The challenges of Climate Change and the COP21: ambition and aims

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Clean Energy and Sustainable Development Laboratory

Mission

The Clean Energy and Sustainable Development (CleanED) lab is an international and interdisciplinary research team contributing to the green growth of the energy sector in Vietnam. Established in December 2014 with support from USTH and French Embassy, the CleanED lab hosts today four researchers from France and Vietnam, three doctoral fellows and two internationally qualified staff under the direction of Dr. Minh Ha-Duong.

Our expertise ranges from engineering to public policy on:

- Natural resources characterization and management
- Biomass and waste to energy conversion process technologies
- Energy systems optimization from smart grid to national plans

The CleanED lab is a working place for researchers, doctoral fellows and students from USTH's Energy department welcome Bachelor and Master level interns. Most are coming from or going to our partner laboratories in France: CEBioWooEB/CIRAD, LAGEP/Université de Lyon, LABEX ARBRE/Université de Lorraine, LOG/Université du Littor; other USTH consortium members, and our partner institute in Vietnam: IES/VAST.

Facilities

The CleanED lab office and experimental room are both located on the Campus of Vietnam Academy of Science Hoang Quoc Viet, Cau Giay, Hanoi.
Minh Ha-Duong’s Publication List

Energy, climate, society economics & uncertainty

Articles in peer-reviewed journals


Transition to low carbon world

Renewable energy technologies set new installation records as their contribution to the global energy mix continued to climb in 2013. Renewable power capacity jumped more than 8 percent in 2013, accounting for over 56 percent of net additions. It now has the potential to account for over a fifth of world electricity generation.
Climate negotiations since 1992

1992
UNFCCC Rio

1997
Protocol Kyoto

2007
COP 13 Bali

2009
COP 15 Copenhagen

2010
COP 16 Cancun

2011
COP 17 Durban

2012
COP 18 Doha

2013
COP 19 Varsovie

2014
COP 20 Lima

2015
COP 21 Paris

Bali process

2009
COP 15 Copenhagen

Durban platform

Bali roadmap
Towards a post-2012 agreement in 2009

Cancun agreement
Engagements de financement et de limitation des émissions à 2020, mise en place d’instance sur le financement, d’adaptation et le transfert de techno.

Bali roadmap end

Décision :
Accord de principe sur une 2ème période d’engagement du PK et création de la plateforme de Durban pour un accord en 2015

Starts 2005
No USA
27% of GHG emissions.
39 countries - 5,2% over 2008-2012 relative to 1990
The IPCC Synthesis Report

→ Integration of three Working Group Reports of the 5th Assessment, 2013-2014

• WG I: The Physical Science Basis

• WGII: Impacts, Adaptation and Vulnerability

• WG III: Mitigation of Climate Change
The IPCC Synthesis Report

- Written by 60 authors from Working Group reports
- Chaired by the IPCC Chair R.K. Pachauri
- Member governments approved the SPM on 1st November 2014 (total membership of IPCC is 195 governments)
Key Messages

→ Human influence on the climate system is clear.

→ The more we disrupt our climate, the more we risk severe, pervasive and irreversible impacts.

→ We have the means to limit climate change and build a more prosperous, sustainable future.
Humans are changing the climate

It is extremely likely that we are the dominant cause of warming since the mid-20th century.
Temperatures continue to rise

Each of the past 3 decades has been successively warmer than the preceding decades since 1850.
Oceans absorb most of the heat

More than 90% of the energy accumulating in the climate system between 1971 and 2010 has accumulated in the ocean.

Land temperatures remain at historic highs while ocean temperatures continue to climb.
Global anthropogenic CO₂ emissions

Quantitative information of CH₄ and N₂O emission time series from 1850 to 1970 is limited

- Fossil fuels, cement and flaring
- Forestry and other land use
GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.
Sources of emissions

Energy production remains the primary driver of GHG emissions:

- **35%** Energy Sector
- **24%** Agriculture, forests and other land uses
- **21%** Industry
- **14%** Transport
- **6.4%** Building Sector

2010 GHG emissions
Antropogenic forcings are extremely likely the cause of warming.
Some of the changes in extreme weather and climate events observed since about 1950 have been linked to human influence.
Impacts are already underway

- Tropics to the poles
- On all continents and in the ocean
- Affecting rich and poor countries

AR5 WGII SPM
Projected climate changes

Continued emissions of greenhouse gases will cause further warming and changes in the climate system.

