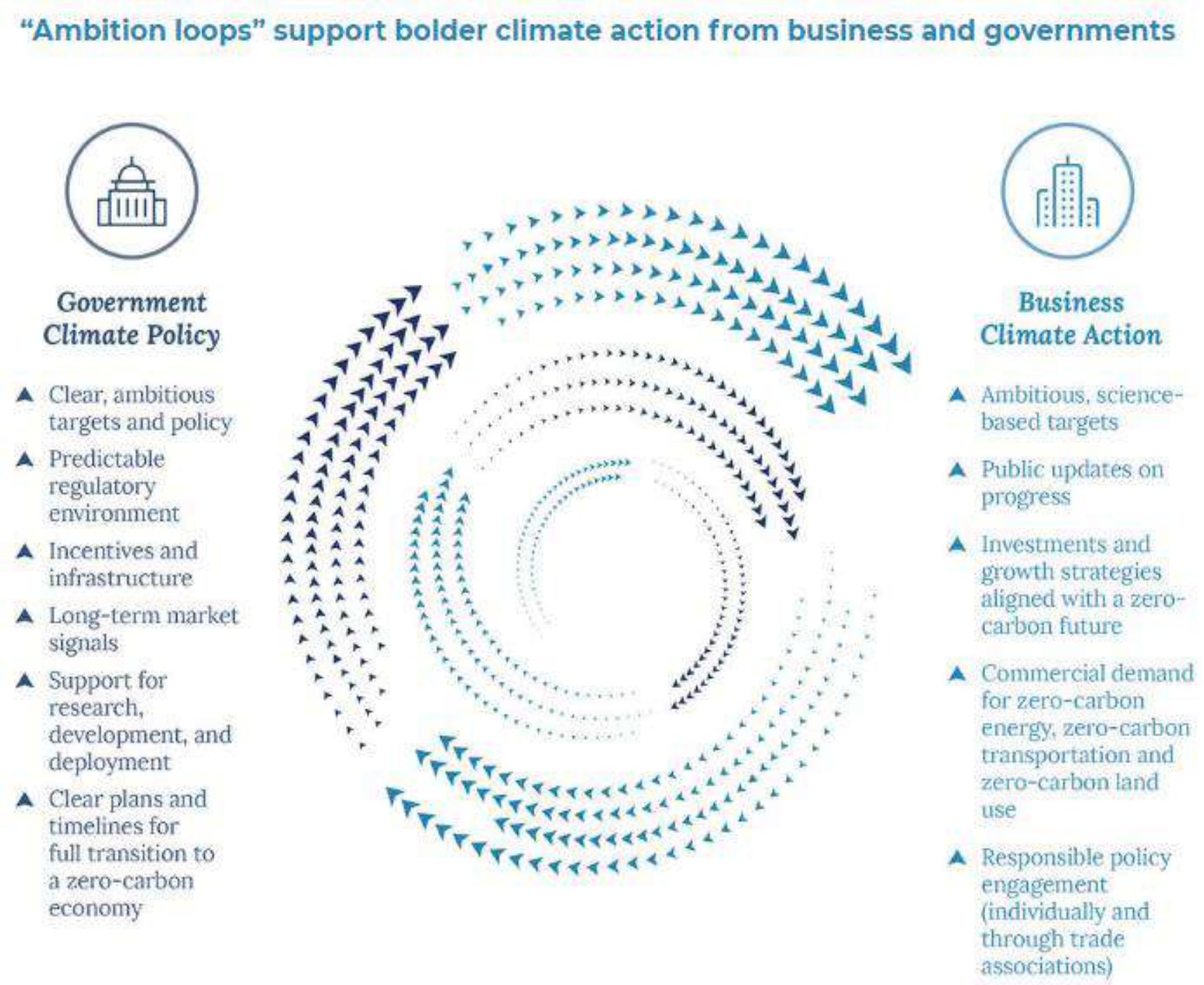
- Strong government commitment is essential to solving the climate emergency.
- Danish Prime Minister Mette Frederiksen pledged to work to achieve Denmark's ambitious 70% cut in CO2 emissions by 2030.
- Ambitious targets and legislation from governments to address climate change gives businesses greater confidence that investing in a zero-carbon future is a good investment decision.

Source: World Resources Institute

Private Sector Involvement:

- Innovation in green technologies and air quality solutions.
- Carbon pricing: Existing market schemes should be both strengthened and extended to include more economic sectors.
- Encourage asset managers, asset owners, banks, and insurers to decarbonize the economy and account for the true risks posed by climate change
- New business and investment opportunities with the transition to a low-carbon economy.
- UN Global Compact reports that 1,300 companies worldwide have already incorporated a carbon price into their operations.

Need for strong leadership between the public and private sectors to increase collaboration

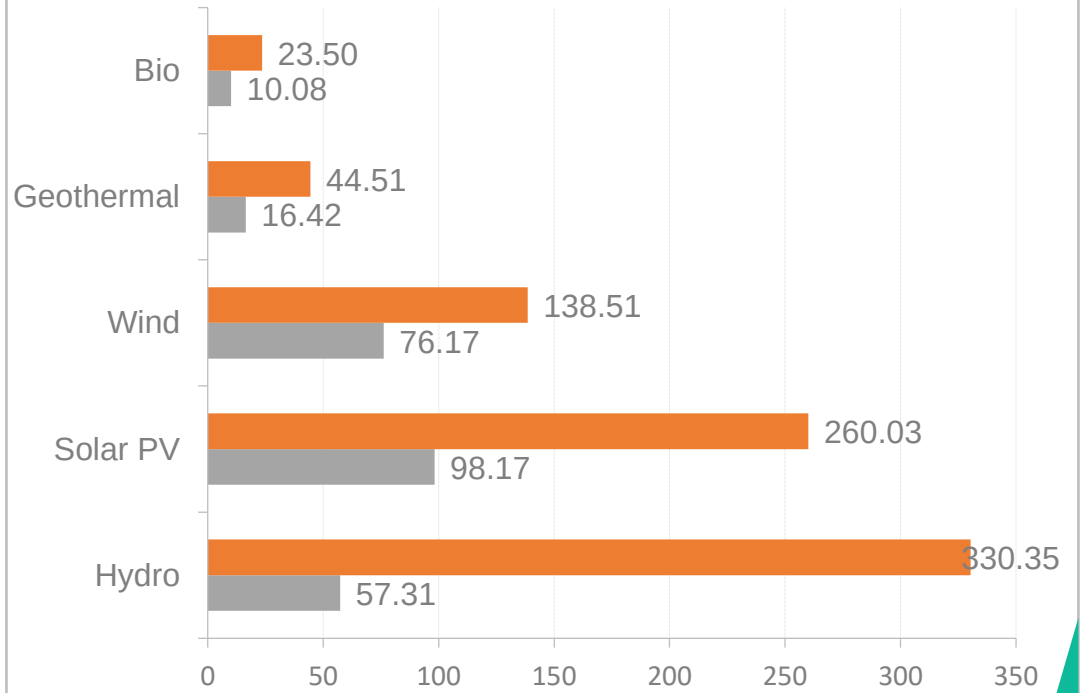


Graphic Source: World Resources Institute 2019

Finance

Developing bankable projects in developing countries is key for the energy transition

RE investment needs by tech. in developing countries[1] (USD bn)



