Jefferson County Public Utility District 1

proposed

METER REPLACEMENT PROJECT

Kevin Streett,

Assistant General Manager

PUD
Jefferson County
Public Utility District

About Me

Kevin Street

Assistant General Manager

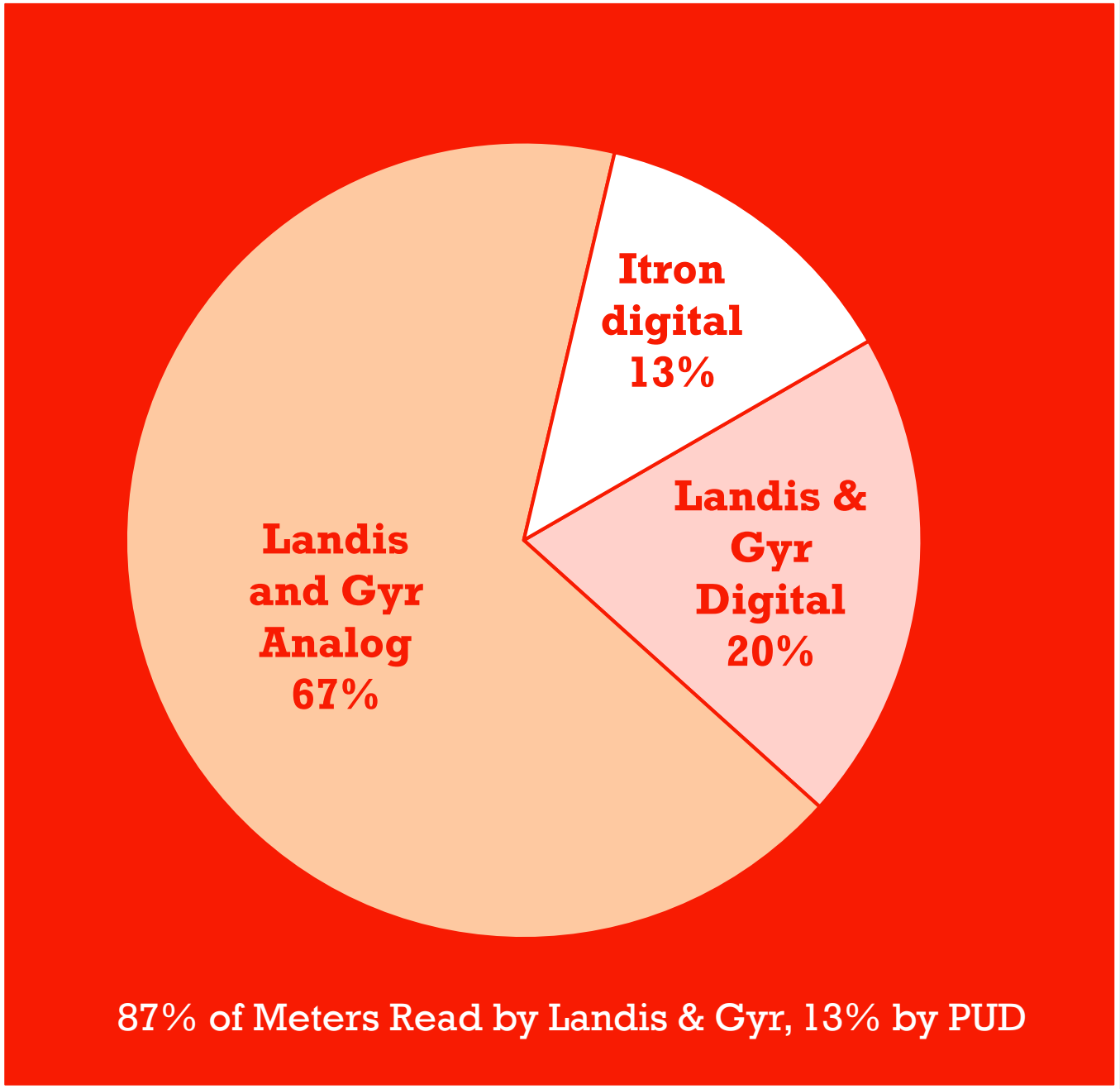
JEFFERSON COUNTY PUD

- 8 Million years in the electrical power business
- Worked all across the Western US
- Have worked every position from line to foreman to Operations Director to Asst. GM
- Helped build Jefferson County's Electrical power business
- PUD has come a long way, but still a long way to go
- We need to continue invest in, improve, and modernize or electrical infrastructure to provide the level of service and reliability our customers expect and demand of us.
- We can't go backwards.

Current AMR Metering System in Jefferson County

- 19,500 Meters in Jefferson County
- Age range from 1- 6o years old
- Several different styles, manufacturers
- Both Analog and Digital
- 450 meters fail per year, many more underperforming
- Up to 60 per week during storms
- Bound to $300K contract for reading of existing meters
- Meter readers drive 1000s of miles per year
- Analogs retrofitted with AMR "One Way" transmitters by PSE up to 15 years before JPUD took over power service.
- All currently read remotely. All broadcasting RF signals every 5 minutes.
- No "Opt-Out" program

