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An international collaborative network of advanced scientific thinking
NGO in Special Consultative status with the Economic and Social Council of the **United Nations** (ECOSOC)

January 19, 2018

For the attention of: Doreen Friis
Regarding: **Nova Scotia Power Incorporated** Hearing E –
Advanced Metering Infrastructure (AMI)
Capital work order CL# 47124 **M08349**

Regulatory Affairs Office
NSUARB -**Nova Scotia Utility and Review Board**
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Dear Ms. Doreen Friis:

As President of the **Planetary Association for Clean Energy** (**PACE**), I wish to bring to the attention of the **Nova Scotia Utility and Review Board** considerations stemming from several decades of independent scientific research and of multi-disciplinary peer review into electromagnetic and other issues that appertain to the hearing E - **Nova Scotia Power** Incorporated (M08349) – ***advanced metering infrastructure*** (**AMI**) for the approval of capital work order Cl 47124 in the amount of $ 133,228,952,

Our organisation was conceived by **Parliament**'s first woman Speaker, Maritimes **Senator Muriel McQueen Fergusson**, and co-founded by scientist **Senator Chesley W**. **Carter**, M.Sc. of Jeddore Oyster Ponds, Nova Scotia, while chair of 2 Senate standing committees on Science and Health in the early 1970s.

Senator Carter considered electromagnetic field issues to be among the top three scientific and technological priority issues of national concern. He arranged for a comprehensive multi-year study by **National Research Council** and **Queens University** on the biological effects of electromagnetic fields, and especially microwaves, which were articulated and published in several reports between 1971 and 1972. Likewise, he had similar research conducted by the **Medical Research Council** (MRC), which he help found (since 2000 replaced by **Canadian Institutes of Health Research** – CIHR) and by other research facilities, often in academe.

In view of his leadership and concerns, PACE organized conclaves of international specialists, leading to pioneer international conferences, from the mid-1990s, on various electromagnetic issues involving scientists, engineers, MDs and government agencies and was the first to facilitate the in-depth examination of medical issues associated with environmental hypersensitivity (EHS). It also led to the development of realistic exposure guidelines and standards, which have since been accepted in many circles, including the **European Union**. These initiatives also led to the development and availability of many now mainstream electromagnetic measuring instruments, protocols, as procedures for monitoring and tracing errors. For several years, PACE worked with **Canada Mortgage and Housing Corporation** (CMHC) with the view of examining electromagnetic fields in Canadian housing, including interface with advanced SMART systems.

More directly associated with this intervention is the matter of PACE conducting surveys of premises where advanced metering infrastructure have been installed, starting with the first experimental run of hook-ups conducted by **Hydro Québec** years before their formal submission with the Quebec's **Régie de l'énergie** in 2011.

Our on-the-ground experience with AMI / smart meter installations

These surveys of meters (and their associated infrastructure) also include those conducted by experts across North America, have led to a number of real-life observations. Some meters transmit much more frequently, at higher intensity (often at levels higher than the federal ***Safety Code 6***), across more electromagnetic spectrum bands (including an irritating & troublesome audio range of clicks, rushes, hums and saw-tooth pulsing), introduce access to indoor environments of signals in the microwave band through wires and other conductors – even when no/low power is being consumed,

These circumstances can create combinatory and cumulative electromagnetic field effects with other emissions associated with wireless technology infrastructure, including electrostatics, clusters of charges which can cause interference and (sometimes even explosive) failure of devices such TV, AV and DVD players, battery chargers. We have monitored phenomena of greater microwave power density and electric fields that accrue to the height of AMI infrastructure antenna "collectors" – towards 4-5 metres elevation, thus affecting upper floor levels in some communities for entire groups of structures, and potentially even interfering with automobile performance, such as braking and acceleration.

When examining certain cases in detail, we observed that the advanced metering infrastructure can generate deleterious aggravation to fauna (notably pets (dogs and cats), horses, livestock, etc.) – sometimes to the point of ruin of keepers - and to flora, including crops. Such contra-indications are not indicated in formal submissions to review boards, but can impact on regional welfare as well as ecology.

Their existence also raises the question of the applicability of the ***Precautionary Principle***, as indicated for such decisions as that of the Board, by the **United Nations Environmental Programme** (**UNEP**) and the recent guidelines from the **European Commission**. (See ***Appendix A***)

We suggest ***Hazard and Operability Study*** (***HAZOP***) methodology of considering everything that could possibly go wrong (used in software research). It applies to complex 'processes' such as AMI whereby sufficient predictable and explicitly-identified information is available. This range of data is contrasted with the Board's defined objectives and mandate. Prudent decision-making adjusts for foreseeable variations in time and requirements and harmlessness.

No attention is given to the generally involuntary introduction of 24-hour microwave transmitters indoors or in premises whether they are adjacent to zones of long-term occupation, such as bed-sites, working posts, and other places such a play areas for children.

Furthermore, no assessment is factored by utilities for the actual installation locations of smart meters and their **LAN** / **NAN** (**Local Area Network, Neighbourhood Area Network**) collectors/transmitters to avoid beaming through living areas. This is an especially significant issue for the linear community layouts, stringed along highways, so common in Nova Scotia. Only the basic engineering efficacy and minimal costing is consider in installations of such facilities.

Ignored are the combinatory and signal amplificatory effects associated with soil moisture, wetlands, ricocheting, focusing (by way of conductive material frames such as doors, windows, stud walls, and other structures). Ultimately, beaming effects can occur in valleys, dependent on geologic surfaces, for example.

The presence of lower frequency facilities radio-frequency – Radio and TV transmitters / microwave / military and commercial radar donates energy to the AMI's (faster / higher frequency) power density, from 4 to 10-fold, depending of a variety of factors, both of short-term (about a week-at-a-time and long-term duration.

Remarkably, few smart meters are properly installed in due process – leading to injurious affectation of the contracting party installers (one of the most dangerous professions) as well as serious fire and safety issues for premises and the meters. Such errors can include ultraviolet radiation, which is unseen by the eye, but harmful

What is AMI, what are smart meters? What are the dynamics and the extensions into emerging wireless context?