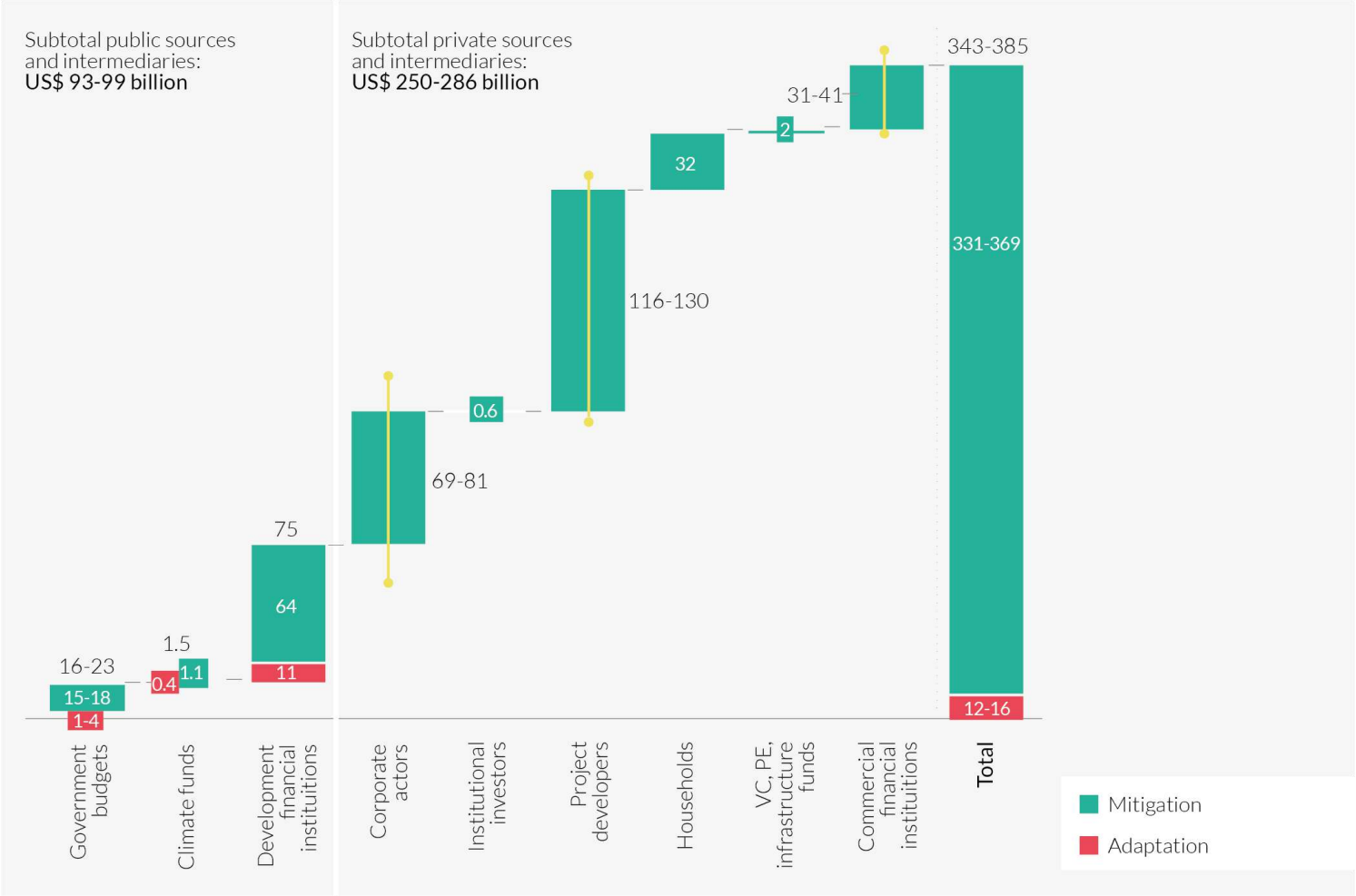
Financing the energy transition

- 60-70% of the required investment in the energy sector needs to be done in developing countries
- The total estimated **investment required for developing countries by 2030 ranges US$258-797 billion**[1]
- **Top 5 countries**:
  - India (US$140-292 billion)
  - Mexico (US$29-65 billion)
  - Indonesia (US$18-53 billion)
  - Ethiopia (US$15-92 billion)
  - Morocco (US$11-24 billion)

1. Calculation based on 27 selected developing countries

Source: Meeting Conditional Targets in NDCs of Developing Countries: Renewable Energy Targets and Required Investment of GGGI Member and Partner Countries, 2018

Figure 13. Climate change mitigation and adaptation investment by source of finance in 2011



Source: World Economic Forum, 2019.

GGGI

Intergovernmental organization established to accelerate the green transition

GGGI Signing Ceremony at Rio+20

The Ceremony for Signing of Agreement on the Establishment of GGGI was held on Wednesday, June 20 in 2012 on the occasion of Rio+20, United Nations Conference on Sustainable Development in Rio de Janeiro, Brazil.

Sixteen* industrialized, emerging economies and developing countries joined the ceremony to sign the Establishment Agreement that converted GGGI into an international organization.

** **Australia, Cambodia, Costa Rica, Denmark, Ethiopia, Guyana, Kiribati, Republic of Korea, Norway, Papua New Guinea, Paraguay, the Philippines, Qatar, the UAE, the United Kingdom, and Vietnam***

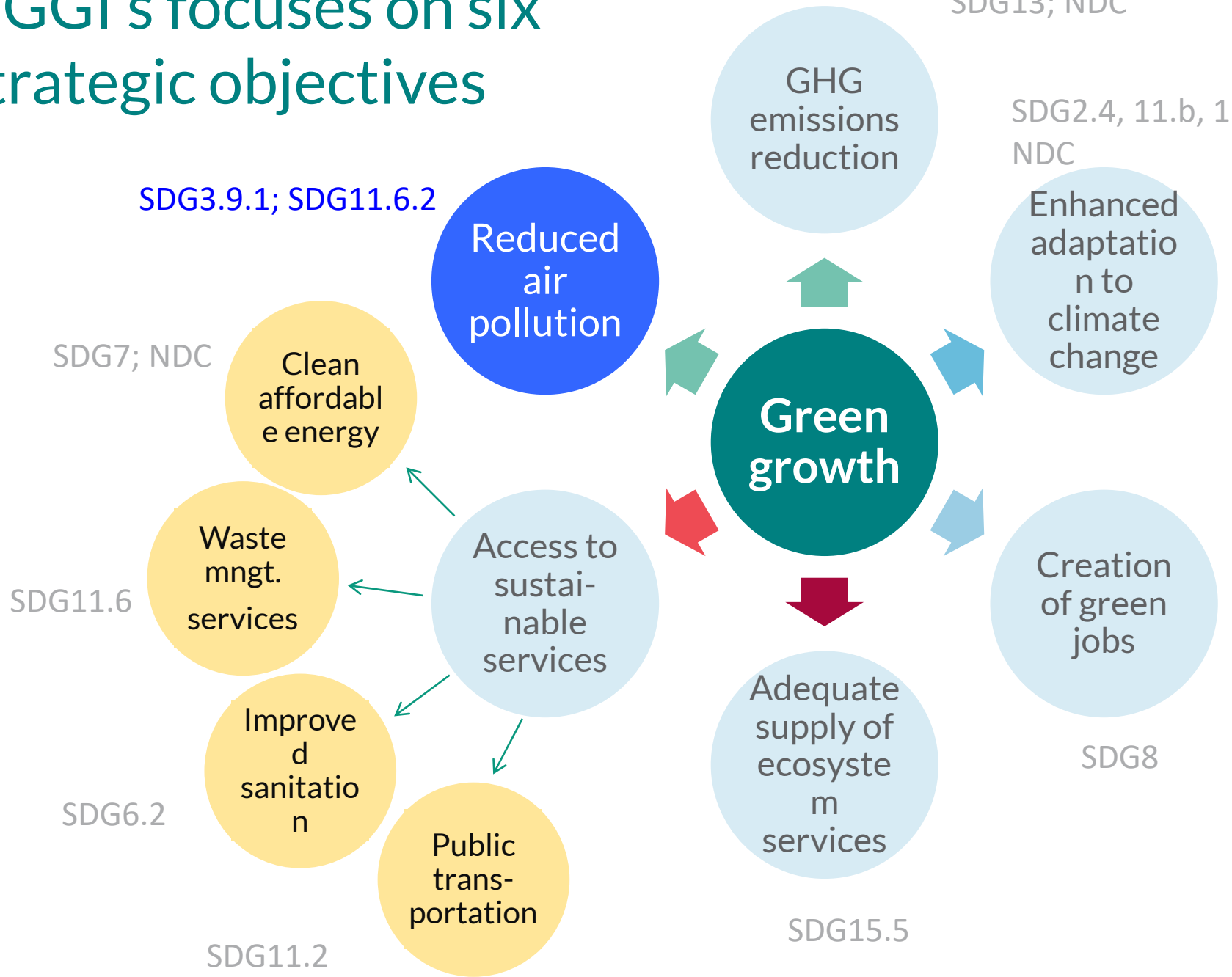
The purpose of the Signing Ceremony was to prepare the legal framework for GGGI's conversion into an international organization. The signatories became the founding Members of GGGI.

