



EMSD SUMMIT 2016 Imaginovate HK

17 November, 2016

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Paris Climate Change Conference (COP21) : Implications for Engineering Sector

by

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THIS PAPER CONSISTS OF TWO PARTS :

- (1) History of UNFCCC leading to Paris Agreement.**
- (2) Implications for Engineering Sector.**

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(1) HISTORY OF UNFCCC LEADING TO PARIS AGREEMENT

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PROGRESS OF THE COP IN THE PAST 21 YEARS

With the IPCC report and the Second World Climate Conference in November 1990, the world was dawning to the fact that climate change will impact on the weather, eco-system, water, agriculture, health, economy, and well being of the world. As climate change has no boundary, a global treaty was called for.

Negotiation at the UN General Assembly to establish of Framework Convention began in December 1990. The Convention was adapted in May 1992 and UNFCCC (United Nation Framework Convention on Climate Change) was open for signature at the Rio World Summit. UNFCCC entered into force in March 1994.

The Secretariat of UNFCCC is based in Bonn and the first COP was held in Berlin in 1995.

There had been 21 COPs since Berlin and it had been notably held at Kyoto, Montreal, Bali, Copenhagen, Durban, Lima and Paris among other cities.

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EVENTS LEADING TO THE PARIS AGREEMENT

Nov 1989	Establishment of Intergovernmental Panel on Climate Change (IPCC)
Nov 1990	IPCC and Second World Climate Conference called for global treaty
Dec 1990	UN General Assembly Negotiation on a Framework Convention began
May 1992	Convention adapted
Jun 1992	UNFCCC (United Nation Framework Convention on Climate Change) open for signature at Rio de Janeiro Earth Summit
Mar 1994	UNFCCC entered into force
Apr 1995	COP at Berlin
Aug 1996	UNFCCC Secretariat moved to Bonn
Dec 1997	Kyoto Protocol adapted, start of the first commitment period up to 2012, adaptation of Clean Development Mechanism (CDM)
Jan 2005	EU Emission trading launched
Feb 2005	Kyoto Protocol entered into force
Dec 2005	COP11 at Montreal
Jan 2006	CDM commenced
Dec 2007	COP Bali Road Map
Jan 2008	Joint Implementation Mechanism started
Dec 2009	Copenhagen, agreed on setting up USD 100 per annum Climate Fund
Dec 2011	Durban – Setting up of Ad Hoc working group on the Durban Platform for enhanced action (ADP)
Dec 2012	Doha, Second commitment period 2015-2020
Mar 2014	IPCC second part of Fifth Assessment Report
Mar 2014	Reality Check
Sep 2014	UN Secretary General's Climate Summit in New York
Dec 2014	Lima, Lima Paris Action Agenda
Dec 2015	COP 21, Paris Agreement

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WHAT IS COP (Conference of Parties)

COP is the supreme decision body of the Convention. All States that are parties to the Convention are represented at the COP, at which they review the implementation of the Convention and any other legal instruments that the COP adapts and takes decision necessary to promote the effective implementation of the Convention, including institutional and administrative arrangements.

A key task for the COP is to review the national communications and emission inventories submitted by Parties. Based on this information, the COP assesses the effects of the measures taken by Parties and the progress made in achieving the ultimate objectives of the Convention.

The COP meets every year, unless the Parties decide otherwise. The first COP meeting was held in Berlin Germany in March 1996. The COP meets in Bonn, the seat of the secretariat, unless a Party offers to host the session. Just as the COP Presidency rotates among the five recognized UN regions – that is Africa, Asia, Latin America and the Caribbean, Central and Western Europe and others - there is a tendency for the venue of the COP to also shift among these groups.

