# Infrastructure and the Environment (Pt 1)

## Building expertise on sustainable and resilient infrastructure

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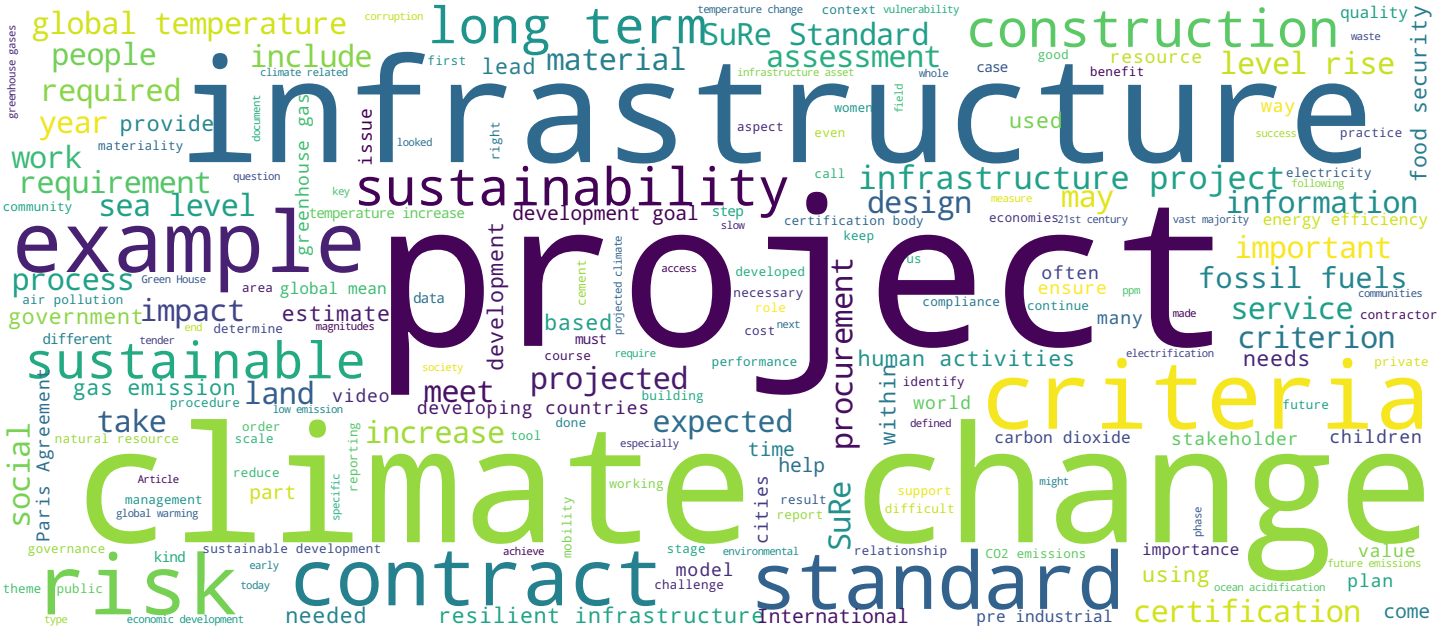


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Video

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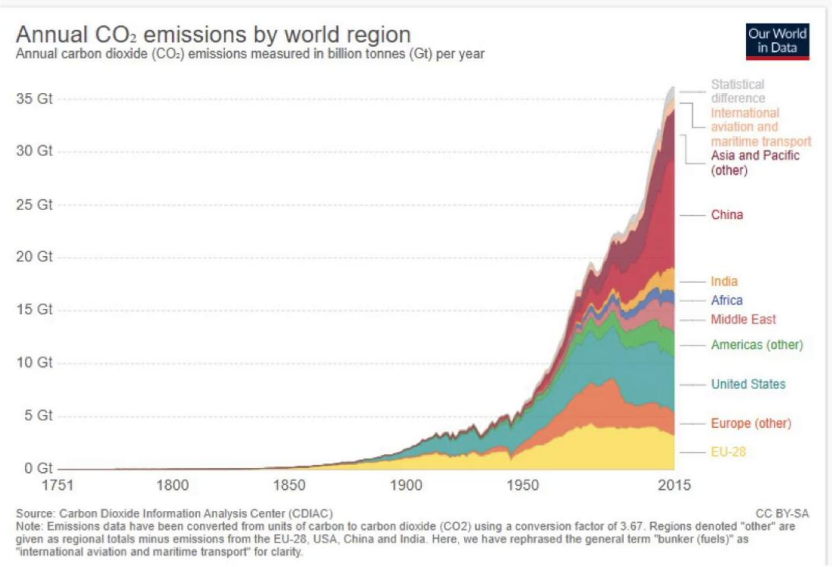
This video consists of two parts. We will present basic knowledge in the field of climate change, and biodiversity losses and the use of natural resources. We will explore the three phenomena, look at the nexus with infrastructure and draw conclusions regarding the characteristics of the infrastructure we need.

