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Cluster 7/Module 5 (C7/M5): Climate Change, Green Growth and Transport

This presentation is one of the support materials prepared for the capacity building program ***Building Leaders in Urban Transport Planning (LUTP).***

Support for LUTP was provided by:

- Public-Private Infrastructure Advisory Facility (PPIAF)
- The Energy Sector Management Assistance Program (ESMAP)
- Korean Green Growth Task Force
- The World Bank

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Objectives

- Establish a general understanding of climate change and its causes
- Identify harms of climate change and how to deter its detrimental effects
- Overview of global initiatives to address climate change
- Non state actors: initiatives at subnational level to address climate change in transport sector
- Efforts of reducing transport emission
- Examples of best practices addressing climate change in the transport sector.

In this module, we will establish a general understanding of climate change and its causes.

Then, we will identify harms of climate change and current efforts of risk/crisis management in the transport sector.

Furthermore, we will discuss the global efforts to curb climate change in the transport sector.

Lastly, we will also look into successful cases of reducing greenhouse gases emission around the world.

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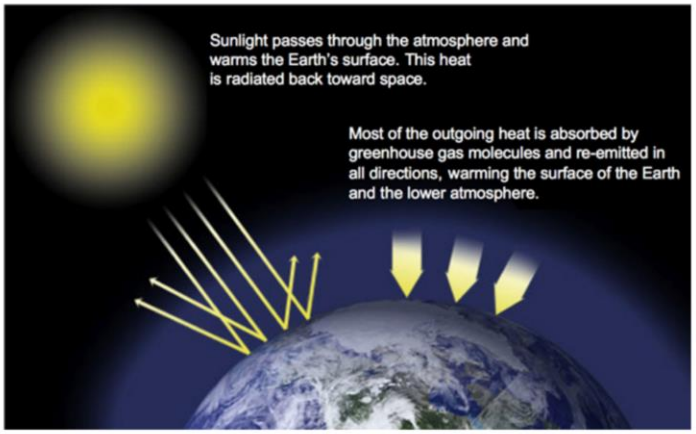
What is Climate Change?



A layer of greenhouse gases – primarily water vapor, and including much smaller amounts of carbon dioxide, methane and nitrous oxide – acts as a thermal blanket for the Earth, absorbing heat and warming the surface to a life-supporting average of 59 degrees Fahrenheit (15 degrees Celsius).

Source: NASA

Climate change is a pattern in which the average temperature of the Earth keeps rising due to the accumulation of Greenhouse Gasses (GHG). Instead of the sunlight bouncing off the surface of the Earth, it gets trapped in the blanket of GHGs. As a result, average temperatures are rising in the atmosphere, on the Earth's surface and on the oceans.

Other consequences of climate change are the changes of weather patterns: in fact even the average temperatures may be increasing, this impacts weather in a specific locations in different ways (e.g. hotter, colder, wetter, dryer, windier, etc.)