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STRUCTURE OF COP

COP is served by CMP (the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol) and supported by :

- SBSTA (Subsidiary Body for Scientific and Technological Advice)
- SBI (Subsidiary Body for Implementation)
- ADP (Ad Hoc Working Group on the Durban Platform for Enhanced Action)
- Plus Many sub- and sub-sub committees, task forces and working groups

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OVERVIEW OF THE INSTITUTIONS, MECHANISMS AND ARRANGEMENTS UNDER THE CONVENTION

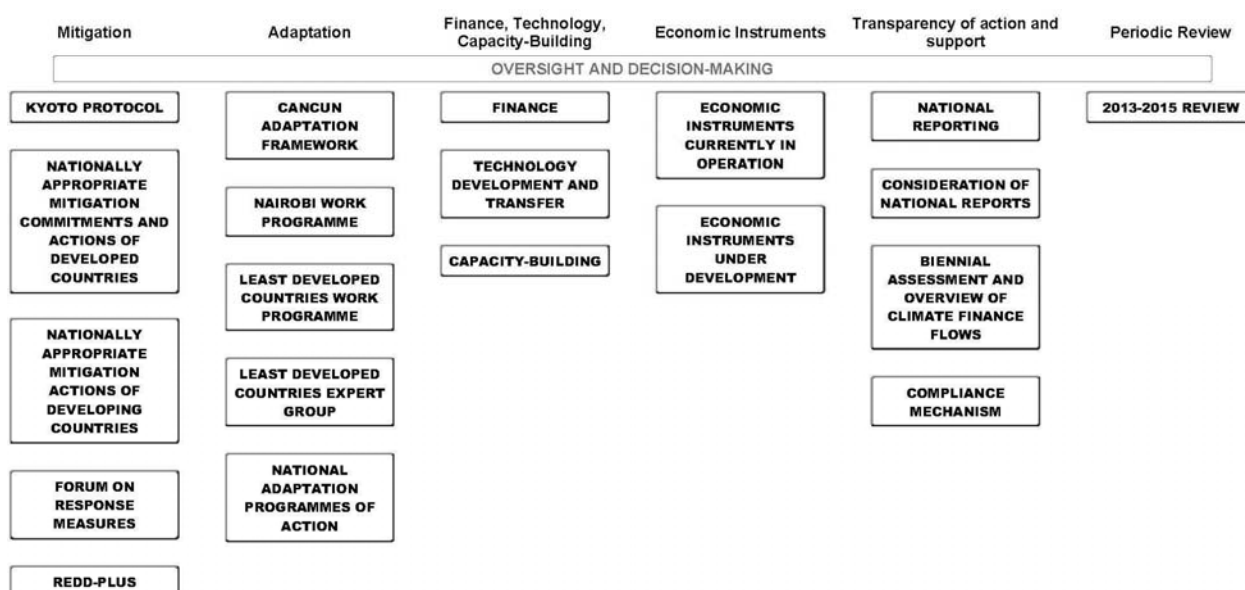
The ADP requested that the Secretariat prepared an overview of the mandates and progress of work by institutions, mechanism and arrangements under the Convention.


In response to this mandate, the Secretariat prepared the overview document. The Secretariat has also prepared an initial online presentation of the arrangements which covered

- Mitigation
- Adaptation
- Finance, technology and capacity building
- Economic instruments
- Transparency of action and support
- Periodic review

and can be found below.

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Since the first COP in Berlin in 1995, it is fair to say only little progress had been made up to 2014. The difficulty was mainly due to the difference in interpretation of the term :

“COMMON BUT DIFFERENTIATED RESPONSIBILITIES”

by the developed and developing countries.