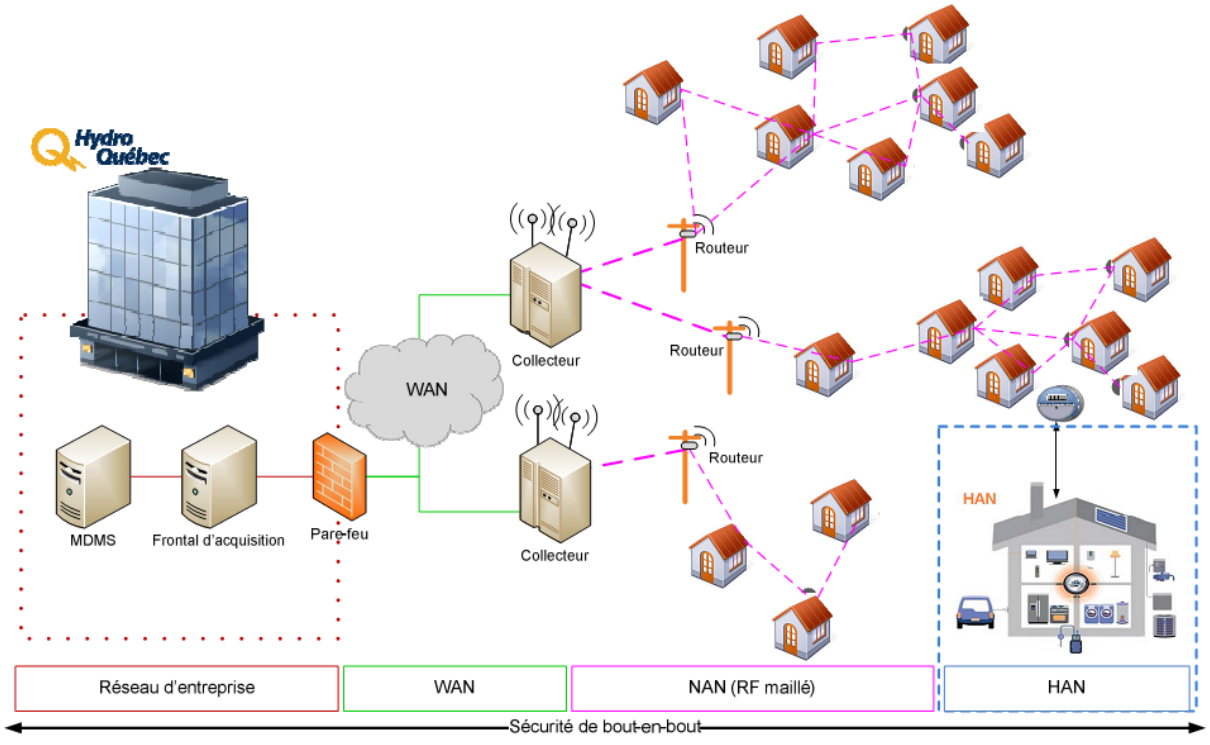
Smart meters are new electric, gas, and water digital meters that send usage information via microwaves to a utility company. They are primarily called AMI (advanced metering infrastructure). Electric and gas smart meters are wireless. Smart Meters can also be wired – as applied in some countries. The meters collect energy usage information in very detailed format and transmit that information directly to the utility company every day, throughout the day. Wired smart meters, instead, send the usage data via electrical lines or telephone lines.

Most electric meters use a mesh network system in which the meters relay the energy information from meter to meter until it arrives at a collector meter, which then sends the information on to an antenna, usually mounted on a utility pole. From there, it is transmitted to the utility company.

Electric smart meters have a 2nd antenna to "talk" to indoor new smart appliances and devices. This is called the **Home Area Network** (**HAN**). These appliances and devices, such as thermostats, air conditioning units, refrigerators, washing machines, dishwashers, and various sensing units are outfitted with 2-way transmitter/receivers which send to and receive information and to potentially control indoor devices and apps from the smart meter throughout the day. The graph below, prepared by Hydro Québec shows the ensemble of the microwave-based wireless version.

The Board may note that the collector antennas can receive up to about 5,000 installations, making it that some users may be processing fulltime, non-stop, data relays. If the collection antenna is located in out-lying zones, it has to step up its power to connect – sometimes exceeding the federal Safety Code 6; proportionally an user's meter has to also step up its intensity in order to communicate; in such circumstances, even the geology, and the presence of trees, other obstacles, reflectivity, etc. can leverage further augmentation of power to critical heating (thermal effect) power density of injurious potential.

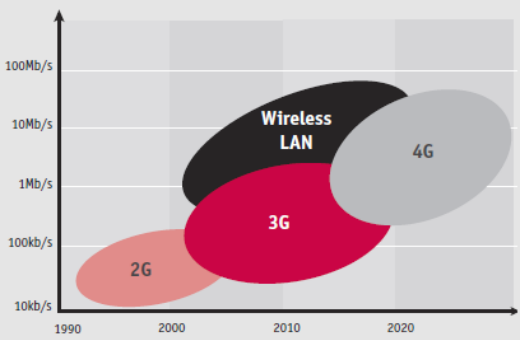
Without guidelines, such situations could occur frequently in Nova Scotia, due to geography and coastline of the AMI's territory, and the commonality of linear distribution of users not only in most urban areas (we estimate that 22 major urban zones out of Nova Scotia's 37 to be particularly vulnerable) but in out-lying areas. (See ***Appendix B***)



Non-smart digital meters can have the capacity to be upgraded to smart meters merely by installation of a module which enables the wireless function. The switching mode power supply of digital meters is a major problem, as it is with AMI smart meters.

