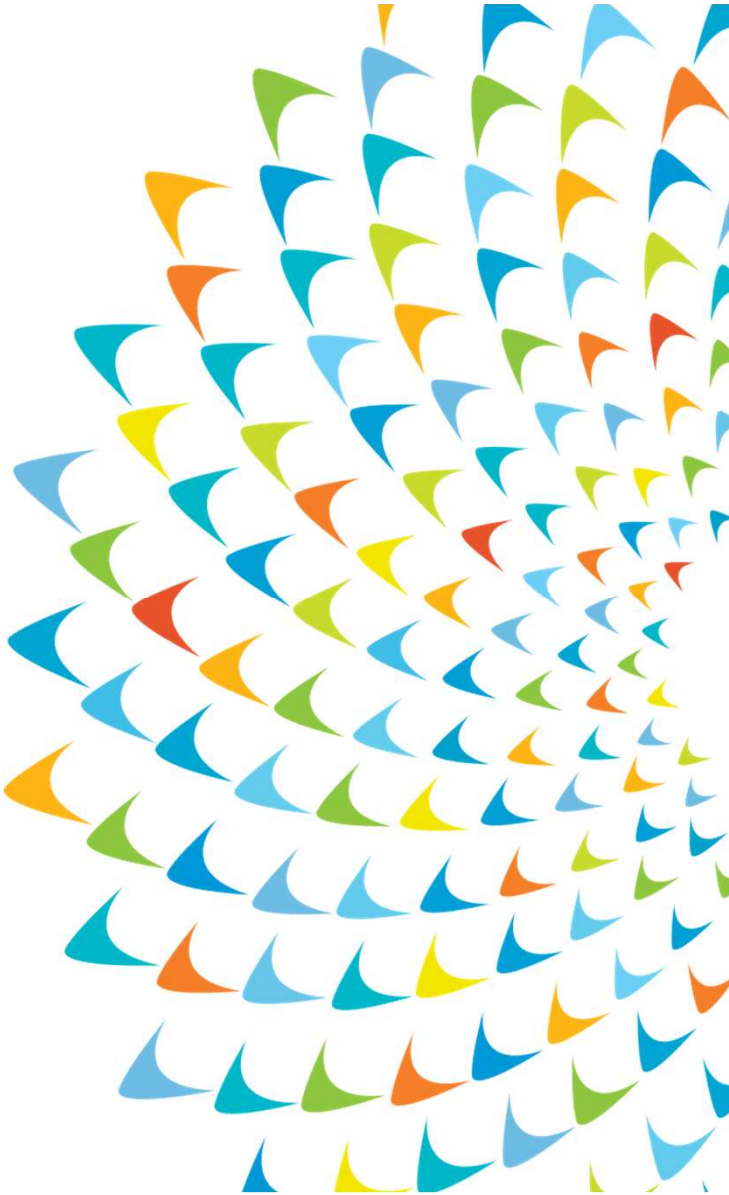
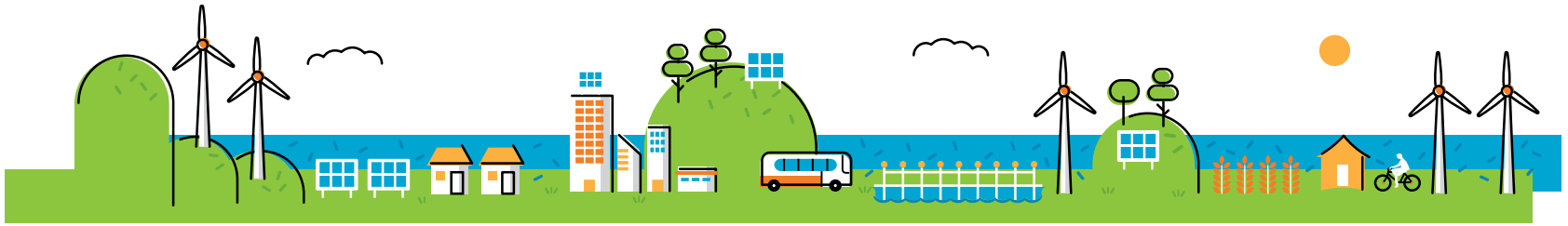
Developing Sustainable Infrastructure

Sujata Gupta, Director
Sustainable Infrastructure Division
East Asia Department
Asian Development Bank



Outline

- About Asian Development Bank
- Infrastructure – contributions and challenges
- Climate change
- Planning for sustainable infrastructure
- Disruptions



ADB in brief

- Founded in 1966
- Goal is an Asia Pacific free of poverty
- 68 member countries – 49 regional, 19 nonregional
- HQ in Manila, 29 resident missions, 3 rep offices
- Provides loans, grants, TA, equity, policy dialogue
- In 2019, ADB provided $19.7 B total assistance
- Sovereign and private sector operations
- Long-term ratings: S&P: AAA; Moody's: Aaa; Fitch Ratings: AAA

A multilateral development financier: dedicated to achieving a prosperous, inclusive, resilient and sustainable Asia and the Pacific

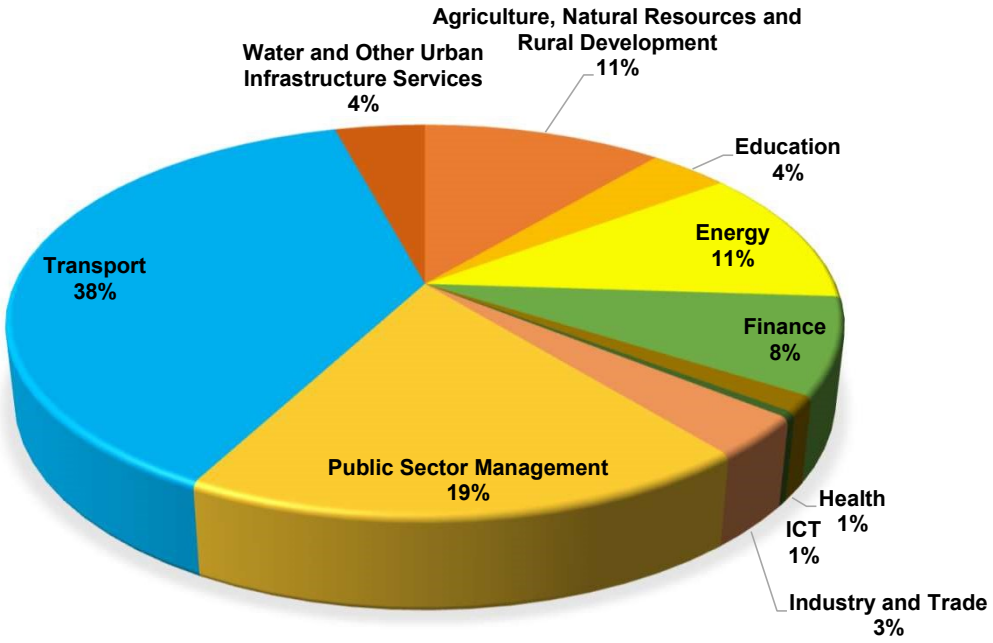
Building a Prosperous, Resilient Asia

ADB Strategy 2030:
Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific

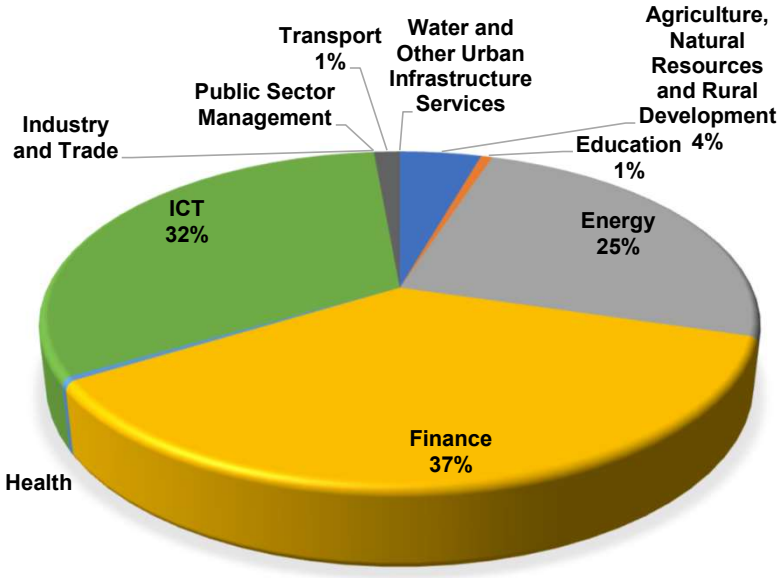
Seven Operational Priorities

- Addressing Remaining Poverty and Reducing Inequalities
- Accelerating Progress in Gender Equality
- Tackling Climate Change, Building Climate and Disaster Resilience, and Enhancing Environmental Sustainability
- Making Cities More Livable
- Promoting Rural Development and Food Security
- Strengthening Governance and Institutional Capacity
- Fostering Regional Cooperation and Integration

Share of different sectors in ADB lending, 2019



Total amount: $19.7 billion*



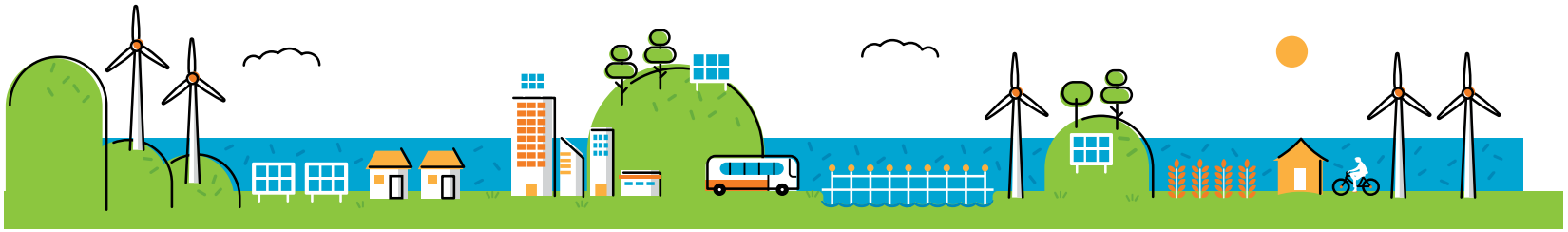
Total sovereign lending amount: $18.1 billion*

Total non-sovereign lending amount: $1.64 billion

* Including concessional assistance

Infrastructure

contributions and challenges



Infrastructure

- **Infrastructure** – *"the basic systems and services that are needed in order to support an economy, for example, transport and communication systems, electricity and water supply" – Cambridge Dictionary*
- Facilitates the production of goods and services
- Structures that support society
- Connects people and markets
- Mostly/typically owned and managed by governments or public utility companies

Types of Infrastructure

TRADITIONAL INFRASTRUCTURE

ENERGY

TRANSPORT

WATER

SANITATION

TELECOMMUNICATIONS

NATURAL INFRASTRUCTURE

LANDSCAPE

WATERSHED

WETLANDS

SOCIAL INFRASTRUCTURE

EDUCATION

HEALTH

PUBLIC SPACE

HOUSING

Role of infrastructure

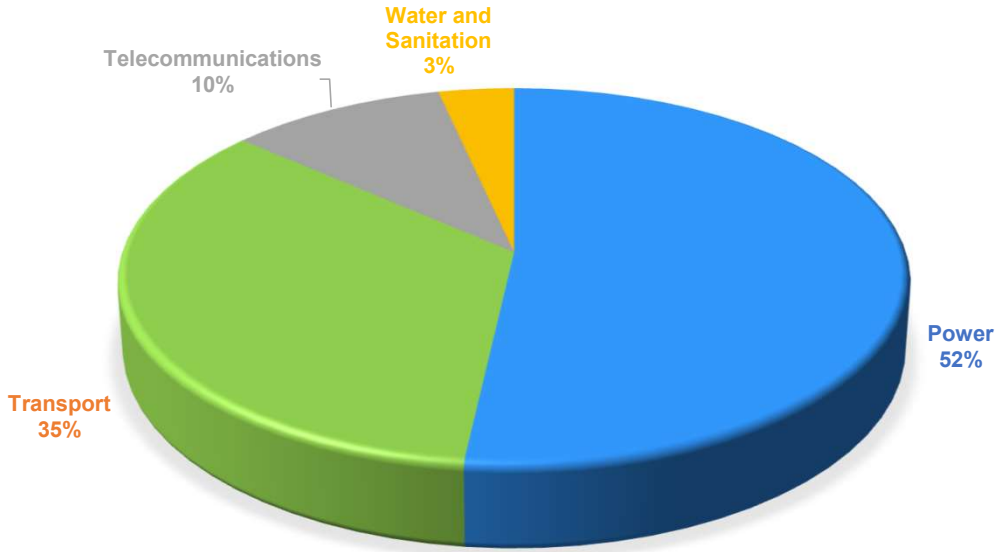
- Infrastructure underpins core economic activity – essential foundation for achieving inclusive sustainable growth.
- Infrastructure facilities and services are prerequisites to social and economic development.
- Indispensable for development and poverty elimination, as it enhances access to basic services, education and work opportunities, and can boost human capital and quality of life.
- Sustained growth requires continuous, predictable, and affordable infrastructure services.
- These conditions support productivity, investment, job creation, human development, and country competitiveness

Infrastructure investment is the key

Investment Needs for Infrastructure

- Estimated global infrastructure investment needs to be $94 trillion between 2016 and 2040.[1]
- Developing Asia will need to invest $26 trillion (2016-2030) if the Region is to maintain its growth momentum, eradicate poverty, and respond to climate change. [2]

INFRASTRUCTURE INVESTMENT NEEDS IN ASIA AND PACIFIC BY SECTOR, 2016-2030



- Source: ADB. 2017. Meeting Asia's Infrastructure Needs. Manila

[1] Oxford Economics. 2017. Global Infrastructure Outlook.

