5/06/16

Direct Current (DC) Transmission Lines

The Southern Cross Transmission Project is a ±500 kV direct current (HVDC) transmission line proposed to connect the nation's energy markets and provide the southeastern United States (U.S.) with access to cost-effective, renewable energy.

What is DC Transmission?
HVDC Transmission is a unique type of Transmission line that has a frequency of zero. HVDC is used for special purposes such as efficiently transmitting power over very long distances or where it is important to control the amount or direction of power being delivered across the line. Electricity is transmitted as a current and voltage that flows from generating stations over transmission lines, to substations, and then through distribution lines before it reaches our homes and offices. Since the U.S. electric system operates using AC almost exclusively, a HVDC system includes two converter stations, one at each end of the HVDC transmission line. The converter stations change AC power to HVDC at one end of the line, and HVDC power to AC at the other end of the line.

What is the difference between DC and AC transmission?
The primary difference between HVDC and AC transmission is that HVDC flows constantly in only one direction, like a battery, whereas AC changes direction 60 times per second. Most people use a combination of AC and DC (similar to HVDC but at lower voltage) power every day. Some of the benefits of using DC or HVDC over AC include:

- A HVDC line offers the benefit of "scalability," meaning the amount of power the line can transmit can be increased by adding equipment at each end of the line. This decreases the need to build more power lines in the area if demand for power increases.
- HVDC lines are more efficient than AC. One 500 kV DC line can transmit a similar amount of power as four double circuit 230 kV AC lines or seven single circuit 230 kV AC lines
- All power lines experience line losses—power that's lost in the form of heat when a line is operating. HVDC transmission lines typically experience 30-50% less transmission losses compared to AC lines, meaning better energy efficiency and less power wasted.

What are electric and magnetic Fields?
Electric and magnetic fields, also called EMF or "electromagnetic fields," are produced by any wiring or equipment that is energized and carrying electric current, whether AC or DC., including lights, appliances, electrical wiring and power lines. The strength of both electric and magnetic fields decrease rapidly with increasing distance from the source.

How do electric and magnetic fields differ for AC versus DC transmission?
Electric and magnetic fields differ between HVDC and AC because of the difference in frequency, i.e. the alternation of the current. Because HVDC current doesn't alternate as it does for an AC line, the fields are referred to as "static", which is a frequency of zero. DC electric and magnetic fields are identical to those found in the natural environment.