These dynamics are part of unintended mixing of signals & of their harmonics that were not originally planned to happen. They constitute a new ***electromagnetic hash*** extending over vast territories, into hinterland. (See ***Appendix C***)

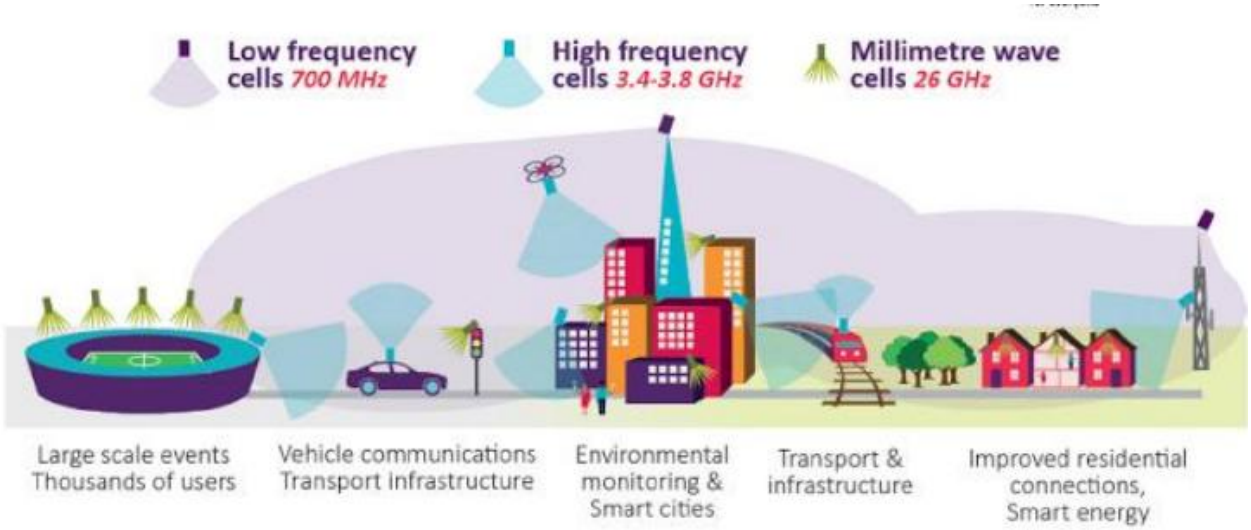
The increase in wireless "machine to machine" data traffic demands more and more traffic, and greater electric power (consuming, in some cases as much as all of the power that has been saved by careful consumer power saving schemes). During a 2010 **Verizon *LTE*** Boston trial (www.youtube.com/watch?=dCOJvhm1Oo) **Research in Motion** (RIM) made it clear that increased bandwidth usage, including those from smart meters, strain networks and interrupt calls. The illustration below describes a Canadian analysis of the data usage by the incorporation of several wireless systems into LAN that smart meters also use. The Board may want to consider how much of the question at hand is only an electric utility capital work order, and not a requirement for a transformational work order for extension into something that will become beyond the ability of the public domain of the Board to regulate as technology for the best interests of Nova Scotia, beyond the Precautionary Principle. Does the Board want to start off something that once it initiates cannot stop or modify from injurious affectation in the public sphere and territory?



More and more user & stakeholder requirements are being staged. Such upsurges and still emerging trends are combined with such uncertainties as: information insecurity, software development in expertises and attempts at forcing aging population to adapt to the technology.

Ancillary data may be collected from a smart meter's HAN transceiver, destined, with continuous & significant spending (6.3% - $ 63 million – of Hydro Québec's AMI work estimates presented to its Board) in updating software and informatics applications. Gathering information household by household, with algorithms, consumer preferences and movements can be packaged. Such info may be use even for determining voting profiles through chips located indoors in smart appliances, products, and circuits use & timing. [In 2012 Florida, a recent diaper purchase registered from a smart apps in a home by a meter, would profile for pollsters a confirmed pro-Democrat and thereby unworthy for robotic calls aimed at steering votes election-time. Such info is extra income for the data collector, and a disincentive for an utility in energy-efficiency initiatives and in advanced clean energy generation and transmission systems.]

In the near future this scenario expands into the ***5G – Internet of Things (IoT)***, which is well described by the 2 images below, from the **European Commission**. We see how the smart meter "domotics", in ***5G,*** are linked with LAN to electric grids, directly into hospitals, commerce, Graphene clothing, traffic monitoring, etc. Is this the decision of the Board?



The Principal Factors warranting attention

Our independent collaborative network submits that there are three principal factors that warrant the attention of the Board:

HEALTH CONCERNS with Smart Meter technology:
1. There is extensive scientific evidence of adverse health effects associated with cumulative effects

SAFETY CONCERNS with Smart Meter technology
2. Significant problems have been attributed to Smart Meters, including explosions and fire

ECONOMIC/INSURANCE COVERAGE CONCERNS
3. Hydro companies in Canada and the US are facing class action suits based on health claims, and standard exclusion from any liability coverage for claims (Exclusion 32, Lloyd's of London/ CFC Underwriting Limited)

Health Concerns

The AMI emissions are not a matter of choice for those subjected to them, unlike when one decides or not to use a cellphone, or to purchase cigarettes. They are an imposition that the Board is to determine for the public consumption of electric power.