GGGI: supports Member countries to transform their economy to a green-growth pathway and achieve NDCs and SDGs

- 300 staff
- $55M annual budget
- 36 Member countries
- Another 20+ becoming Members
- Projects in 4 thematic areas

Energy
Water
Sustainable Landscapes
Green Cities

GGGI's focuses on six strategic objectives



(Luo et al, 2014)

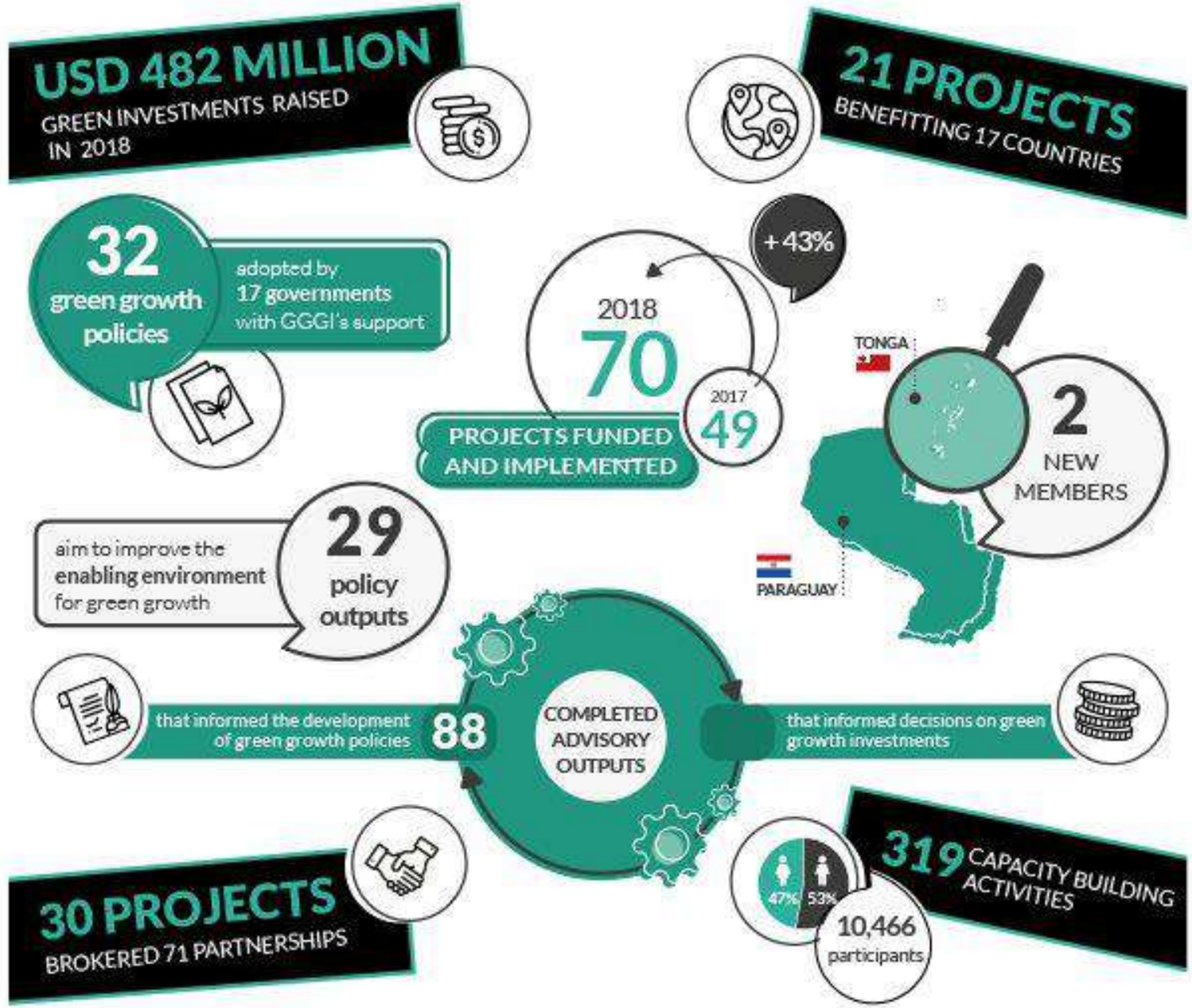
GGGI's value chain based delivery model enables a systematic approach for Green Growth

- Moving towards securing investments for implementation
- Replication of successful models at national, provincial and local level (e.g. district, municipalities) as well as global level
- Thematic areas:

Sustainable Energy | Water & Sanitation | Sustainable Landscapes | Green Cities

GGGI

2018 RESULTS



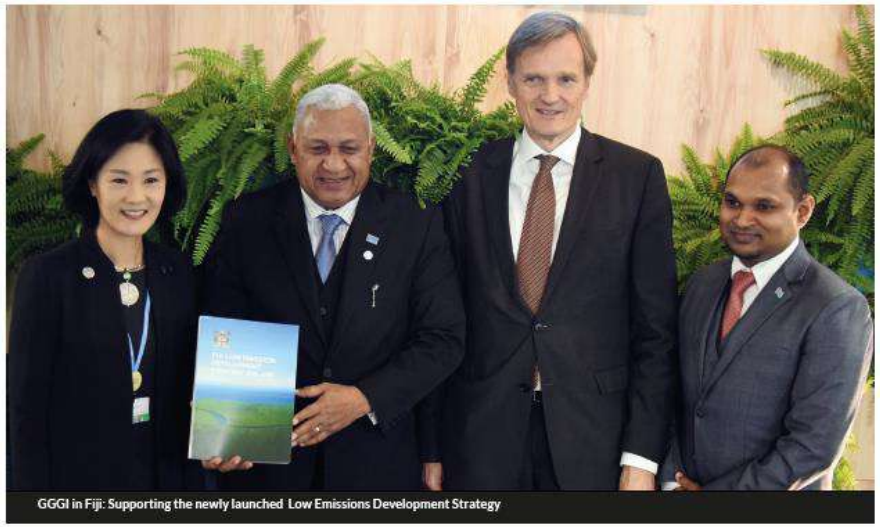
Mexico: Sonora State Adopts Landmark Green Growth Strategy

GGGI in Mexico: Promoting green growth and developing an innovative, resilient, low-carbon economy

The Sonora State Green Growth Strategy was adopted in 2018. Developed by GGGI at the Mexican government's request and with regular civil society participation, the Green Growth Strategy (GGS) is the first of its kind in Mexico.

The strategy aims to build an innovative, resilient, low-carbon economy by working across a range of strategic areas, including renewable energy, energy efficiency, sustainable mobility, water management, and sustainable rural and urban development.

Fiji: Fiji Continues to Lead International Climate Action with Launch of Comprehensive Low Emissions Development Strategy



GGGI in Fiji: Supporting the newly launched Low Emissions Development Strategy

Fiji has adopted a detailed development plan that could see the Pacific Island country soak up more carbon than it emits by 2050. Fiji's Low Emissions Development Strategy was launched at the UN climate conference held in December 2018 in Katowice, Poland.

Rwanda: Rwanda Green Fund – Mobilizing Climate Finance and Scaling up Green Growth

In March 2018, the Government of Rwanda received a grant of USD 32.8 million from the Green Climate Fund to strengthen climate resilience in rural communities in northern Rwanda. This was just the latest example of the Rwanda Green Fund demonstrating its capacity and leadership in mobilizing finance for green growth and climate action.

GGGI has supported FONERWA through capacity development and the elaboration of a multi-year business and sustainability plan. GGGI has also assisted the fund to prepare a number of successful funding proposals.

Mongolia: Raising Green Growth Awareness among Youth in Mongolia

In 2018, a collection of short animated videos brought Mongolia's green growth plans directly to new audiences and advocated for environmentally-friendly policies and practices.

GGGI played a leading role in preparing and producing the videos for the government, as part of its support to Mongolia in promoting the mainstreaming of green growth among government institutions and the general public.

UAE: Assessing Climate Risks as a Key Step toward Resilience in the UAE

GGGI in UAE: Responding to climate change through the National Climate Change Plan

UAE has been achieving economic success, overcoming the challenges of a harsh desert environment with scarce water resources and less arable land. However, the increasing impacts of climate change may impede progress and thus require proactive approaches to enhance resilience while tapping potential opportunities. In response to this challenge, the UAE developed the National Climate Change Plan through the support of GGGI. One of the plan's main pillars is an adaptation program that aims to conduct climate risks assessments in key sectors as the basis for implementing adaptation measures.