Types of Meters in Jefferson County



87% of Meters Read by Landis & Gyr, 13% by PUD

THE CURRENT METER SYSTEM IS FAILING

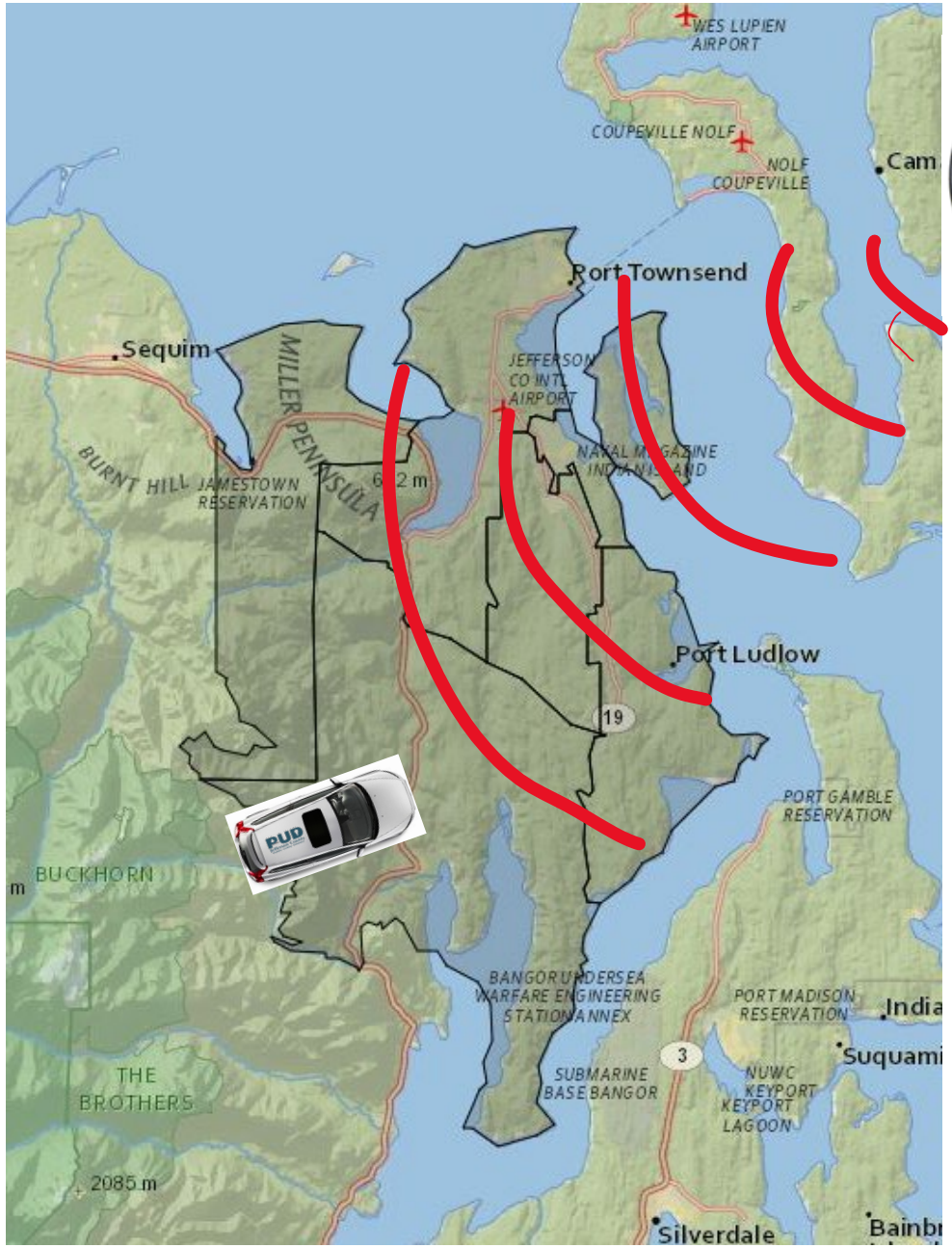
THE CURRENT SYSTEM NEEDS TO BE REPLACED

Proposed New AMI Meter System

- AMI "Two-Way" Meters" from WA based ITRON
- Signal can be sent from meter to PUD and back from PUD to meter
- Fully programmable with multiple configuration options
- Single, consistent, new meter utilizing current technology
- Greatly Improved Accuracy, Maintenance
- Read remotely over secure network, no driving necessary
- $50K read contract, reduced maintenance, service costs
- Improved Response Times: Remote dis/reconnect
- Improved Usage Data reporting
- Much Less RF emitted: transmits every 4hrs vs every 5 minutes
- Opt Out Available

How Meters are Read Now

From the meter to the truck to the laptop to the cloud to the PUD


WES LUPIEN AIRPORT
COUPEVILLE NOLF
NOLF COUPEVILLE
Port Townsend
Sequim
MILLER PENINSULA
JEFFERSON CO INTL AIRPORT
BURNT HILL
JAMESTOWN RESERVATION
Port Ludlow
19
PORT GAMBLE RESERVATION
BUCKHORN
BANGOR UNDERSEA WARFARE ENGINEERING STATION ANNEX
PORT MADISON RESERVATION
SUBMARINE BASE BANGOR
NUWC KEYPORT KEYPORT LAGOON
3
THE BROTHERS
2085 m
Silverdale
PUD


PUD
Safeway
Jefferson Healthcare Medical Center
Kah Tai Lagoon
Kah Tai Lagoon Nature Park
Jefferson County Historical Museum
Historic Fire Bell Tower
Northwind Arts Center
Hastings Building
Chetzemoka Park
Point Hudson
Port Townsend Coupeville Ferry


PUD
Quilcene Historical Museum
Quilcene School District
Quilcene
Hood Canal Ranger District Quilcene
Mt Walker Inn
Olympic Timberhouse
Olympic Hwy
East Quilcene

How the new meters will be read

No more trucks, no more driving, all read by PUD

Serial Number, Usage data

Aggregated data

Advanced
Two-Way
Communications

Operation control

PUD
Jefferson County
Public Utility District

New Meter Benefits

- Improved Safety & Service
  - *Remote connect/disconnect, diagnostics, voltage monitoring*
- Reduced Costs
  - *Big reduction of current expenses to maintain and service meters over lifetime of product*
- Environmental Benefits
  - *Less carbon emissions, thousands of miles of driving saved*
- Improved Conservation
  - *Enhanced usage data reporting and tracking helps customer and PUD help conserve power, resources*
- Integration with PUD control systems (SCADA, OMS, Smart Hub)
  - *New meter tech allows instant partial reconnects in outages… (limited reconnect)*

AMI AND SMART METER

QUESTIONS, CONCERNS, & ANSWERS

Cost?

Will my bills go up from the new meters?

- Estimated at 2.5 million over 3 years
- No rate increases proposed to fund the project
- PUD staff install all meters over 3+ year timeframe
- Currently functioning meters should see little change in swap out
- Underperforming meters will be begin to track the correct usage amounts

Accuracy?

Some articles suggest that smart meters can be wildly inaccurate. What is the evidence supporting the statement that smart meters are more accurate than analog?

- Majority of current PUD meters inaccurate
- Current meters also inconsistent
- New meters tested, calibrated, consistent, replacable
- Trouble shooting problems with reads will be much faster and easier
- Analog meters may last 60 years, but are not accurate for 60 years
- Digital or Solid State accuracy more stable over active life cycle

Security?

How secure is our meter data from being stolen, sold, or hacked?

- No personal identifiable information transmitted, only meter serial number and usage data
- Fully Encrypted
- Unlike CA, IL, TX, WA state is a closed energy market.
- The PUD has a privacy policy and does not sell anyone's data

Health?