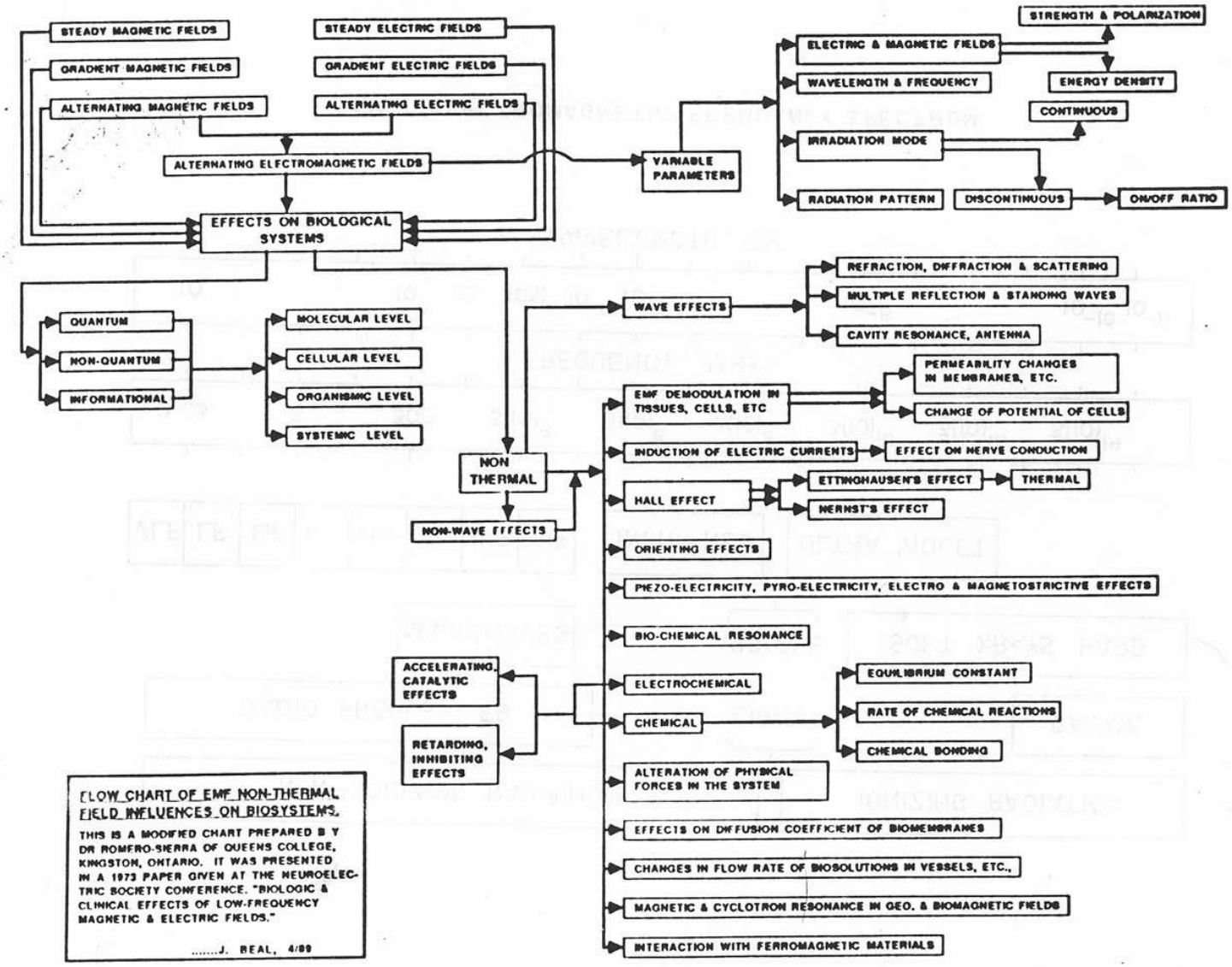
The AMI system is ultimately one of telecommunication transceivers operating within premises at the ultrasound / radiofrequency band (80, 130 and 340 kHz – from their switching circuits inside the meters) and at the 2 microwave bands serving the HAN and LAN networks. (See ***Appendix D***) Also, AMI can generate annoying audio clicks and noises.

The biological effects of these electromagnetic bands differ according to their frequency bands, their combinatory and non-linear (randomness) and their intensity/durations. Overall the electromagnetic haze by AMI is complex.

A study that was performed by the **National Research Council,** before the commercialization of microwave technology outlines the numerous biological effects that can be caused by very low intensity emissions, at levels hundreds of times below the federal **Safety Code 6,** termed as "non-thermal", that is, not heating the body in less than 6 minutes.

It should be retained that a significant proportion of society is consciously sensitive to electromagnetic field emissions, and an another is not consciously so, yet can suffer malaise without attributing the cause to be at least partially caused by such emissions: such as memory and attention, impaired motor function, cardiac arrhythmias and arrest, dizziness, irritability, insomnia, fatigue, difficulty in breathing, chest pain, and indigestion, among others. Such group can consist of up to 30% of the population, according to numerous studies. The **European Council *Resolution 1815 [2011***] arrived at a 0.1 microWatt/cm2 limit for general population, with an objective of lowering to 0.03 microWatt/cm^2, in contrast with the current federal guideline of the 600.0 to 1,000.0 microWatt/cm2, which is uniquely based on raising body temperature by 1^o Celsius within a determined for a healthy young adult male, associated with the federal government.

Biological effects on humans such as infants, pregnant women, the sick and the elderly are not implicitly considered by the federal guidelines. Consider alone that by 2021, by when AMI could have been in place, the proportion of older persons (65+) in Nova Scotia would be about 16%.



To understand the significance of the intensity-by-intensity impact of the power density of microwave exposure, the **Canadian Human Rights Commission** developed the listing below:

BIOLOGICAL EFFECTS OF WIRELESS TECHNOLOGIES BELOW CANADA'S REGULATORY LIMIT

Power density ($\mu W/cm^2$)	**Reported Biological Effects**	**References**
0.0000000000001	Altered genetic structure in E. Coli	Belyaev 1996
0.0000000001	Threshold of human sensitivity	Kositsky 2001
0.000000001	Altered EEG in human subjects	Bise 1978
0.0000000027	Growth stimulation in *Vicius fabus*	Brauer 1950
0.00000001	Effects on immune system in mice	Bundyuk 1994
0.00000002	Stimulation of ovulation in chickens	Kondra 1970
0.000005	Effect on cell growth in yeast	Grundler 1992
0.00001	Conditioned "avoidance" reflex in rats	Kositsky 2001
0.000027	Premature aging of pine needles	Selga 1996
0.001	**100 Yards / metres from a Cell Phone**	
0.0027	Growth inhibition in *Vicius fabus*	Brauer 1950
0.0027 to 0.065	Smaller tree growth rings	Balodis 1996
0.007	**50 Feet from a Cordless Phone**	
0.01	Human sensation	Kolbun 1987
0.016	**1 Mile from a Cellular Tower**	
0.06	Altered EEG, disturbed carbohydrate metabolism, enlarged adrenals, altered adrenal hormone levels,structural changes in liver, spleen, testes, and brain in white rats and rabbits	Dumanskij 1974
0.06	Slowing of the heart, change in EEG in rabbits	Serkyuk, reported in McRee 1980
0.05	**10 Feet / 3 meters from a Wireless Computer**	
0.1	Increase in melatonin in cows	Stark 1997
0.1 to 1.8	Decreased life span, impaired reproduction, structural and developmental abnormalities in duckweed plants	Magone 1996
0.13	Decreased cell growth (human epithelial amnion cells)	Kwee 1997
0.168	Irreversible sterility in mice	Magras 1997
0.2 to 8.0	Childhood leukemia near transmitters	Hocking 1996
0.3	Impaired motor function, reaction time, memory and attention of school children, and altered sex ratio of children (fewer boys)	Kolodynski 1996
0.6	Change in calcium ion efflux from brain tissue	Dutta 1986
0.6	Cardiac arrhythmias and sometimes cardiac arrest (frogs)	Frey 1968
0–4	Altered white blood cell activity in schoolchildren	Chiang 1989
1.0	Headache, dizziness, irritability, fatigue, weakness, insomnia, chest pain, difficulty breathing, indigestion (humans—occupational exposure)	Simonenko 1998
1.0	Stimulation of white cells in guinea pigs	Shandala 1978
2.5	Breakdown of blood-brain barrier (used a digital cell phone to radiate)	Salford 1997
5.0	Leukemia, skin melanoma and bladder cancer near TV and FM transmitter	Dolk 1997
2.0	(lower "Microwave hearing" - clicking, buzzing, chirping, hissing, or high-pitched threshold not tones known)	Frey 1963, 1969,1971,1973,1988 Justeson1979,Olsen1980,Wieske1963,Lin1978
5.0	Biochemical and histological changes in liver, heart, kidney, and brain tissue	Belokrinitskiy l982
10.0	Damaged mitochondria, nucleus of cells in hippocampus of brain	Belokrinitskiy 1982a
10.0	Impaired memory and visual reaction time in people living near transmitters	Chiang 1989
10.0	Decreased size of litter, increased number of stillborns in mice	Il'Chevich (reported in McRee 1980)
10.0	Redistribution of metals in the lungs, brain, heart, liver, kidney, muscles, spleen, bones, skin, blood	Shutenko 1981
1,000.0	United States **FCC Exposure Limit, Safety Code 6 Canada limit**	

In addition, the mechanism which explains the non-thermal effects observed as have injurious affectation on humans, fauna and flora is that of oxidative reactions and their associated calcium flux (influx and efflux) from the full spectrum of electromagnetic fields. These reactions are, in simple terms, associated with the death of cells, whether human or of other biological kingdoms.

Discussions on the health issue interface are in ***Appendix F*** - which also indicate rule-changing results from the US **National Toxicology Program**, at the **National Institutes of Health**.

There is also the critical issue of interference with medical devices.

In view of the AMI health concern, it is suggested that the Board, should it approve the Capital work order:

a) Set up a database of all the AMI LAN base stations and their emissions, as essential parts of their licensing;
b) Independent, random, on-going audit of all of these base stations be carried out, with due analysis of cumulative effects associated with electromagnetic hash to ensure that chosen guidelines are not exceeded and that they comply with agreed upon specifications – if they do not comply, they should be decommissioned until compliance is demonstrated;

c) Particular attention be paid initially to the auditing of facilities near to schools and sensitive areas (residences, hospitals, senior facilities and facilities for the environmentally sensitive); AMI units should not fall on any part of school grounds or buildings without the agreement of the school and parents; Planning authorities should have the power to ensure that microwave fields to which the public is / will be exposed be kept at the lowest levels commensurate with the telecommunications system, which is technically able to function at levels of less than 0.00001 microWatt/cm^2.

Safety concerns

The complexity of safety concerns is described in excerpts from a report of the Fire Marshall of Ontario. (***Appendix E***)

Some safety concerns are described in our earlier statements, such as the manner of installation. There is also the question of interference with the ground fault circuit interrupter.

The illustrations below speak for themselves. The location of units should not be haphazard and inconsiderate of hazard operability, which is also why a ***HAZOP*** is crucial, especially in the weather conditions Nova Scotia experiences.






Economic / Insurance Coverage Concerns

It appears anomalous that the-**Nova Scotia Power** Incorporated (M08349) – ***advanced metering infrastructure*** (**AMI**) for the approval of capital work order Cl 47124 in the amount of $ 133,228,952, is up-front more costly by about 11.25% than **the Hydro Québec** submission's accounting before the **Régie de l'énergie**, which includes software updates. (See ***Appendix G***).

It is urged that the Board inquire *in camera* with **Hydro Québec** and /or the collegial Quebec review board, **Régie de l'énergie** whether the 2011 submission costs have over-run in view of massive failure rates of AMI units as well as the significant number of users demanding other types of meters (about 16% of the population of the Island of Montreal). Such information should help elucidate a factor of the realities of the actual, real-life economics associated with AMI.

Regarding the insurance, the actual Lloyd's analysis is attached separately as a document. The rating is basically an ultra-high liability risk. This also includes, implicitly, the wireless frequencies induced, as we have surveyed through indoor wiring and such conductors as those associated with water and gas supply.

It is likely that even with UL certification, insurance is not a *fait accompli* – as after all, the entire AMI system, meter and the connectors – is composed of wireless transceivers.

Also, de facto acceptance of UL certification may incorporate the impossibility for the Board to revert its decision at a later date, as well as for the users to disconnect or modify electric power metering modalities.

It does not make common sense to "throw away" existing quality meters for potentially lower quality, short-span duration ones.

The public is generally in the dark about this program and its problems, including economics and insurance concerns. Yet the public needs safe, affordable and reliable energy service.

We hope this information moves the public and policy makers to take action.

Andrew Michrowski
President

(signed)

APPENDIX A

Precautionary principle

Incomplete information, inconclusive evidence and public controversy can make it difficult to achieve consensus over the appropriate response to hazardous substances or activities, but these are precisely the sorts of conditions that often demand hard and fast decisions. The precautionary principle is designed to assist with decision-making under uncertainty and is a core principle of EU environmental law, enshrined in Article 191(2) of the Treaty ***on the Functioning of the EU***. The classic definition of 'a precautionary approach' comes from the 1992 **Rio Declaration on Environment and Development**, which states that:

> "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (UNEP 1992).