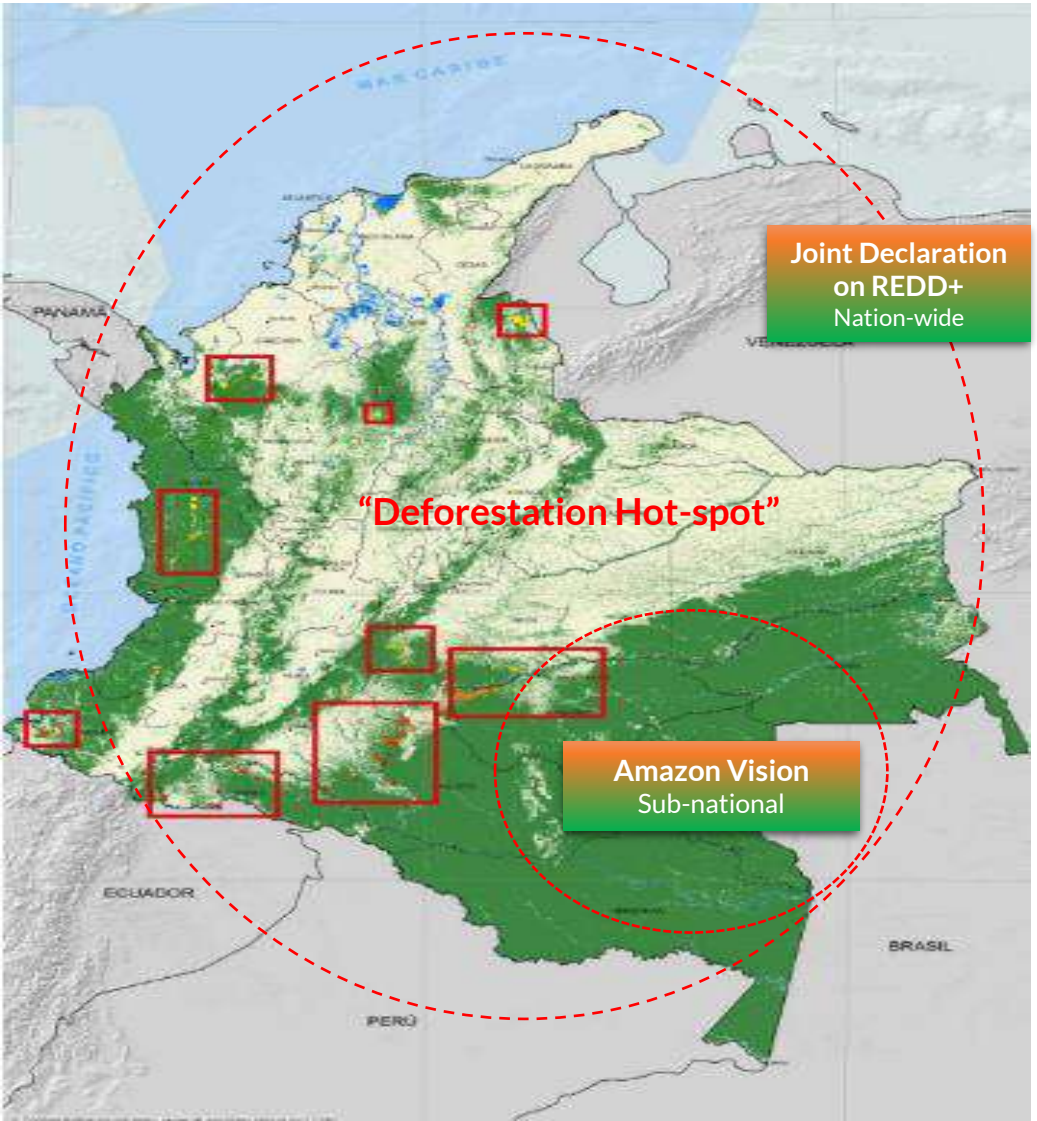
Vanuatu: Financing 100% Renewable Energy in Vanuatu

GGGI in Vanuatu: Planning the transition to clean energy

As Vanuatu's government looks to improve their electricity supply while following a path of sustainable, environmentally-friendly growth, GGGI is playing a key role in securing investment for the Pacific Island country to achieve its development goals.

GGGI, which developed parts of the National Energy Road Map, covering energy efficiency and green growth — has helped create the National Green Energy Fund to mobilize finance for investment.

Colombia – Accelerated Amazon Vision and Joint Declaration on REDD+ with int'l partners



Amazon Vision Program – up to USD 125M over 5 years

Subnational Results-Based Payments Program

- Amazon region: 45.8M ha (size of Germany), 40% territory of country, 67% of forest totalling 39M ha, with high-level biodiversity, more than 50 indigenous group, with1.2M population
- 5 strategic interventions: forest governance; sustainable sectoral dev't; agro-environment; indigenous people; enabling conditions (i.e. forest carbon accounting system)
- Impact: e.g. USD 12M invested in Agro-environment pillar, 2,707 families benefited; 234,633 ha under conservation pacts, which preserve natural species.

Joint Declaration on REDD+ & Sustainable Rural Dev't - Up to USD 178M by 2020, plus USD 250M (2020-2025)

Nationwide Results-Based Payments Program

- Modality 1 (Policy milestones) & Modality 2 (Result-based payment). USD $15M disbursed in 2017 by Norway to Sustainable Colombia Fund
- On April 10, 2018, Norway committed additional USD 250M, building on current achievements

Sustainable Forest Landscapes: Highlights from Myanmar

Mangrove Landscape Restoration

1. Multi-stakeholder governance and policy framework
   - Multi-stakeholder platform created/strengthened and equipped with a 3Returns tool
   - Inclusive policy on forest carbon rights and benefit sharing mechanism
   - Framework for carbon trading decision-making at national level

2. Bio-economy business models and investment project design
   - Capacity of multi-stakeholder platform and targeted project owners strengthened
   - Pre-feasibility studies for blue carbon projects

3. Blended finance to improve access to finance
   - Financial instrument to support SMEs in key value chains
   - A blended finance vehicle for risk sharing for mangrove restoration

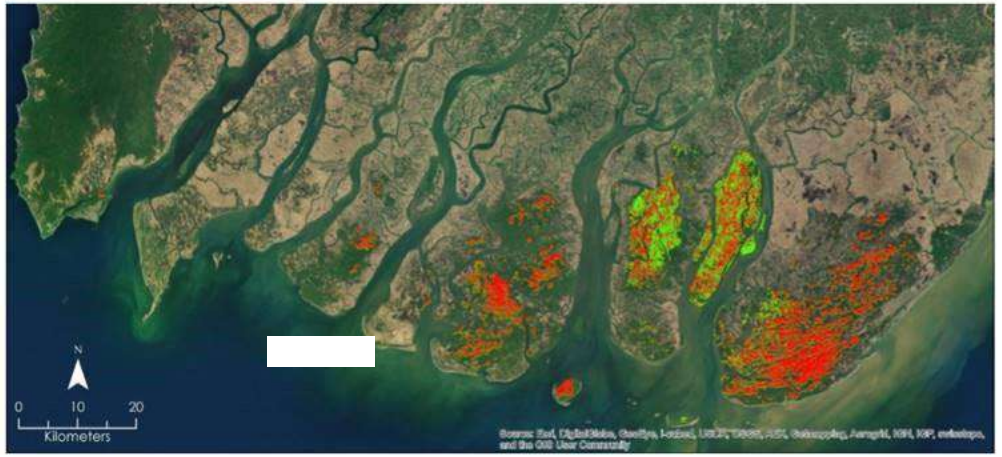


Figure 4: The Rakhine and Ayeyarwardy regions are forecasted to undergo disastrous deforestation from 2013-2030. Many of the smaller fragmented stands will not survive and this loss will put heavy stress on both local communities and the environment if not managed sustainably.

Green Employment

Country examples

- In **Fiji**, a recent GGGI study estimated that jobs generated under a very high ambitious scenario could create 2.1 and 3.2 times more jobs by 2030 and 2050, respectively—mainly in ***electricity, transport, and forestry*** —compared to BAU.

- In **Uganda**, according to EPRC/GGGI/NCE (2016), the green growth transition could generate 1.3 million jobs by 2020, rising to around 4 million in 2040, compared to BAU. ***Sustainable agriculture*** offer the highest potential.

- In **Cambodia**, a recent GGGI analysis estimated that greening key industrial sectors of Cambodia—***food processing, bricks, garments, and electronics manufacturing***—through deploying energy, water, and other efficiency technologies, would provide an additional 512,000 jobs while reducing GHG emissions by 3.37 million tons relative to BAU by 2030.