[2] ADB.2017. Meeting Asia's Infrastructure Needs. Manila.

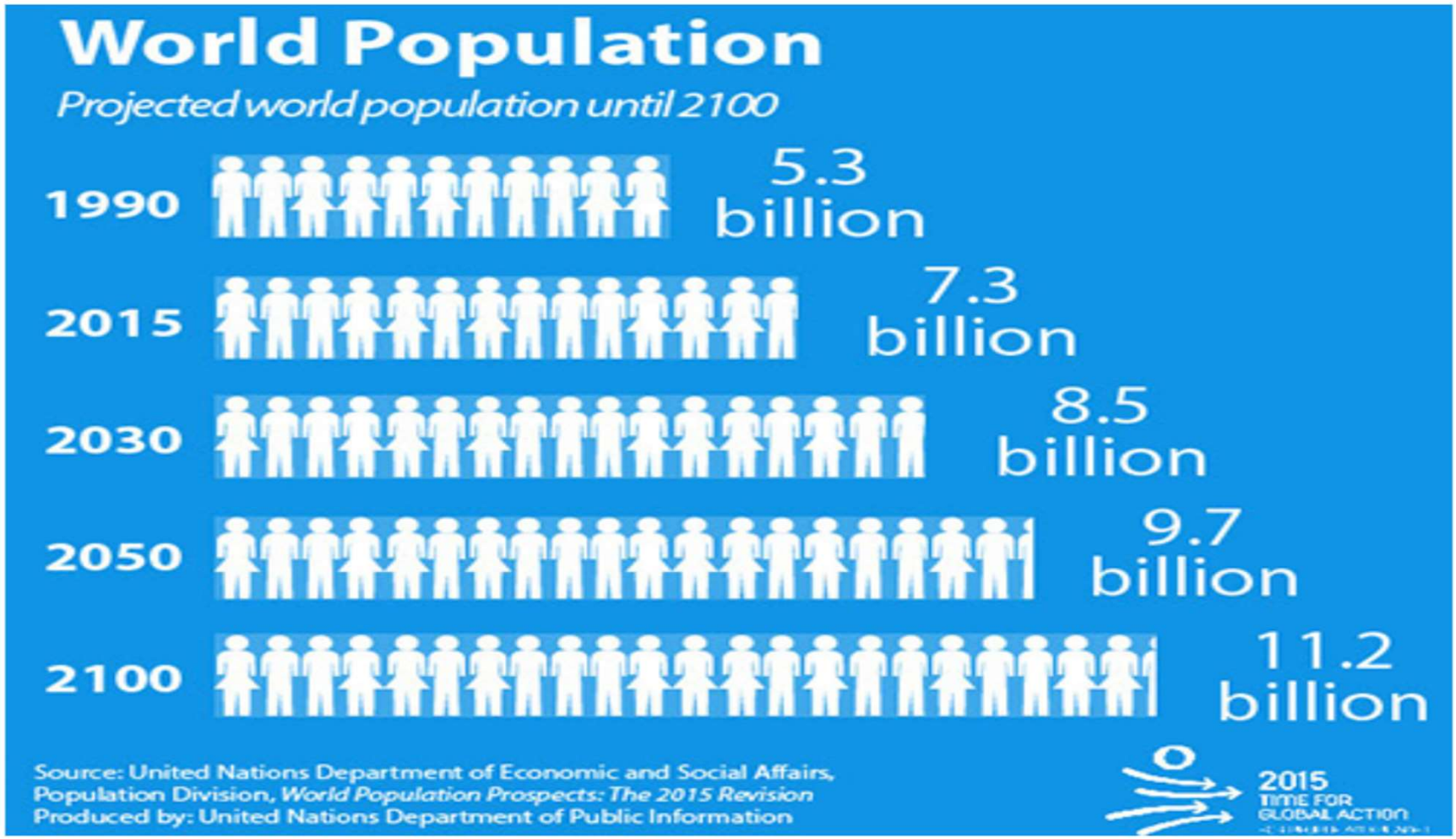
Challenges

- Scope, scale, resources, and geography
  - Lack of connectivity – need to connect people and markets
  - Lack of energy resources
- Financial, technical, and managerial capacity
- Institutional and policy constraints
- Quality of regulation and oversight
  - Poor sector governance, weak regulation
- Limited private sector
- Contributes to environmental issues if not appropriately planned
- Poor infrastructure, high costs