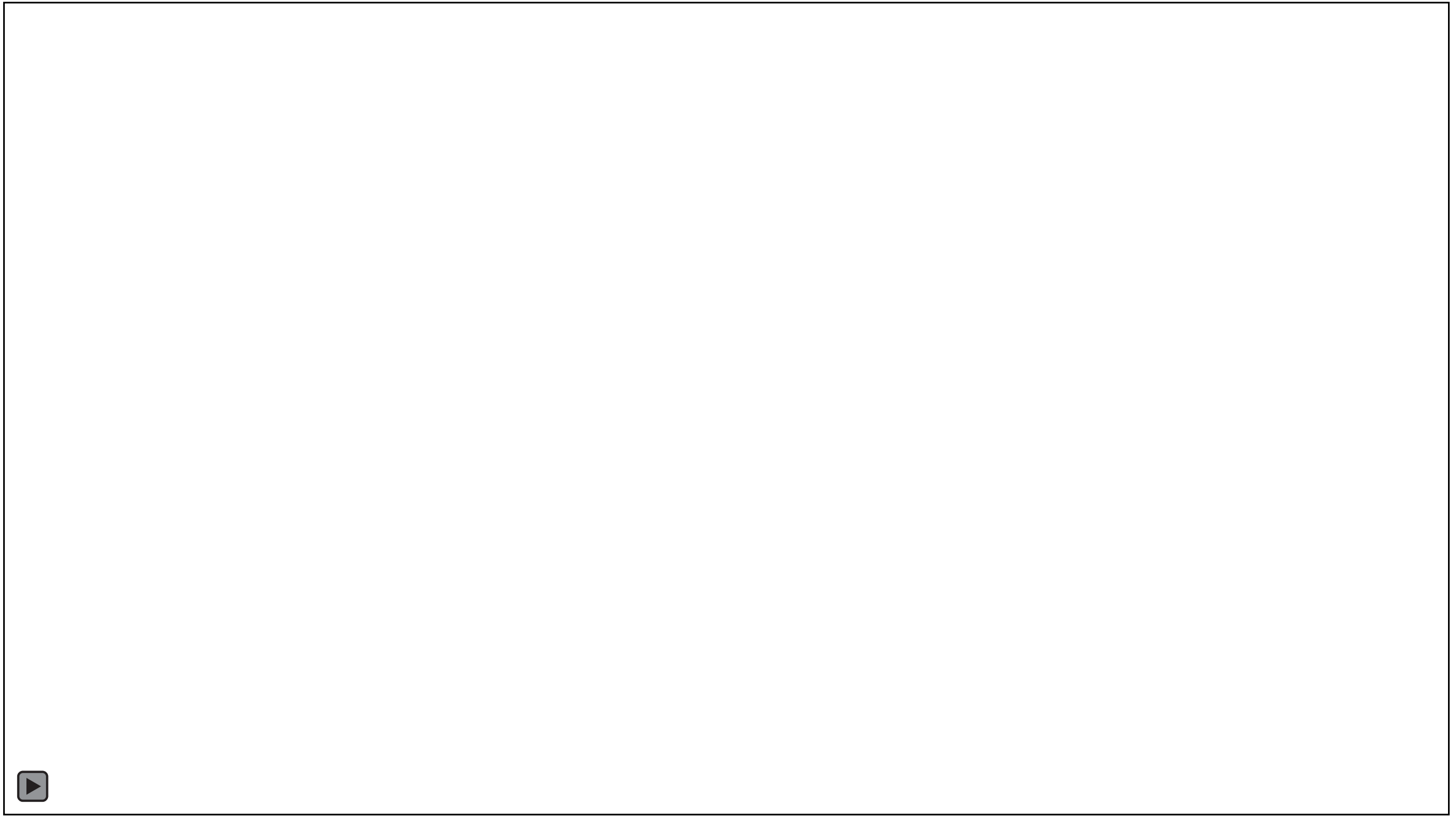
Are there any negative health effects from contact with smart meters, RF, or EMF emissions?

- PUD and CAB has studied health effects thoroughly
- Links to sources on our website
- Similar or lower in RF emissions than cell phones, WiFi, baby monitors, cordless phones
- Cellnet modules have been sending RF signals from all meters in Jefferson County for more than 15 years
- New meters will send 48 times less RF transmissions per day than current meters

Safety?

Do Smart Meters cause or increase risk of fire?

- 64 million advanced or smart meters installed in the US alone. 1 billion worldwide projected for 2020
- Common cause of meter fires is poorly maintained meter boxes
- Customer is responsible for meter box
- PUD meter technicians will test every meter box before installing
- No meters will be installed in unsafe boxes
- Watch the video about how we test meter boxes…



2013 - 2021

Meter Replacement Timeline

PAST TO PRESENT

- April 2013 – present: PUD employees discover and replace numerous aged and defective meters, up to 450 failing per year.
- Dec 9, 2013: PUD Citizens Advisory Board (CAB) creates a Smart Meter Subcommittee to meet regularly and report to larger CAB about possible uses, benefits, and risks of smart meters.
- May 19, 2015: PUD General Manager Jim Parker presented a memorandum to the PUD Board of Commissioners (BOC) concerning a need to formalize a plan for meter replacement.
- May 9, 2016: CAB recommends PUD proceed with RFP for replacement of all current meters with new advanced meters.
- Feb 22, 2017: PUD BOC approves release of RFP for new meter vendor.
- June 25, 2017: BOC approves selection of WA based ITRON to provide new advanced "two way" meters.

PRESENT TO FUTURE

- Oct 30, 2017: Special Public Meeting to discuss meter replacement program. Chimacum Fire Hall, 5pm.
- Mid December, 2017: Planned acquisition of first batch of of new meters.
- Mid January, 2018: Planned installation of first batch of new meters.
- January 2018-Mid 2021: Planned countywide meter replacement by PUD staff.

Opt-Out Program

CURRENTLY UNDER REVIEW

- Will be available to customers as option in 2018
- Charges for additional installation and service
- Currently under review by staff, commissioners
- Public input welcome

POWERLINE COMMUNICATION OPTION

- Turn off radio in new meter, transmit signal through wire
- Opt Out customer pays for initial purchase and installation of transmitter on power pole
- No additional monthly reading fee
- No need for driving, all response time benefits
- No RF transmitted from meter on customer property

Radio Frequency Radiation
What is it?