Notes

Summary

0m 05s




https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

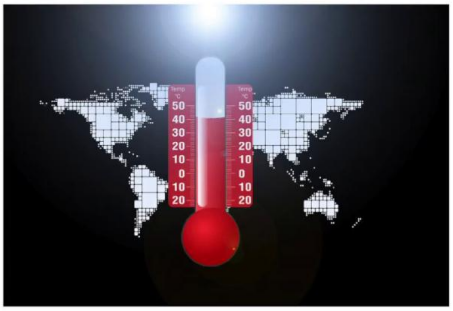
The accumulation of Green House Gases, particularly CO2, in the atmosphere prevent energy to leave the planet and leads to changes in the earth climate. Multiple lines of evidence indicate a strong, consistent, almost linear relationship between cumulative CO2 emissions and projected global temperature change to the year 2100. The primary greenhouse gases in Earth's atmosphere are carbon dioxide, methane, nitrous oxide, Chlorofluorocarbons (CFCs), Hydrofluorocarbons and ozone. Human activities since the beginning of the Industrial Revolution (around 1750) have produced a 40% increase in the atmospheric concentration of carbon dioxide (CO2), from 280 ppm in 1750 to 406 ppm in early 2017.

Notes

Summary

0m 29s

- Environmental and social risks resulting from climate change

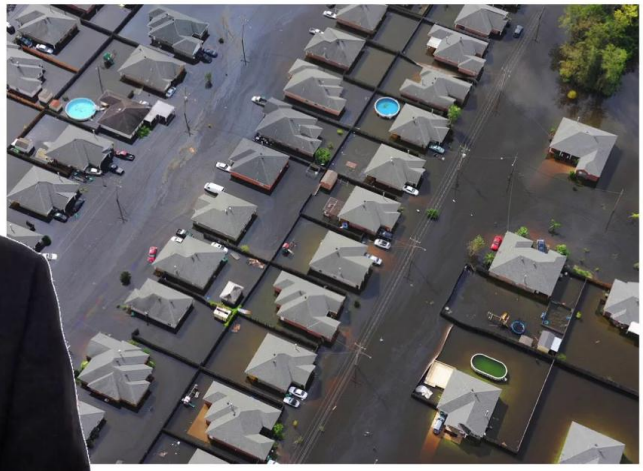


This increase has occurred despite the uptake of more than half of the emissions by various natural "sinks" involved in the carbon cycle. The vast majority of anthropogenic carbon dioxide emissions (emissions produced by human activities) come from combustion of fossil fuels, principally coal, oil, and natural gas, with additional contributions coming from deforestation, changes in land use, soil erosion and agriculture. Risk of climate-related impacts results from the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems. Rising rates and magnitudes of warming and other changes in the climate system, accompanied by ocean acidification, increase the risk of severe, pervasive and in some cases irreversible detrimental impacts. Some risks are particularly relevant for individual regions, while others are global. The precise levels of climate change sufficient to trigger abrupt and irreversible change remain uncertain, but the risk associated with crossing such thresholds increases with rising temperature.