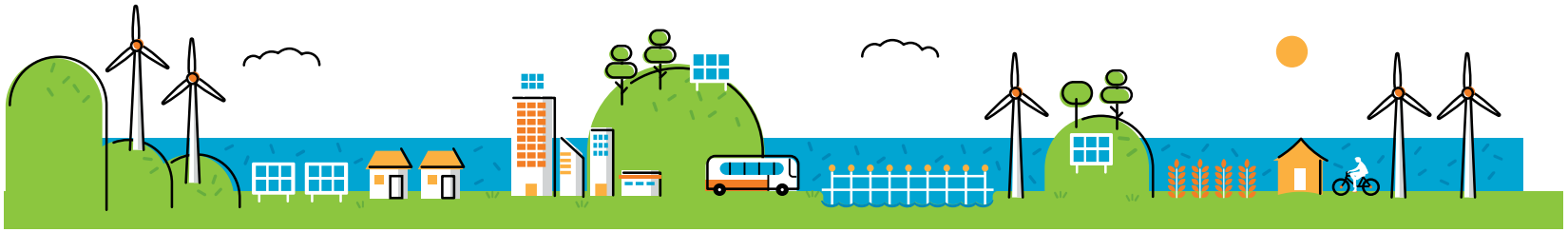
Congestion

Air pollution

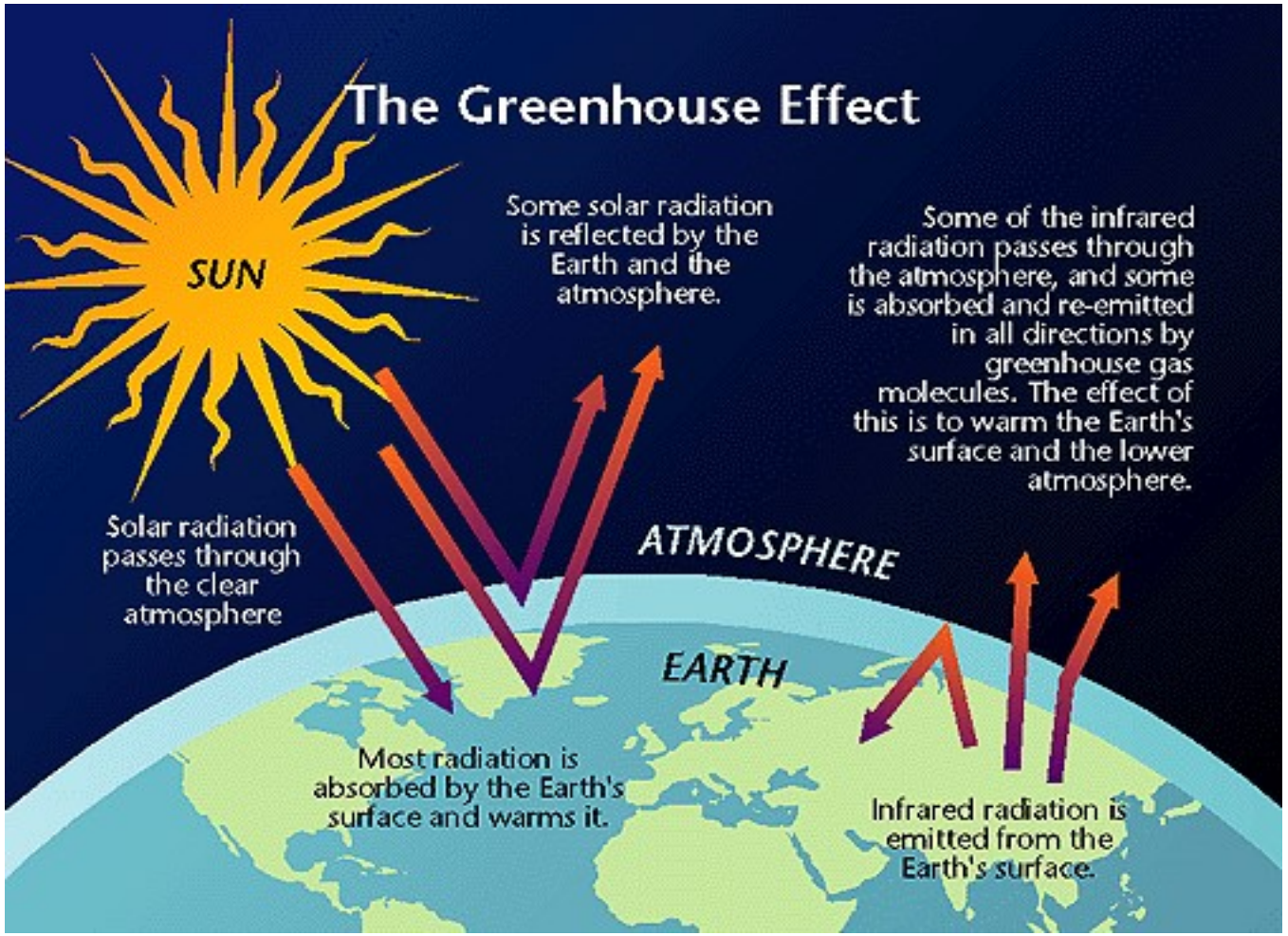
World Population



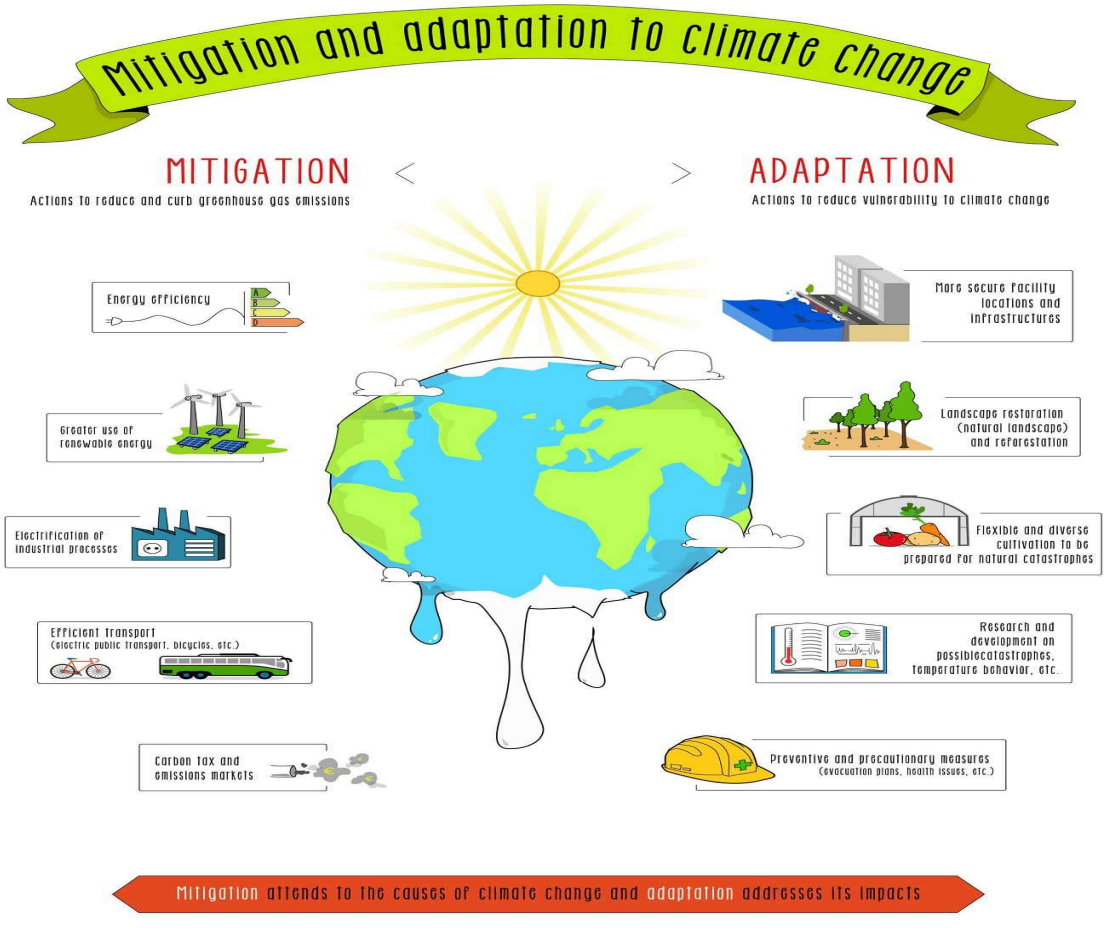
Climate change



The Greenhouse effect



Climate Change Mitigation and Adaptation



Sustainability for all
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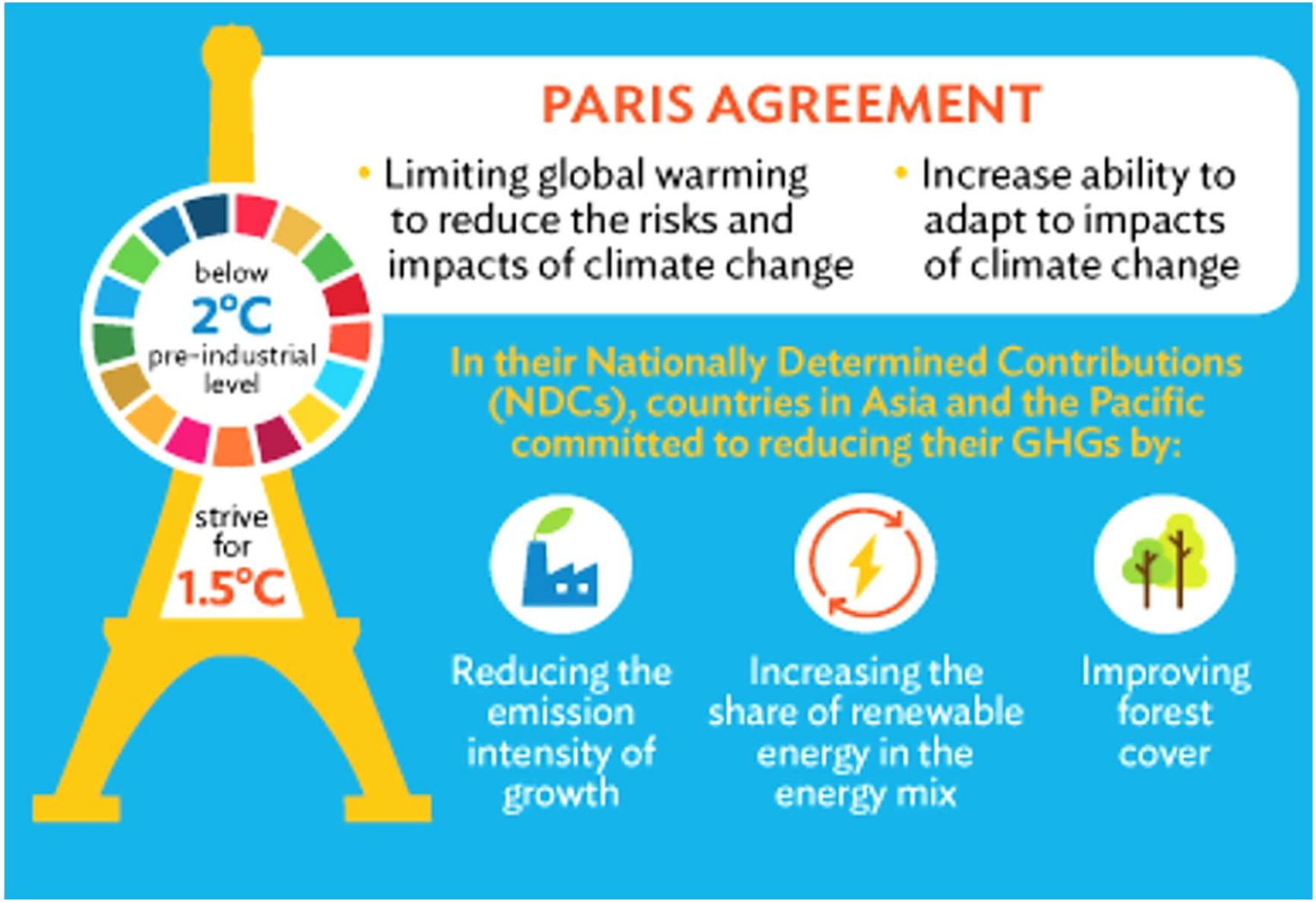
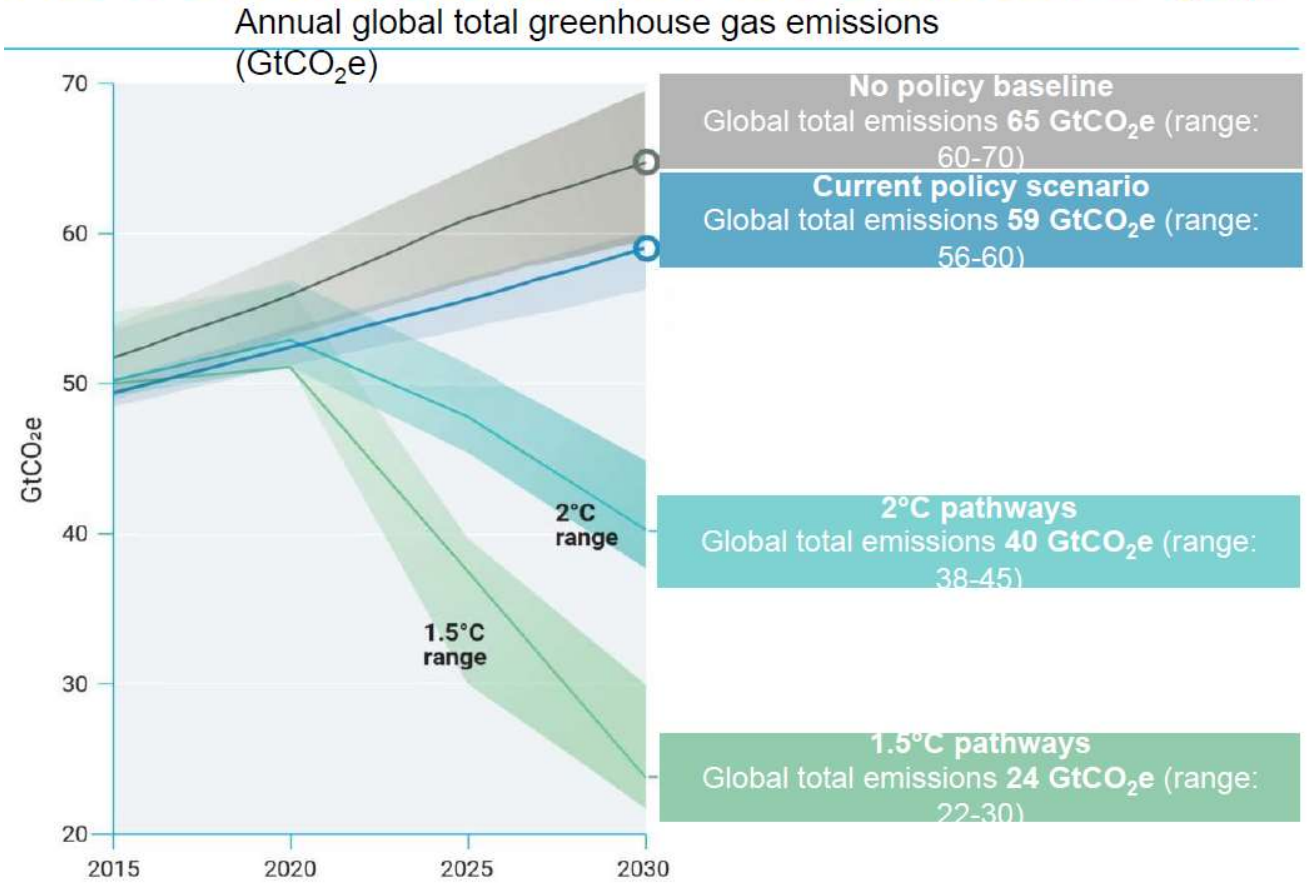
acciona

ADB

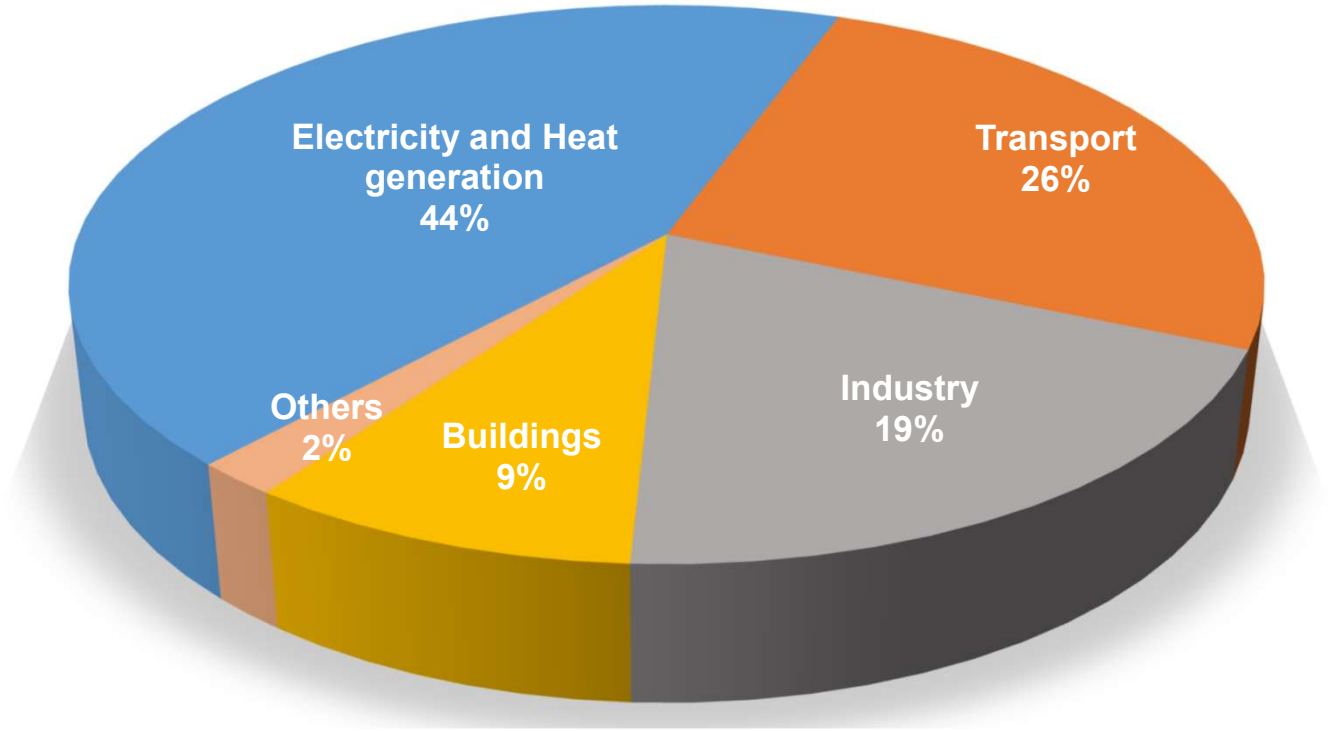

PARIS AGREEMENT
• Limiting global warming to reduce the risks and impacts of climate change
• Increase ability to adapt to impacts of climate change
below 2°C pre-industrial level
strive for 1.5°C
In their Nationally Determined Contributions (NDCs), countries in Asia and the Pacific committed to reducing their GHGs by:
Reducing the emission intensity of growth
Increasing the share of renewable energy in the energy mix
Improving forest cover