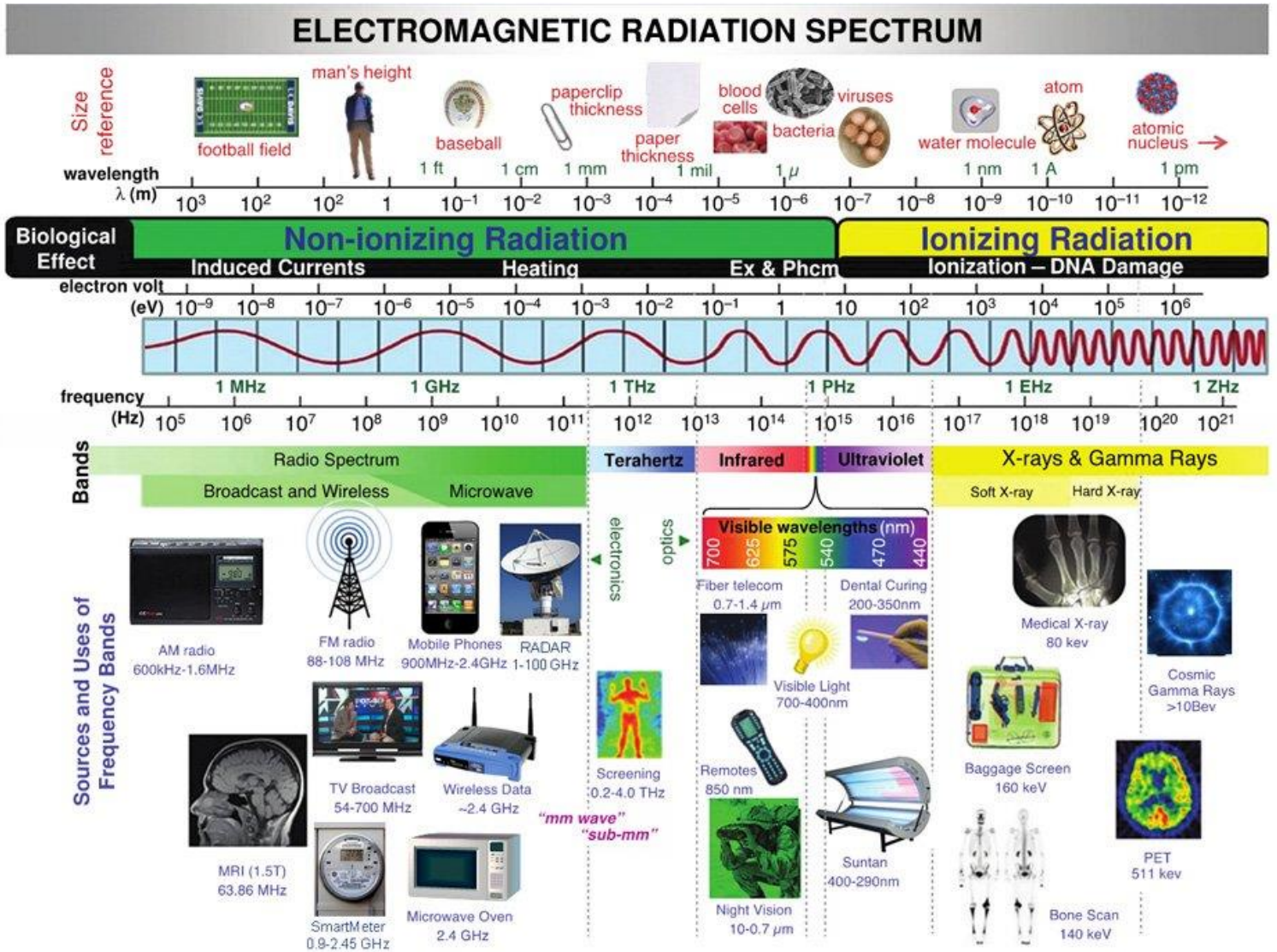
What are
the health risks of exposure?

Thomas Engel

About me

- Retired UW chemistry professor
- Local 20/20 Energy Action Group moderator
- Member PUD Citizen Advisory Board
- Committed to energy conservation and reversing climate change
- Have built small house that can be heated with hand held hair dryer
- Generate 75% of energy that house needs using solar panels
- Committed to healthy living

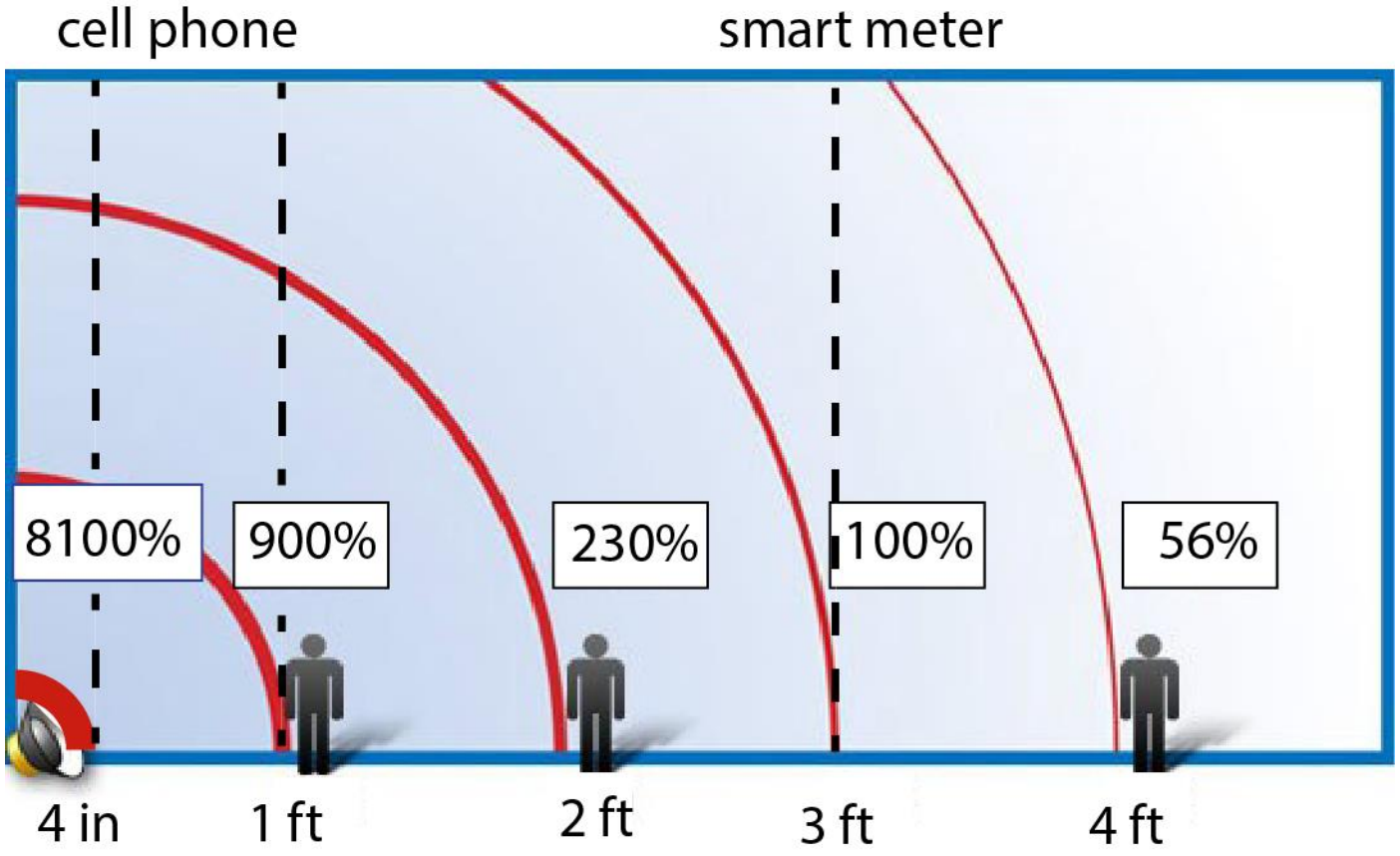
What is radiofrequency radiation?



Common Sources of radiofrequency radiation

- **Cell phones**
- Cell phone towers
- Microwave ovens
- Smart meters
- WiFi and Bluetooth
- 2-way radios
- Cordless phones
- Baby monitors and other wireless devices

Why are cell phones the dominant source of rf exposure?