Notes

Summary

1m 27s



A large fraction of species faces increased extinction risk due to climate change, especially as climate change interacts with other stressors. Most plant species cannot naturally shift their geographical ranges sufficiently fast to keep up with current and high projected rates of climate change in most landscapes; most small mammals and freshwater molluscs will not be able to keep up at the rates projected under RCP4.5 (+ 1.1°C to 2.6°C). Marine organisms will face progressively lower oxygen levels and high rates and magnitudes of ocean acidification, with associated risks exacerbated by rising ocean temperature extremes (medium confidence). Coastal systems and low-lying areas are at risk from sea level rise, which will continue for centuries even if the global mean temperature is stabilized. It is virtually certain that global mean sea level rise will continue for many centuries beyond 2100, with the amount of rise dependent on future emissions. The threshold for the loss of the Greenland ice sheet over a millennium, and an associated sea level rise of up to 7 m, is greater than about 1°C but less than about 4°C of global warming with respect to pre-industrial temperatures.

Notes

Summary

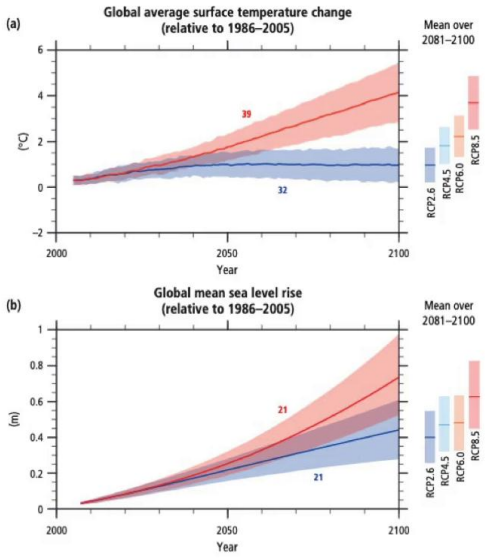
3m 04s


Climate change is projected to undermine food security. Due to projected climate change by the mid-21st century and beyond, global marine species redistribution and marine biodiversity reduction in sensitive regions will challenge the sustained provision of fisheries productivity and other ecosystem services. For wheat, rice and maize in tropical and temperate regions, climate change is projected to negatively impact production for local temperature increases of 2°C or more above late 20th century levels. Global temperature increases of ~4°C or more above late 20th century levels, combined with increasing food demand, would pose large risks to food security globally. Climate change is projected to reduce renewable surface water and groundwater resources in most dry subtropical regions, intensifying competition for water among sectors. Until mid-century, projected climate change will impact human health mainly by exacerbating health problems that already exist. Throughout the 21st century, climate change is expected to lead to increases in ill-health in many regions and especially in developing countries with low income.

Notes

Summary

5m 03s



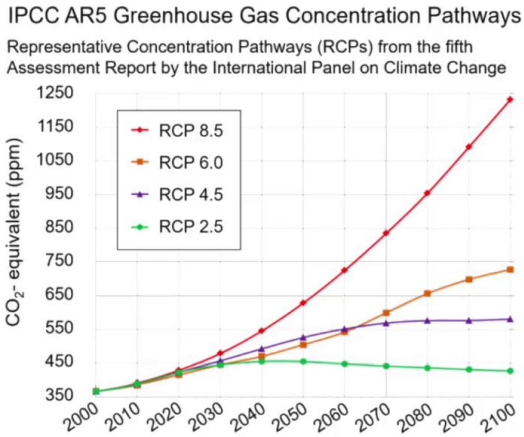

https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf

By 2100 for RCP8.5 (+ 2.6°C to 4.8°C), the combination of high temperature and humidity in some areas for parts of the year is expected to compromise common human activities, including growing food and working outdoors. In urban areas climate change is projected to increase risks for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scar-city, sea level rise and storm surges. These risks are amplified for those lacking essential infrastructure and services or living in exposed areas. Rural areas are expected to experience major impacts on water availability and supply, food security, infrastructure and agricultural incomes, including shifts in the production areas of food and non-food crops around the world. This graph shows you projections of global average surface temperature change and global means of see level rise. Projections of such kind vary over a wide range, depending on socio-economic development such as population size, economic activity, lifestyle, land-and energy use and climate policy.