NDC contributions and the emissions gap



NDC – nationally determined contributions

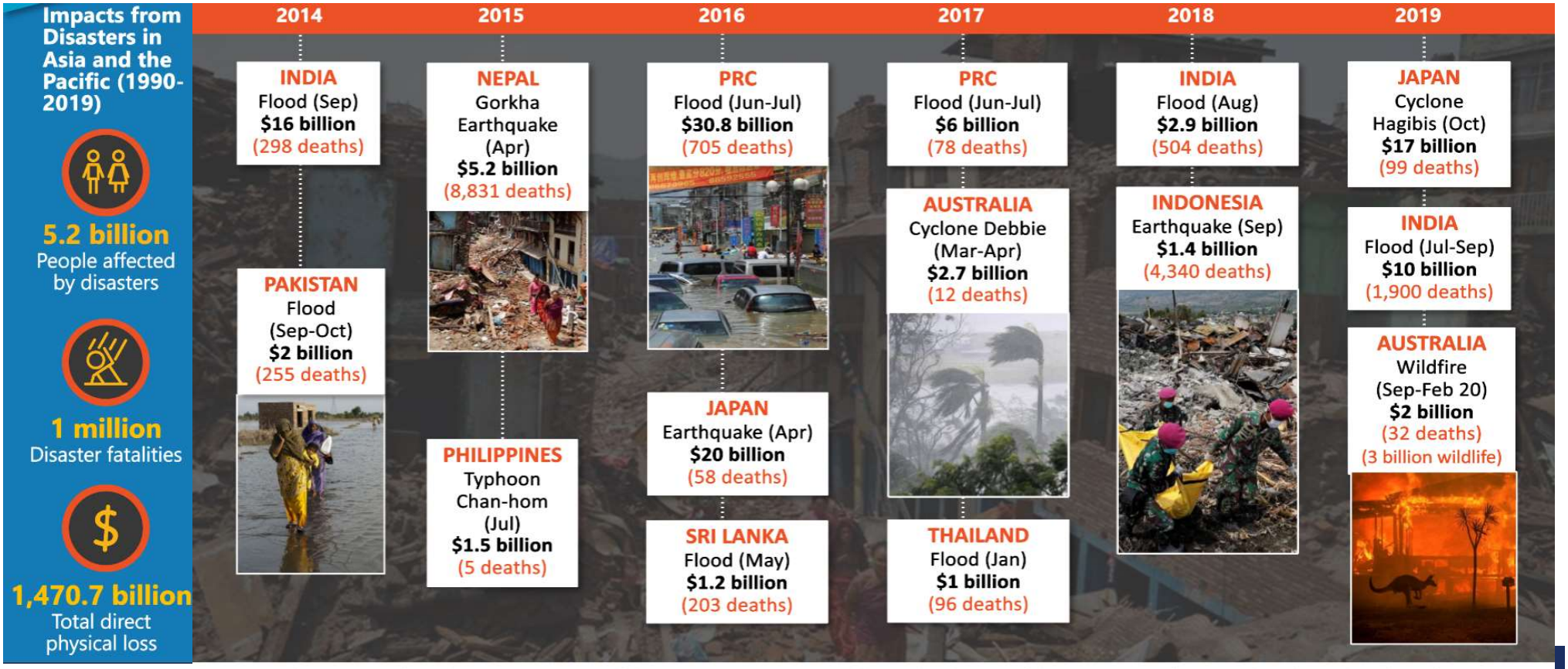
Global CO_2 Emissions by Sector, 2018



Effects of Climate Change on Infrastructure

ADB

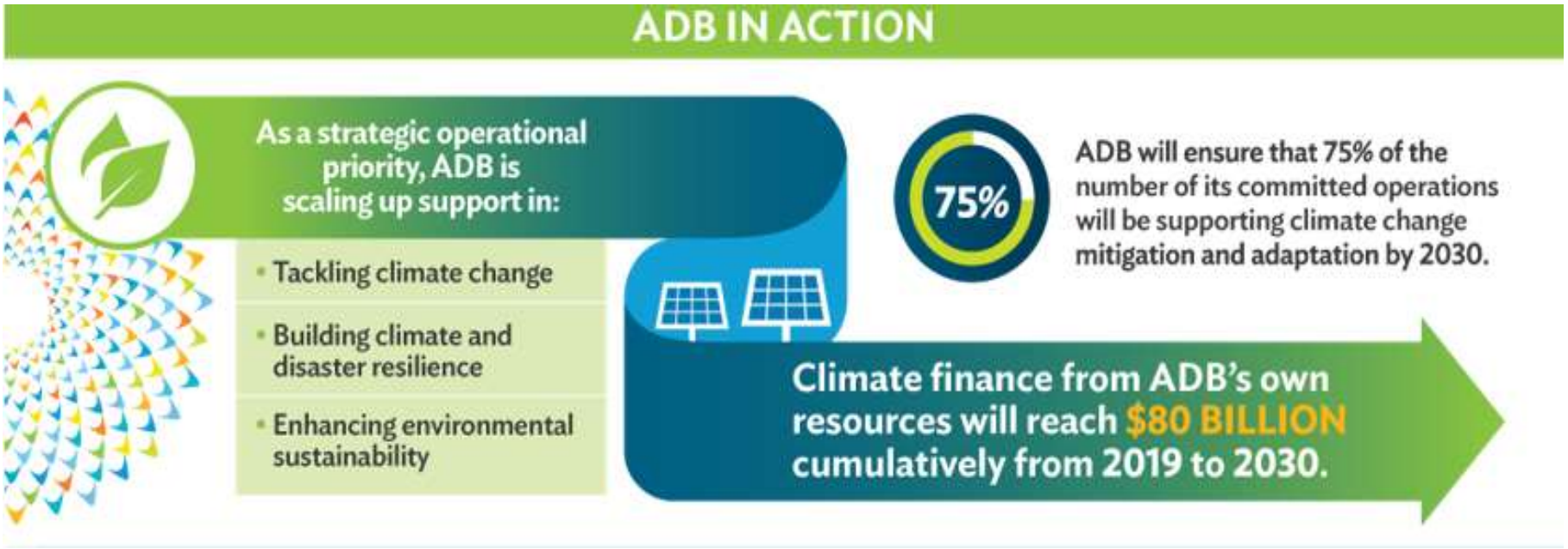
Disaster Impacts in Asia and the Pacific, 1990-2019



Note: 1. The amounts refer to the monetary amount of damage to property, crops and livestock at the year of the event. (Center for Research on the Epidemiology of Disasters)

Provided by: ADB's Climate Change and Disaster Risk Management Division

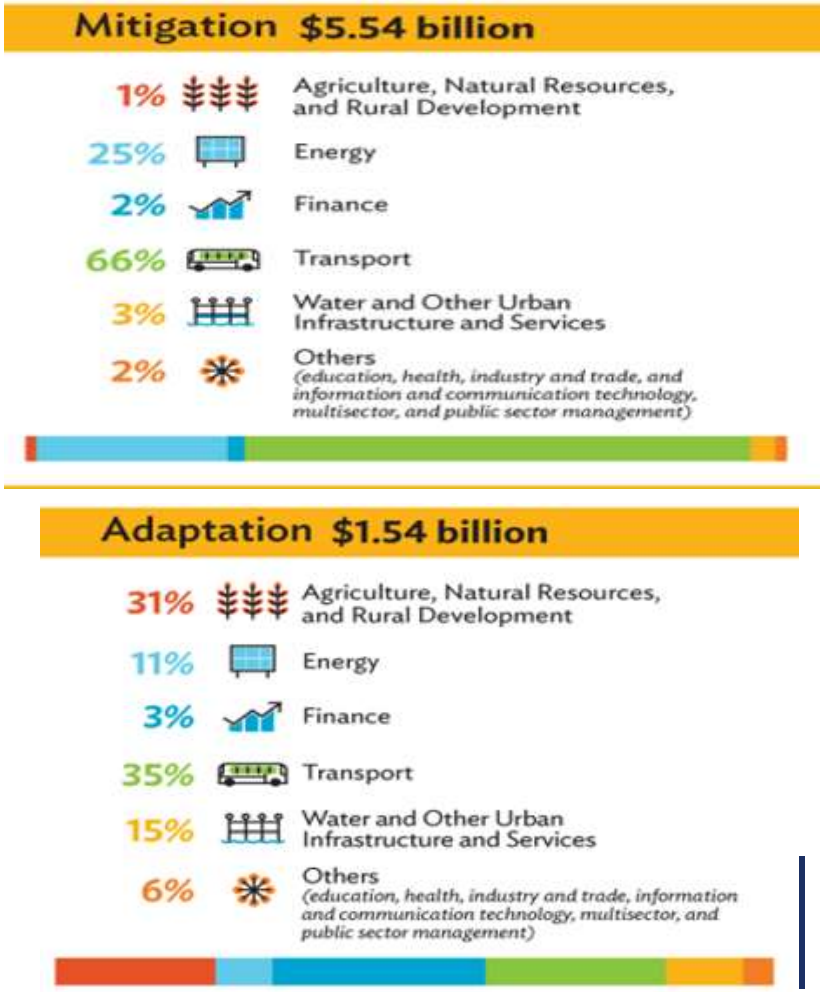
ADB's Climate Finance Target by 2030



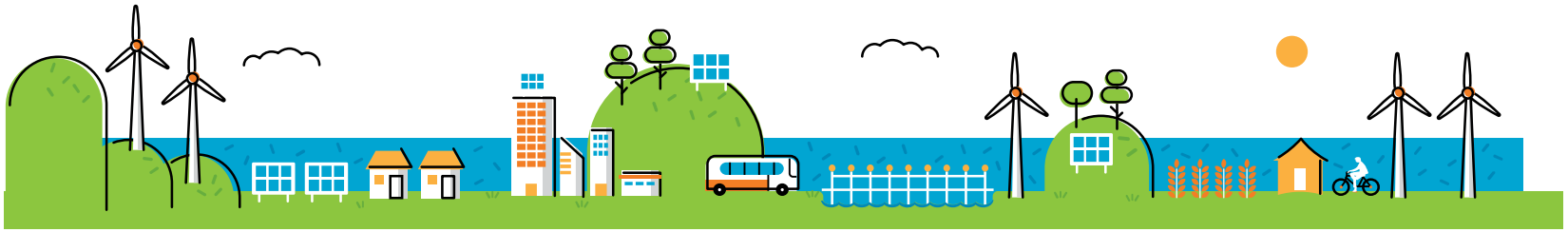
ADB's Role in Tackling Climate Change

ADB's Strategy 2030: **Prosperous, Inclusive, Resilient, and Sustainable** Asia and the Pacific.

