**Presentation Notes**

**Slide 5**: Line Plot of Cumulative total across years

* Values plotted are cumulative total for that given year, 2011-2017 because of the availability of data
* Up until 2014, wind provided more power per year than solar
* With Wind staying relatively constant, the growth in Total Renewables was primarily dependent on the growth of Solar Power. Solar power becomes the dominant renewable source providing power to the grid
* Total Renewables includes Biogas, Biomass, Geothermal, and Small Hydro
* If trends stays constant, we can predict 75,000 GWh produced in 2020
* GWh = 1000 MWh
* 1 MWh is continuously producing 1000 watts of power for an hour

**Slide 6:** Bar plot 2017 vs 2012 monthly renewable production

* Most growth between the years is in summer months, somewhat expected with knowledge that solar drove most of the growth in the total renewable production per year.
* Nearly double the production in the sunnier months
* 2012 less seasonal fluctuation because of less dependence on solar

**Slide 7:** Solar Scatter plots

* Plots show a dot for every hour of energy production across every day for the year, color coded to the time of day. Shows both seasonal and daily fluctuation in solar production.
* Showing daily and seasonal fluctuation is important with renewable sources because:
  + Not many storage options
  + Unlike coal or natural gas where you can increase how much fuel is burned to increase production across a given hour, renewables are available when the environment says so
* Scale difference
* Can see hourly lines for evening and morning between the equinoxes
* Spring Equinox: sun moving across equator while moving north
* Summer Solstice: Sun reaches northern most declination of 23.5 degrees, northern hemisphere’s longest day
* Fall Equinox: pass equator moving south
* Winter Solstice: Southern most declination, 23.5 south, northern hemi shortest day

**Slide 8:** Solar Daily Box Plot

* Box plot
  + Colored portion shows Interquartile Range (25th percentile to 75th percentile). 50% of data is here
  + Middle line is median of data. Half of data above, half below.
  + Whiskers show minimum and maximum value that aren’t considered outliers
    - Minimum: Q1 - 1.5\*IQR
    - Max: Q3 + 1.5\*IQR
  + Dots are outliers, beyond the max or min values
* Large IQR shows that there is a large standard deviation in MWh production per hour across all the years. This could be because of the large growth in solar power production in the years in our data set
* Expected increase in solar power production during daytime hours

**Slide 9:** Wind Daily production Box Plot

* Somewhat opposite trend as solar, if increased wind production in California, could help have more renewable power across the entire day
* Overall less power produced than solar
* Relatively large IQR and min/max values and therefore standard deviation in wind production too, since it has less growth than solar, as demonstrated in the 2012 vs 2017 scatter plots, this shows wind has more fluctuation per hour and may be a less reliable renewable source than solar