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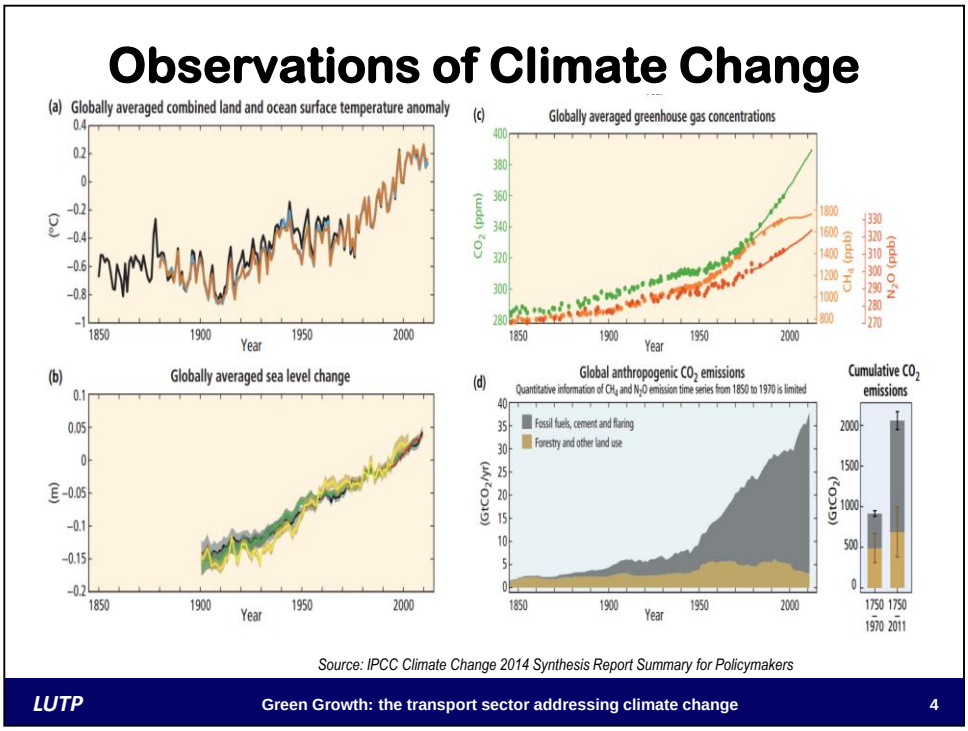

The most noticeable effect of climate change is the rise of GLOBAL temperature and sea level rise (Chart A).

The consequences of climate changes however, vary based on the geographical location (e.g. certain region may experience weather getting hotter, colder, wetter, dryer, windier etc.).

Also, the sea level has been rising consistently (Chart B), due to glaciers shrinking world wide, as permafrost temperatures have increased due to increased surface temperature and changing snow cover.

While there have been skeptics of climate change due to human activities (Chart C and D), the international community of scientists have reached a consensus that climate change is largely caused by anthropogenic emissions of greenhouse gases.

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Several initiatives have been taken around the world to tackle climate change:

The Conference of Party (COP) are yearly conferences, they serve as the formal meeting of the **United Nations Framework Convention on Climate Change (UNFCCC)**. Parties assess progress in dealing with climate change and beginning in the mid-1990s, to negotiate the **Kyoto Protocol** to establish legally binding obligations for developed countries to reduce their greenhouse emissions.

The COP 21 was held in Paris from 30 November to 12 December 2015. Negotiations resulted in the adoption of the **Paris Agreement**. The **Paris Agreement** aims to keep the rise in global temperature in this century below 2 degrees Celsius. As of October 2016, 143 parties have ratified the agreement, achieving the threshold for entry into force. In anticipation of the Paris Agreement, member nations had publicly outlined climate actions they intended to take post-2020, called Intended Nationally Determined Commitments. These commitments became **Nationally Determined Commitments**—binding policies—when the Paris Agreement entered into force.

Transport is a critical component to COP21 as it is a sector that can contribute to both reducing GHG emissions and building economy wide resilience to the impacts of climate change.

Habitat III (also known as United Nations Conference on Housing and Sustainable Urban Development) was a non-binding conference where heads of state met to strengthen the discussion for sustainable development of cities. Habitat III resulted in the **New Urban Agenda**: an action-oriented document to set global standards and principles of planning, construction, development(>>>) of urban areas to achieve sustainable urban development. The document is a resource for every level of government. The NUA is linked with Goal 11 of the SDG

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Sustainable Development Goals (SDGs) is a set of 17 global goals (and 169 targets) for sustainable development, set globally by the United Nations. **The Sustainable Development Goals** are the blueprint to achieve a better and more sustainable future for all. Goals address the global challenges, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. The Goals interconnect and in order to leave no one behind. Goal 13 is specific to Climate change.