Notes

Summary

6m 43s

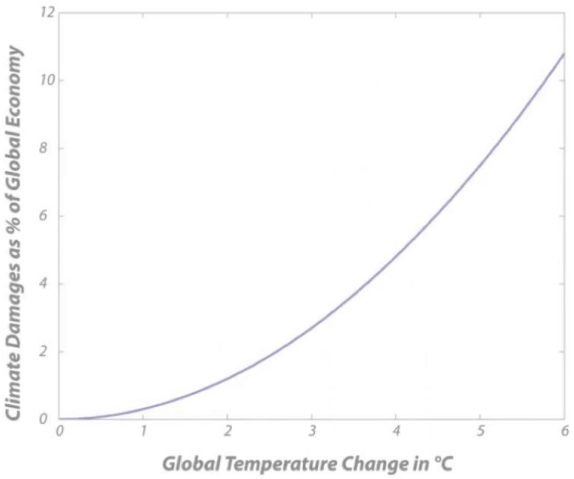



RCP stands for Representative Concentration Pathways. The RCPs are used for making projections based on these factors. The RCPs include a stringent mitigation scenario (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6.0) and one scenario with very high Green house Gas emissions (RCP8.5).

Notes

Summary

8m 20s




https://www.e-education.psu.edu/earth103/node/717

- Economic risks resulting from climate change
  - Slow down of economic growth
  - New poverty traps especially in urban areas
  - Displacement and migration
  - Violent and political conflicts

Economic costs related to climate change. William Nordhaus, the prize winner and Yale University professor expresses the damages as a percentage of the global economic output.

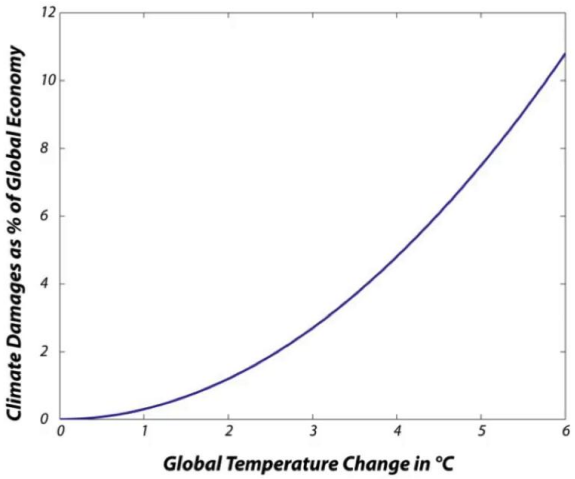
Aggregate economic losses accelerate with increasing temperature, but global economic impacts from climate change are currently difficult to estimate. From a poverty perspective, climate change impacts are projected to slow down economic growth, make poverty reduction more difficult, further erode food security and prolong existing and create new poverty traps, the latter particularly in urban areas and emerging hotspots of hunger. International dimensions such as trade and relations among states are also important for understanding the risks of climate change at regional scales. Climate change is projected to increase displacement of people (medium evidence, high agreement). Populations that lack the resources for planned migration experience higher exposure to extreme weather events, particularly in developing countries with low income. Climate change can indirectly increase risks of violent conflicts by amplifying well-documented drivers of these conflicts such as poverty and economic shocks. Various economists tried to estimate the economic costs related to climate change.

Notes

Summary

8m 58s

# Climate and Infrastructure




https://www.e-education.psu.edu/earth103/node/717

- Various economists tried to estimate the economic costs related to climate change. William Nordhaus, the nobelprize winner and Yale University professor expresses the damages as a percentage of the global economic output.

William Nordhaus, the nobelprize winner and Yale University professor expresses the damages as a percentage of the global economic output., and the relationship he adopted looks like this: You can see that for a 4°C increase in global temperature, the climate damages amount to about 4% of the global economy, which puts Nordhaus' formulation in line with an estimate by the IPCC of between 2 and 5% for a 4°C rise.

