Synopsis of IPCC Fifth Assessment Report - Working Group I
Summary for Policymakers

Introduction
The Intergovernmental Panel on Climate Change (IPCC) Working Group I is tasked with evaluating the physical science basis for climate change. It has published five assessment reports since 1990. The Fifth Assessment Report (AR5), published in 2013, was written by 259 climate scientists from 39 countries and incorporated 54,677 comments during the peer review process.

Key Findings
AR5 states that warming of the climate system is unequivocal, with many observed changes unprecedented. The report lays out observed changes in the climate system across five main areas:

- Atmosphere
  - From 1880 to 2012, average land and ocean surface temperature has risen 0.85°C. Each of the last three decades has been successively warmer at the Earth's surface.
  - The troposphere (lower atmosphere) has warmed since the mid-20th century, while the stratosphere (upper atmosphere) has cooled – indicating heat from below, not from the sun.
  - The number of extreme weather events is likely to increase, including higher maximum and lower minimum temperatures, more frequent and intense heatwaves, and heavy precipitation.
- Ocean
  - Ocean warming accounts for 90% of increased energy in the climate system from 1971 to 2010.
  - Ocean warming is largest near the surface. The upper 75m warmed by .11°C.
  - Over 60% of the energy increase in the climate system is stored in the upper ocean (0-700m).
- Cryosphere (frozen areas of planet – glaciers, polar regions)
  - Greenland and Antarctic ice sheets have lost mass; glaciers are shrinking; Arctic sea ice is decreasing.
  - Rate of ice loss from glaciers has increased [226 Gt/yr (1971-2009) to 275 Gt/yr (1993-2009)]
  - Rate of ice loss in Greenland has substantially increased [34 Gt/yr (1992-2002) to 215 Gt/yr (2001-11)]
  - Rate of ice loss from Antarctic ice sheet has increased [30 Gt/yr (1992-2001) to 147 Gt/yr (2002-11)]
  - Summer ice minimum of Arctic sea ice has decreased 9.4-13.6% per decade from 1979 to 2012.
- Sea Level
  - Rate of sea level rise since mid-19th century is higher than rate in previous two millennia.
  - From 1901 to 2010, global average sea level rose by 0.19 meters (7.5 inches)
  - Rate of sea level rise is increasing [1.7mm/yr (1901-); 2.0mm/yr (1971-); 3.2mm/yr (1993-)]
  - Glacier mass loss and ocean thermal expansion explain 75% of sea level rise since 1970s.
- Carbon and other Greenhouse Gas Cycles
  - Concentrations of CO2, CH4, and N2O in atmosphere are unprecedented in last 800,000 years.
  - The ocean has absorbed 30% of CO2 emissions, causing acidification that threatens marine life.
  - Level of CO2 is 391 ppm; CH4 is 1803 ppb, N20 is 324 ppb -- up 40%, 150%, and 20% since 1750.
  - From 2002 to 2011, average annual CO2 emissions from burning fossil fuels was 8.3 GtC/yr.
  - Since 1750, 375 GtC has been released by burning fossil fuels, and 180 GtC released from deforestation. Cumulative human-caused emissions of carbon is 555 Gigatons.

Options
The Copenhagen Agreement reached at the 15th session of the Conference of Parties to the United Nations Framework Convention on Climate Change specified that global temperature increase must be kept below 2°C to prevent dangerous human-caused interference with the climate system. To meet this target, AR5 calculates that total CO2 emissions of 1570 GtC have a 33% chance, 1210 GtC a 50% chance, and 1000 GtC a 66% chance.

AR5 lays out a series of Representation Concentration Pathways (RCPs), or scenarios for various levels of Radiative Forcing compared to pre-industrial levels. Radiative Forcing (RF) quantifies the change in energy in the earth's climate system caused by drivers of climate change such as greenhouse gas, and is measured in Watts/m2.

Recommendation
Four RCPs are considered: Lowest (RF 2.6 times pre-industrial levels); Medium Low (4.5); Medium High (6.0); Highest (8.5). **Of these, only the Lowest RCP scenario keeps warming below 2°C by year 2100**. This scenario requires that total cumulative human-caused C02 emissions stay below 1000 GtC. We are currently at 555 GtC. Therefore we must take swift and immediate action to decrease carbon emissions through phasing out the burning of fossil fuels by implementing renewable energy, and ending deforestation for logging, grazing and crops.