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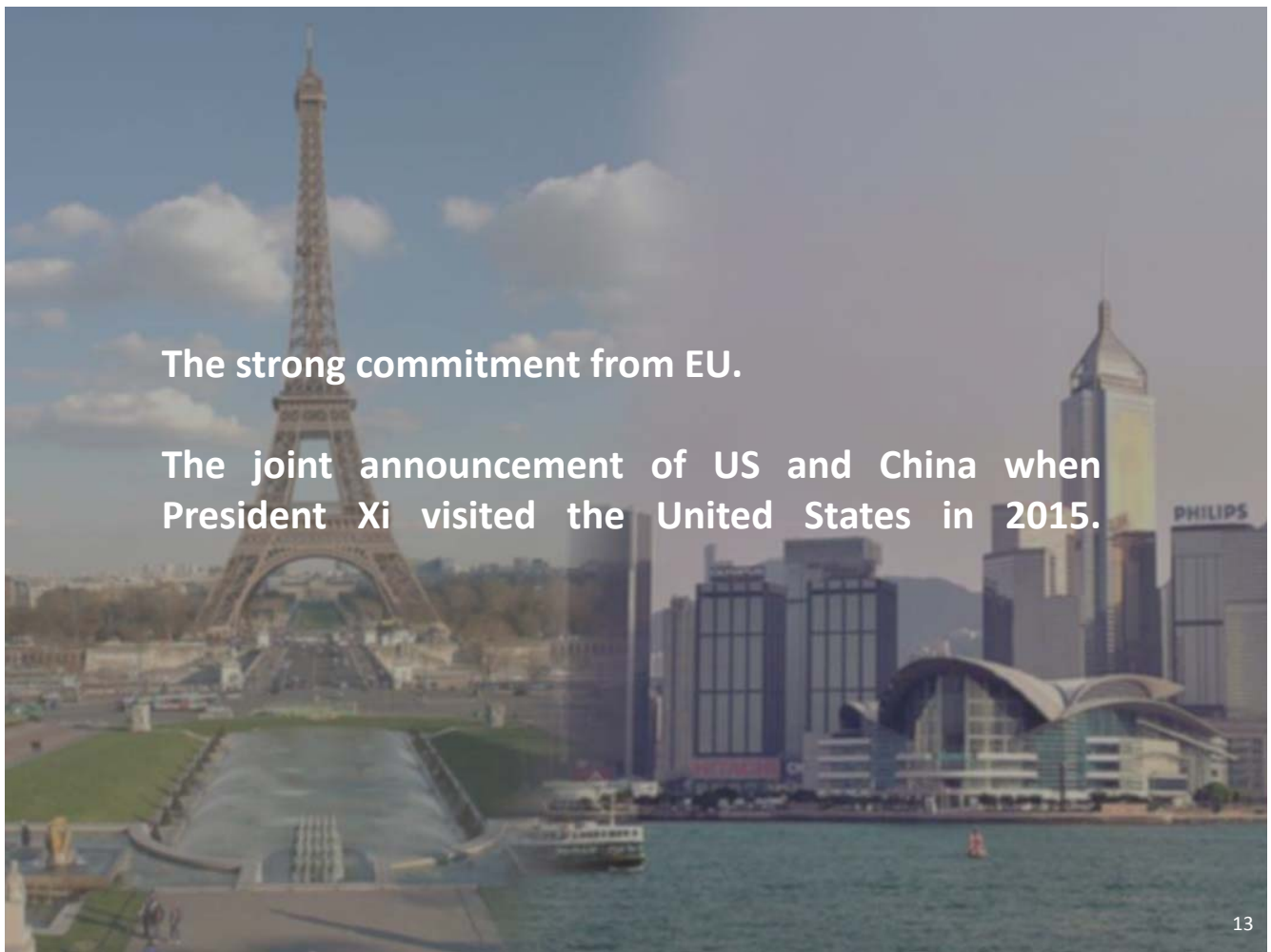
The real breakthrough was due to :-

- "Reality Check" by UNFCCC in March 2014.



- The publication of the Fifth Assessment Report (AR5) by Intergovernmental Panel on Climate Change in 2014.

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The strong commitment from EU.

The joint announcement of US and China when President Xi visited the United States in 2015.

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France took over the Chairmanship of COP21 and its strong advocacy was instrumental in making a breakthrough leading to the Paris Agreement.

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After two weeks plus one day of hard work, the President of COP21 declared in the morning of Saturday, 12 December, 2015 that Paris Agreement was reached and the aim of the Agreement is described in Article 2 "Enhancing the implementation" :

- (a) Holding the increase in the global average temperature to well below 2°C above the pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above the pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.
- (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate-resilience and low greenhouse gas emission development, in a manner that does not threaten food production.
- (c) Making finance flows consistent with a pathway towards low greenhouse gas emission and climate-resilient development.

Countries furthermore aim to reach "global peaking of greenhouse gas emissions as soon as possible".

The contribution that each country should make in order to achieve the worldwide goal are determined by all countries individually called INDC "Intended Nationally Determined Contributions". Article 3 requires them to be "ambitious", "represent a progression over time" and set "with the view to achieving the purpose of this Agreement".