Transport contribute **directly** to 5 targets (I. Road Safety II. Energy efficiency III. Sustainable infrastructure IV. Urban access V. Fossil fuel subsidies) and **indirectly to 7 SDG goals** (I. Agricultural productivity II. Air pollution III. Access to safe drinking water IV. Sustainable cities V. Reduction of food loss VI. Climate change adaptation VII. Climate change mitigation. (www.slocat.net/sdgs-transport)

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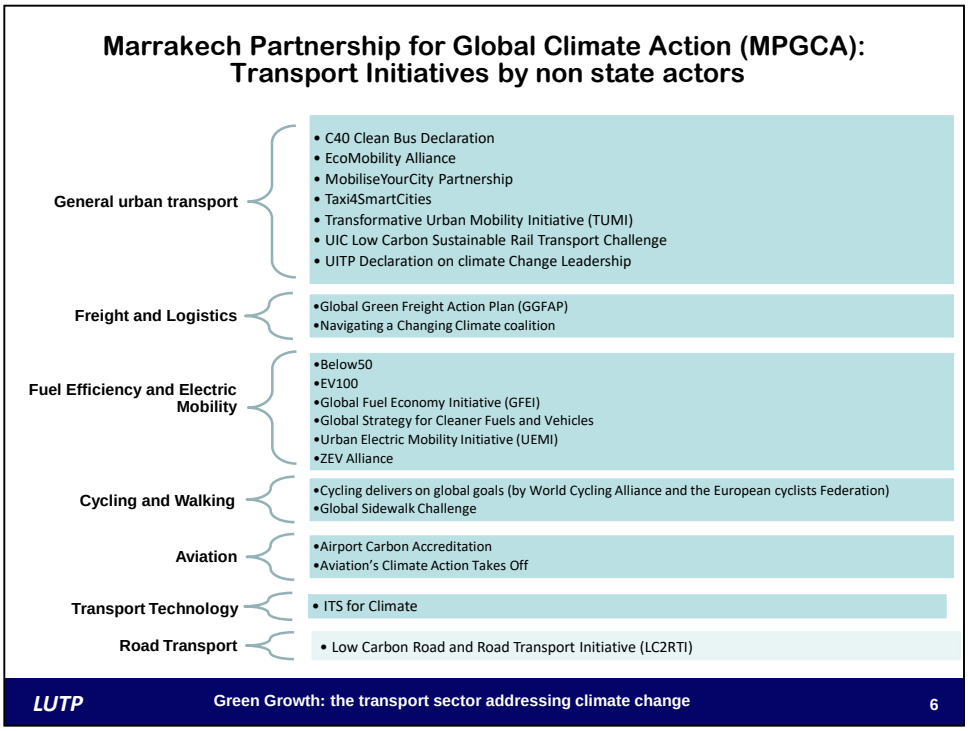

Transport Initiatives by non state actors are voluntary commitments towards the implementation of the Paris agreement and 2030 agenda for sustainable development.

Electric Vehicles Initiative (EVI)

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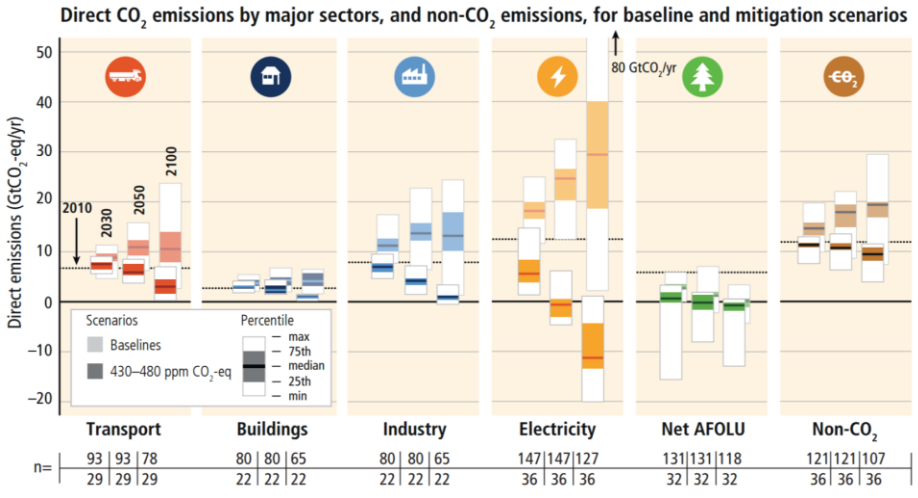
Transport Adds to Climate Change



Source: IPCC Climate Change 2014 Synthesis Report Summary for Policymakers

Along with electricity generation and factories, transport is one of the biggest emitters of GHGs. Transport contributes 23% of energy-related CO2 emissions today and demand for transport services is rising.

