



Dirty Electricity: A Literature Review

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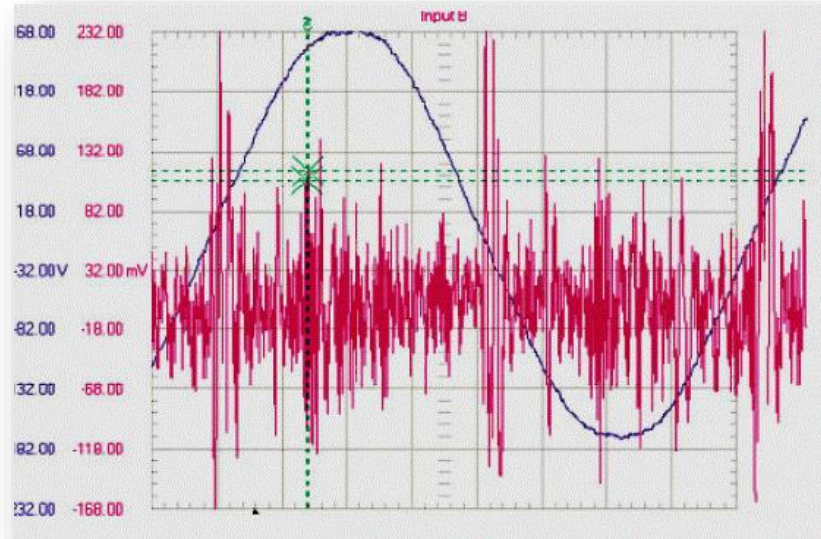
Outline of Presentation

- *Introduction*
- *High-frequency voltage transients (HFVT)*
- *Impacts of HFVT on the human and animals health*
- *Methods of Measuring Dirty Electricity*
- *How to mitigate Dirty Electricity?*
- *Conclusions*

- "Clean" electricity enters buildings at a frequency of 50-60 Hz
- "Dirty electricity" refers to electromagnetic energy that flows along a conductor and deviates from a pure 50-60-Hz sine wave
- *Introduction*
 - Electricity becomes 'dirty' or polluted when it develops scattered higher frequency signals as a result of:
 - Contact with some electronic equipment
 - Arcing on electrical conductors caused by loose wires, switching of electrical load or contact with trees
 - Mobile or broadcast antennas
 - Dirty electricity also enters buildings from neighbours and even from power supply company who share the same transformer
 - Hence, one hazardous downside of electricity is exposure to electromagnetic radiation
 - This exposure has been ubiquitous in the last 4-10 decades after the invention and commercialization of Radio (1920s), Radar (1940s), Television (1950s), Computers (1970s), and Cell phones (1980s)
 - The electromagnetic fields are classified as "non-ionizing" and "ionizing" radiation.
 - The focus of this presentation is on the non-ionizing electric and magnetic fields
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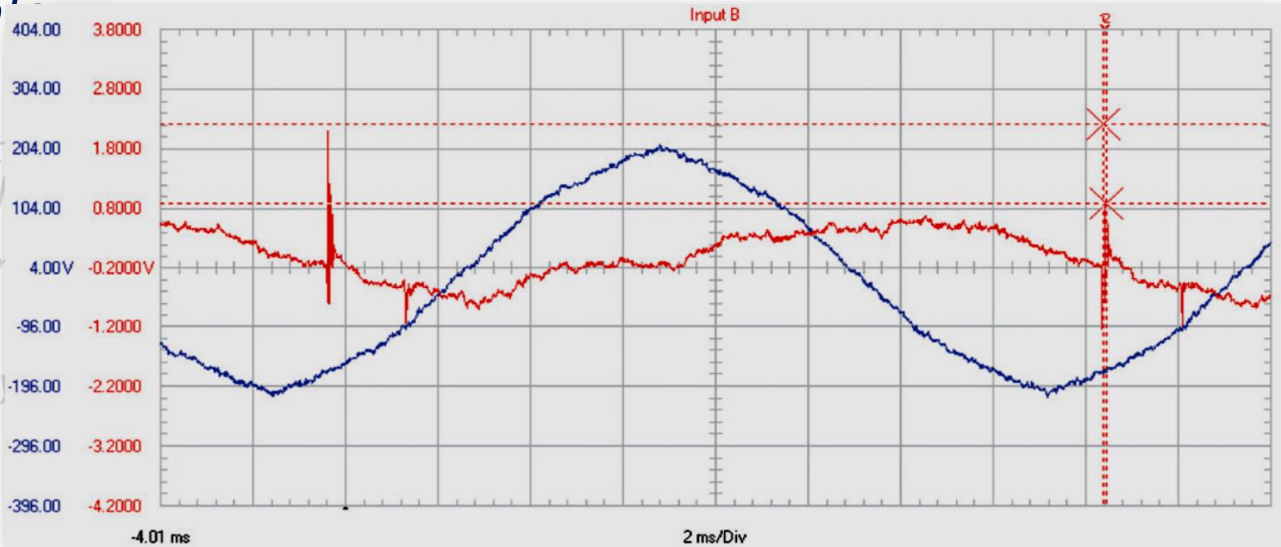
- In most homes today the 50 or 60 Hz sine wave is often distorted by microsurgs or high frequency harmonics and transients