Green Employment

Agriculture and Forestry are Key Sectors in the Green Growth Transition

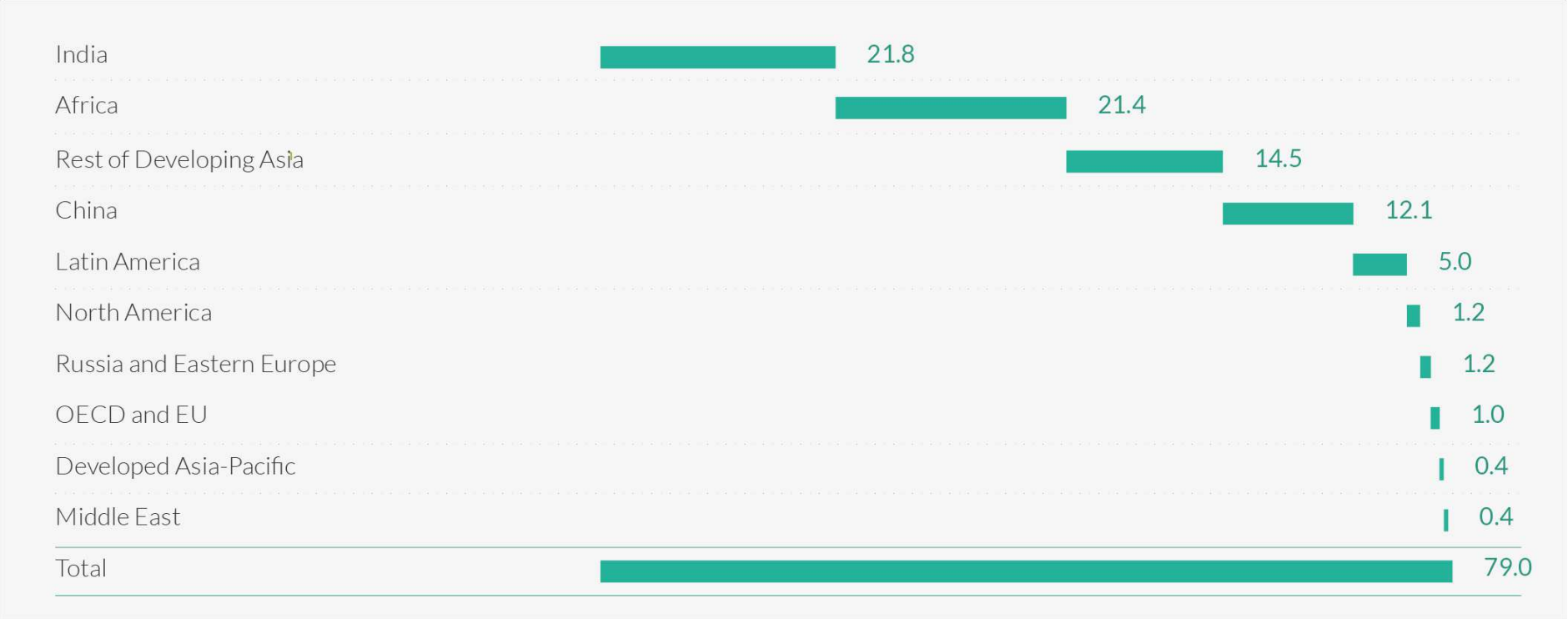


Figure 12. Employment opportunities in sustainable agriculture and land use by 2030

Source: Business Sustainable Development Commission and Alpha Beta, 2017.

Green and Climate Finance

- US$482 million in 2018, plus US$ 525 million in 2017
- ***GGGI mobilized green and climate finance commitments of over US$1 billion in 2017-18***
- Still a very short track record – to mature and scale up!
- Strong GCF strategic partnership: ***focus on direct access for members***
  - 24 countries elected GGGI as delivery partner,
  - 12 readiness projects awarded
  - 12 more in pipeline plus 5 NAPs
  - 6 full proposals submitted to GCF for about $250M in climate finance
- Growing private sector engagement (15 project examples in 2018)

Jordan : Amman Bus Rapid Transit (BRT)

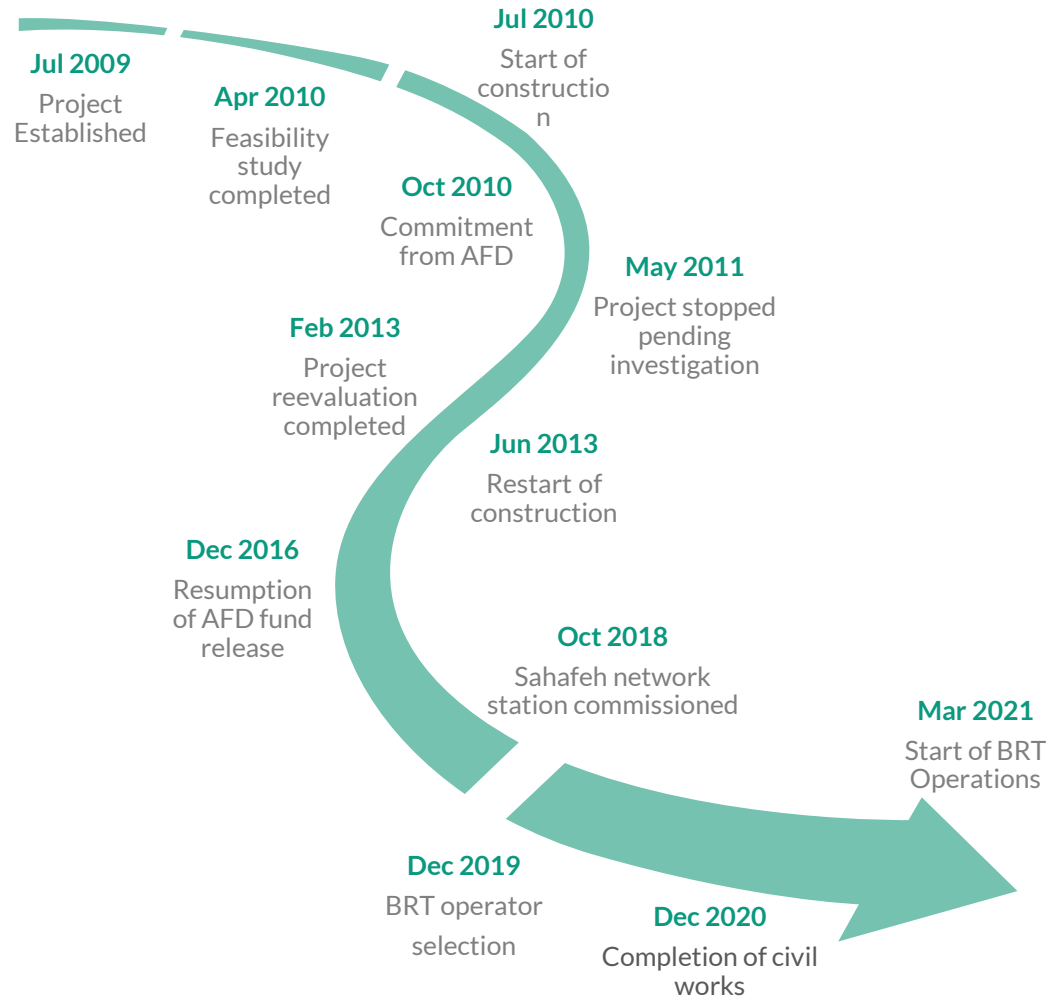
Project Overview

The Bus Rapid Transit (BRT) is the first public transport project that includes the development of infrastructure and transport operating system in Amman.

BRT Components

- 32 km dedicated bus lanes separated from other regular traffic with lane barriers serving, sidewalks, mixed-traffic lanes and non-motorized lanes.
- As per GGGI proposal, a critical section of the BRT system is expected to run on a fully electric bus system.
- 60 modern buses with capacity of 120 passengers per bus.
- High quality stations with park-n-ride facilities
- Integrated fare collection system

Project Timeline



Nepal's Success Story

Nepal: Advancing Green Growth in Nepal through Electric Mobility

Nepal's new electric buses will help the government fulfill its commitment under the country's Nationally Determined Contribution, which sets targets for air quality and electric vehicle adoption.

A collaborative effort by the Ministry of Forests and Environment, Ministry of Physical Infrastructure and Transport, and GGGI led to the launching of Nepal's first National Action Plan for Electric Mobility—a road map for achieving the NDC targets.

GGGI in Nepal: Integrating the first set of electric buses in Kathmandu for eco-mobility © BYD

Rwanda's Success Story

Rwanda: Green Certification of the New Bugesera International Airport

The Government of Rwanda (GoR) through the Ministry of Infrastructure (MININFRA) and GGGI have a standing Memorandum of Understanding (MoU) to advocate sustainability and provide support to the enable a sustainable built environment in Rwanda. GGGI has been supporting GoR in green cities development focusing in Kigali and the six secondary cities.

Along these lines, GGGI in collaboration with MINIFRA embarked on Green Certification of the New Bugesera International Airport. This project is looking into several measures to demonstrate resource efficiency and the overall sustainability of the airport infrastructure when completed.

Rwanda's Success Story

Rwanda: Green Building Minimum Compliance System

The building sector is a key economic driver. Green buildings offer an opportunity for GHG emission reduction, job creation, resource efficiency, improved productivity to building occupants, and decreased impact on the environment.

GGGI worked closely with the Buildings Regulations Standards Inspection & Audits (BRSIA) Division of the Rwanda Housing Authority (RHA) and other stakeholders to develop the Green Building Minimum Compliance System, a point-based system to help building owners and developers choose indicators based on the applicability to the building type, usage, and the benefits associated.