Notes

Summary

10m 18s

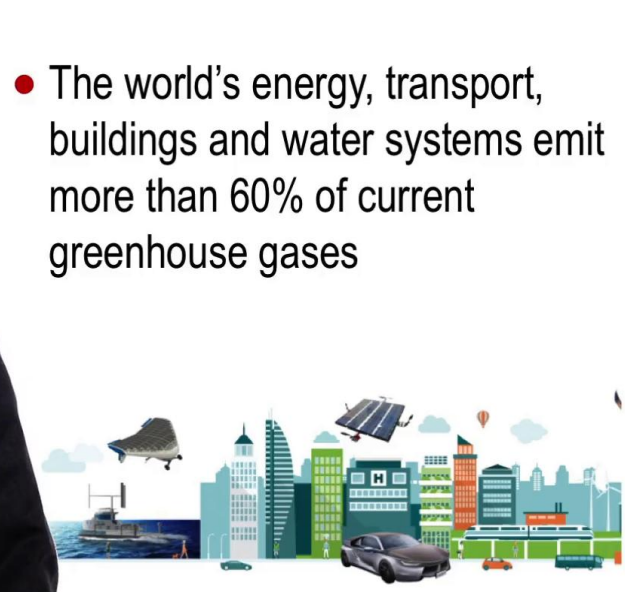
To limit global temperature increase to well-below 2° C and towards 1.5° C above pre-industrial levels as laid out in the Paris Agreement requires a radical change to infrastructure, technologies and behaviours.

A pathway compatible with the objective of the Paris Agreement to limit global temperature increase to well-below 2°C and towards 1.5°C above pre-industrial levels requires a radical change to infrastructure, technologies and behaviours. Significant greenhouse gas emissions are embedded in the vast majority of human activities and preferences.

Notes

Summary

10m 48s

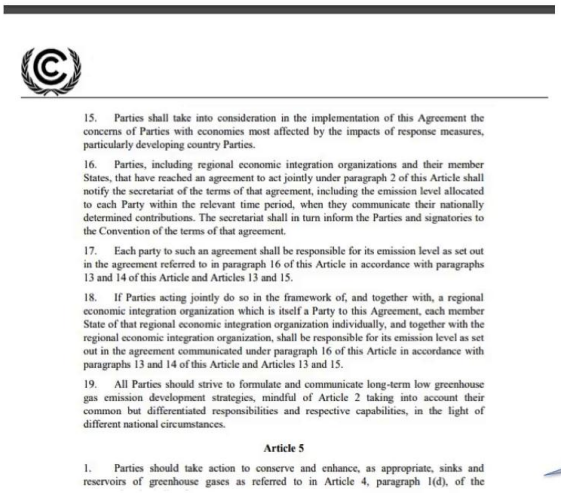



The world's energy, transport, buildings and water systems emit more than 60% of current greenhouse gases. emissions are increasing as a result of several trends: an increased appetite for mobility and ownership of individual cars; a growing population that is expected to move towards meat-intensive food diets, which puts more pressure on agricultural productivity; use of cement and aluminium in house construction; and increasing reliance on heating and cooling systems. The urgency and scale of the infrastructure challenge was starkly laid out in the Intergovernmental Panel on Climate Change (IPCC)'s special report on the impacts of global warming of 1.5°C above pre-industrial levelsto limit warming to 1.5°C. CO2 emissions must fall by about 45% by 2030 compared to 2010 levels, and would need to reach net-zero around 2050. Success in limiting global temperature rise to well-below 2°C and towards 1.5°C hinges on rapid and unprecedented transformations of infrastructure stocks in energy, land-use and industrial systems worldwide. While the emission reductions pledged in countries' 2030 nationally determined Contributions (ndCs) can be achieved with current infrastructure systems, post-2030 decarbonisation pathways that meet the Paris Agreement temperature goals will require far-reaching changes to infrastructure, technology and industrial systems.

Notes

Summary

11m 14s



15. Parties shall take into consideration in the implementation of this Agreement the concerns of Parties with economies most affected by the impacts of response measures, particularly developing country Parties.

16. Parties, including regional economic integration organizations and their member States, that have reached an agreement to act jointly under paragraph 2 of this Article shall notify the secretariat of the terms of that agreement, including the emission level allocated to each Party within the relevant time period, when they communicate their nationally determined contributions. The secretariat shall in turn inform the Parties and signatories to the Convention of the terms of that agreement.

17. Each party to such an agreement shall be responsible for its emission level as set out in the agreement referred to in paragraph 16 of this Article in accordance with paragraphs 13 and 14 of this Article and Articles 13 and 15.