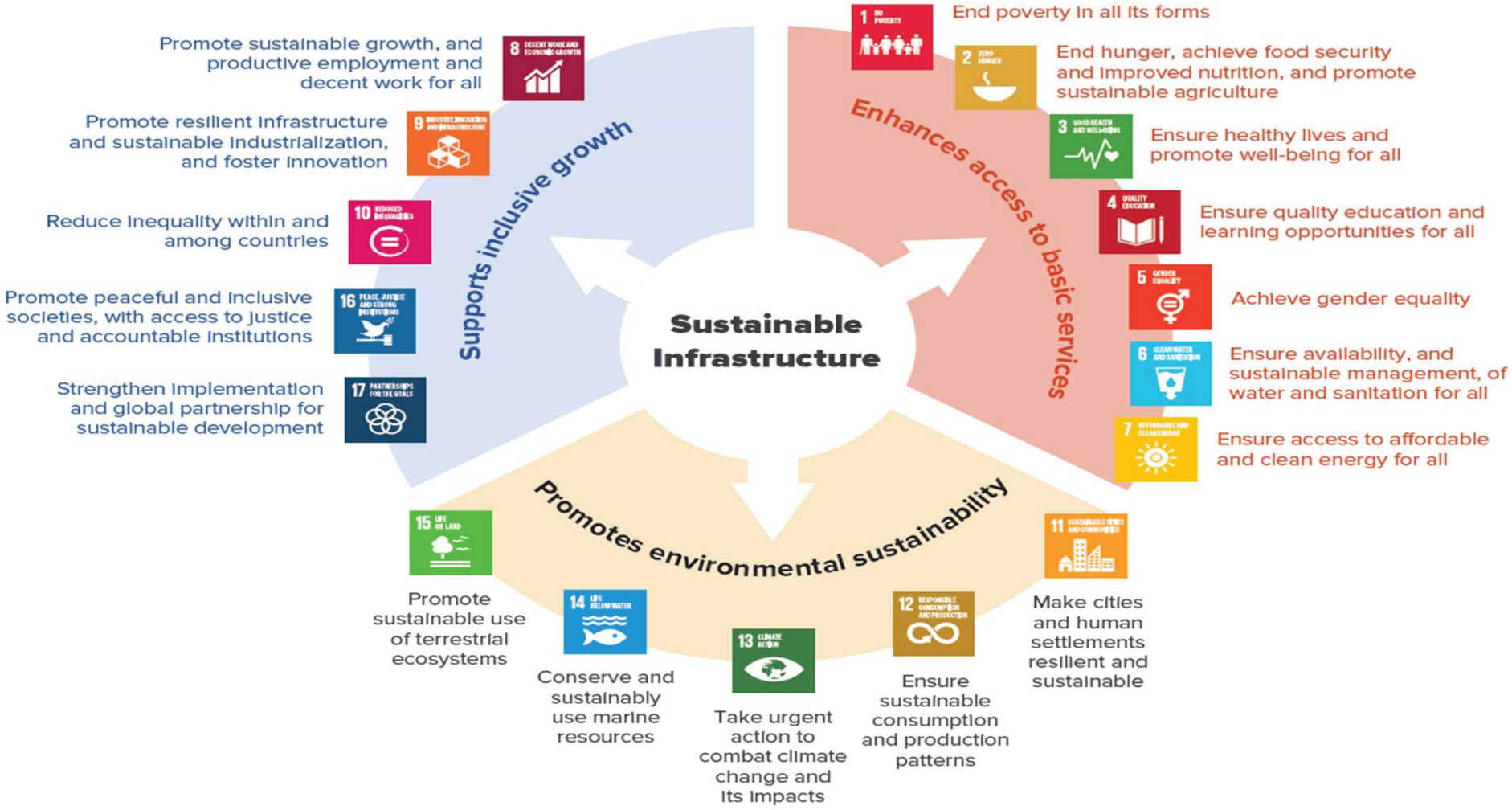
- Tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability is a priority of ADB
- ADB committed **$80 billion** in climate finance cumulatively between 2019 and 2030
- At least 75% of its projects will address climate change mitigation and adaptation by 2030
- In 2019, ADB delivered **$7.07 billion** in climate finance from its own resources



Sustainable Infrastructure

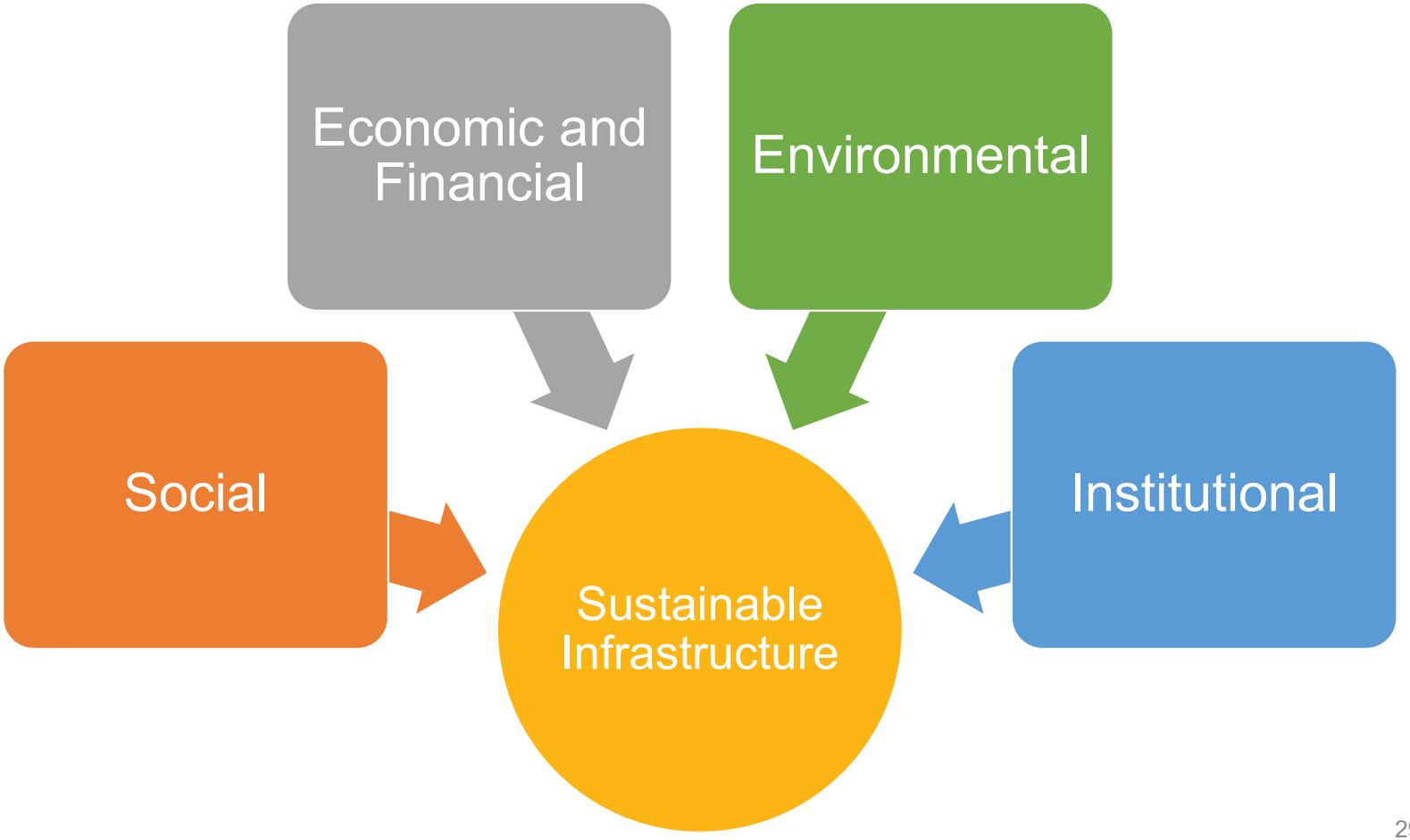


SUSTAINABLE DEVELOPMENT GOALS (SDGs)



Source:
Bhattacharya et al., 2016. *Delivering on Sustainable Infrastructure for Better Development and Better Climate*.

Four Dimensions of Sustainable Infrastructure



Infrastructure Life Cycle

CO_2 Contribution of each life cycle

- Construction Phase: 5%-12%
- Operations phase: 70%-80%
- Maintenance and Decommissioning: 8%-10%

Infrastructure Project Planning and Design

The feasibility study should tell management:

- How should the project be done?
- What are the alternative solutions?
- What are the criteria for choosing among them?
- Is there a preferred alternative?
- What are the benefits?
- How will this be financed?
- What is the life span of the project?

Economic Analysis

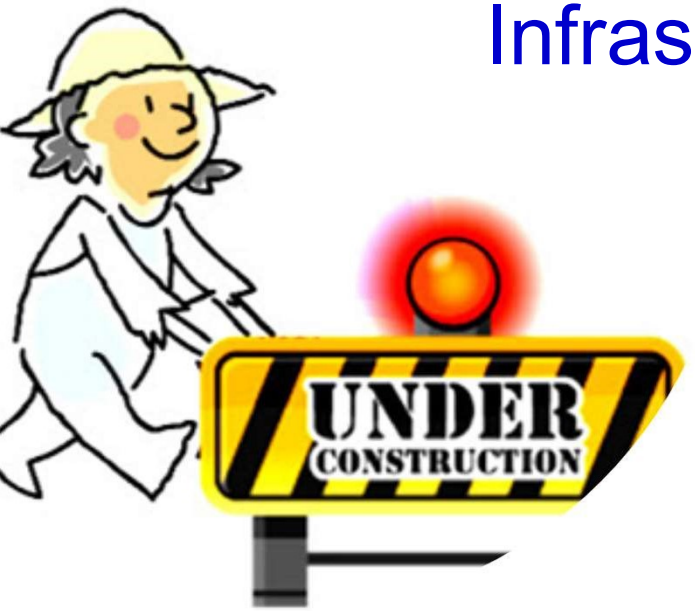
- More than rate of return calculations; Integrated framework/tool to select and design good projects
- To help identify areas where investment is needed
- To establish the economic rationale for public sector involvement
- To help make the choice among alternative instruments and solutions
- To assess a project's economic benefits and costs, potential development impact, and potential risks

Financial Analysis

- The financial analysis of a project examines the adequacy of returns to the project-operating entity and to the project participants
- FIRR
- Undertake risk and sensitivity analysis. The sensitivity analysis examines the likely effect of changes in forecasting assumptions on the project's financial viability

Source: ADB (2006), Financial Management and Analysis of Projects, ADB Manila

Infrastructure Project Implementation



- After the feasibility study phase has been approved, financing locked, the project implementation stage begins.
- Includes detailed design, procurement, and project construction
- Important to maintain control and communicate during implementation.
- Monitor progress continuously and appropriate adjustments (variance from original plan)

Operations Phase

- This phase is the use of the infrastructure.
- It considers the capacity and level of service standards to be maintained
- Sustaining reliable service levels is the goal of any infrastructure service provider.

Maintenance Phase

- This stage is after construction and during operation of the infrastructure.
- The maintenance phase involves making changes to the infrastructure to support its operational effectiveness.
- It includes making changes to improve a system's performance, correct problems, or address user requirements.

Recycling/Decommissioning

- Decommissioning (also called abandonment) is the process by which the owner-operator of an facility or infrastructure will plan, gain approval for, and implement the removal, disposal, or reuse of an installation when it is no longer needed for its current purpose

- This stage is the end of life of the infrastructure. Usually after 35 years. If designed and maintained properly, sustainable infrastructure can last 100 years.

- A decommissioning plan is usually produced and submitted to relevant authorities.

Avoid-Shift-Improve Paradigm

Avoid the need to travel

Shift to sustainable modes

Improve efficiency of all modes

<u>Lower</u> congestion, emissions, air pollution, road accidents
<u>Better</u> health

Green Recovery

REGIONAL AND NATIONAL STIMULUS PACKAGES

EUROPEAN UNION

€750 billion ($847 billion)

"Next Generation EU" recovery fund and "Just Transition Fund" for climate action

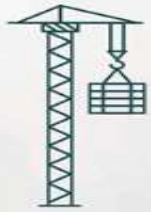
The *Next Generation EU* recovery fund will provide €500 billion in grants and €250 billion in loans for member states. 25% of the fund will target climate action, including €30 billion to boost the *Just Transition Fund* for coal-dependent states, with investments based on a *sustainable finance taxonomy* under a 'do no harm' principle.

REPUBLIC OF KOREA

W76 trillion ($62 billion)

New Deal Korean style

The government's plans include a Digital New Deal, a Green New Deal and measures to boost job creation. The *"Green New Deal"*, will invest W12.9 trillion ($10.5 billion) from 2020-22 to support development of green infrastructure, energy efficiency, and renewable energy.



UNITED KINGDOM

£40 million ($50.54 million)

Clean Growth Fund to *"drive a green and resilient economic recovery"*

The *Clean Growth Fund* aims to mobilize private sector funds to support green start-ups, develop clean technology, and achieve net zero emissions by 2050.

£283 million ($357.57 million)

Stimulus package for the transport sector

The transport package will provide support to *restore buses and trams services* and improve safety during the pandemic.