Elements of climate change-inducing factors in the transport sector are:

- Congestion
- Urban sprawl
- Reliance on fossil fuels
- Inefficient transport (low occupancy/fuel efficiency)
- Lack of environmental standards and regulation

When planning for urban transport, it is essential to do so with a long-term sustainability in mind, so as to not create lock-ins where newly designed transport systems aggravate climate change and pollution. The difficulty lies in the tendency where with lower economic activities sustainability is not prioritized but by the time economic activity is booming a city finds itself locked into an unsustainable path.

11.16.2018 https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

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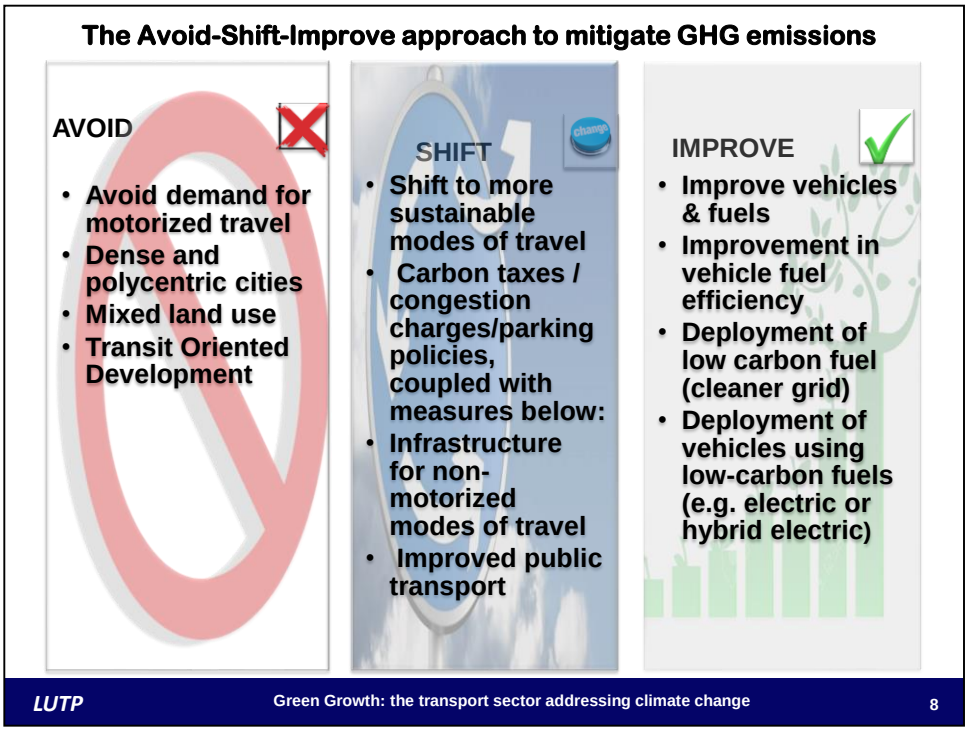

https://www.sutp.org/files/contents/documents/resources/A_Sourcebook/SB5_Environment%20and%20Health/GIZ_SUTP_SB5f_Adapting-Urban-Transport-to-Climate-Change_EN.pdf

Urban transport policies primarily seek to enable people and goods to meet their travel demands but by imposing the least negative externalities on society.

Broadly, the policies fall into three clusters: **Avoid, Shift, and Improve**.

Avoid: or decrease the distance travelled achievable through a careful land use planning that aims to maintain mobility while reducing the km travelled. TOD increase the density along highly efficient public transport.