Effect even larger because of duty cycle, directionality, and shielding

The proposed PUD replacement meters will reduce rf exposure relative to your current meter by a factor of ~40.

Takeaway lesson:

If cell phones don’t affect your health, you will not be affected by the replacement meters

If you don’t use a cell phone and want to reduce your rf exposure

- Remove WiFi and Bluetooth devices from your home
- Don’t use cordless phones
- Hard wire your computer to the router
- Have your microwave oven checked for rf leakage
- After you have done all that, you might want to opt out of PUD rf meter

What is known about health effects of rf radiation?

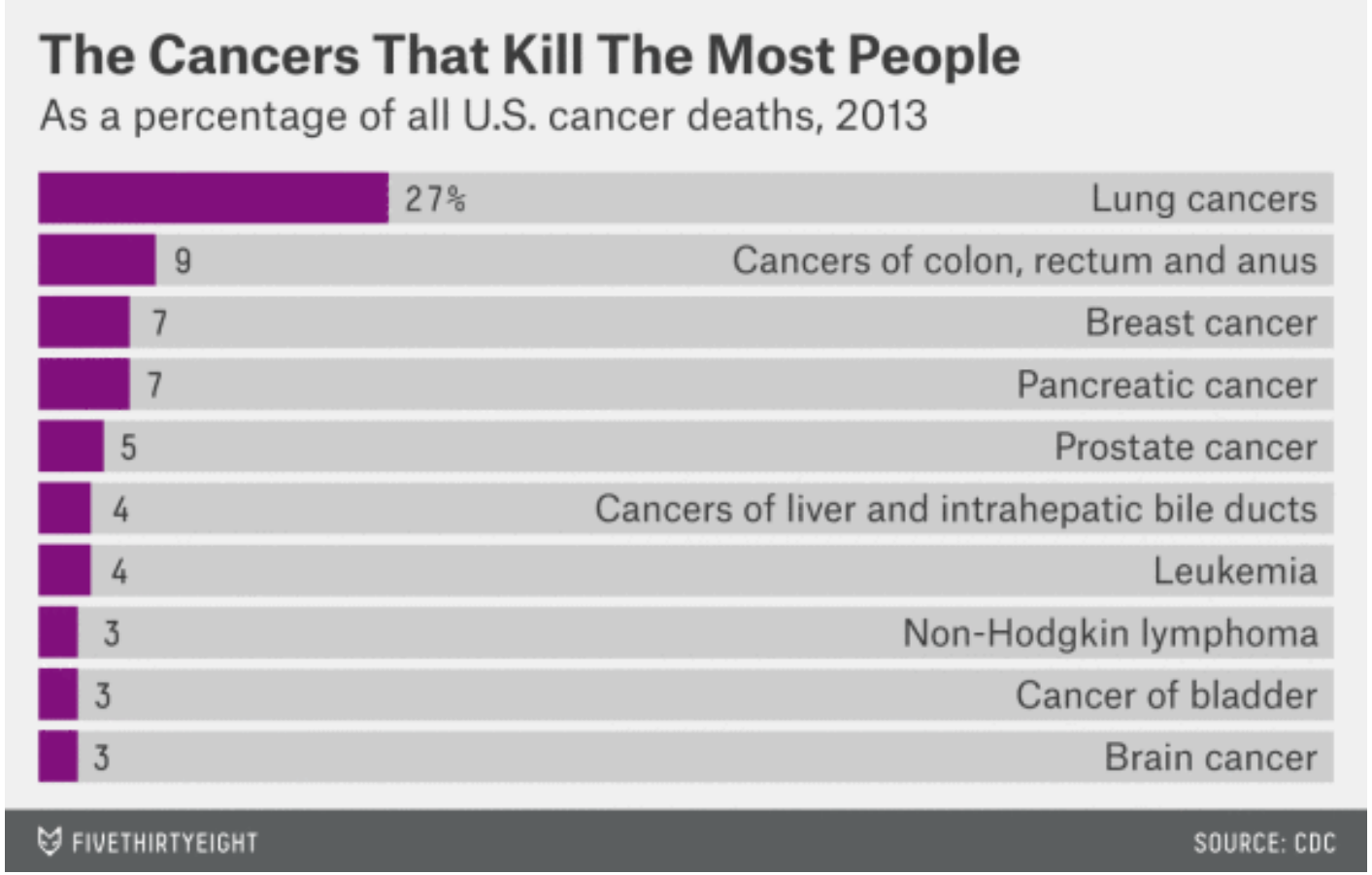
- Only known mechanism for interaction of rf radiation with humans is heating
- Safety standards based on heating
- Cell phone and smart meter rf exposure well below safety standard
- Increasing number of studies suggest that non-thermal effects may be important
- However, results are inconsistent and often not reproducible
- No understanding of how rf radiation could affect humans other than heating

How do we know what we know?

Anecdotes or stories – person to person communication about direct experience

- Powerful and emotional
- Close and compassionate
- Strongly subject to bias
- Not quantitative

"cell tower and brain cancer"
"smart meters cause fires"