The INDCs declared by Parties during COP21 were accepted and to be reviewed by 2020 when more ambitious INDCs are expected.

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The Paris Agreement was open for signature on 22 April, 2016 (Earth Day) in a ceremony in New York City.

As of October 2016, 197 UNFCCC members have signed the treaty, 87 of which have ratified it.

After the European Union ratified the Agreement in October 2016, there were enough countries that had ratified the Agreement that produce enough world's greenhouse gas for the Agreement to enter into force.

The Agreement takes effect on 4 November, 2016.

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South China Morning Post
24 April, 2016

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The big risk is if Parties with large emission such as United States will abide by the Agreement. US signed but did not ratify Kyoto Protocol which still echoes up to the present day.

With the election in the US and with a new administration, how the Congress and Senate will deal with the Paris Agreement is still unclear.

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Economist

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Trump Picks Top Climate Skeptic to Lead EPA Transition

- Choosing Myron Ebell means Trump plans to drastically reshape climate policies.

Physics Doesn't Care Who Was Elected President

- Eight worrisome climate patterns are well underway, regardless of politics.


Could Trump Simply Withdraw U.S. from Paris Climate Agreement?

- It's possible, but tricky, and could undermine global cooperation on other issues.

No Plan B at Climate Talks, Given Trump Win

- But leaders from other nations vow to band together to meet emissions targets.

From Scientific American, 10 November, 2016



Considering that the Annex 1 and Annex 2 camps had held substantially different views based on "Common but Differentiated Responsibilities" for the past 20 years, one cannot expect Paris Agreement will provide a complete answer to the problems. But it is almost a miracle that over 180 countries endorsed the Agreement in Paris at the end of COP 21 and 175 countries signed the Agreement in New York UN Headquarters on 22 April, 2016 - the first official date for signing the Agreement.

Paris Agreement is definitely a big step in the right direction.