Shift: policies aim at getting people to shift to more efficient and low emission modes of travel, like public transport and non-motorized modes. This could happen through a combination of investments in improved public transport, safer infrastructure for non-motorized modes, and disincentives for the use of personal motor vehicles, such as carbon taxes and higher gas prices.

Incentivize the shift to non-motorized transport and public transports modes Transport Demand Management (e.g.. congestion charging, parking fees) incentivize the transport more shift to a more sustainable transport option.

Improve: policies seeking to reduce the negative effects of motor vehicle use, such as the amount of fuel consumed or pollutants emitted, per unit of travel. This could be achieved through policies such as improving vehicle fuel efficiency, developing low carbon fuel through cleaner grid technology, and incentives for deployment of low emission vehicles such as electric and hybrid electric vehicles.

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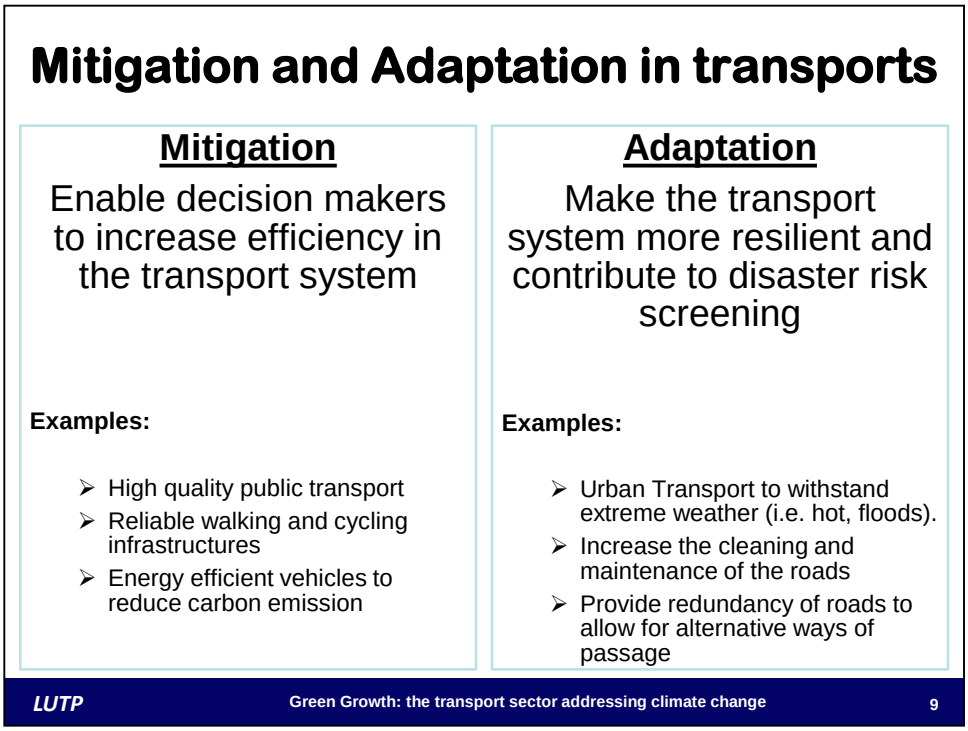

Depending on the varying priority and economic capacities, cities and nations have different ways dealing with climate change.

Mitigation is an effort to "stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (from the 2014 report on Mitigation of Climate Change by the UNIPCC). For example, governments incentivize corporations and individuals to use less fossil fuels and to shift to renewable energy to reduce the emission of GHGs.