An oscilloscope waveform showing the 60-Hz (blue) sine wave (channel 1) and the high frequency (pink) microsurgs (channel 2) on indoor wiring at a school in Minnesota, USA

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Diesel generator sets are also a major source of dirty electricity:



Electrical output of a large commercial diesel generator set

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- Sources of dirty electricity may include:

- ◆ Computers
- ◆ Variable-speed motors
- ◆ Television sets
- ◆ Entertainment units
- ◆ Energy-efficient lighting
- ◆ Energy-efficient appliances
- ◆ Diesel Generators
- ◆ Dimmer switches
- ◆ Power tools
- ◆ Arcing on power lines
- ◆ Shared transformers
- ◆ Mobile-phone antennas
- ◆ Broadcast antennas.

- High frequency microsurgs (dirty electricity) travel along the electrical distribution grid (wires inside buildings and between buildings) and along the ground
- Conducting objects, including living organisms, in contact with the ground become part of the circuit
- Frequencies above 2 kHz are likely to penetrate living organisms, while those below 1 kHz dissipate external (heating the skin)

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Dirty electricity has harmful effects on people and may contribute to the disorders like:

- Diabetes prevalence
- Fasting plasma glucose
- Obesity
- Attention-deficit disorder (ADD)
- Attention-deficit/hyperactivity disorder (ADHD)
- Cancer
- Asthma
- Multiple sclerosis
- Tinnitus (perception of noise or ringing in the ears)
- Electrical hypersensitivity

- Diabetes prevalence, fasting plasma glucose and obesity are **highest** on small islands and other places electrified by diesel generators:

Ten Highest and Lowest Countries of 199

Body Mass Index (BMI)		Fasting Plasma Glucose (FPG)		Diabetes Prevalence (A.S.)	
Country	Kg/M ²	Country	mmol/L	Country	Percent
<i>Highest 10 countries of 199:</i>					
Nauru*	33.85	Marshall Islands*	6.9	Marshall Islands*	25.5
Cook Islands*	32.64	Kiribati*	6.8	Kiribati*	23.6
Tonga*	30.97	Samoa*	6.6	Saudi Arabia	22.0
Samoa*	30.38	Saudi Arabia	6.6	Samoa*	21.2
Palau*	30.35	Cook Islands*	6.5	Cook Islands*	20.5
Marshall Islands*	29.37	Palau*	6.3	Palau*	17.5
Kiribati*	29.22	Jordan	6.2	Jordan	17.2
Kuwait	29.15	Tonga*	6.2	Solomon Islands*	17.1
USA	28.64	Kuwait	6.2	Kuwait	17.0
St. Kitts and Nevis*	28.24	Solomon Islands*	6.0	Tonga*	17.0
<i>Lowest 10 countries of 199:</i>					
India	20.99	Central African R.	5.1	Indonesia	6.6
Viet Nam	20.94	Philippines	5.1	Dem. Rep. Congo	6.6
Eritrea	20.90	United Kingdom	5.0	Philippines	6.5
Nepal	20.79	Dem. Rep. Congo	5.0	Timor Leste*	6.4
Zambia	20.70	Timor Leste*	5.0	Malawi	6.4
Timor Leste*	20.61	Myanmar	5.0	Burundi	6.2
Afghanistan	20.63	Rwanda	5.0	Myanmar	6.1
Bangladesh	20.44	Burundi	5.0	Netherlands	6.1
Ethiopia	20.26	Peru	4.9	Peru	5.8
Democratic R. Congo	19.88	Cambodia	4.7	Cambodia	4.7