Viet Nam's Success Story

Viet Nam: Solar Leasing Finance Facility (SLFF) Project

Viet Nam has great potential for solar rooftop development for 328 industrial parks nationwide. However, due to barriers such as cost-competitiveness, lack of appropriate financial mechanisms and inexperience of factory owners in the installation of solar rooftop systems, there is minimal solar rooftop development.

GGGI is providing support on developing a distributed SLFF for Viet Nam, which is an innovative financial instrument to overcome green growth barriers in the energy sector and is at the right-hand side of GGGI's value chain. The objective of the SLFF is to provide green finance for companies and industrial parks to access renewable energy efficiently and at scale.

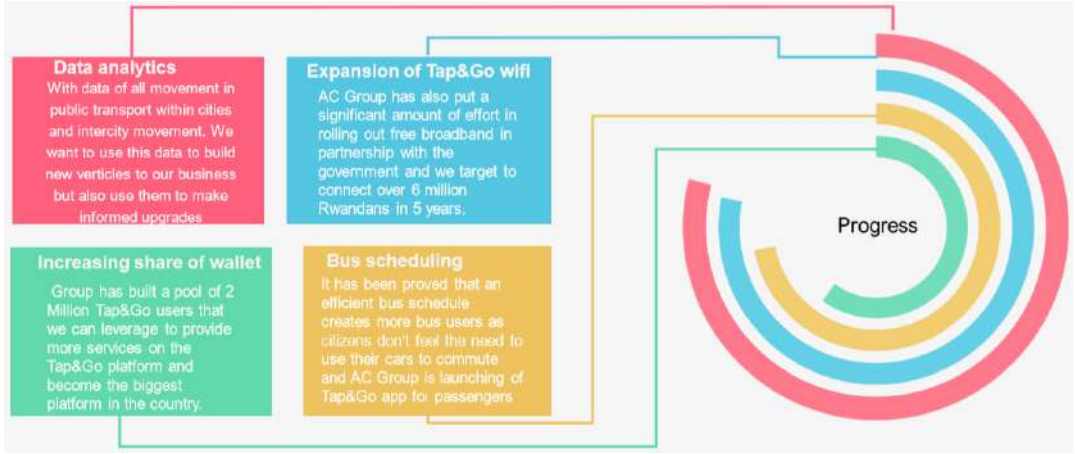
Rwanda : Smart Payment for Public Transport

Investment Overview (Readiness : Investment Ready)

- GGGI is supporting the government of Rwanda to develop secondary cities as competitive economic centers pursuing climate resilient, sustainable & inclusive growth.
- An outcome of this engagement is the identification of AC Group as a potential solution provider for automatic payment systems for public transportation.
- The proposed investment in AC group is an equity raise of US$ 2 m towards implementation of 'Tap & Go" automatic payment systems in the secondary cities

AC Group

- AC Group Ltd is a Rwandan tech company providing smart transport solutions. Since 2015, AC Group has changed payments on all public buses in Kigali to smart payments known as Tap & Go and introduced WiFi on all buses.
- In the next phase, a smart phone app, Tap & Go 2.0 is scheduled to be launched by June 2019 to provide value added services for the 2 million Tap & Go users
- Using the data collected, AC Group plans to optimize routing and scheduling with an aim of making public transport the preferred means of transport for all citizens.
- The governments of Angola, Tanzania and Kenya have approached AC Group to replicate the solutions that have been deployed in Rwanda.



PNG : Green Telecom Towers

Investment Overview (Readiness : Origination Phase)

- The proposed investment aims at funding the Energy Service Companies (ESCO) in PNG towards providing simple, efficient, and reliable power for telecom networks by replacing diesel fuel with solar hybrid system.
- A total of 100 towers operated by the major telecom operators in PNG is being targeted in the current phase. The total investment required is approx. US$ 20 million.

Project Highlights

- Solar hybrid system addresses the two main challenges faced by the telecom tower companies in PNG
  - High operating expenditure: Energy costs account for ~30 to 40% of total operational expenditure for a telecom tower company.
  - Diesel pilferage losses ~20% have been observed in the industry which further increases the energy costs
- Pilot project in PNG has demonstrated the following benefits
  - Monitoring of the project during the first year of operation has revealed an operational cost saving of over $40,000 and a 72% reduction in diesel fuel consumption.
  - Reduced maintenance requirements and increased service intervals.

Project Characteristics	
Location	100 Telcom towers in urban and semi-urban areas of PNG
Asset ownership	ESCO
Cost of Solar Hybrid system	US$ 150 – 200k per unit
Capital Structure	TBD
Contract Period	10 - 15 years
Funding	ESCO
O&M	ESCO
Risk	Risk sharing between Tower company and ESCO
Expected Payback	7 – 8 years

India : Solar PV for New Industrial Towns

Investment Overview (Readiness : Origination Phase)

- 150 MW Solar PV development to cater to the new industrial town development (NTD) along the under construction 700 KM Nagpur-Mumbai highway
- Total project cost is US$ 120 million and the equity requirement is US$ 40 million

Project Highlights

- The development of the 700 km highway in the region is a national priority and industrial belt development is key to revenue generation from the new highway. Land acquisition for the highway complete, funding secured by AIIB and nationalized banks and government budget.
- The Krushi Samruddhi Kendra (new industrial towns) will spread across 10 districts and comprise agro-based industrial, manufacturing and commercial hub along with a residential area equipped with basic amenities.
- Power (renewable) for the new industrial corridor is in the planning document of State-run power utility. The utility commits to buy the power of the new solar PV plant.
- GGGI designed project will be directly aligned and contributes to the Renewable Generation Obligation.

New Town Development Locations	
Nagpur	Jalna
Wardha	Aurangabad
Amaravati	Ahmednagar
Washim	Nashik
Buldhana	Thane

Project Characteristics	
Location	5 locations in 10 districts. 1000 acres land locations identified for the project
Total Investment	US$ 120 million
Capital Structure	30% Equity ; 70% Debt (expected)
Transaction Structure	Design, build, finance, operate, and transfer (DBFOT)
Power Purchase Agreement tenure	20 year firm fixed price
Unlevered IRR (Expected)	12%

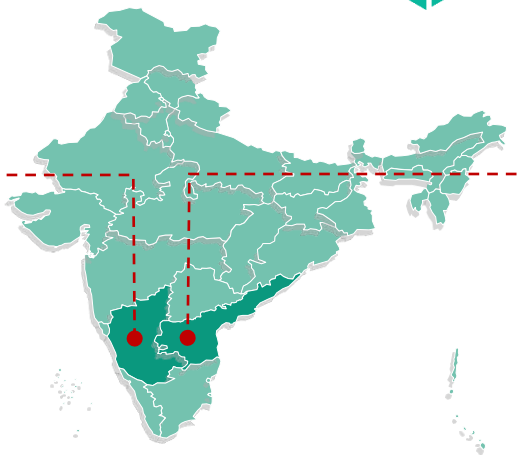
India : Organic Waste to Bio-CNG

Investment Overview (Readiness : Origination Phase)

- The proposed investment aims at establishing high technology bio-methanation facilities in 10 Tier 1 & 2 cities of India, where organic waste from vegetable & fruit market is converted to high grade natural gas.
- The total investment is estimated at US$ 11 million, of which the sponsor's equity commitment is US$ 2.6 million. The local financial institutions will provide the remainder of the debt financing required.

Key Investment Highlights

- Project to be implemented under PPP structure (BOOT model) between the government and the project sponsor.
- Standardized plant design based on commercially proven Bio-CNG production process. Useful life is 20 years.
- Favorable long term bulk supply of segregated organic waste from the respective municipal corporation.
- Attractive Bio-CNG off-take policy by the Govt. of India guaranteeing price certainty for first 3 years
- Capital subsidy from Govt. of India – up to 20% of project cost.



Karnataka

5 municipalities in Tier 1 & 2 cities have been identified by GGGI.

Formal mandate letter from the government is under consideration.

Andhra Pradesh

5 municipalities in Tier 1 & 2 cities have been identified by GGGI.

Formal mandate letter from the government is under consideration.

Project Characteristics	
Location	10 Municipalities in Tier 1 & 2 cities of the states of Karnataka & Andhra Pradesh
Total Plant Capacity (aggregate)	450 Tonnes per day of Vegetable & Fruit market organic Waste
Bio-CNG : Production (aggregate)	18 Tonnes per Day
Bio-Fertilizer : Production (aggregate)	6 Tonnes / Day
Investment Metrics (US$ Basis) • Project IRR • Simple Payback	 14.5 % 7 years

All figures in US$ is based on a FX conversion rate of US$ 1 = INR 70

Key Investment metrics is calculated based on the assumption that the INR depreciates annually against the US$ at the CPI differential rate of 4% p.a.