Adaptation aims to reduce our vulnerability to expected and already present devastating effects of climate change. For instance, millions face the threat of sea level encroachment in the East Asia and Pacific region. Latin America and the Caribbean region is suffering from the impact of El Niño accompanied by drastic change in temperatures and precipitation, causing harm to the community and their crops. In order to deal with such immediate harms of climate change, governments engage in policies such as sustainable forest and land management, land restoration and building coastal resilience, as well as developing risk and recovery support system.

https://www.sutp.org/files/contents/documents/resources/A_Sourcebook/SB5_Environment%20and%20Health/GIZ_SUTP_SB5f_Adapting-Urban-Transport-to-Climate-Change_EN.pdf

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Putting it all together: Synergies between adaptation and mitigation

Strategic approach	Opportunities for synergies	Mitigation	Adaptation
AVOID	• Sound-Land-use planning with compact and transit oriented cities with green spaces • Combined with climate proofed design standards for infrastructure	• Short distances reduce land conservation, travel demand and related emission • Reliable public transport, walking and cycling infrastructures	• Parks and green roads provide cooling • Short distances reduce the total infrastructure requiring adaption • Short distances favor walking and cycling • Resilient infrastructures
SHIFT	• High quality transport (with TOD measures) • Climate proof design for vehicles and contingency planning • High quality pedestrian and cycling infrastructures • TDM measures to disincentivize the use of private motorized vehicles	• High quality public transport attracts more customers and reduce car trips • Less road space is needed • Less Co2 emissions per passenger per KM	• High quality public transport necessary to maintain mobility for these without access to car • Reliable public transport is vital for disaster risk management and evacuation
IMPROVE	• Procurement of efficient and resilient vehicles • Vehicles standards	• Energy efficient vehicles reduce the carbon emission per KM	• Resilient vehicles are necessary to maintain mode share (reliable and comfortable) • Aid conditioning should not be based on HFC but CO2 (Lover warming potential)

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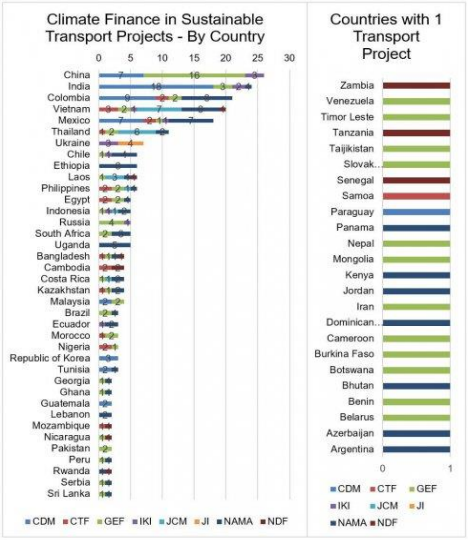
Climate Finance



Source: SLoCaT, period 1992 - 2016

Climate finance is financing administered for climate change mitigation and adaptation projects and programs

- *The World Economic Forum forecasts that by 2020, about $5.7 trillion will need to be invested annually in green infrastructure, much of which will be in today's developing world*
- *The IFC estimates that the NDCs of 21 emerging market economies alone represent $23 trillion in investment opportunities. This includes $2.6 trillion in sustainable transport in Argentina, Brazil, Colombia and Mexico.*
- *The WBG has committed to increase climate financing to 28 percent of the Bank Group's portfolio by 2020, in response to client demand. At current levels of co-financing, that would mean a potential $29 billion a year for climate projects by 2020. Meeting these targets is conditional on sustained aggregate WBG lending volumes, access to concessional finance, and client demand.*

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Climate change impacts in urban transport

Extreme weather event associated with climate change	Impact on the road infrastructures and rails
Increase in temperature (increase of hot days and heat waves)	• Thermal expansion and degradation of bridges and rails. • Concerns regarding pavements (deformation of roads, asphalt rutting). • Increased temperatures in underground network
Temperature decrease in very cold days	• Rail track deformities may lead to equipment failure.
More frequent drought	• Dry soil combined with heavy rain may lead to landslides. • Road foundation deration. • An increase of dust can lead to reduced frictions of the breaks and reduced visibility
Sea level rise and costal erosion	• Road inundation • Underground flooding • Degradation of roads and base layers due to the salt.
Extreme rainfall	• Flooding • Decrease of infrastructures integrity
More frequent storms	• Damage to infrastructures (bridges, lighting system, stations) • Inurnment risks by the sea especially in combination with high tide. • Weathering infrastructures and flooding of tunnels and rail lines. Degrease structural integrity