In other words, a precautionary approach captures the idea that regulatory intervention may still be legitimate, even if the supporting evidence is incomplete or speculative and the economic costs of regulation are high. Better safe than sorry. In the ***Communication on the Precautionary Principle*** from 2000 the **European Commission** clarified that:

> "Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty. The implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying at each stage the degree of scientific uncertainty"
>
> (European Commission, 2000, COM (2000) 1 final).

The European Commission also refers to the need for 'reasonable grounds for concern' about potential risks. Crucially, this means that the principle ought only to be used if a risk is deemed to be plausible. Any regulatory measures introduced as a result of the precautionary principle should also be subject to review in light of new scientific data, and may have to be modified or abolished as new scientific data become available. In this sense, the Communication provides a step-by-step guide to applying the principle; however, it is not prescriptive and is designed to be flexible, allowing for the variety of circumstances in which the principle might operate. The Commission notes that it is ultimately for decision-makers and the courts to flesh out the details.

Precautionary Principle must not be based on false assumptions, especially with regards to health risks from electromagnetic fields.

It is not the mandate of scientists to determine what level of risk is acceptable to society. Thus, an incorrect reflection of the degree of scientific uncertainty can occur.

This is a very difficult challenge for decision-makers who are responsible for risk management. Knowledge of how risk management works is required for a risk assessment to be correct.

We therefore propose that working groups be supplemented with legal expertise. They must also be provided with substantially clearer instructions on the conditions of their mission.

APPENDIX B

The listing suggests that since up to 5,000 users can be hooked up by one smart meter in a structure, in any population centre smaller than Antigonish, there is a risk that then burden of excessive electromagnetic microwave power density – perhaps even exceeding Safety Code 6 may occur. The emission from such devices, could, especially in linear distribution, results in beaming of microwaves in the LAN configuration through lived-in zones.

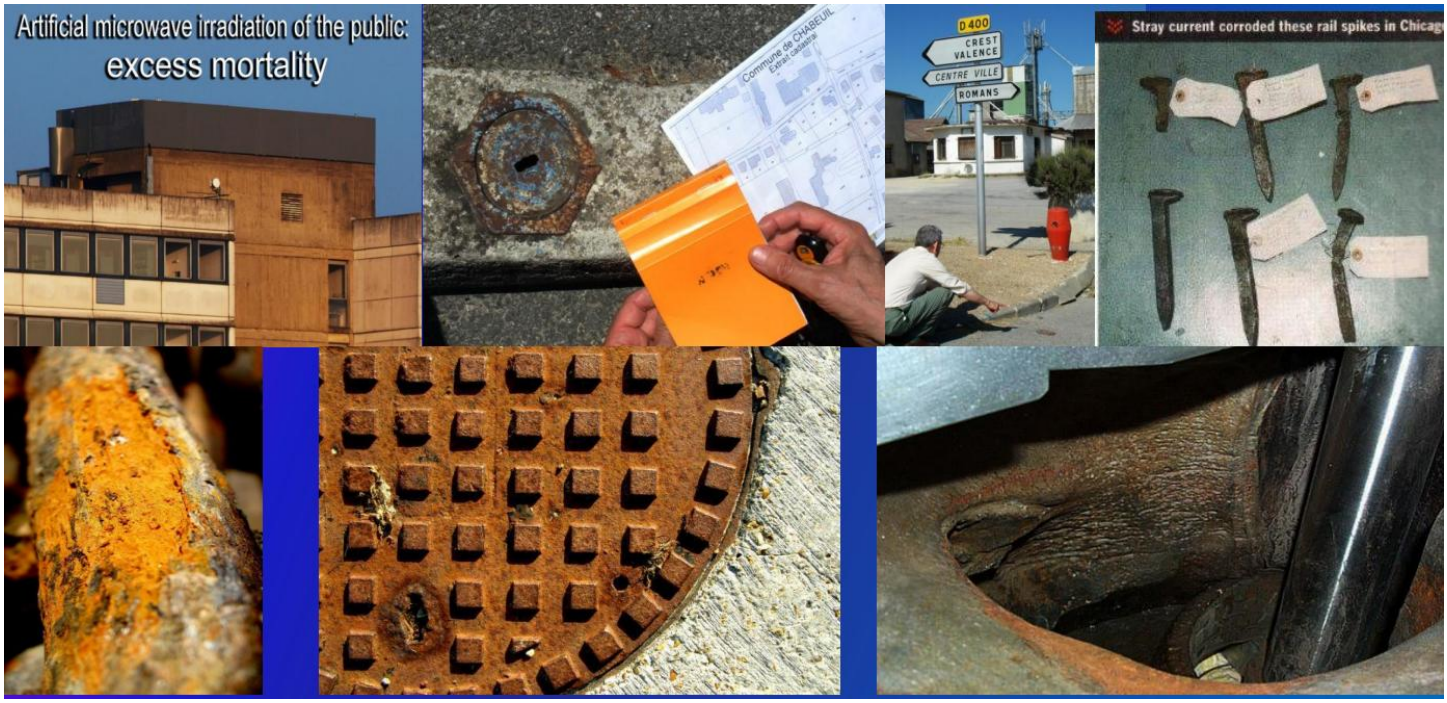
Rank	Population centre	Size group	Population in 2011	Population in 2006
1	Halifax	Large urban	297,943	285,480
2	Sydney	Medium	31,597	33,496
3	Truro	Small	23,261	22,376
4	New Glasgow	Small	20,609	20,876
5	Glace Bay	Small	19,076	19,968
6	Kentville	Small	14,234	13,552
7	Sydney Mines	Small	14,135	15,315
8	Amherst	Small	9,811	9,598
9	New Waterford	Small	8,942	9,661
10	Bridgewater	Small	8,310	8,021
11	Yarmouth	Small	6,761	7,162
12	Kingston - Greenwood	Small	6,595	6,528
13	Antigonish	Small	5,084	4,712
14	Wolfville	Small	4,269	3,772
15	Windsor	Small	4,095	3,986
16	Enfield	Small	3,892	3,415
17	Springhill	Small	3,868	3,941
18	Lake Echo	Small	3,562	3,467
19	Pictou	Small	3,437	3,813
20	Port Hawkesbury	Small	3,366	3,517
21	Liverpool	Small	2,653	2,759
22	Berwick	Small	2,504	2,524
23	Lunenburg	Small	2,313	2,317
24	Digby	Small	2,152	2,097
25	Hammonds Plains Road	Small	1,840	3,124
26	Middleton	Small	1,749	1,829
27	Shelburne	Small	1,686	1,879
28	Still Water Lake	Small	1,677	855
29	Lantz	Small	1,533	1,626
30	Brookside	Small	1,531	1,824
31	Chester	Small	1,529	1,496
32	Inverness	Small	1,387	1,464
33	Hantsport	Small	1,377	1,432
34	Parrsboro	Small	1,305	1,401
35	Oxford	Small	1,151	1,178
36	Hayes Subdivision	Small	1,090	1,053
37	Bridgetown	Small	1,014	1,082