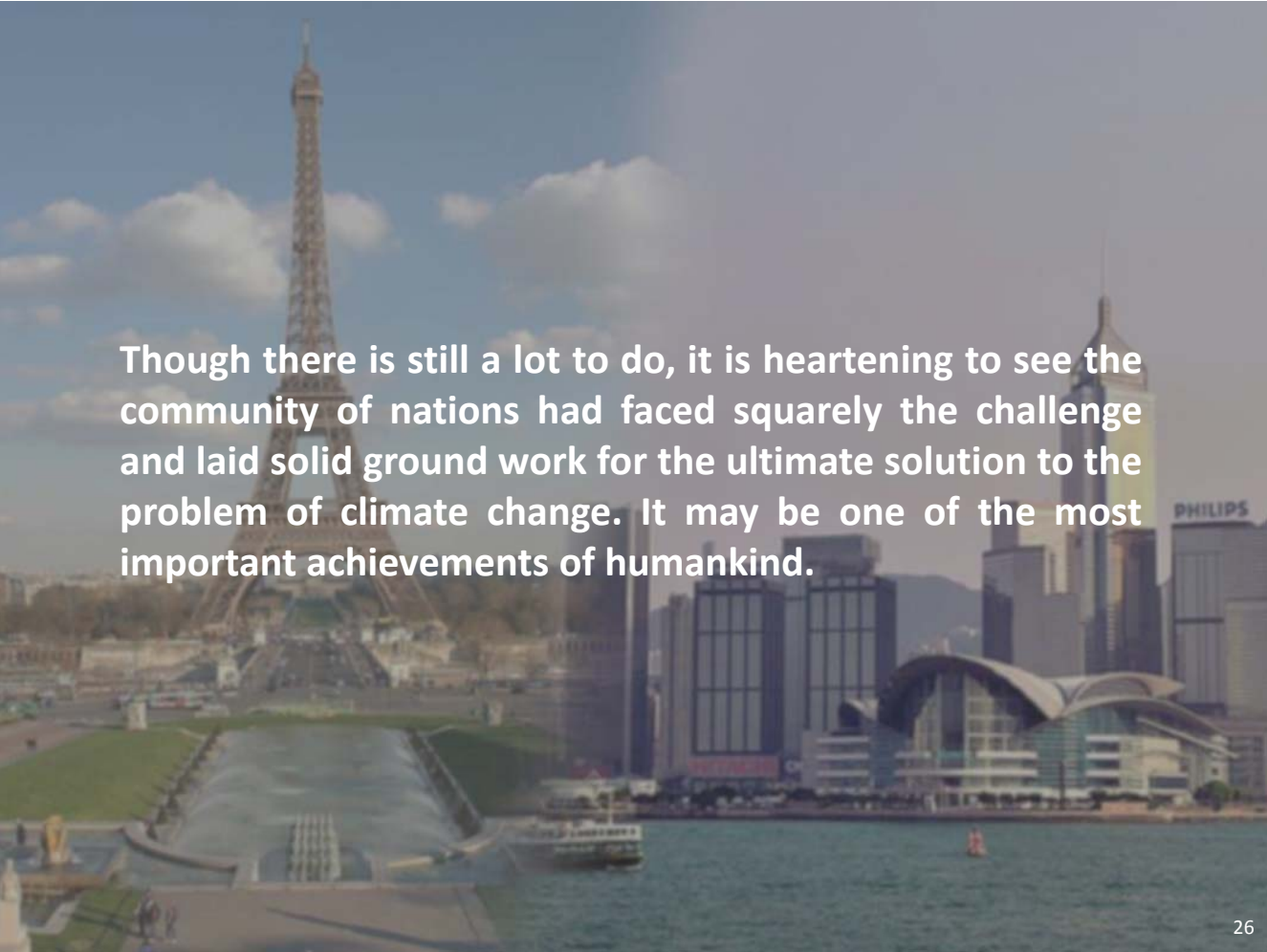


A New Development

Montreal Protocol Meeting at Kigali, Rwanda on 15 October, 2016

1. On 15 October, close to 200 countries struck a landmark deal to phase down the production and use of HFCs.
2. Developed and developing nations meeting in Rwanda capital Kigali adopted an amendment to the Montreal Protocol that could prevent 0.5°C of global warming by 2100.
3. HFCs (R22, R410A, R407C and R134a) are widely seen as the world's fastest-growing climate pollutant and are used in air conditioners and refrigerators. The Kigali deal – which is legally binding for all 197 Parties to the Montreal Protocol – sees developed countries take the lead on phasing down these potent greenhouse gases, starting with a 10% reduction in 2019 and delivering an 85% cut in 2036 (compared to the 2011-2013 baseline).
4. Developing countries are split into two groups. The first one – which includes China and African nations – will freeze consumption of HFCs by 2024, with their first reduction steps starting in 2029. A second group including India, Iran, Iraq, Pakistan and the Gulf countries will meet a later deadline, freezing their use of these gases in 2028 and reducing consumption from 2032.
5. The amendment gets us “about 90% of the way” to reduce global warming by 0.5°C by 2100. This is the “largest temperature reduction ever achieved by a single agreement. The Kigali agreement is “equal to stopping the entire world's fossil-fuel CO₂ emissions for more than two years”.
6. With a clear phase-down schedule now in place, hopes are high that the market will step up to deliver the targets enshrined in the deal.
7. Compromises had to be made, but 85% of developing countries have committed to the early schedule starting 2024, which is a very significant achievement.

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Though there is still a lot to do, it is heartening to see the community of nations had faced squarely the challenge and laid solid ground work for the ultimate solution to the problem of climate change. It may be one of the most important achievements of humankind.

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(2) IMPLICATIONS FOR ENGINEERING SECTOR

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The Paris Agreement calls for mitigation and adaptation measures :-

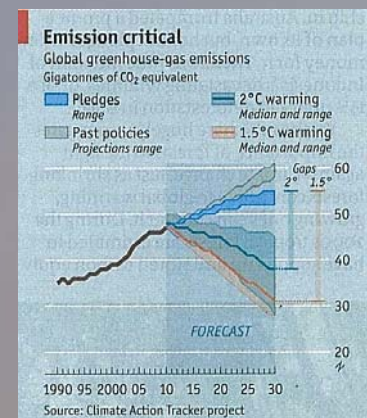
- De-carbonize
- Strengthen Resilience to Extreme Weathers

Referring to this graph, without the Intended Nationally Determined Contributions (INDCs) and business as usual, annual emission would be over 60 gigatonnes by 2030 which would mean temperature rise way above the 2 deg C rise considered by the scientific community as reasonably safe.


