



# UNDERSTANDING WITRICITY



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# What WiTricity isn't

- ❑ Traditional Magnetic Induction
  - ❑ Electronic tooth brushes
  - ❑ Charging pads
  - ❑ Transformers
- ❑ How it works
  - ❑ Conductive coils transmit power wirelessly through short distances an electronic current runs through main coil inducing a current to the receiving coil
  - ❑ Efficiency reduces as distance increases



Use with electronic toothbrushes, though must be in cradle to couple and transfer power

# What WiTricity isn't

- Broadcasted radiation of radio frequency
  - Used for wireless information transfer
    - Information can be transmitted over an extensive area to multiple radios or wireless receivers
  - Power
    - Power received is very small
      - Increased through receiving unit with an external power supply
    - Wasted in free space
    - Increasing Power
      - Safety hazard
      - Interferes with other radio frequency devices

# What WiTricity isn't

- Directed Radiation
  - ▣ Microwave Radiation
  - ▣ Highly directional antennas beam energy from a source to receiver
    - May be Unsafe for people
      - Especially when in the line-of-site
    - Reacts with certain metallic objects
      - Example: microwaving tinfoil
  - ▣ Defense researchers are looking into using this to deliver lethal doses of power to targets
    - In war, space, etc..



# What WiTricity isn't

- Light Waves
  - ▣ Invisible and Visible
  - ▣ Examples
    - Sunlight: Researchers are looking into making electrical energy from sunlight
    - Laser beam: uses light waves and then makes them into a collimated beam
      - Delivers targeted energy
  - ▣ Used for energy transfer
  - ▣ Downfall is the target must be in sight



“Artist rendering of European Space Agency Aeolus Satellite with laser beam pointing at the Earth's atmosphere. Aeolus will use laser Doppler radar to better understand weather phenomena.  
Credits: ESA/AOES Medialab”

# What WiTricity Isn't

- Magnetic Resonance Imaging or MRI
  - ▣ Magnetism is the foundation for diagnostic imaging of soft tissue
    - Uses a DC magnet that positions the magnetic fields of atoms within tissues, and then radio frequency fields to control the atoms
  - ▣ Not a way of wireless power transfer
    - WiTricity uses Resonant magnetic coupling but the two aren't related



# What WiTricity is

- Non-radiative power transfer
  - ▣ Most other techniques use radiative techniques
- Relies on magnetic coupling
- Clear line of sight not needed
- Safe

# History

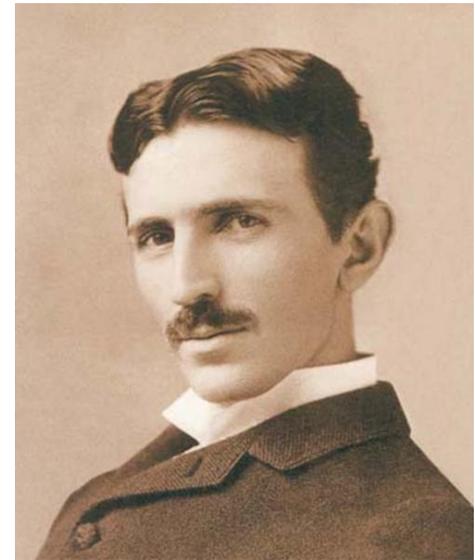
- A few scientists in the late 1800s and early 1900's
  - wires could be used for transferring energy everywhere
    - would be too expensive
  - Nikola Tesla

Picture: Nikola Tesla's Wardenclyffe tower on Long Island, NY was built in 1904 (later destroyed in 1917). It was built in hopes of transmitting power and information throughout the globe.



# History of Tesla

- Nikola Tesla had a vision for a wireless world
  - ▣ Power and communication everywhere
  - ▣ Invented three-phase ac power systems, induction motors fluorescent lamps, radio transmission, and much more
  - ▣ His vision was different than WiTricity but helped



# Benefits

- Wireless power transfer is very efficient
  - ▣ Many times 90%+ efficiency
  - ▣ Distances: centimeters to meters
- Transfers only when needed
- Only uses the amount of energy needed
  - ▣ When not being used will go into an idle state to conserve power

# Features

- Uses a magnetic near field
  - ▣ A lot of regular building and furnishing materials are “transparent” to these fields
    - Examples: wood, plastics, glass, brick, and concrete
  - ▣ When metallic obstacles get in the way the magnetic field “wraps around” them
  - ▣ Reacts weakly with living things
    - Professor Sir John Pendry, a world renowned physicist explained “The body really responds strongly to *electric* fields, which is why you can cook a chicken in a microwave. But it doesn't respond to *magnetic* fields. As far as we know the body has almost zero response to magnetic fields in terms of the amount of power it absorbs.”

# Features

- WiTricity is designed to contain electric fields within the source
  - ▣ Results in levels of electric and magnetic fields which fall well within regulatory guidelines/
    - This doesn't bring the radio frequency emissions up that interfere with other electronic devices
      - Safe
  - ▣ The FCC and ICNIRP have set limits for human exposure to magnetic fields
    - Based on broad scientific and medical consensus

# Features

- Designed to deal with large range of power levels
- Highly efficient at distances of milliwatts to a many kilowatts
  - ▣ Examples: wireless mouse (milliwatts) and recharging an electronic passenger vehicle (kilowatts)
    - Versatile



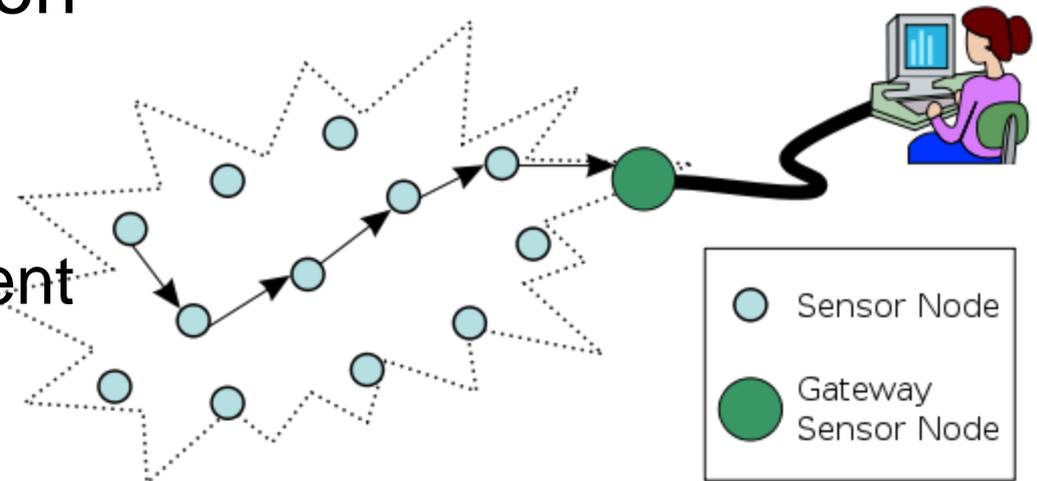
# Flexibility

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- Being designed to be versatile
  - ▣ Engineers can design power sources and devices of many shapes and sizes because of the physics of WiTricity
    - Compact enough to fit a cell phone

# Conclusion

- There are many ways of information transfer
  - ▣ Not always safe
  - ▣ Not always efficient
- WiTricity
  - ▣ Safe
  - ▣ Efficient
  - ▣ Still being improved



“Typical Multihop Wireless Sensor Network Architecture”