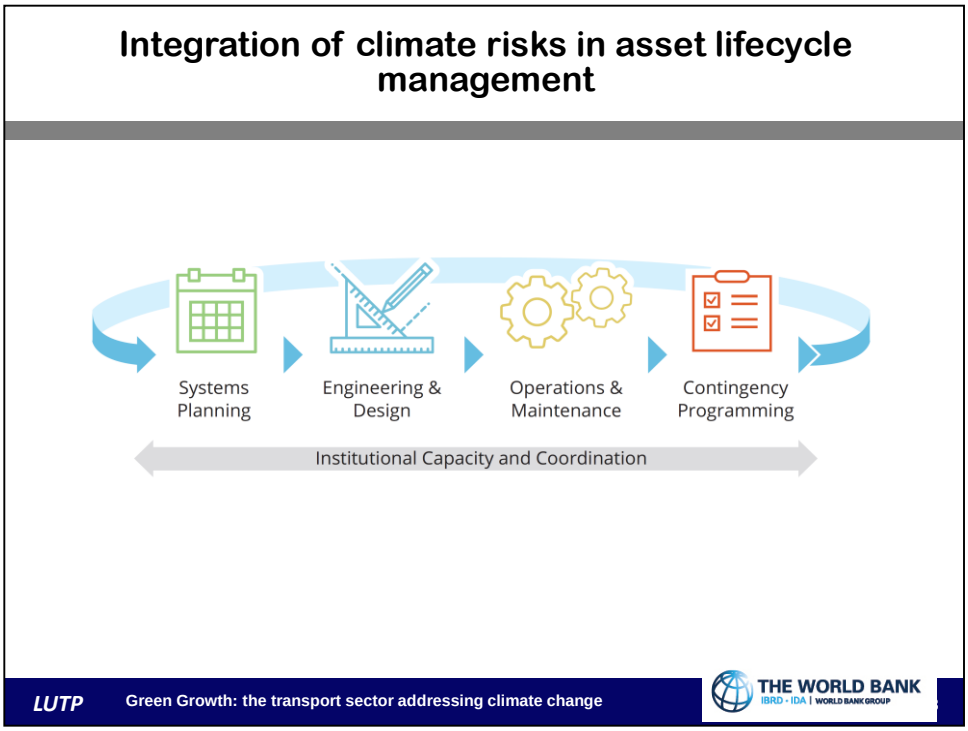
Climate change is an increase in global average temperature and that the impacts can be different in different geographies. Further, climate change increases the risk of natural disasters and managing climate change impacts is associated with risk management.

All modes of transport (land, marine and aviation) can be negatively affected by climate change impacts, such as the increase in strength and frequency of extreme weather events.

All modes of transport (land, marine, aviation) can be negatively affected by climate change impacts (such as the increase in strength and frequency of extreme weather events).

In this slide we focus on the risks in urban transport.

https://www.nap.edu/read/12179/chapter/5#112



To enhance the resilience of transport systems, this report proposes an holistic approach of integration of climate risks in infrastructure lifecycle management:

- **Systems Planning:** Promote development in less hazard prone areas, explore transport infrastructure flood/coastal protection function, analyze transport systems at network level to understand critical infrastructure and thresholds and use this to prioritize investments in resilience.
- **Engineering & Design:** Apply innovative materials, upgraded design standards and specifications to enhance robustness of infrastructure as well as its ability to be retrofitted in the future.
- **Operations & Maintenance:** Improve inventory and mapping of transport infrastructure assets, improve institutional and financial arrangements for maintenance and deploy routine and ongoing maintenance programs,.
- **Contingency Programming:** Invest in emergency preparedness and response to meet local and regional evacuation, response and recovery needs and relief distribution; pre-quality goods and service provides to support speedy procurement processes and effective post-disaster damage assessment.