With Paris Agreement and based on the INDCs declared by the Parties, emission will reach 55 gigatonnes by 2030 and mean temperature rise over 2 deg C.

To achieve 2 deg C, total annual emission has to be around 38 gigatonnes in 2030; and for the ambitious safe target of 1.5 deg C, emission has to be further reduced to some 32 gigatonnes.

It is obvious that Paris Agreement is not adequate to cap the temperature rise to 2 deg C let alone 1.5 deg C. It is therefore necessary for the Parties to increase their ambition from 2015 until 2020 when the next assessment will take place.



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To hold the temperature rise of 2°C, there are a lot for the community of nations to do just to meet their INDC.

Opportunities available globally, regionally and locally are :-

- Carbon reduction technologies (supply and demand sides).
- Renewable energy.
- *Financial services for carbon reduction technologies and renewable energy systems.*
- *Capacity building.*
- *Financial instrument for carbon trade.*

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The implications of the COP21 Agreement may vary from one country to another because it was up to individual countries to decide :

- Their emission reduction targets in submitting their Intended Nationally Determined Contributions (INDCs) prior to commencement of COP21; and
- The approaches and measures to take to realize their commitments.

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Drawing on published information, the impacts of the CO₂ emission reduction initiatives will be discussed from the perspectives of :

- General implications
- China's planned actions and implications
- Hong Kong's planned actions and implications

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An international sustainability consultant ^[1] anticipates that :

- The 2020's will be a decade of transition :
 - Carbon pricing regimes will spread across the world;
 - The cost of carbon emissions will become increasingly material through the 2020's; and
 - The focus on energy efficiency will be reinforced through mandates and taxes, as a critical enabler of the transition towards a lower-emission economy.

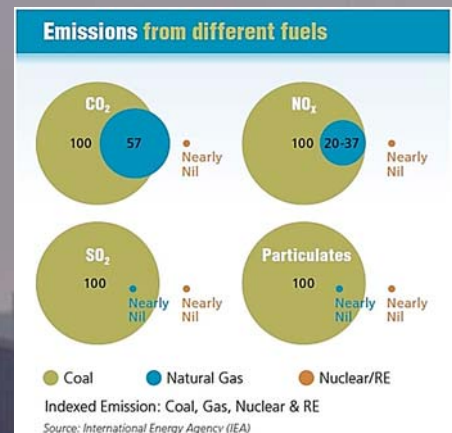


[1] ERM, What the COP21 Paris Agreement means for your business, 2015

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Changes will centre on the energy sector :

- Renewables will become a growing source of power, backed by quotas and targets;
- Coal power will become increasingly marginalized;
- Gas will become the default source of power; and
- Government funding will be needed for early carbon dioxide capture and storage (CCS) demonstrators in some countries and regions.




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For businesses:

- Multinational firms would have to tailor actions to meet each nation's unique requirements.
- Firms that produce, transform and deliver energy or raw materials to end users will feel increased pressure to reduce the carbon intensity of the fuels, power, commodities and feedstocks they deliver.
- Firms that consume energy, power, commodities and feedstocks to produce and deliver materials, goods and services to end users will feel increased pressure to reduce the carbon intensity in their own operations and in their value chains.
- Service firms (e.g., transport, wholesale / retail, information / communications technology, finance, leisure and other service provider sectors) will feel increased pressure to reduce the carbon content and the carbon intensity of activities.

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- GHG accounting and reporting will become mandatory for all major industries, in all major economies.
 - Pricing on carbon emissions will drive up the profitability and value of low-carbon, efficient assets and negatively impact high-carbon, less efficient assets.
 - Grid electricity will decarbonize in many regions of the world, at different rates in different countries, helping electricity users to lower their emissions, albeit at a cost.
 - The transport sector will come under increasing focus, driving efficiency improvements and the prospect of major technological shifts.

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- The cost of carbon in value chains will become increasingly material, creating opportunities for low-carbon innovation across product and service chains in many sectors of the economy.
 - The market for innovative, energy-efficient products and services will be stimulated.
 - As carbon pricing and other forms of climate change regulation take hold, the financial sector increasingly will need to manage the carbon risk and opportunity associated with the companies and projects in which it invests and to which it lends.
 - Forestry and land use will be in the spotlight to halt deforestation.