APPENDIX C

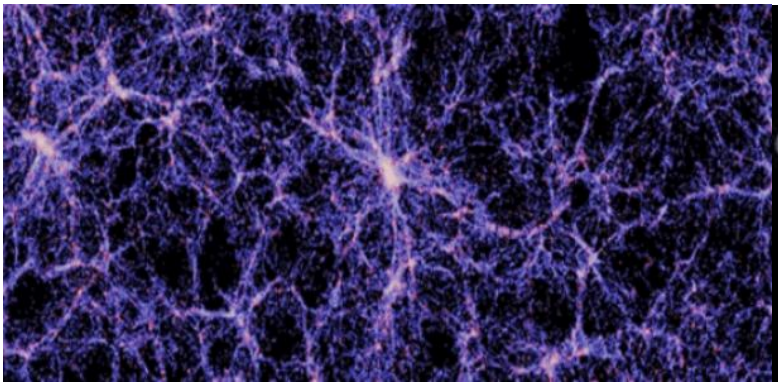
The AMI system would be integrated with the bandwidth, frequencies, aggregation, beam forming, coding, spacing and spectrum occupancy pending the ***5G – Internet of Things*** (IoT) inauguration sometime between 2020-25,

	LTE	NR Phase 1
Frequency of Operation	Up to 6 GHz	Up to 52 GHz
Carrier Bandwidth	1. Max: 20 MHz	Max: 100 MHz (@ <6 GHz) Max: 1 GHz (@ >6 GHz)
Carrier Aggregation	Up to 32	Up to 16
Analog Beamforming (dynamic)	Not supported	Supported
Digital Beamforming	Up to 8 Layers	Up to 12 Layers
Channel Coding	Data: Turbo Coding Control: Convolution Coding	Data: LDPC Coding Control: Polar Coding
Subcarrier Spacing	15 kHz	15, 30, 60,120, 240 kHz
Self Contained Subframe	Not Supported	Can be implemented
Spectrum Occupancy	90% of Channel BW	Up to 98% of Channel BW

Already cumulative nature electromagnetic hash is initiating accelerated corrosion of buildings, surface and sub-surface infrastructure, railway bonds, and even reactors

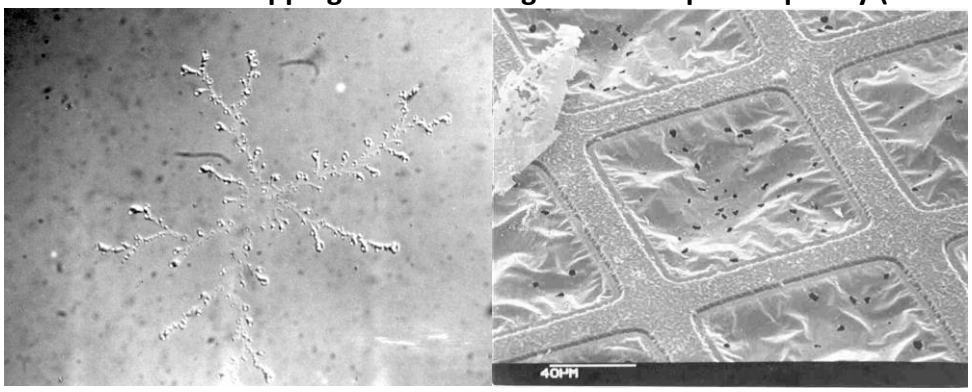


Visualizing aspects of electromagnetic hash / swarming: *"γ-relaxation"* clusters and *"ion resonance"*



*The image to the left shows the physical phenomenon recently (2016) analyzed by **Dasadia Sarthak**, **University of Alabama in Huntsville (UAH)** by using Chandra X-ray Observatory observations captured from un-relaxed [**"γ-relaxation"**] clusters such as* **Abell 665** *that permit the study of superimposition (or "merger") features such as electromagnetic "shocks" and "turbulence, where undefined boundaries of charge clusters are drawn together. We can consider the prevalence of millions of electromagnetic gadgets in the same volume of space of indoor, structural, urban and rural areas to be quite similarly. This observation is, under peer review already being represented with this observation of weather and other geophysical – "because there is not much difference as far as the physics involved. Technically, we observe the same features in space that we do on Earth." UAH studies tornado and micro-climate disaster, including firestorms. The image to the right objectifies how an ion resonance phenomenon can appear like - above ground level - as an interference type of plasma cloud between overlapping fields of various bandwidths - at least 2 sources of different frequencies - (60Hz, with harmonics & and tones interchanging with RF and microwave bandwidths & their emission sources).*

Electron stripping and swarming from multiple-frequency (low + high energy source) emissions



*The image to the left is a SEM micrograph of electron stripping on chromium film target, fractal in formation, during the process of multiple frequency EMF resonance emissions. Note the same fractal drawing together of charges as observed by Chandra observatory and analyzed by **Dasadia Sarthak** (UAH). The optical photo of witness plate taken by **Kenneth Shoulders** at 1,500X showing electromagnetic swarm connected as bead chain structure. [1] Such random charges can evolve into tons of force and evidenced in accelerated nuclear reactor corrosion.*