GERMANY

€80 billion ($90.4 billion)

Recovery program focuses on innovation, sustainability and support for municipalities

Germany's program targets *clean energy infrastructure* digitalisation, and support for *green recovery in municipalities* such as public transport and cycle paths, the Environment Minister said.

NORWAY

NOK 3.6 billion ($370 million)

Support package for green industries

The package supports projects implementing *green technologies*, including hydrogen, battery technology, offshore wind and low-emission shipping. Enova, the Research Council, and Innovation Norway will decide the allocations of the funds.

LUXEMBOURG

UP TO €30,000/HOUSEHOLD ($33,800) AND €8,000/ELECTRIC CAR ($9,017)

Green subsidies for households and the auto industry

The government will help households willing to make homes more *energy efficient*, including insulation and use of renewable energies. The government will also subsidize the purchase of electric vehicles.

INDONESIA

$3 billion for SDG Indonesia One plus resources for the national Action Plan to Reduce Plastic Pollution.

SDG Indonesia One platform to drive green growth is one of the first SDG platforms globally. ADB is supporting development of a catalytic green finance facility within the platform that will help drive a *sustainable COVID-19 recovery*. A *plan* to reduce plastic in coastal waters by 70% by 2025 will create investment and jobs in recycling and waste disposal.

PHILIPPINES

₱2.5 billion ($50 million)

Green Green Green Program

The government will provide assistance to make 145 cities more liveable and sustainable as part of the government's "Build, Build, Build" program. Green recovery packages will invest in urban areas, by scaling up projects such as *EDSA Greenways* that provides non-motorized commuting in parts of congested Manila.

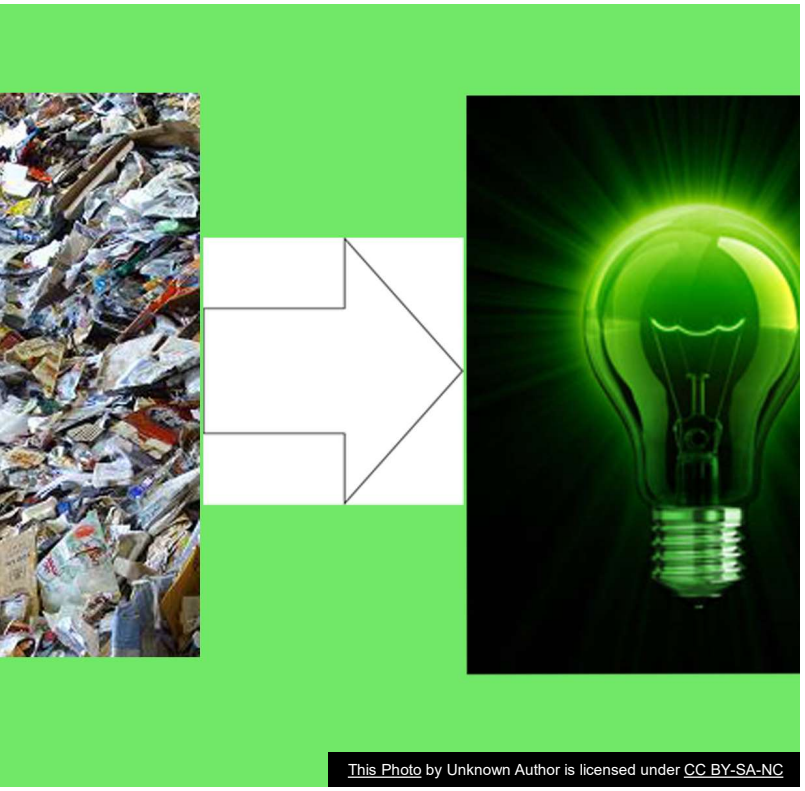
VIET NAM

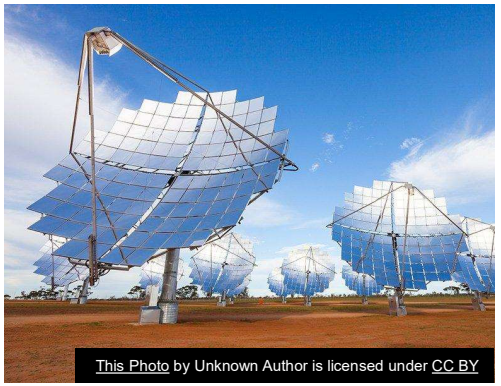
National Strategy on Green Growth

The centerpiece of the government efforts to stem environmental degradation, this strategy will provide a strong framework especially through development of investment guidelines and methodologies for prioritizing investment opportunities and mobilizing public and private finance into green economic recovery projects.

Technologies for Sustainable Infrastructure

ADB





Energy Technologies

- Solar power
- Wind power
- Waste to energy technologies
- Hydrogen

Floating Solar Panels

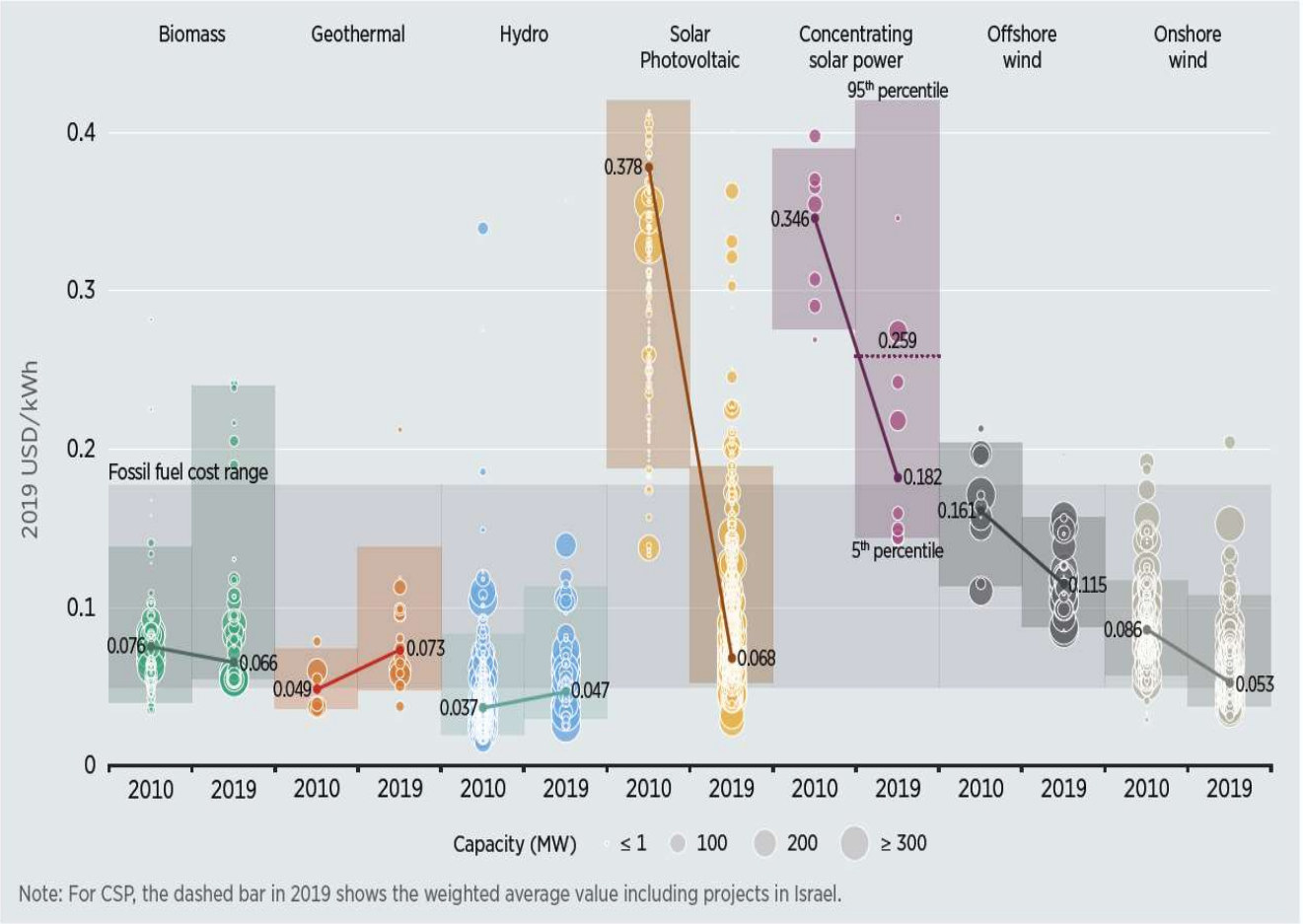
The floating solar photovoltaic (PV) power generation panels at the Da Mi hydro power plant in Binh Thuan, Viet Nam.

The Floating Solar Energy Project finances the Da Nhim - Ham Thuan - Da Mi Hydro Power Joint Stock Company (DHD) to install floating solar photovoltaic (PV) power generation panels, on the man-made reservoir of its existing 175 megawatt (MW) Da Mi hydropower plant.

Clean Energy, Now a Popular Alternative

Cost of Electricity for Renewable Power Generation Technologies (2010-2019)

- Average costs decreased from 2010 - 2019 for solar and wind power
- 82% average decrease for solar PV
- 47% average decrease for CSP
- 29% average decrease for offshore wind
- 38% average decrease for onshore wind



Source: IRENA Renewable Cost Database.

Note: This data is for the year of commissioning. The diameter of the circle represents the size of the project, with its centre the value for the cost of each project on the Y axis. The thick lines are the global weighted-average LCOE value for plants commissioned in each year. Real weighted average cost of capital (WACC) is 7.5% for OECD countries and China and 10% for the rest of the world. The single band represents the fossil fuel-fired power generation cost range, while the bands for each technology and year represent the 5th and 95th percentile bands for renewable projects.

Drivers for Renewable Energy

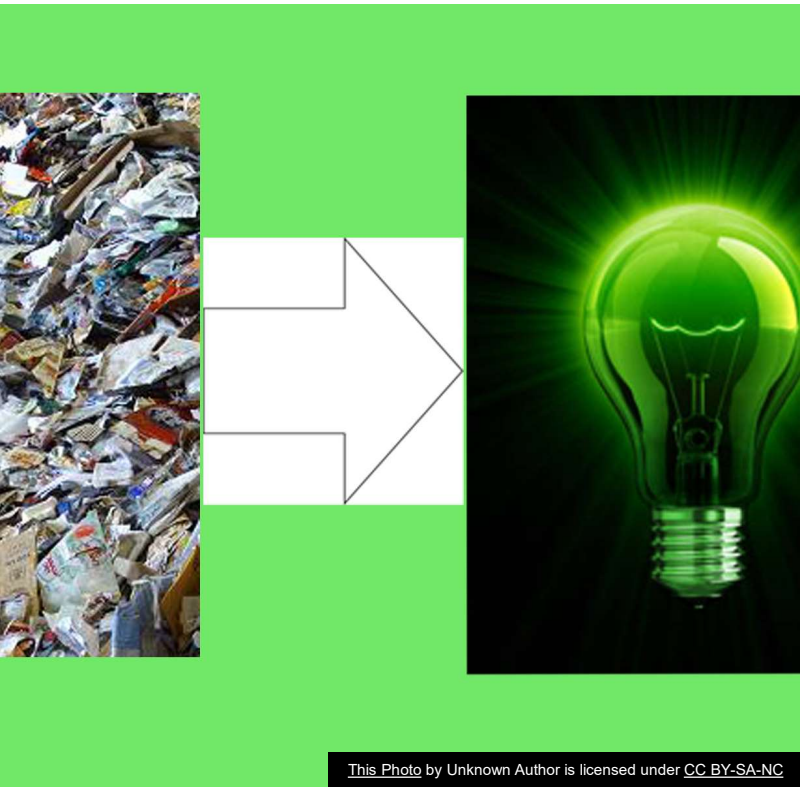
Solar

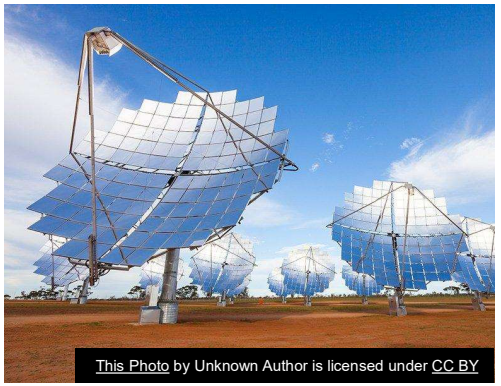
Wind

Hydro

Geothermal

- Technology improvements for solar and wind power technologies
- Competitive procurement
- Large base of internationally active project developers
- Renewable Energy Purchase Obligation
- Feed-in-tariff