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China committed to : ^[2]

- Lower CO₂ emissions per unit of GDP by 60% to 65% from the 2005 level by 2030.
- Increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level by 2030.

[2] Zhou D, Keynote Address, Hong Kong's Role in Low Carbon Development: Challenges and Way Forward, HKIE Environmental Division Annual Forum, 18 April 2016.

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- Promote green power dispatch, giving priority, in distribution and dispatching, to renewable power generation and fossil fuel power generation of higher efficiency and lower emission levels.
 - Start in 2017 its national emission trading system (ETS), covering key industry sectors, such as iron and steel, power generation, chemicals, building materials, paper making, and nonferrous materials, imposing cap on about 10,000 companies and regulating 3 – 4 billion tons of CO₂.^[3]

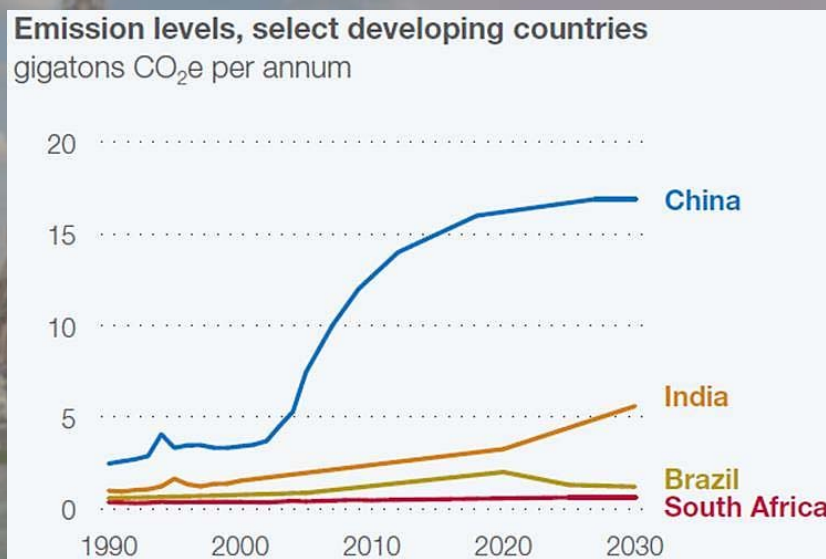
[3] Hodge, J., Global experience in carbon pricing: potential implications for Mainland China and Hong Kong, The HKIE Environmental Division Annual Forum, 18 April 2016

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- Raise the share of green buildings to 50% in newly built buildings in cities and towns by 2020.
- Raise the share of public transport in motorized travel reaching 30% in big- and medium-sized cities by 2020.
- Finalize next-stage fuel efficiency standards for heavy-duty vehicles in 2016 and implement them in 2019.
- Continue to support and accelerate actions on HFCs, including effectively controlling HFC-23 emissions by 2020.

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Having committed to significant reductions in the GHG intensity per unit of GDP, China expects to see emissions plateau and begin to decline from 2025–2030 onwards.



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Some figures to show the scale of China's action ^[4] :

- The National Strategy Centre for Climate Change estimates that China will need to invest US\$6.3 trillion in the low carbon transition including energy efficiency improvements, development of renewables, nuclear and CCS technology over the next 16 years. This equates to \$400bn per year.
- For increasing the share of non-fossil fuels in primary energy consumption to around 20%, China need to install, by 2020 :
 - 104GW of wind capacity involving approximately US\$130bn of investment;
 - 72GW of solar, which will cost approximately US\$100bn; and
 - Over 60GW of nuclear capacity, which will cost approximately US\$130bn.^[5]

[4] PwC, China – emissions targets and implications for business, PricewaterhouseCoopers LLP, 2015.

[5] According to World Nuclear Association, nuclear power plants in China would cost from \$1807/kWe to \$2615/kWe.

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Hong Kong's planned actions ^[6]

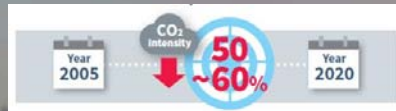
- Targets
 - Hong Kong is obliged to follow China's national commitment on climate change mitigation targets.

