**Notes – IPCC 5th Assessment Report (full & summary for policymakers) - 2014**

* Recent anthropogenic emissions of GHGs are the highest in history
  + Total anthropogenic GHG emissions have continued to increase over 1970 to 2010 with larger absolute increases between 2000 and 2010, despite a growing number of climate change mitigation policies
* Globally, economic and population growth continued to be the most important drivers of increases in CO2 emissions from fossil fuel combustion
* Consequences of climate change:
  + Warmer global temps
  + Rising sea levels
  + More extreme weather events (heat waves, extreme precipitation/flooding)
* Continued emission of GHGs will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in GHG emissions which, together with adaptation, can limit climate change risks
  + Anthropogenic GHG emissions are mainly driven by population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy
* Climate change risks will amplify existing risks and create new risks for natural and human systems
  + Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development
* Climate change projected to undermine food security
  + 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 without adaptation is projected to negatively impact production for local temperature increases of 2degreesC or more
  + Global temp increases of 4degreesC or more, combined with increasing food demand, would pose large risks to food security globally
* Climate change projected to reduce renewable surface water and groundwater resources in most dry subtropical regions
  + Will intensify competition for water among sectors
* 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
* Climate change projected to increase displacement of people
  + Can indirectly increase risks of violent conflicts by amplifying well-documented drivers of these conflicts such as poverty and economic shocks
* Many aspects of climate change and associated impacts will continue for centuries, even if anthropogenic emissions of GHGs are stopped
  + The risks of abrupt or irreversible changes increases as the magnitude of the warming increases
  + A large fraction of anthropogenic climate change resulting from CO2 emissions is irreversible on a multi-century to millennial timescale, except in the case of a large net removal of CO2 from the atmosphere over a sustained period
* Substantial reductions in GHG emissions over the next few decades can give us and the planet a better chance at effectively adapting to the changes
* Climate change is a collective action problem at the global scale
  + Effective mitigation will not be achieved if individual agents advance their own interests independently
  + Cooperative responses, including international cooperation, are required to effectively mitigate GHG emissions
* Without additional efforts to reduce GHG emissions beyond those in place today, global emissions growth is expected to persist, driven by growth in global population and economic activities
  + Global mean surface temperature increases in 2100 in baseline scenarios – those without additional mitigation – range from 3.7C to 4.8C above the average for 1850-1900 for a median climate response. They range from 2.5C to 7.8C when including climate uncertainty

**IPCC 2022 – Mitigation Report – Presentation Slides**

* We are not on track to limit warming to 1.5°C
  + “unless there are immediate and deep emissions reductions across all sectors, 1.5°C is beyond reach”
* Sectors in which significant reductions are needed:
  + Energy
  + Demand and services
    - Potential to bring down global emissions by 40-70% by 2050
    - Walking and cycling, electrified transport, reducing air travel, and adapting houses make large contributions
    - Lifestyles changes require systemic changes across all of society
  + Land use
  + Industry
  + Urban
  + Buildings
  + Transport

**IPCC 2018 – Mitigation Pathways Needed to Achieve 1.5C - Summary for Policymakers**

Illustrative Examples of Potential Pathways:

* Basically, as consumption lifestyles increase (or remain the same), the dependence on technologies like Carbon Dioxide Removal (CDR) and Bioenergy with Carbon Capture and Storage (BECCS) increases to reach net emission reductions that limit global warming to 1.5C
* Mitigation and adaptation consistent with limited global warming to 1.5C are underpinned by enabling conditions…Strengthened multilevel governance, institutional capacity, policy instruments, technological innovation and mobilization of finance, and changes in human behaviour and lifestyles are enabling conditions that enhance the feasibility of mitigation and adaptation options for 1.5C-consistent systems transitions
  + 1.5C pathways that include low energy demand, low material consumption, and low GHG-intensive food consumption have the most pronounced synergies and lowest number of trade-offs with respect to sustainable development and SDGs
    - Such pathways would reduce dependence on CDR

**IPCC 2018 – Mitigation Pathways Compatible with 1.5C in the Context of Sustainable Development**

* Pathways consistent with 1.5C of warming above pre-industrial levels can be identified under a range of assumptions about economic growth, technology developments and lifestyles
  + However, lack of global cooperation, lack of governance of the required energy and land transformation, and increases in resource-intensive consumption are key impediments to achieving 1.5C pathways
    - Governance challenges have also been related to scenarios with high inequality and high population growth in the 1.5C pathway literature
* Demand-Side Mitigation and Behaviorual Changes
  + Demand-side measures are key elements of 1.5C pathways. Lifestyle choices lowering energy demand and the land- and GHG-intensity of food consumption can further support achievement of 1.5C pathways
    - …policy-driven pathways that encompass accelerated change away from fossil fuels, large-scale development of low-carbon energy supplies, improved energy efficiency and sustainable consumption lifestyles reduce the risks of climate targets becoming unreachable (Clarke et al., 2014; Riahi et al., 2015, 2017; Marangoni et al., 2017; Rogelj et al., 2017, 2018; Streffler et al., 2018b)
* FAQ: What kind of pathways limit warming to 1.5C and are we on track?
  + There is no definitive way to limit global temperature rise to 1.5C above pre-industrial levels. Scientists have used computer models to simulate the emissions of GHGs that would occur in different scenarios.
  + If we were to ‘overshoot’ our GHG emissions and go beyond 1.5C warming, we would have to rely more heavily on technologies that remove CO2 from the atmosphere on top of reducing the sources of emissions (mitigation).
    - Such ideas for CO2 removal have not been proven to work at scale and run the risk of being less practical, effective or economical than assumed
    - There is also the risk that the use of CO2 removal techniques ends up competing for land and water, and if these trade-offs are not appropriately managed, they can adversely affect sustainable development
    - Additionally, a larger and longer overshoot increases the risk for irreversible climate impacts, such as the onset of the collapse of polar ice shelves and accelerated sea level rise
  + CDR deployed at scale is unproven, and reliance on such technology is a major risk in the ability to limit warming to 1.5C
    - CDR is needed less in pathways with particularly strong emphasis on energy efficiency and low demand
* FAQ: What do energy supply and demand have to do with limiting warming to 1.5C?
  + Limiting global warming to 1.5C above pre-industrial levels would require major reductions in GHG emissions in all sectors (buildings, industry, transport, energy, agriculture, forest, and other land use (AFOLU))
  + Demand- and supply-side measures are not an either-or question, they work in parallel with each other

**IPCC 5th Assessment Report – Full**

* gigatonne of CO2 (GtCO2)
* between 1750 and 2011, cumulative anthropogenic CO2 emissions to the atmosphere were 2040 +/- 310 GtCO2
  + About 40% of these emissions have remained in the atmosphere (880 +/- 35 GtCO2)
  + The rest was removed from the atmosphere and stored on land (in plants and soils) and in the ocean
  + The ocean has absorbed about 30% of the emitted anthropogenic CO2, causing ocean acidification
  + About half of the anthropogenic CO2 emissions between 1750 and 2011 have occurred in the last 40 years