Transport Technologies

- Intelligent Transport Systems
- Electronic Road Pricing
- Hybrid to Full Electric Vehicles

ADB

Electric and H_2 vehicles

ADB

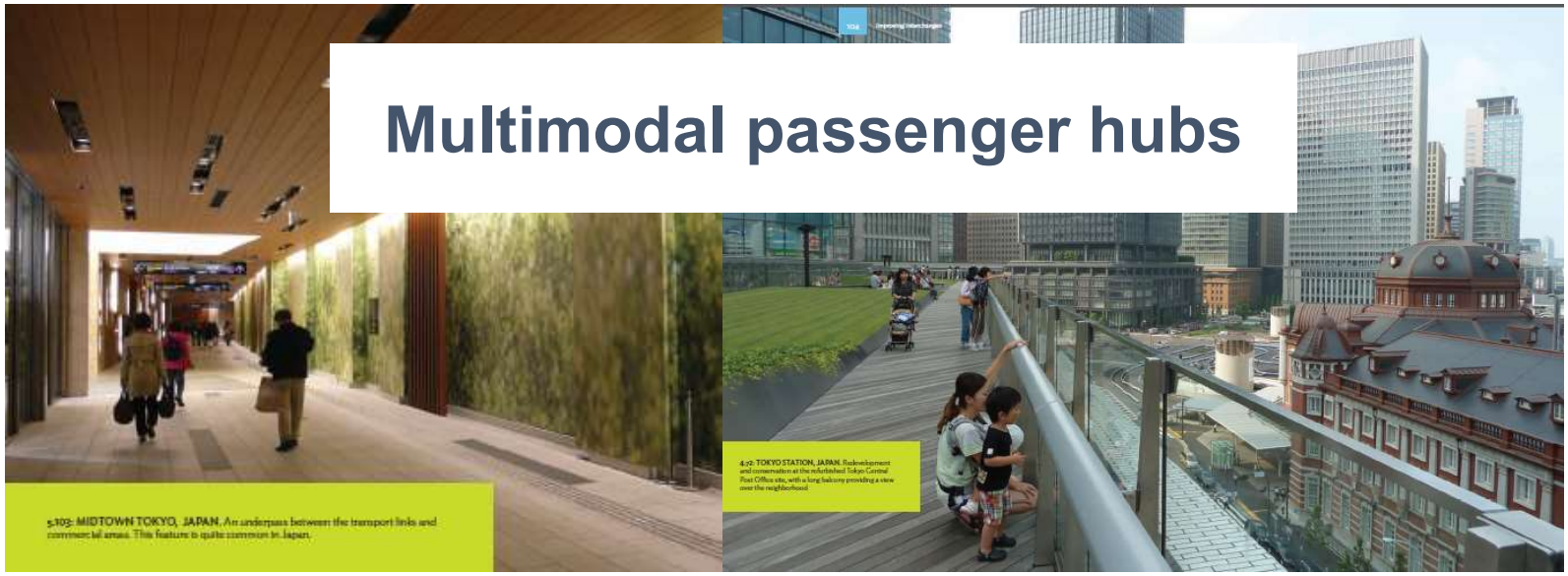
Low Carbon Technologies for Buses

- Hybrid buses – Buses with two sources of onboard power (e.g. diesel-hybrid or gas-hybrid) – small battery size
- Plug-in Hybrid – Buses with fuel-electricity combination (charged directly from the grid)
- Battery Electric Buses (full electric buses) – Buses with different charging systems
- Fuel Cell Electric Vehicle (FCEV) is a type of electric vehicle which uses a fuel cell, instead of a battery, or in combination with a battery, to power its on-board electric motor.

Future opportunities: highways ITS

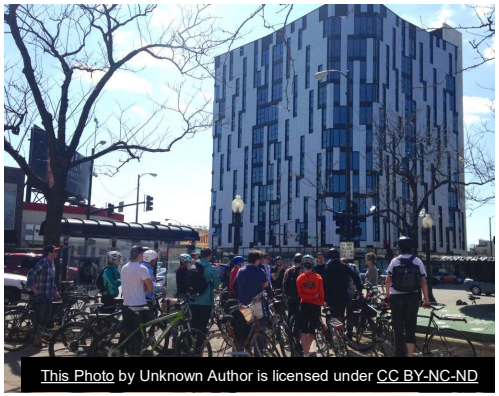
General rationale	Using information on traffic, road conditions and hazards improves transport efficiency and safety
Types of high-level technology	Travel information systems, road safety systems Vehicle registration systems
Approved projects	TA study of overall highway ITS architecture, PRC TA study of ITS for highway safety, PRC
Planned projects	Highway ITS in Kazakhstan, Papua New Guinea

Multimodal passenger hubs

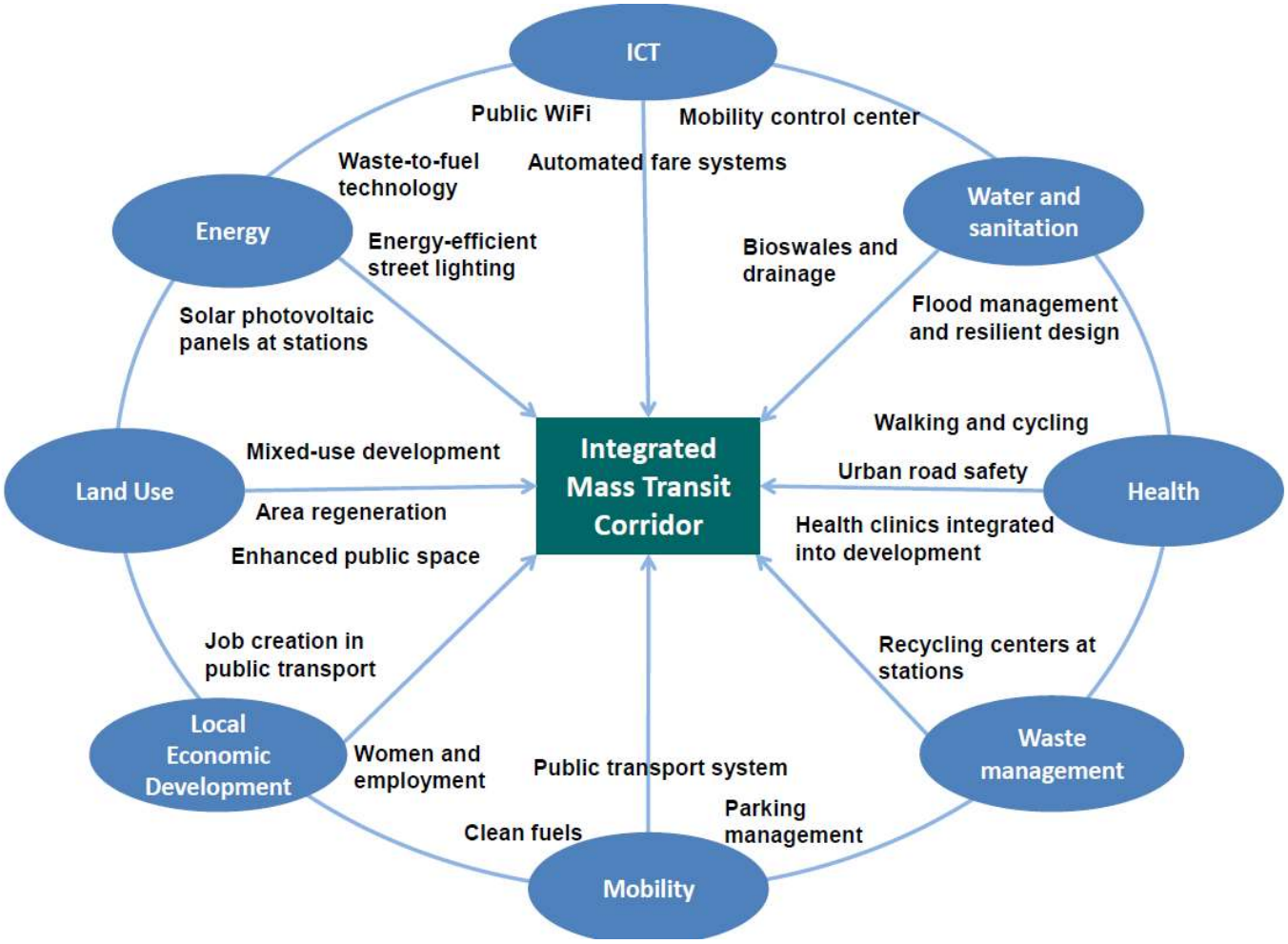


General rationale	Well-designed hubs ensure ease of passenger transfer between modes, and create complementary commercial opportunities
Types of high-level technology	Advanced passenger station/hub design
Approved projects	TA on improving interchanges, PRC
Planned projects	E'mei-Miyi rail project, PRC Yuxi-Mohan rail project, PRC

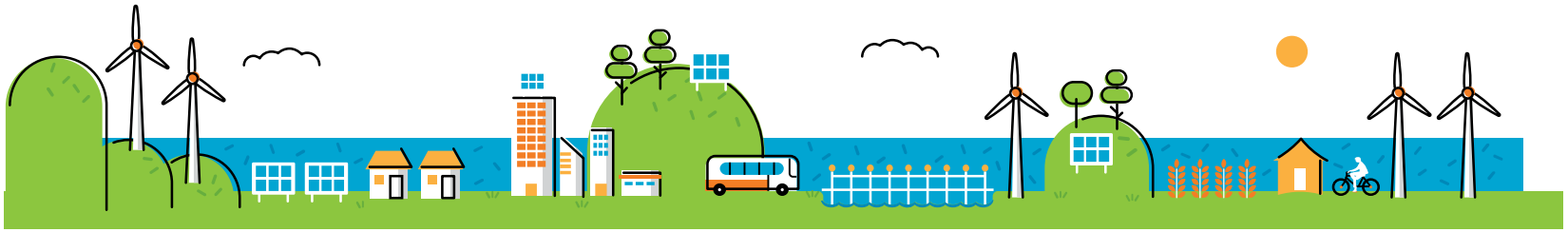
Transit oriented development



Green urban corridors built around mass transit



Disruptions



ADB ASIAN DEVELOPMENT BANK

COVID-19 (Coronavirus): ADB's Response

ADB is supporting its developing members in responding to the COVID-19 outbreak through finance, knowledge, and partnerships.

$6.5 B
(18 March 2020)

$20.0 B
(13 April 2020)

Short-term emergency needs

- Protective equipment
- Health supplies
- Testing
- Communication
- Entry screening

Medium- to long-term needs

Help DMCs counter the socioeconomic impacts of the COVID-19 pandemic

ADB

Bounce-back strategy

Feedback loop, monitoring of health and quarantine instructions

PHASE 1: RESPONSE

Immediate → 3 months

1. Restrict non-essential travel
2. Ensure uninterrupted electricity supply
3. Protect transport and utility staff, passengers, and consumers
4. Ensure health monitoring systems in place
5. Provide necessary financial support to consumers and utilities

PHASE 2: RECOVERY

3 months → 12 months

1. Monitor, evaluate and review
2. Implement preventive and precautionary operating measures as restrictions ease
3. Introduce advanced technology for contactless systems and agile response
4. Identify fiscal sustainability measures

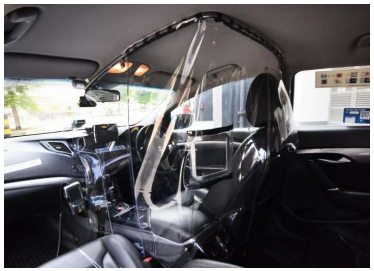
PHASE 3: ADAPTATION

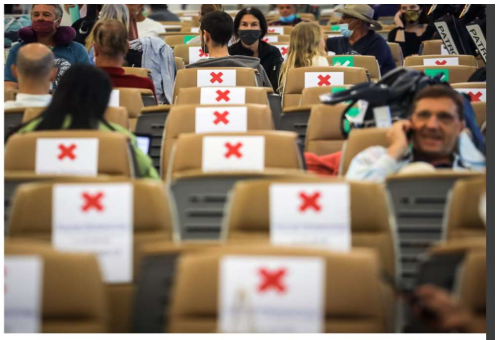
1 year onwards →

1. Mainstream measures as part of overall pandemic resilient response
2. Sustainable transport and energy systems revived, modernized, and better prepared to respond to future pandemic/disaster

Note:
- Durations of each phase is indicative.
- Preparation of each activity should commence ahead of implemented.
- In case of repeated wave of transmissions, countries may fall back to earlier phases and the process repeats.