[6] HK Government, Hong Kong Climate Change Report 2015.



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- China committed in 2009 to lower its overall carbon intensity by 40-45% from the 2005 level by 2020.
- In 2010, Hong Kong put forward the target to reduce the carbon intensity by 50-60% from the 2005 level by 2020.

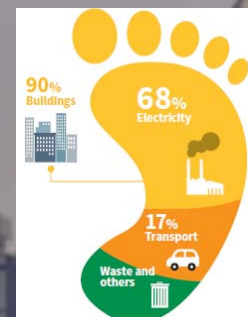


- Since China's latest commitment is to lower the nation's overall carbon intensity by 60-65% from the 2005 level by 2030, Hong Kong will use this as the reference to shape mitigation plans.

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Major mitigation measures :

- Setting energy intensity reduction targets.
- Revamping electricity fuel mix :
 - Electricity generation accounts for 68% of total GHG emission of HK.



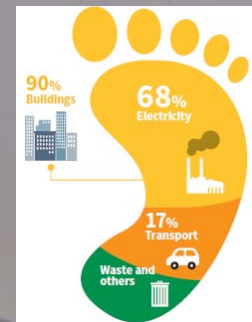
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- Improving energy efficiency of buildings, both new and existing :

- Buildings are responsible for consuming 90% of electricity generated in Hong Kong.

- Greening transportation :

- Transportation is the second largest emission source responsible for 17% of GHG emission of HK.



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- Greening the city :

- This can lead to better landscape, enhance biodiversity and external environmental quality.

- Turning waste to resources :

- This will help alleviate the shortage of landfill site and at the same time produce energy.

Greening the City

Better landscape networks
Enhance biodiversity and native planting / urban agriculture

Explore blue-green infrastructures to improve external environmental qualities

Turning Waste-to-Resources

Implement waste reduction, reuse and recycling plans

Recover energy from waste treatment, including organic waste

Maximise use of landfill gases

Capture energy from waste water treatment

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Adaptation efforts :

- Some of the risks, such as flooding and landslides, have already been very greatly reduced over the years through planning and infrastructure investments though the efforts need to be sustained.
- The risks related to temperature rise, infectious diseases and drought require on-going attention.

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More specific implications :

- Knowledge and skills in the following fields will be in increasing demand :
 - Carbon emission trading
 - Carbon / energy auditing
 - Sustainable building design (architectural and building services)
 - Retro-commissioning, retro-fitting and optimized operation and maintenance of plants in existing buildings
- Products that will be in increasing demand include :
 - PV and other RE devices
 - Electric vehicles, rechargeable batteries, ...
 - Smart / intelligent / energy efficient systems and appliances, ...

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SUMMARY

- For mitigation and adaptation of climate change, innovative solutions from engineers are needed to enable further reductions in anthropogenic carbon emissions, and to enhance resilience of city infrastructure.
- Engineers should continue to:
 - Develop low carbon and renewable energy technologies applicable to energy production, building, transport and other sectors,
 - Secure fresh drinking water and food production in the face of drought impacts,
 - Protect cities and communities against flooding due to adverse weather and rising sea level,

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CONCLUSION I

To hold the temperature rise of 2°C, there are a lot for the engineering sector to do just to meet their INDCs.

In the context of the urban environment, opportunities available globally, regionally and locally are :-

(A) MITIGATION

- Carbon reduction technologies (supply and demand sides).
- Renewable energy.
- Green building.
- Green manufacturing.
- Green transport.
- Low embedded carbon infrastructures.
- Smart city.
- Capacity building.

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CONCLUSION II

To hold the temperature rise of 2°C, there are a lot for the engineering sector to do just to meet their INDCs.

In the context of the urban environment, opportunities available globally, regionally and locally are :-

(B) ADAPTATION - Resilience against Extreme Weathers for :

- Buildings.
- Civil infrastructures.
- Drainage and sewerage systems.
- Ports and airports.
- Public transport.
- Emergency services.
- Telecommunication.
- Electricity and gas supply.
- Capacity building.

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Thank You

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