* = islands; (A.S.) = Age Standardized

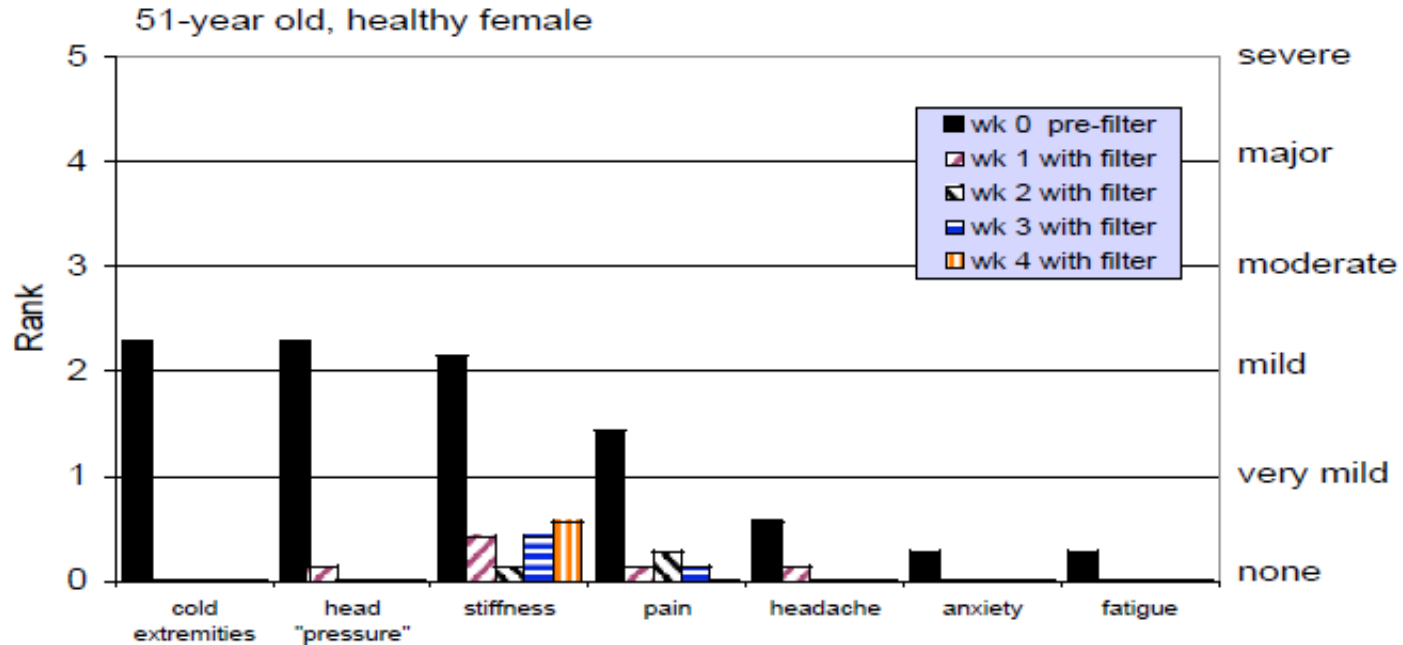
- Power quality in the home or workplace of each of the five case studies:

Case	Details	Dirty Electricity (GS units)			
		Without Filters		With G/S Filters	
		Mean	Range	Mean	Range
#1: Healthy	Home: Dimmer Switches off	300	190-470	40	30-50
	Home: Dimmer Switches on	440	190-1130	70	30-290
	Office	400		100	
#2: EHS ¹	Home	~900	300-1900	~20	13-30
#3: MS ²	Home	170		30	
#4: Diabetes	Home	800	160 - > 2000	13	10-15
#5: School ³	School	23	13-101	13	8-24