18. If Parties acting jointly do so in the framework of, and together with, a regional economic integration organization which is itself a Party to this Agreement, each member State of that regional economic integration organization individually, and together with the regional economic integration organization, shall be responsible for its emission level as set out in the agreement communicated under paragraph 16 of this Article in accordance with paragraphs 13 and 14 of this Article and Articles 13 and 15.

19. All Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

**Article 5**

1. Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the

Article 4.19 of the Paris Agreement calls on countries to "formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2..."

https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_english_.pdf

Such radical shifts require better planning practices that align short-term infrastructure investment plans and strategies with long-term climate and development goals. The Paris Agreement recognises the importance of long-term planning in Article 4.19, which calls on countries to "formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2". such long-term strategies can help countries scale up the ambition of their ndCs, which has been inadequate to date, and reconcile decisions in the present with long-term climate goals.

Notes

Summary

13m 16s

# Climate and Infrastructure: Action & Changes

- To achieve carbon neutrality, actions anc changes are required in

Given the long lifespan of infrastructure assets, the alignment of today's infrastructure choices with long-term targets is essential, since what countries build today will determine their emissions and vulnerability to a changing climate for decades to come. If they plan prudently, countries can wean their economies off dependence on fossil fuels and ensure that financing flows towards low-emission, resilient infrastructure projects. Such planning can identify and exploit synergies between climate and economic development goals to foster public support for the transition. Otherwise, countries risk building infrastructure assets that would inevitably face stranding – i.e. retirement before the end of their economic lifecycle – and lock their economies into elevated future emissions and costly path dependencies. not only are investments in emissions-intensive infrastructure risky and possibly unprofitable, they also attract capital that could otherwise support and scale up infrastructure compatible with climate objectives. Aligning public and private investments in low-emission and resilient infrastructure has now become critical to increase resilience, avoid further emissions lock-in, and deliver on climate and the sustainable development Goals.

Notes

Summary

14m 06s

# Climate and Infrastructure: Action & Changes

- To achieve carbon neutrality, actions anc changes are required in

Getting investment and climate policy right is a necessary condition of success in meeting the climate challenge, but it is not enough. Existing policy frameworks, institutions and economic incentives encourage incremental changes when a rapid transformation is needed. Only systemic change will disrupt the roots of institutional inertia and vested interests that serve to frustrate and slow the pace of change in climate and development policy. Action across six areas is needed: planning, innovation, budgeting, financial systems, development and cities, and a whole-of-government, whole-of-society approach to the climate challenge.

Notes

Summary

15m 46s


While there are many different pathways to achieve carbon neutrality, all require action across the following systems: - Energy. Today's energy systems rely heavily on centralised power generation based on fossil fuels. Tomorrow's energy systems will need to see a substantial reduction in demand through energy efficiency, a decline in the carbon intensity of electricity to zero by mid-century, and an increase in electrification of energy uses. In a pathway consistent with 1.5°C warming, renewables supply 70-85% of the electricity in 2050, while coal disappears from the electricity mix by 2050. - Land use. A sustainable intensification of land-use practices, enhanced agricultural productivity and potentially a change in dietary preferences will be necessary in order to meet the goals of poverty reduction, access to food, biodiversity conservation, and climate and development objectives. Changes in urban planning are also essential. limiting urban sprawl is particularly important in the context of cities in developing countries, which are projected to grow rapidly in the coming decades. - Heavy industries. Cement, aluminium, chemicals and steel are essential to the built environment and to manufacturing and will remain so for decades to come.

Notes

Summary

16m 35s

Yet their production is extremely energy- and emissions-intensive. A significant transformation of such energy-intensive industries is needed, going beyond energy efficiency measures to more innovative business models and technologies. - Transport and buildings. Current transport systems rely largely on fossil fuels and impose a very high environmental cost (air pollution, noise and congestion). Improving the energy efficiency of transport and buildings is a key step, with more efficient vehicles or appliances, insulation of existing buildings and electrification of vehicles. Demand measures are also required to reduce the need for mobility through more efficient public transport and a better integration of land-use planning and transport policies. So far we have looked the relationship between infrastructure and climate change. In the second part of this lecture, we discuss issues such as biodiversity and use of natural resources.

Notes

Summary

18m 24s