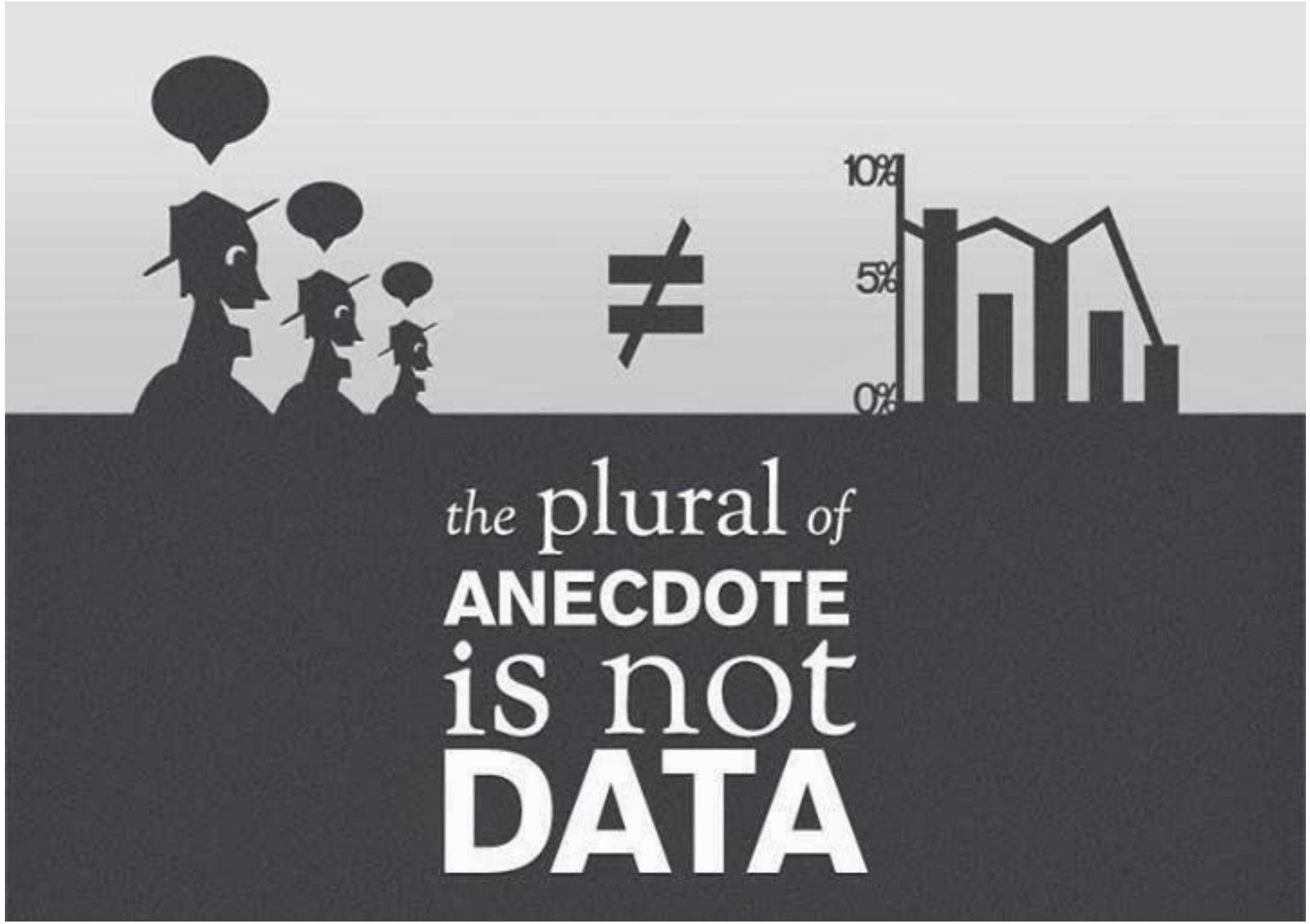


Statistical Studies - randomized controlled trial

- Remove emotion from study
- Bias much less than anecdotes

Take a group of people without mobile phones, give half of them mobile phones, and follow them for 15 to 20 years to see how many of them develop brain tumors.

- Need a huge sample because only 3 in 100,000 individuals develop brain cancer
- Expensive – need funding
- Difficult to study topic such as fatigue, headaches, cognition decline that has a lot of possible causes


10%
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≠
the plural of
ANECDOTE
is not
DATA

Three large epidemiologic studies have examined the possible association between cell phone use and cancer: Interphone (13 countries); the Danish Study (358,000 participants); and the Million Women Study (UK).

No statistically significant association between cell phone use and brain cancer was found.

Smaller studies were carried out, some of which found an association between cell phone use and brain cancer.

The World Health Organization has classified cell phone use as “possibly carcinogenic to humans,” based on limited evidence from human studies, limited evidence from studies of radiofrequency energy and cancer in rodents, and inconsistent evidence from mechanistic studies

What is known about the relationship between non-cancer illnesses and rf radiation?

- Extensive **unbiased** collection of abstracts of published articles 1990-2012 by Dr. Henry Lai , Department of Bioengineering, UW

http://www.bioinitiative.org/research-summaries/

- Many articles are contradictory
- Limited evidence for non-thermal effects, although mechanism not understood.

Assume that “truth” is found in all studies: Combine scientific, anecdotal, and statistical research

- Cell phones by far greatest source of rf exposure for most people
- If you don’t have health issues using a cell phone, replacement meters will not affect you
- Little evidence relating rf exposure to brain cancer
- Ongoing research suggestive of non-thermal rf effects
- May be wise to limit rf exposure, especially in children, but do so QUANTITATIVELY
- Be aware of your biases! The internet can be either a source of learning or a source of junk food for the mind.

ELECTROMAGNETIC FIELDS PRODUCED BY SMART METERS

Bill Kaune

ABOUT ME

- Ph.D. in physics
- Collaborated with biologists and epidemiologists investigating biological effects arising from exposure to the electric and magnetic fields produced by our electric power system
- Past member of the PUD's Citizen Advisory Board (CAB)
- CAB requested that I look into questions related to the safety of smart meters

ELECTROMAGNETIC FIELDS

- Interwoven electric and magnetic fields travel at the speed of light away from a source
- Carry energy from the source
- Characterized by the energy passing through a small area in one second
- Units of watts per square meter, or more commonly millwatts per square centimeter
- Abbreviated mW/cm^2

US SAFETY GUIDELINE

- Established by the Federal Communications Commission (FCC)
- At the frequencies used by smart meters, strength of field to which a member of the general public can be exposed must be less than 0.60 mW/cm^2 averaged over 30 minutes
- This level 50 times less than the level at which adverse health effects first occur in humans

RATIONALE FOR FCC GUIDELINE

- Protect against thermal effects, i.e., exposure that results in an elevation in temperature
- Only known mechanism for biological effects
- But, some report biological effects at levels of exposure too small to be thermal in nature
- Numerous groups have examined these reports and have concluded that reported non-thermal effects are inconclusive and/or not harmful