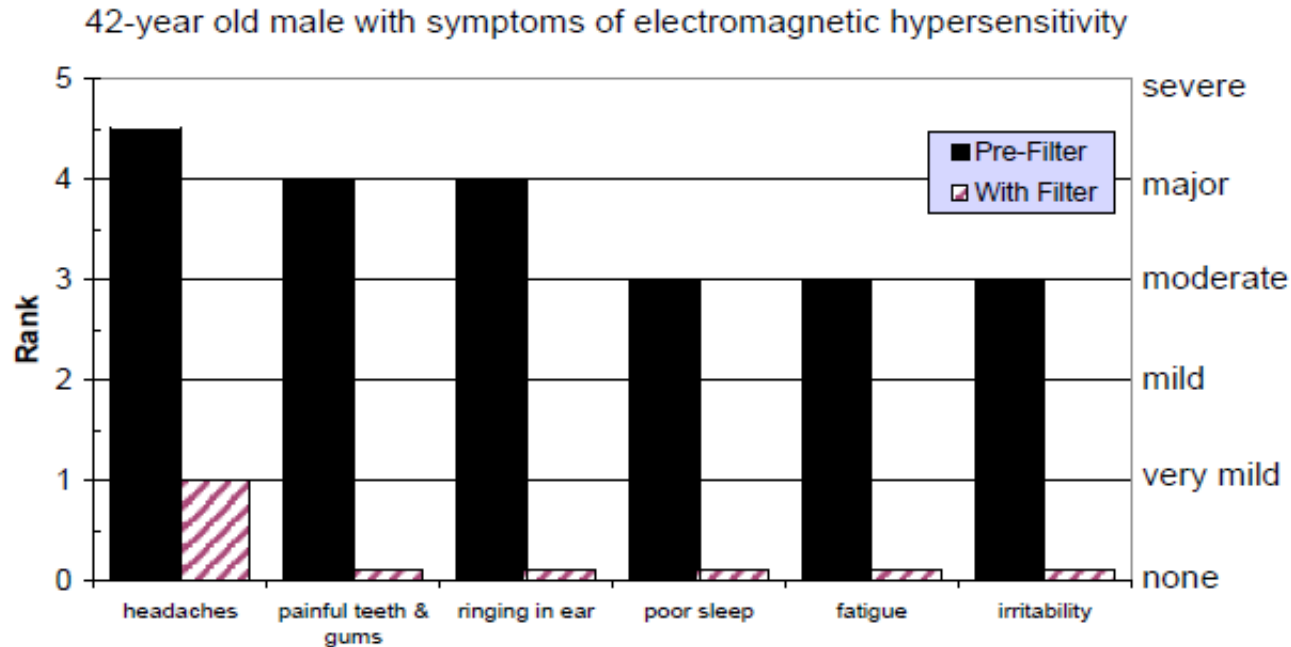
¹ EHS: electrical hypersensitivity

² MS: multiple sclerosis

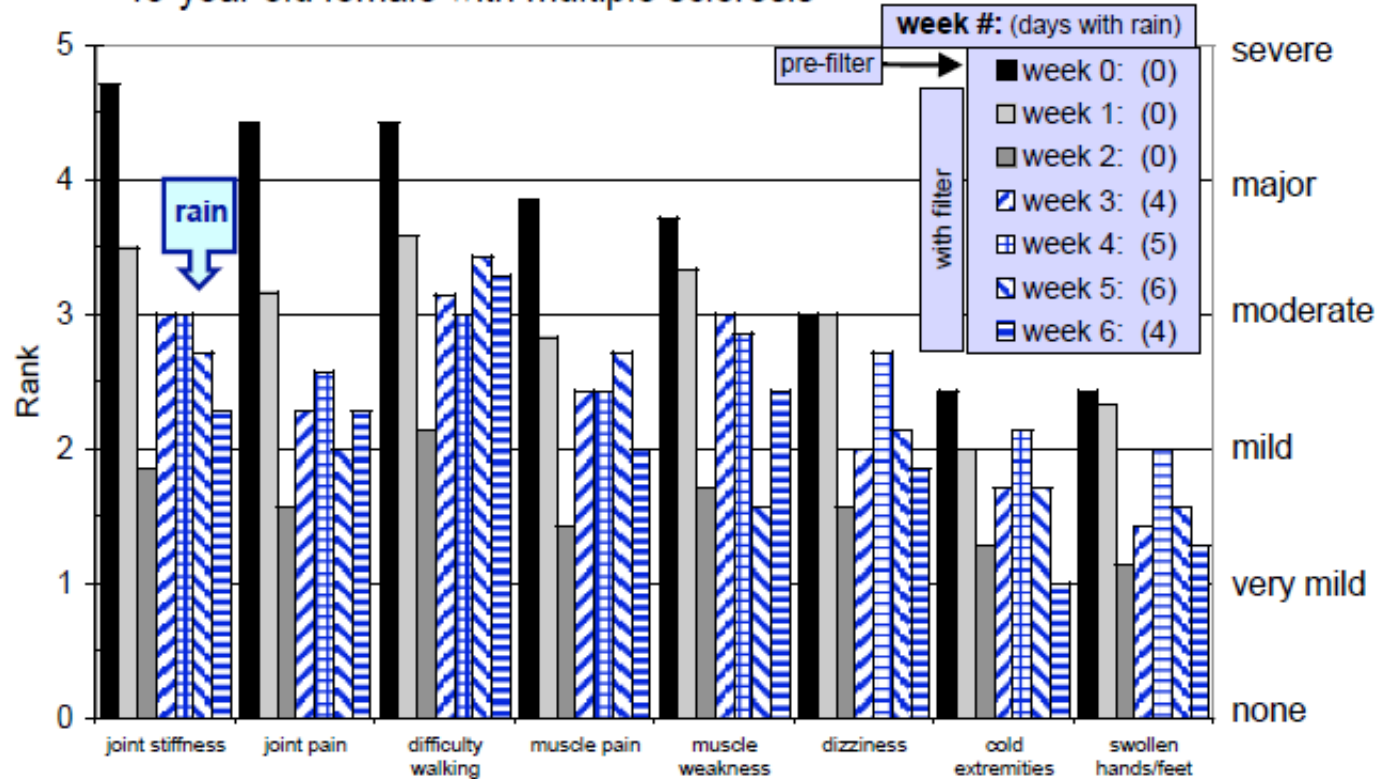
- Case 1: Response of a healthy 51-year old female to G/S filters:



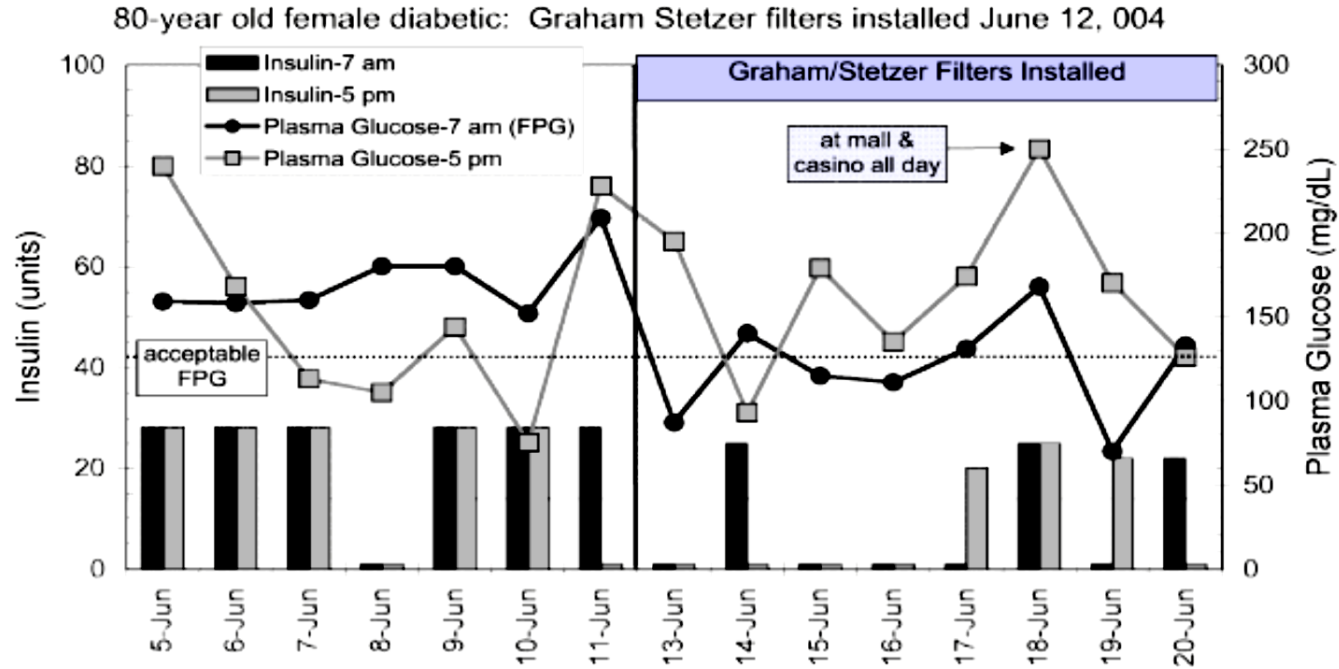
- Case 2: Response of a 42-year old male who was experiencing symptoms of electromagnetic hypersensitivity to G/S filters:



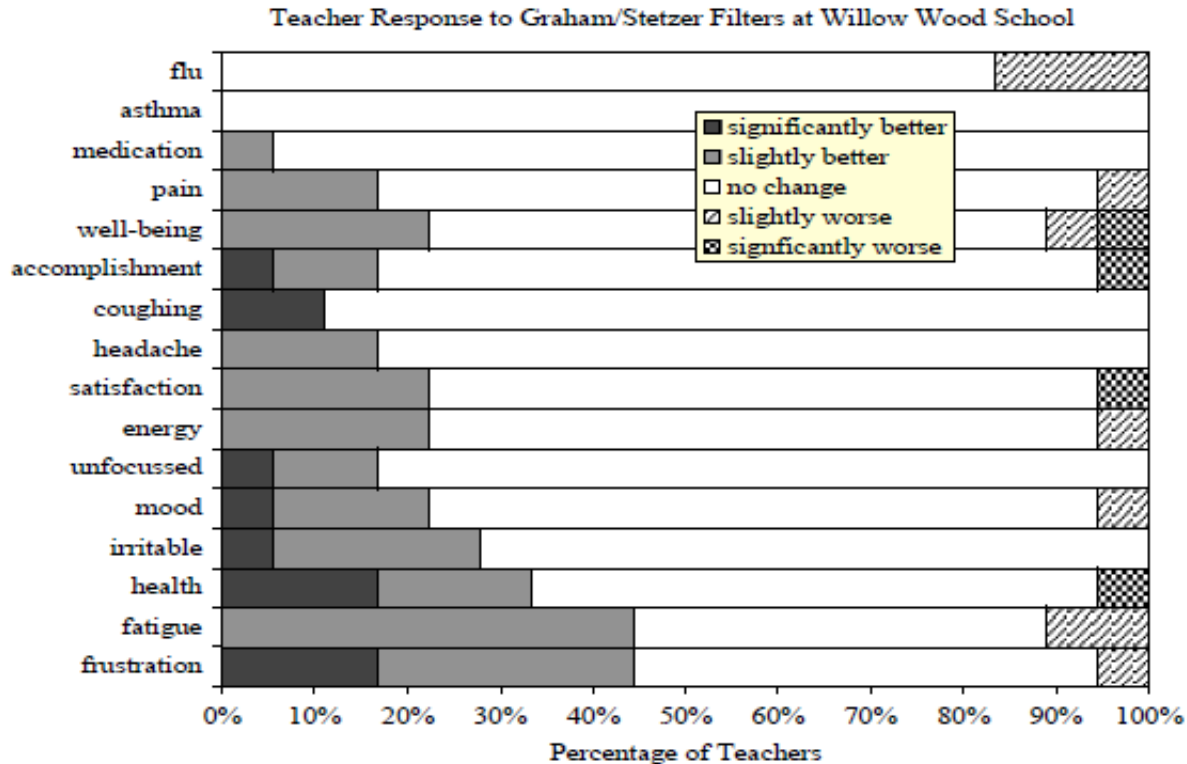
- Case 3: Response of a 43-year old female with multiple sclerosis to Graham Stetzer filters:



- Case 4: Response of an 80-year old female with diabetes to Graham Stetzer filters installed in her home :



- Case 5: Teachers' response to G/S Filters in Willow Wood School. Results are based on 18 teachers, 10 females and 8 males:

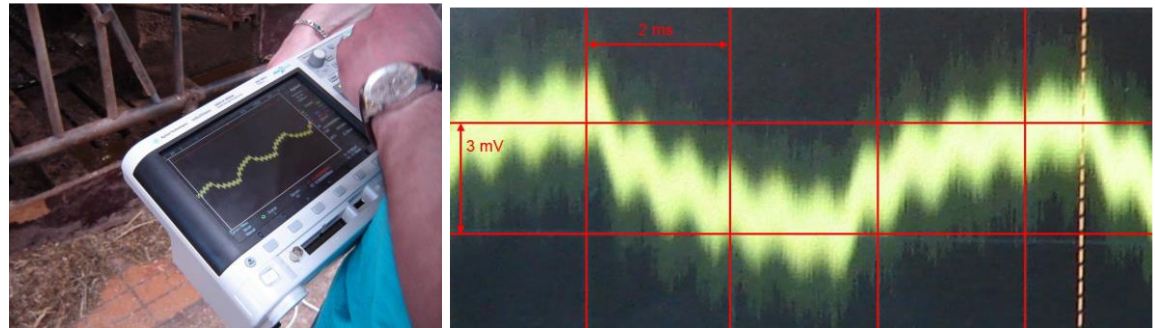




Cows Sensitive to Electromagnetic fields:

- A PV-installation with a large array of solar panels on a cows stable
- The cows were anxious and refused to enter the area
- The PV installer suspected EMF as a possible cause to this abnormal behaviour
- The measured EMF was far below the considered safe exposure limits however high frequency transient voltage spikes were present

○ *Impacts of HFVT on the human and animals health*



- A month after the commissioning, the cows started returning to their place. they discovered that the initially strange situation was not going to cause them any harm.

Four ways to measure dirty electricity:

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- AM Radio:



- Line Noise EMI Meter:



- Graham-Stetzer Meter:

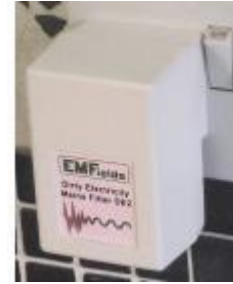


- Oscilloscope or Spectrum Analyzer

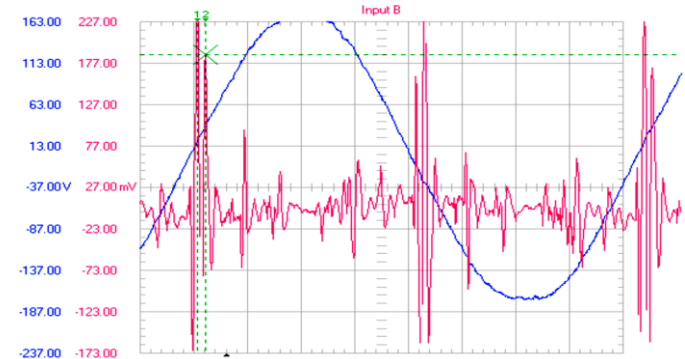
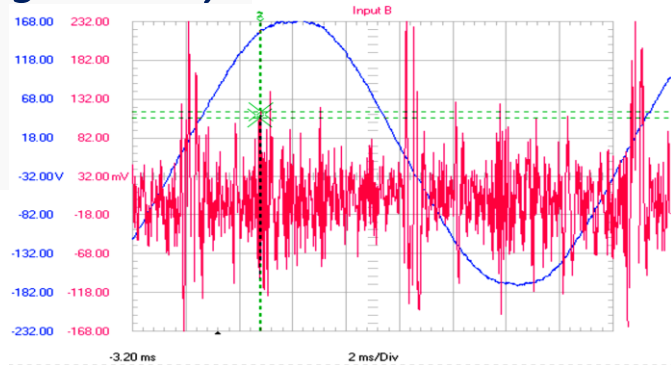


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○ If the dirty power is detected as narrated, it is important to filter out the level of unwanted components :



○ **Graham/Stetzer filters** can reduce the amplitude of microsurgers on indoor wiring and thus reduce the frequencies most likely to be biologically active:



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- *Acknowledgments*
- The findings of a literature review on the impacts of dirty electricity on human health was presented
- **Dirty electricity is causing the worldwide epidemics of obesity and diabetes**
- Animals are more sensitive to the high frequency transients
- **By improving the power quality using the filters some symptoms that have been classified as electrical hypersensitivity can be alleviated**
- Methods of measuring dirty electricity were also presented