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Seoul and green transport

Restoration of Cheonggyecheon -- Recreational area constructed in place of overpasses, around a revived stream with walkways, bridges & greenery

Seoul was facing high level of GHG emissions, air pollution, traffic congestion, increase in fatalities. The Supply-oriented transportation policies became irrelevant

To overcome this problem Seoul made a great shift to green demand-side policies;

- Increased the bus routes and improved reliability of the service

- Created exclusive BRT lanes and traffic centers

- Introduced and integrated fares with free transfers between buses and metro

The results was:

- Energy consumption in Korea's road sector lowered

- Decreased congestion and congestions costs

- Reduced CO2 emissions in the transport sector

Seoul had been experiencing the side effects of fast economic growth, from serious traffic congestion, high levels of GHG emissions to heavy air pollution. Seeing that supply-side oriented development had met its limitations,

Seoul made a great shift to green demand-side policies focusing on creating a transit-oriented city. Seoul already had an extensive metro system, but most of the rise in metro ridership came from former bus riders rather than passenger car drivers. After a 2002 expansion of the metro network, automobile passenger trips and metro ridership were both higher than in 1996, while bus ridership was lower.

In order to encourage more passengers to shift away from private vehicles, the government modernized and expanded the bus system and integrated it with both metro and a new system of feeder buses. Also, exclusive BRT lanes and efficient transit centers allowed faster and more reliable service as transfers became more convenient. In addition, the introduction of distance-based fares and free transfers between buses and metro played a significant role in swinging private vehicle users to public transport modes.

The key in Seoul's transition to greener transport is in maximizing reliability of the public transport and user convenience through implementing multimodal solutions. As a result, energy consumption in Korea's road sector is lower than in other countries with similar GDP. Congestion costs have been decreasing, and CO2 emissions in the transport sector have been kept under control.

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Impact of BRT system in Mexico City

Source: OECD

Mexico City 200km of metro were insufficient to handle the demand. The city was facing a traffic congestion problem and pollution.

Mexico city invested in Metrobus. A Bus Rapid Transit System which comprise 7 routes and has a daily ridership of 1.8 million.

The benefits achieved by the BRT are many:

- ***BRT helped alleviate traffic and reduced the commuting time for the route from 1.5 to 1 hour.***
- ***Reduced the CO2 emission by 35,000 tons annually.***

Mexico City's 200 kilometers of metro was not sufficient to handle the demand for mass transport. In 2000, only 9% of the 14.8 million daily trips on public transport were taken on the metro. It was clear that Mexico City needed to vastly expand its transportation system and, in 2002, Mexico City started the planning process for its first Metrobús BRT corridor. Ten years later, in 2012, Mexico City has 95 more kilometers of corridors with mass transport.

Locally, Metrobus grew out of a greater effort to address poor air quality in Mexico City, but evolved into a low-carbon, climate-change mitigating project due to World Bank

participation. Larger, newer buses operating at high speeds successfully reduced travel time per passenger and achieved lower emissions. Also, 15% of users report having left their vehicles in order to use the Metrobus system, amounting to about 122,000 fewer daily trips in personal vehicles.

The **Mexico City** Metrobús (officially Sistema de Corredores de Transporte Público de Pasajeros del Distrito Federal and simply known as Metrobús) is a bus rapid transit (BRT) system that has served **Mexico City** since line 1 opened on June 19, 2006. Between 2005 and 2015, it is estimated that the Metrobús corridor will reduce on average 144 tons of total hydrocarbons, 690 tons of oxides of nitrogen, 2.8 tons of fine particulate matter, and 1.3 tons of sulfur dioxide annually. These emissions reductions avoid an average of 6100 work loss days, 660 restricted activity days, 12 new cases of chronic bronchitis, and 3 deaths annually. These health improvements are estimated to result in $3 million (U.S. dollars) in health benefits each year.

Over the same 10-year period, the Metrobús corridor on Insurgentes is expected to eliminate 280,000 tons of carbon dioxide-equivalent emissions. We do not attach a monetary value to this emissions reduction because of the difficulty in estimating the social benefit of reducing greenhouse gas emissions.