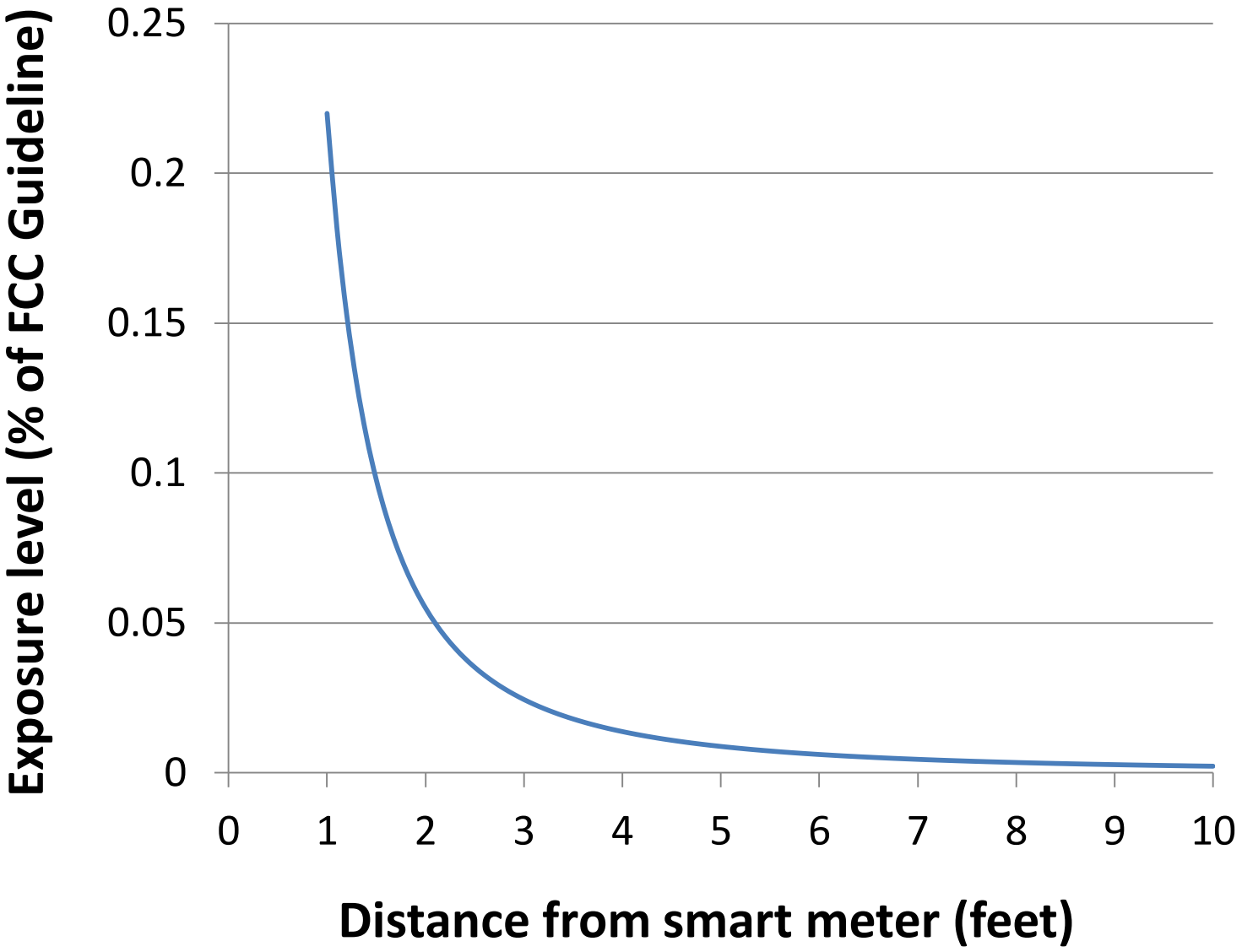
EXPOSURE FROM SMART METERS

- Meters transmit data in short bursts. Most of the time they are off. Duty cycle = % of time meter is transmitting.
- Current meters of the PUD transmit every 5 minutes. Proposed new meters will transmit only every four hours. Cumulative exposure may be less by as much as a factor of 48
- Estimated maximum duty cycle < 1%

EXPOSURE FROM SMART METERS

- Exposure drops rapidly with distance from the meter.

Exposure Levels 1 to 10 Feet From Smart Meter



MEASURED EXPOSURES FROM SMART METERS

- Estimates based on measurement in homes in SE Washington and in Vermont.
- Largest measured exposure in garage, assuming meter was transmitting 3.4% of the time, was 0.004% of FCC Guideline (i.e., 25,000 times less)
- Average exposure in all rooms of studied homes about 20 times less

EXTRAPOLATE MEASURED EXPOSURE DATA TO PUD

- Transmitters in PUD's proposed meters potentially more powerful
- PUD's choice of one transmission every four hours means duty cycle < 1%
- Extrapolated exposure levels would be less than 0.0040% of the FCC guideline, i.e., 25,000 times less.
- FCC guideline already has a safety factor of 50, so overall safety factor is 1,250,000

MY CONCLUSIONS

- Exposure from smart meters is so small compared to US guidelines that it seems to me very unlikely that there are any adverse health effects arising from their usage.

OTHER ORGANIZATIONS REACHED SIMILAR CONCLUSIONS

- California Council on Science and Technology
- Arizona Department of Health Services
- Public Utility Commission of Texas
- American Cancer Society
- World Health Organization
- National Radiological Protection Board (UK)
- International Council on Non-Ionizing Protection

WANT TO KNOW MORE

- I have written a 15-page report of my findings. It is available to any interested person
- Email wtkaune@yahoo.com
- There is lots of information on the internet

Dirty Electricity: What is it? Is it hazardous?

By Peter O. Lauritzen
Member, Jefferson PUD Citizen's Advisory Board
Professor Emeritus of Electrical Engineering, University of Washington
Second Version: October 30, 2017

1.0 Introduction

The switching signals injected into a house's wiring from digital electronic products like a digital power meter have recently been reported as a possible human health hazard. This report describes how Dirty Electricity DE is generated and measured with comments on health hazards summarized from the recent comprehensive review paper by de Vocht and Olsen [1]. The electrical analyses are based on the author's experience. Estimates of the electric and magnetic field magnitudes are given in the Appendix.

2.0 What is Dirty Electricity DE? How is it injected into a home's wiring?

Most modern digital electronic products make use of internal switching power supplies that convert the 120 Volt 60 Hz input alternating current power into a relatively low Voltage direct current dc power for their internal electronics. The diagram in Figure 1 indicates how this conversion is accomplished by interrupting or switching the input current. This switching occurs at frequencies above 20 kHz so any sound produced is above the range of human hearing. These higher frequencies also allow the use of much lighter and smaller internal transformers and filters and enable the whole power supply to use little internal space or even be built into a special plug, like that on a cell phone charger or into a "lump" on a charging cord such as on a laptop computer. Typical products include TVs, computers, wi-fi routers and modems, DVD players, streaming devices, digital toys, cell phone and tablet chargers, compact fluorescent lights, LED lights and the PUD's digital meters. Just about every non-battery powered digital product can be included.

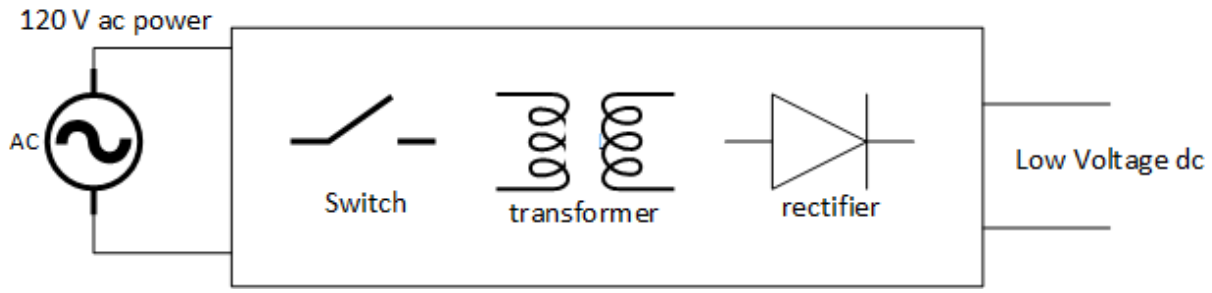


Figure 1. Block diagram of a typical switching power supply

A relatively small amount of this switching current can become injected into a house's wiring and produces weak electromagnetic fields within a house that are considered a health hazard by some people. Digital products that operate from 120 Volt electrical outlets should result in

extremely weak electric and magnetic fields. In a properly wired house, two wires, a "hot" wire and a neutral wire, run in parallel from the service panel to the outlet. Thus the magnetic field from any current flowing in the "hot" wire is effectively cancelled by the identical current flowing in the opposite direction in the neutral wire. The electrical field is similarly shielded by the presence of the neutral wire. The switching currents injected into the household wiring can be reduced further if the power supply designer includes a little extra circuitry in the switching power supply. For example, "Energy Star" rated power supplies [2] and LEDs [3] are required to have high efficiencies and a specified low level of injected switching currents that is reflected in their specification for a maximum Power Factor PF. Generally, the closer the Power Factor is to a maximum of 1.0, the lower will be the magnitude of the observed switching currents.