Guyana : JV Partnership for Onsite Solar PV

Investment Overview (Readiness : Investment Ready)

- Local Engineering, Procurement, and Construction company seeking a Joint Venture partner to expand its early stage onsite solar PV business in Guyana
- JV partner will acquire a stake of up to 60% to develop a $20 million 14 MW pipeline
- JV will set up a SPC to finance, build, own, and operate the projects under solar lease agreements

Key Figures	
Total Solar PV Capacity	14 MW
Total Investment	US$ 20 million
Capital Structure	30% Equity ; 70% Debt
Solar Lease Term	10 to 15 years
Equity IRR	15%
Guyana Credit Rating	Not Rated
Guyana – Ease of doing business	Medium

Key Investment Highlights

Local Partner : Soventix GmbH

- Strong local engagement of small and medium businesses with more than 20 years of operations in Guyana.
- Experienced in permitting, building, and operating onsite solar PV in Guyana, with over 30 installations to date

Strong market fundamentals

- Nearly one-third of Guyana's energy use is off grid, with reliance on diesel: cost of electricity around $0.29/kWh.
- Grid power (85% diesel and oil, 15% biomass) is high cost and unreliable, with tariff rates for commercial and industrial customers around $0.25/kWh

Favorable regulatory framework

- Guyana established the Urban Sector Solar Energy Program to scale up renewable energy deployment. Guyana has a national target of transitioning to 100% renewable energy by 2025
- Local utility (Guyana Power and Light) is working on ways to encourage more grid-connected onsite solar PV

Thailand : E-Waste Recycling Plant

Investment Overview (Readiness : Origination Phase)

- GGGI, in partnership with Udon Thani City Municipality, is working to establish the systematic e-waste management system and scalable material recycling center.
- Capex estimates from the pre-feasibility study for a pilot e-waste treatment plant of 500 kg/day at Udon Thani is US$ 3 million.
- Preliminary desktop economic analysis of the project suggests that break-even is achieved by processing high grade e-waste of > 100 Tonnes per year.

Implementation Structure

- Project to be implemented under PPP structure (BOOT model) between the government and the project sponsor.
- Standardized plant design based on commercially proven E-Waste treatment process. Useful life is 20 years.
- Favorable long term bulk supply of electronic waste from the respective municipal authorities.
- Capital subsidy from Govt. of Thailand.

Pilot Project - Key Characteristics	
Location	Udon Thai Municipality
Plant Capacity	150 Tonnes per year
E-Waste Composition (Base Case)	TV : 30% Mobile : 40% Laptop : 20% Printer : 10%
Revenue Factor	75% of potential value recovered by recycling
Economic Appraisal (Key Findings)	• Below a throughput of ~100 tonnes per year, break-even is not reached • Commodity prices have a strong impact on the business performance • Profitable to treat IT equipment whereas a high share of TVs would lower the financial performance. • Printed Circuit Boards (PCB) is a major revenue driver.

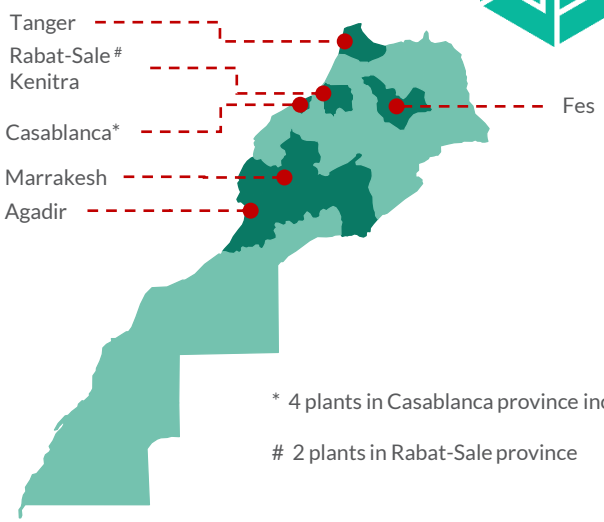
Morocco : Organic Waste to Energy

Investment Overview (Readiness : Origination Phase)

- The proposed investment aims at establishing anaerobic digestor plants in 7 provinces of Morocco, where organic waste is converted to biogas, which is then converted to heat and power (CHP – Combined Heat & Power).
- The total investment is estimated at US$ 54 million, of which the sponsor's equity commitment is US$ 16 million. The local and multi-lateral financial institutions are expected to provide the debt financing required.

Key Investment Highlights

- Project to be implemented under PPP structure between the government and the project sponsor.
- Standardized plant design based on commercially proven anaerobic digestion process. Useful life of the plant is 20 years.
- Favorable long term bulk supply of segregated organic waste from the fruit/vegetable markets and animal slaughter waste.
- Support from the provincial government on the off-take of electricity and heat produced from the plant.
- European Investment Bank (EIB) has conducted the feasibility study and has expressed interest in supporting this investment.



* 4 plants in Casablanca province including one in Zenata Eco City

\# 2 plants in Rabat-Sale province

Project Characteristics	
Location	11 plants located in the industrial areas of 7 provinces in Morocco
Feedstock capacity (aggregate)	440 Tonnes per day of Organic waste
Annual biogas Output (aggregate)	21.7 million m^3
Net power capacity for sale of electricity (aggregrate)	6.3 MW
Net thermal capacity for sale of heat output (aggregate)	4.2 MW
Investment Metrics (US$ Basis) • Project IRR • Simple Payback	 9.0% 11 years

All figures in US$ is based on a FX conversion rate of US$ 1 = MAD 9.5

Cambodia : Sanitation Services in Siem Reap

Investment Overview (Readiness : Design and Structuring Phase)

- GGGI has been supporting the Cambodia government and selected municipalities in the development of a "Sustainable City Strategic Plan" for secondary cities in Cambodia.
- Siem Reap, a major secondary city in Cambodia with an estimated population of 248,777 people and 56,571 households as of 2017, was selected by GGGI to improve its sanitation delivery system.

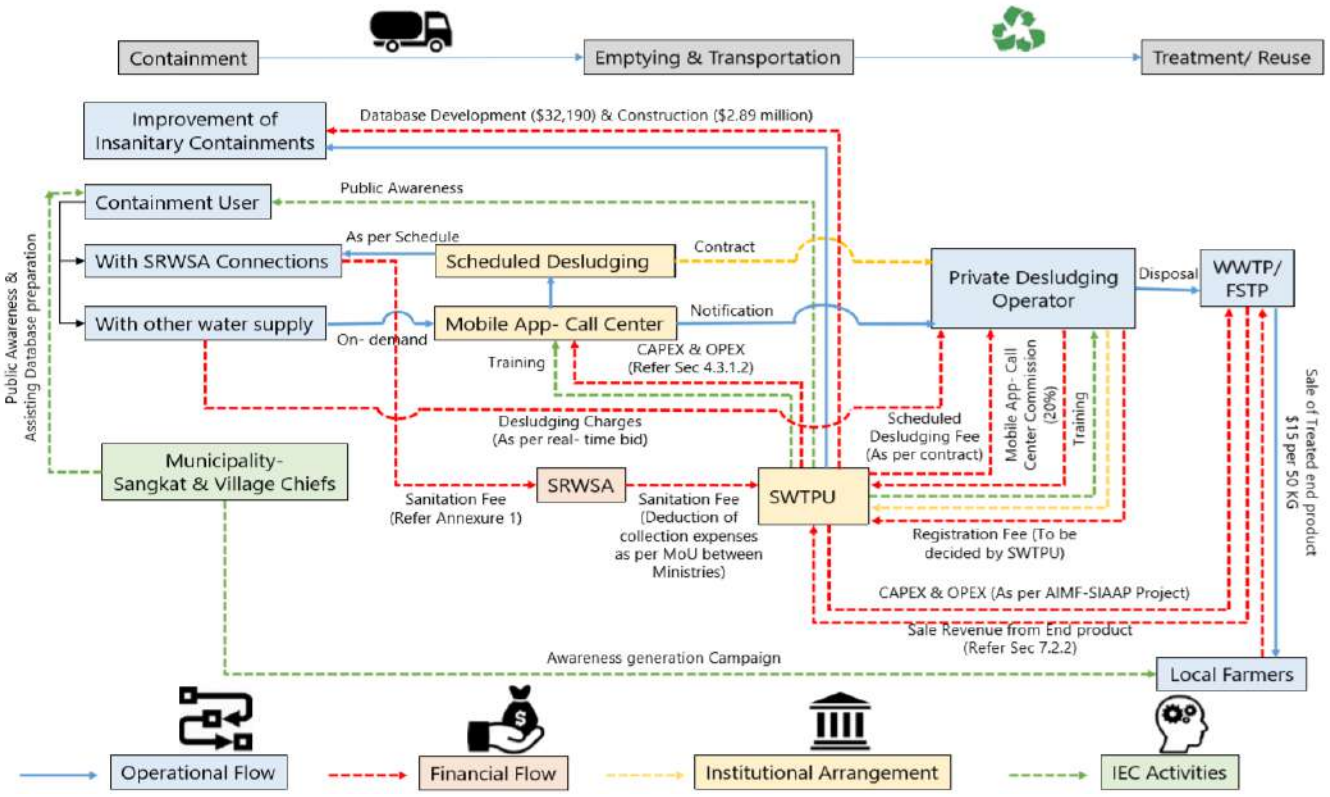
Investment Opportunities

A business and operational model was developed by GGGI and three investment opportunities for private sector participation have been identified.

