Implications of the Paris Climate Agreement on Knoxville

1	**Title Slide** – introduce TIPL
2	**CO2 emissions 1751-2010** • Annual emissions of carbon into atmosphere from pre-industrial to current time • Pre-industrial: people burned wood and other biomass for heat • Industrial period began in England in 1850 – coal burned in newly invented steam engine to power cotton textile factories. • After Civil War, intensification of burning of coal for textile factories, railroads, and other applications. • After WWII – the Great Acceleration – advent of gasoline fueled internal combustion engine: highways, suburbia, mass consumerism
3	**Global Energy Consumption and Mix: 1800 – 2012** *MTOE/a metric tons of oil equivalent* • This slide shows global energy consumption over the past 200 years. • Bottom wedge – (pink?): biomass baseline • Grey wedge – coal: increases from mid-19th century (industrial revolution) with a rise in later years due to coal to fuel steam electrical generation plants. • Green - oil: see the Great Acceleration above. • Red – Natural gas: displacement of coal in heating of buildings. After 2012, is use in generating electricity • Light blue – nuclear • Dark blue – hydro • Sliver of yellow on top – solar and wind. Until we reduce the amount of fossil fuels used, the contribution of renewables will be marginal. Currently about 1%.
4	Now let's talk about Paris Climate Agreement. • In the graph you can see that form the past million years, the carbon dioxide concentration in the atmosphere bounced between 200 and 300 ppm. • In 2016, we reached 400 ppm, meaning that it was at this level year round. • The lower emission scenario, which is the target of the Paris Climate Agreement, has a peak concentration of 490 ppm. • The higher emission scenario, which is what we get if we don't do anything is above 850 ppm. The maps on the right help show the differences between the scenarios. • Looking at the color key, the darker the red the more days above 100 degrees F. • Looking at the top map, this is the historic average of days above 100 degrees F. You can see the southwestern deserts have many days above 100 degrees. • The second map depicts the low emission scenario projections for 2100. You can see that much warming occurs. Climate change cannot be stopped. • Note: even at this level the warmest areas are in our "bread basket" and will experience drought. • The third map show the higher emission scenario projects for 2100. You can see that most of the United States is experiencing two to four months above 100 degrees F. Some areas of the country may be unlivable.
	This slide shows the same information in a different format.

	• Each row represents a scenario. The top row is the lower emission scenario, the basis of the Paris Climate Agreement. The bottom row is the higher emission scenario. • The first column is 2050, the second – 2100, and the third – 2200. • The color differences are based on the differences in average temperature between the historic and projected average. The darkest color is 11 degrees centigrade difference, approximately 20 degrees Fahrenheit. • Looking at the top row – the lower emission scenario, you can see that it is projected that by 2200, the planet has begun to cool. • Looking at the bottom row – the higher emission scenario, it is projected that the planet is still warming and that it has already reached high temperatures that civilization and probably life forms as we know them have utterly changed. • You can see why the lower emission scenario of the Paris Climate Agreement is the one which we need to achieve. • Note: co2 absorbs infrared like a sponge. That's how we retain the heat. Oceans absorb the infrared as well.
6	This slide shows how the two scenarios affect Knoxville. • This graph was produced by the Climate Change Institute of NOAA – National Oceanic and Atmospheric Administration.. • This graph shows the projected number of days above 95 degrees in Knoxville • The top red line is the higher emission scenario, and by 2100 Knoxville will experience 80 more days above 95 degrees, approximately three months above 95. • The bottom blue line is the lower emission scenario, and by 2100 Knoxville will experience 20 more days above 95 degrees, less than one month of additional days. • Also, look at the top red line and see that the frequency of days above 95 degrees is still rising. Now see the bottom blue line, the lower emission scenario and the frequency of days above 95 degrees has stabilized.
7	This slide shows the per capita carbon emissions by country. While this graph is from 2002, we haven't been able to find a better depiction on this information. The information has been updated to the most current available for the U.S. • Per capita emissions are determined by taking the total carbon emissions of a country and dividing it by the population. The total includes household, military, government, agriculture – the total economy's carbon emissions. • You can see that the U.S. has the highest per capita emissions. Currently we emit 16.2 metric tons (MT) carbon dioxide emissions annually. The global average is 4.5 MT. • All of the industrialized countries are high carbon emitters. You can see that the poorest countries in the world also emit the least carbon. • Point out where China and India are on the chart. This surprises people because China and India are depicted are high emitters of carbon. But this chart depicts per capita. These two countries have a lot of people. Per capita, they are close to the world average per capita emissions.
8	This slide shows the cumulative carbon emissions by country from 1850 to current times. • You can see that the U.S. carbon emissions nearly equal the emissions for the rest of the world combined. • Point out China and India. This graph represents total emissions by country.

	• Carbon stays in the atmosphere for 500 years—so if we stop cold today it would still take 500 years for us to return to where we are right now.
9	• This slide shows that the wealthier nations emit most of the carbon emissions, the poorest countries the least. • This is also true for class. Those who wealthy are most responsible.
10	• In the top map, the darker the red, the higher the per capital carbon emissions. The darker the green, the lowest emissions. • In the bottom map, the darker the green the least vulnerable to the damages of climate change. The darker the red, the most vulnerable. • The darkest red are the most unable to recover—we will experience climate change, but we have the resources to recover. • Those most responsible for climate change are the least vulnerable to its damages. Those least responsible are the most vulnerable to climate change. • The wealthier you are, the more resilient you are to any catastrophe. • White countries are so poor there's no way to collect information.
11.	Transition slide.
12	Let's come back to this graph to understand what the Paris Climate Agreement says what we must do to achieve the lower emission scenario. • The Paris Climate Agreement is based upon the findings of the Intergovernmental Panel on Climate Change (IPCC), a consortium of climate scientist brought together by the United Nations. • The recommendations made by the IPCC were rolled into the Paris Climate Agreement. • The IPCC set a world average per capita goal of 1.6 MT carbon by 2050, a reduction from the current 4.5 MT. • The IPCC also said that in order to achieve that goal, the wealthy industrial nations need to reduce their carbon emissions to 3 MT per capita. From our current 16.2 MT to 3 MT by 2050. • Essentially, by 2050 we need to decarbonize our global economy if we are to achieve the lower emission scenario.
13	This slide shows the pathway to the lower emission's requirement that we decarbonize the global economy by 2050. • By the end of every decade, we must have decreased our carbon emissions by half. • Between 2020 and 2030, we reduce our carbon emissions by half. Between 2030 and 2040, by half again. Between 2040 and 2050 by half again. • By 2050 we will have decarbonized the economy, no longer burning fossil fuels as an energy source. • Go back to slide 3—by 2050 we need to get rid of all fossil fuels (decarbonize our economy).
14.	This final slide shows how each sector contributes to total carbon emissions. This chart is for Knoxville, but it is similar to the rest of the nation. • The share of the residential and commercial has reduced over the past decade relative to transportation: we now have energy building codes, the Energy Star program has successfully encouraged consumers to purchase energy efficient appliances, and utilities are replacing coal with natural gas in generating electricity, a product largely used in buildings.

	• Our transportation emissions continue to rise both within the U.S. and especially globally. It is the priority challenge for us to address and begin to reduce.