Digital products that operate on a 240 Volt power line, like a digital power meter or an inverter injecting current from a solar system, inject current into a more complex portion of a house's wiring. Still, they can be expected to have a minor effect on the stray electric and magnetic fields in a house. A digital power meter typically consumes only about 4 Watts, a power level so low that switching currents should be negligible. A 240 Volt inverter associated with a solar system is required to meet a very strict standard for low levels of switching currents.

3. 0 Measurement of Dirty Electricity DE

Most measurements reported of DE utilize a commercial instrument made by Stetzer Electric [4], the Stetzerizer® Microsurge meter that measures high frequency Voltage transients that occur over a frequency range of 10 kHz to 100 kHz s by simply plugging into a 120 Volt electrical outlet. The meter produces an output reading for DE in GS (Graham/Stetzer) Units. The same company sells filters that plug into 120 Volt outlets to supposedly filter out DE.

From an electromagnetic perspective, the critical parameters for measuring DE would be the electric and magnetic field strengths at typical human distances from household wiring. At the frequencies and typical distances in a house, the electric and magnetic fields must be considered separately, the magnetic field generally dependent on current level in the wires and the electric fields generally related to the Voltage. Both electric and magnetic fields drop off abruptly with increasing distance from the source wiring. The Stetzer meter only measures Voltages at 120 Volt electric outlets and neglects to measure currents at all. In fact installing the Stetzerizer® filters may even serve to increase the size of the line currents, increasing the stray magnetic fields.

Little physical justification seems to exist [1] for using the Stetzer products either to measure or mitigate DE. Yet, most reports of DE continue to use these products for their measurements, probably because of the ease of simply plugging a meter or filter into an electrical outlet and getting a reading.

None of the published work [1] attempts to measure the effects of DE using proper instruments designed to measure actual electric and magnetic fields at typical spaces of human occupation in

a house. The IEEE Safety Standards for the 10 kHz to 100 kHz frequencies of interest for DE [5] are based on avoiding the much higher electric and magnetic field levels that cause electric shock, electrostimulation or discomfort and are not based on thermal heating as are the safety standards for radiation at microwave and radio frequencies. See Appendix A for estimates of the electric and magnetic fields.

4. 0 Reported Health Hazards of Dirty Electricity DE

Samuel Milham [6] is an epidemiologist who has written a book telling his personal story of defining and measuring DE, mostly in his retirement. He lacks a knowledgeable electrical engineer or physicist working with him to validate his electrical measurements. A major strength of the DE review paper by de Vocht and Olsen [1] is that it combines an epidemiologist and an electrical engineer working closely together to analyze the available data. Both medical and electrical knowledge must be combined to comprehend and evaluate a DE health hazard. Of the 27 reports of possible health hazards which they review [1], they conclude that the existing evidence of health effects is based on weak and flawed epidemiological evidence.

Defining DE in a more scientifically precise and valid manner is essential to be able to infer anything meaningful. Measurements made with a Stetzerizer® Microsurge meter seem to be a convenient and opportunistic diversion from valid measurements of actual human exposure. Publication of further case studies using just this instrumentation is unlikely to result in any new knowledge. Studies on cell or animal models are also needed to establish a model for a valid health risk. Researchers need to know precisely what they are seeking through double-blind, randomized and controlled trials that are essential to identifying new knowledge.

Presently, little or no solid evidence exists that DE from switching power supplies is a human health hazard.

5.0 Appendix: Estimates of Electric and Magnetic Fields from Dirty Electricity

The magnitude of electric and magnetic fields produced by digital power meters and other digital electronic products can be estimated from electromagnetic field equations [7] and the typical power levels and power factor of a given digital product. These estimates are summarized in Table 1.

For a typical 120 Volt circuit fed with a pair of wires including a “hot” wire and a neutral, the magnetic field is given by $B = \frac{\mu_0 I d}{2\pi r^2} = 5\ nT$ for 0.1 Ampere which is typical of relatively Dirty Electricity.
Here $\mu_0 = 4\pi 10^{-7}$ the permittivity of free space,
I is the Dirty Electricity current, d is the spacing between the 2 wires in a cable and r is the distance away from the wall.

The Electric field from the 120 V circuit is given by $E = \frac{Vd}{2\ln(R_{wire}/d)r^2} = 5\ mV/m$

Where V is the DE voltage and R_{wire} is the radius of a wire.

For a 240 V circuit the current path depends on whether other 240 V loads exist or not. An estimate for worst case or no load magnetic field is given by $B = \frac{\mu_0 I}{w} = 2$ nT.
Here $I = 0.01A$ since the meter is only a 4 Watt device and w is the length of the smallest wall in a room. The electric field calculation is similar to that for a 120 V device.

Table 1. Magnetic and Electric Field Estimates for 30 kHz Dirty Electricity.

	Magnetic Field	**Electric Field**
Maximum Safe Level at 30 kHz [5]	**1000 µT**	**600 V/m**
120 V Digital Product with 100 mA Dirty Electricity	**0.005 µT**	**0.005 V/m**
240 V Advanced Meter with 10 mA Dirty Electricity	**0.002 µT**	**0.005 V/m**

6.0 References

[1] Frank de Vocht and Robert G. Olsen, *Systematic Review of the Exposure Assessment and Epidemiology of High-Frequency Voltage Transients,* Frontiers in Public Health, March 2016, Vol. 4, Article 52.
[2] ENERGY STAR® Program Requirements for Single Voltage External Ac-Dc and Ac-Ac Power Supplies (Version 2), US Environmental Protection Agency
[3] ENERGY STAR® Certified Products, Light Bulb Key Product Criteria, US Environmental Protection Agency,
https://www.energystar.gov/products/lighting_fans/light_bulbs/key_product_criteria
[4] Web page for Stetzer Electric: http://www.stetzerelectric.com/. Also, Graham M, inventor, *Circuit for Measurement of Electrical Pollution on Power Line,* US Patent and Trademark Office 2005
[5] IEEE Standard C95.1 -2005, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 Ghz.
[6] Samuel Milham, MD, MPH, *Dirty Electricity, Electrification and the Diseases of Civilization, 2nd edition,* iUniverse Star, Copyright© 2012
[7] The author wishes to thank W. T. Kaune for assistance with the electric and magnetic field calculations.