Oceans will continue to warm during the 21st century.

Global mean sea level will continue to rise during the 21st century.

It is very likely that the Arctic sea ice cover will continue to shrink and thin as global mean surface temperature rises.

Global glacier volume will further decrease.
Potential Impacts of Climate Change

- Food and water shortages
- Increased poverty
- Increased displacement of people
- Coastal flooding
Climate Change Poses Risk for Food Production

Percentage of yield projections for different time periods from 2010 to 2029, 2030 to 2049, 2050 to 2069, 2070 to 2089, and 2090 to 2109. The color legend indicates the range of yield change, with different colors representing increases and decreases in yield percentages.
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.

Based on Figure 6.7

IPCC AR5 Synthesis Report
Stabilization of atmospheric concentrations requires moving away from the baseline - regardless of the mitigation goal.

Based on Figure 6.7
Figure SPM.10, A reader’s guide

From climate change risks to GHG emissions

(A) Risks from climate change... (B) ...depend on cumulative CO$_2$ emissions...

(C) ...which in turn depend on annual emissions over the next decades
The risks from climate change, assessed by the WGII of the IPCC AR5, and aggregated in five “Reasons for Concerns” levels of risk across the Reasons for Concern can be associated with a level of global temperature change.

Here shown for a warming by 2°C
The link between cumulative CO$_2$ emissions and global mean temperature

The pink plume is from WGI complex models. It includes the uncertainty from non-CO$_2$ gases and climate and carbon cycle.
The link between cumulative CO$_2$ emissions and global mean temperature.

The ellipses show results from the WGIII models, using a simple climate model. It does not include climate and carbon cycle uncertainty, but explores more comprehensively the scenario uncertainty from a range of CO$_2$ and non-CO$_2$ pathways.
Levels of risks can be connected to cumulative CO$_2$ emission levels, for the average climate response, for high climate sensitivity (lower cumulative emissions), and for low climate sensitivity (higher cumulative emissions).
The link between changes in annual GHG emissions by 2050 and the cumulative CO$_2$ emissions of the WGIII scenario categories.
Levels of risks can now be connected to GHG emission changes by 2050. Added uncertainty arises from action on non-CO$_2$ gases, timing of pre-2050 action, and ambition.
The constraint on changes in GHG emissions by 2050 depends on the sensitivity of the climate response.

Here, with large climate sensitivity...
The constraint on changes in GHG emissions by 2050 depends on the sensitivity of the climate response. Here, with low climate sensitivity...
Limiting Temperature Increase to 2°C

Measures exist to achieve the substantial emissions reductions required to limit likely warming to 2°C (40-70% reduction in GHGs globally by 2050 and near zero GHGs in 2100).

A combination of adaptation and substantial, sustained reductions in greenhouse gas emissions can limit climate change risks.

Implementing reductions in greenhouse gas emissions poses substantial technological, economic, social, and institutional challenges.

But delaying mitigation will substantially increase the challenges associated with limiting warming to 2°C.
Mitigation Measures

More efficient use of energy

Greater use of low-carbon and no-carbon energy
  • Many of these technologies exist today

Improved carbon sinks
  • Reduced deforestation and improved forest management and planting of new forests
  • Bio-energy with carbon capture and storage

Lifestyle and behavioural changes
Ambitious Mitigation Is Affordable

- Economic growth reduced by ≈ 0.06% (BAU growth 1.6 - 3%)
- This translates into delayed and not forgone growth
- Estimated cost does not account for the benefits of reduced climate change
- Unmitigated climate change would create increasing risks to economic growth
The window for action is rapidly closing

65% of our carbon budget compatible with a 2°C goal already used

Total Carbon Budget: 2900 GtCO2

Amount Used 1870-2011: 1900 GtCO2

Remaining: 1000 GtCO2
The Choices We Make Will Create Different Outcomes

With substantial mitigation

Without additional mitigation

Change in average surface temperature (1986–2005 to 2081–2100)