1. **Sanitation Control Operator** : Establish and operate a centralized call center for the city of Siem Reap for handling desludging requests, and implement smart systems for real-time management of desludging scheduling and operations.
2. **Desludging Fleet Operator** : Procure and maintain the desludging fleet and conduct operations as per the service requests.
3. **Waste Water Treatment Plant :** PPP project to be awarded to a private concessionaire on Build, Own and Operate (BOO) model

Business & Operational Model

The diagram below depicts the proposed business model in terms of flow of desludging operations, finances and institutional set- up to implement the sanitation system in Siem Reap.



Investment in Senegal Rice Husk Waste to Energy Program

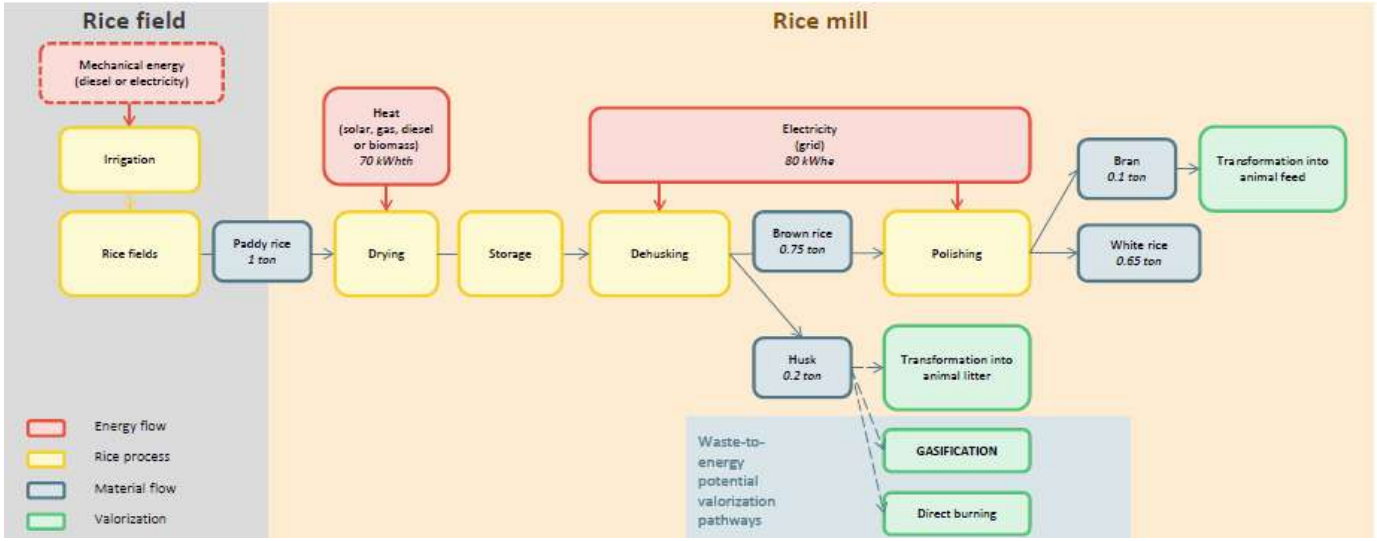
Investment Opportunity

Rice mills have to pay high electricity costs that with negative impact on their productivity and competitivity. Waste resulting from rice processing is disposed in unorganized manner.

Opportunity to design and structure a captive consumption waste-to-energy program in the rice sector in Senegal.

With the Government's rice self-sufficiency program, the rice husk resources are expected to triple.

Program aims to reduce significantly the dependency of rice mills on high electricity costs from unreliable grid and contribute to increase production and competitiveness.



Key Investment Highlights

- Estimated recoverable energy is 26 GWhe
- Contribution to country National Program for Rice self-sufficiency through increased productivity.
- NDC/SDG/contribution to country target of 20% of RE in energy mix, GHG emissions reduction of 16,000 tCO_2e/year

Project Progress/Plan

- Q2/3 2017: Stakeholders identification and engagement
- Q1 & Q2 2018: Stakeholder mapping with Gov't and preparation of business cases
- Q3 & Q4 2018: Organization of investor forum for identified projects + signed LOIs
- S1 2019 : resume development of projects

Investment in Renewable and Energy Efficiency Fund (REEF), Senegal

Investment Opportunity

- Renewable and Energy Efficiency Fund is seeking equity and/or debt for an initial $50 ~ 75 million capitalization
- REEF will be applying for: $10 million from Green Climate Fund and $10 from African Development Bank as Accredited Entity, and $5 million of grant funding for capacity building, and the remaining from local and international investors
- Government of Senegal has committed $5 million of equity
- REEF will provide equity and quasi-equity (i.e. mainly in the form of junior debt) with the express purpose of derisking renewable energy and energy efficiency projects

Key Investment Highlights

Experienced management team

- Local executive team with extensive experience in the Senegalese Finance and banking industry
- International asset management firm will also be hired to provide management and technical advisory services
- REEF will strengthen capacity of local banks and financial institutions to better assess risk and bankability and disbursing loans for green projects through the Technical Assistance facility

Financing terms

- Current lending rates in Senegal are between 12 and 18% per annum, with a tenor up to 60 months
- REEF can offer loans in CFA Francs (XOF) to projects at a targeted fixed rate of maximum 10 % per annum, with a tenor up to 10 years
- REEF will co-finance green projects to encourage additional local financing

Strong pipeline of green projects

- Between 2017 - 2030, 225 MW of solar PV (nine projects) and 150 MW of wind are planned to be installed in Senegal (estimated market of $56 million)
- The ambition of the Government of Senegal is to reach universal access to electricity by 2025, as of 2018 the access rate in rural areas were 40% (estimated market of $4 million for off-grid)
- In 2015, the estimated potential of Energy Efficiency in Senegal is was Energy Saving: 28% of energy savings (estimated market above $10 million)

Investment in Solar Freezers Project, Vanuatu

Investment Opportunity

- Solar-powered freezer systems installed at ten rural tourism bungalows on five islands in Vanuatu
- Project Partners: GGGI, Vanuatu Government, Vanuatu Skills Partnership
- Improve electricity access, reliability, and affordability for small tourism operators
- Increase and improve income streams for tourism operators
- Contribute to Vanuatu's Nationally Determined Contribution and updated National Energy Road Map objectives to increase the use of renewables in all sectors and achieve 100% renewable electricity production by 2030

Key Investment Highlights

- Improved productivity
- Increased revenues
- Easier work for men and women
- Less travel time required to buy food
- New income streams: selling cold drinks and ice pops, renting freezer space
- Increase knowledge on PV systems and on safe food handling
- Increased business for PV suppliers
- Freezer systems provided free of charge under a grant agreement with the Vanuatu Government
- Owners required to save money each month in a special savings account used for maintenance and repairs
- Estimated average savings per bungalow of USD $100 per month

P4G Summit:
Partnering to beat climate & air pollution crises!

- **P4G:** brings together business, government, and civil society organizations in innovative public-private partnerships to advance solutions for green growth.
- **2nd P4G Summit, June 2020, Seoul**

Conclusion

- Our planet is at risk from the impacts of climate change, leading to numerous other consequences.
- Despite the bleak outlook, progress has been made to improve our air quality, reforest the environment, and reduce emissions through new technology and innovations.
- Green Growth is critical for countries to develop in a way that is both economically and environmentally sustainable in the long-term.
- Going forward, it will take strong leadership, enhanced public awareness, and increased finances if we are ever going to solve the sustainability crises we now face.
- GGGI will continue to help its Members around the globe to develop innovative solutions, access climate finance, and reduce emissions, while simultaneously working to improve their economies.

Thank You

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