A new normal is emerging.





System Disruptors

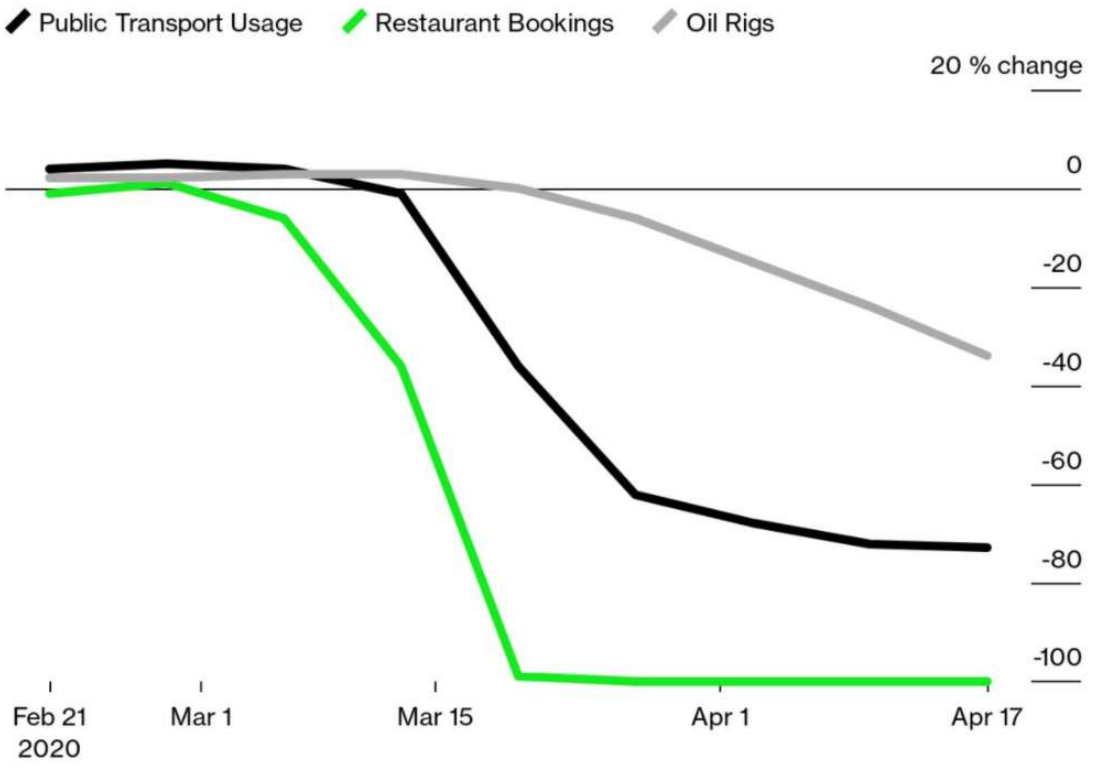
- **System Disruption** is a happening that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market-leading firms, products, and alliances
  - Technology
  - Policies and commitments
  - Unexpected – COVID?
- Stranded assets
- Wall Street is leaving some fossil fuel asset classes
  - Looked bad last year now much worse (different reasons, compounding causes)
  - Price collapse and limited storage options for unsold stock
  - Arctic Oil – Morgan Stanley, Citigroup, Goldman Sachs, JPMorgan and Wells Fargo

Read more at: https://www.bloombergquint.com/onweb/stranded-assets-are-now-everywhere-in-oil-and-gas

Stranded Assets

- IEA definition: those investments which, at some time prior to the end of their economic life (as assumed at investment), are no longer able to earn an economic return, due to changes in the market and regulatory environment.
  - Example, pre-end of life decommissioning of nuclear power stations by the German government after the Fukushima Daiichi nuclear disaster. Financially, payback is curtailed, decommissioning liability increases cost (may need to be paid by taxpayers)
- University of Oxford classification of some environment-related risk factors that could result in stranded assets are:
  - environmental challenges (e.g. climate change)
  - changing resource landscapes including resource depletion (e.g. shale-gas abundance)
  - new government regulations (e.g. carbon pricing, air pollution regulation)
  - falling clean-technology costs (e.g. solar PV, onshore wind, electric vehicles)
  - evolving social norms (e.g. fossil fuel divestment campaign) and consumer behaviour (e.g. certification schemes)
  - Litigation (e.g. carbon liability) and changing statutory interpretations (e.g. fiduciary duty, disclosure requirements)

Impact of COVID-19



Sources: Bloomberg Intelligence Recovery Tracker, Moovit, OpenTable
Note: Transport = change in average of NY, LA, Chicago areas; Restaurants = change in YoY bookings; Oil rigs = change in active rig count from average of first two weeks of January

Bloomberg Green

COVID-19 has opened up new realities and opportunities.

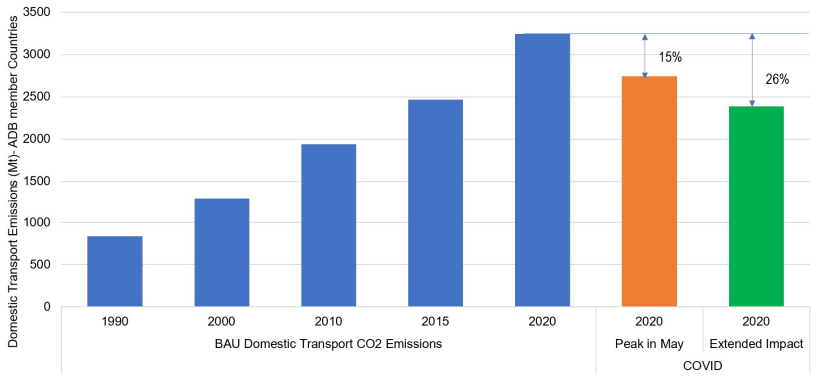
Transport users re-assessed the need for trips. To what extent will these new behaviors will have lasting impact on:

- Increased work from home
- Staggered shifts for office workers and students
- E-learning trends
- Localized trips replacing longer distance trips
- NMT for shorter trips
- e-commerce, resulting in growing demand for urban logistics

Google Meet

zoom

Positive environment impacts brought by COVID-19 in reduced CO2, NO2 and air pollution

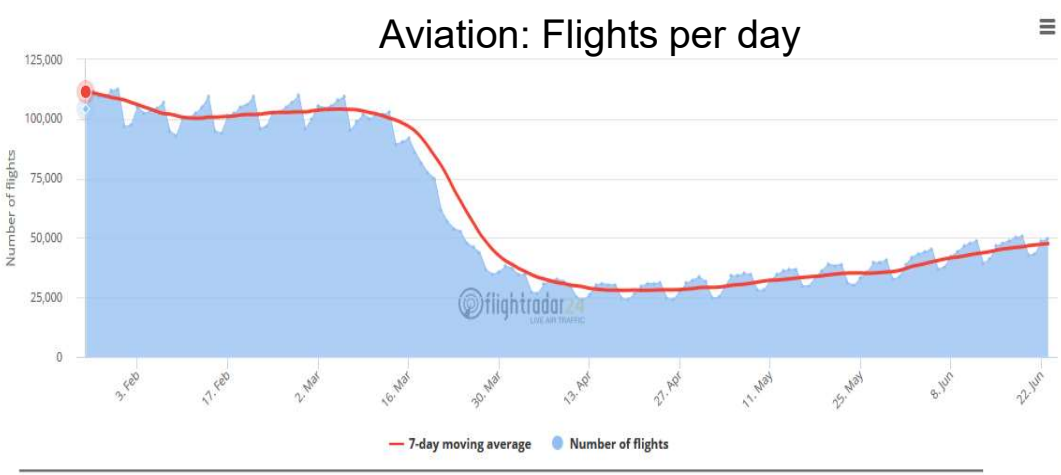


Note
- Peak in May assumes that travel demand reduction peaks in May and there is gradual shift to normality
- COVID-19 extended impact scenario assumes peak in May but situation does not return to normal till December

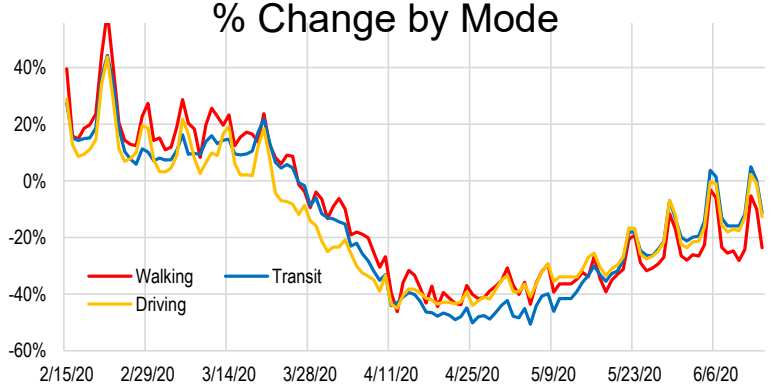
A new study is needed to assess possible scenarios and trends to inform future design and development of transport projects.

COVID-19 Impacts on Transport Patterns and Energy Use

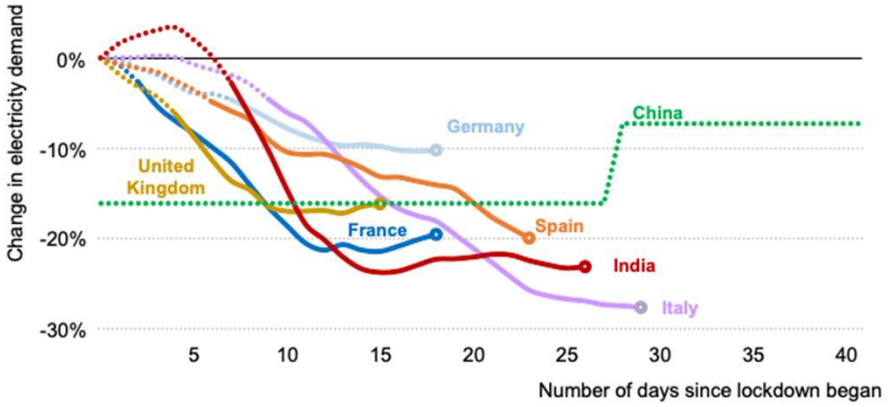
Aviation: Flights per day



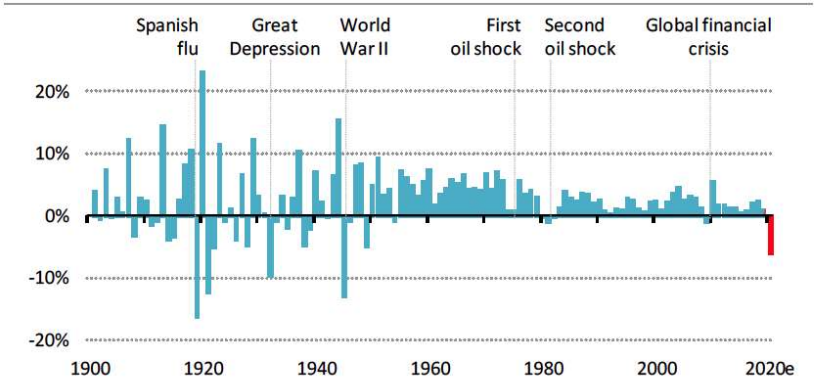
APAC Urban Transport % Change by Mode



Electricity: % demand change



Global Energy Demand: % change



Sources: Flightradar, Apple, and IEA.

Impacts on ADB Developing Member Countries

Challenges

- Shift to less sustainable transport modes
- Financial viability of public transport operators
- Liquidity issues of power utilities
- Energy producer countries taking revenue hit

Observed Benefits

- Good air quality
- Opportunity to modernize public transport systems
- Power mix shifted towards renewables
- Power system demonstrated flexibility

Asian Development Bank

Sustainable infrastructure is…

- ✓ Accessible
- ✓ Affordable
- ✓ Environment friendly
- ✓ Safe
- ✓ Resilient

谢 谢 Thank you!