Challenge of monitoring currently-developing electromagnetic hash

The challenge of measuring and monitoring environments that are subject to so many emitters at so many sources of so many frequency ranges has been reported in peer-reviewed journals from around the world. For example: ***Hot Nano Spots" as an interpretation of so-called* Non-Thermal *biological mobile phone effects***. [2] to help explain why wireless devices, considered implausible for "non-thermal effect" due to low quantum energy and low specific absorption rate levels, can contain, even hotter "Nano spots" on a molecular level according to well-known mechanisms of *γ-relaxation*, assuming a heterogeneous system that consists of water molecules as well as larger-sized functional molecules. A consistent interpretation through temperature increase on the level of nanometer sized molecular compounds promises to favor interdisciplinary discussions with respect to safety regulations. Researchers suggest personal exposimeters – in Australia, Belgium [3] (exposures in Australia were generally lower than in Belgium: Urban exposures were higher than rural and suburban ones; outdoor exposures were higher than indoors. In Spain the **Universidad Politécnica de Madrid** is developing a 50 Mega Hz to 6 Giga Hertz expositometer for assessing daily exposure http://bit.ly/1X8OnoH. 42,112

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[1] Ken R. Shoulders, Steve Shoulders. **Charge clusters**. Planetary Association for Clean Energy Newsletter, Volume 9,1. (February 1997).

[2] Pfützner, H. (2016) "**Hot Nano Spots" as an Interpretation of So-Called Non-Thermal Biological Mobile Phone Effects**. Journal of Electromagnetic Analysis and Applications, 8, 62-69. doi: 10.4236/jemaa.2016.83007.Environ Res. 2016 Apr 27; 148:367-375.doi: 10.1016 / j.envres.2016.04.018. *[Epub ahead of print]*

[3] Bhatt CR, Thielens A, Redmayne M, Abramson MJ, Billah B, Sim MR, Vermeulen R, Martens L, Joseph W, Benke G. **Measuring personal exposure from 900MHz mobile phone base stations in Australia and Belgium using a novel personal distributed exposimeter.** Environ Int. 2016 Apr 29; 92-93:388-397. doi: 10.1016/j.envint.2016.03.032. *[Epub ahead of print]* http://1.usa.gov/21xjKcF

British Police officers and staff were monitored [4] for Terrestrial Trunked Radio (***TETRA***), digital communication system. Participants under-reported number of calls and over-reported their duration. In Kuwait, a study was to determine "safe", year-round EMF levels (below 2milliGauss maximum) for schools. The safety clearance distance from a 300-kV power line is assigned as 200 m and from 132-kV.[5]

Case study of electromagnetic hash – habitat for EHS individuals built by federal government

When challenged about unusual levels of emissions from a multiple Smart meter installation in habitat built by the Federal government housing (**CMHC-SCHL**) for EHS individuals, **Hydro Ottawa** CEO commissioned a 900 MHz only field survey (notwithstanding other frequencies monitored in PACE surveys). The information, underlinedprofusion of co-emitters, whose presence indicates the complexity of the issue at hand: quantification of injurious affection.

Hydro Ottawa Test Conclusions - The findings of the 60 Hertz at 900 Mhz Elster smart meter study. Conclusions derived from the Smart Meter inspection found that the meters were operating as per the manufacturer's parameters. No defects were identified during of two hour inspection conducted: supply voltage, the radio frequency levels and operation appeared normal and within the tolerances expected in an operating system.

Comments provided by the **Elster Canada** technical resource reported: *Based on my experience the readings you have in the table are typical. The in front of the meter readings can vary slightly depending on proximity of the handheld to the meter, and the readings are expected to be lower as you move further from the meter or obstacles come between the meter and the handheld.*

Hydro Ottawa confirmed on the analysis of the smart meter network in Barrhaven that the building at 3005 Jockvale Rd is in an area of low incidence of smart meter traffic compared to neighbouring areas of tighter density homes. The buffer provided by public buildings like churches, large parking lot, road and rail road right away does buffer the RF traffic from the greater network and results in lower densities. This does not diminish local traffic from the customers own smart meters.

Alternate Sources of Interference
Many sources of radio interference were identified at the customer's site during the course of Hydro Ottawa's investigation that were not related to Hydro Ottawa system. These points are being raised to provide balance to the Hydro Ottawa response as it would not be fair to consider the whole source of the customers physical complaints on a singular technology, the Hydro Ottawa smart meter that broadcasts for a couple of minutes a day – approximately four times a day. Sources of radiation identified during the inspection were:

- **Hydro Ottawa**'s 900 MHz smart meters
- Customer owned 60 Hz supply voltage and unit wiring within the customer units and customer owned 60 Hz supply, end wall wiring and metering center and unit service conductors under concrete floor
- **Hydro Ottawa** primary transformer supply approximately 25 feet from the customer unit
- **Bell Canada** telecom infrastructure
- **Bell Canada** telecom VDSL Fibe infrastructure
- **Rogers cablevision** utility termination
- **Via Rail** train line with RF telemetry
- **Ottawa International Airport** flight path and resulting RF telemetry and traffic
- **City of Ottawa** Itron smart meter water meter module with RF broadcast
- Adjacent tenants in area having ***Wi-Fi*** connection for their broadband signal for their internet
- **Cellular towers** for public carriers
- **AM & FM commercial radio and television** broadcasts

900 MHz Test Table of Findings:
Note: the less negative a reading was, the stronger the signal, the more negative the reading the weaker the signal.

Editor: In 900MHz, **Ottawa Hydro** measured **0.03 - 0.06** in μWatt/cm^2 equivalence, **Actual power,** during 3 visits was: for micro-wave range: **7 – 8** μW/cm^2 **~ 233X higher** and, for the 10Hz-100GHz range: **40 - 80** μW/cm^2 **~ 1,333X higher** (from data, etc. modulations).

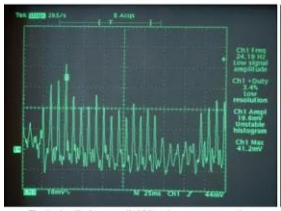
	Observed Signal Itensity (in dBm)				
Badge Number (LAN ID)	In Front of Meters	In Parking Lot (approx. 22m away)	Inside Entrance to Unit #2	Inside Entrance to Unit #4	Inside Entrace to Unit #6
OTT633955 (415230)	-24	-56	-42	-57	-58
OTT633957 (415232)	-23	-61	-49	-41	-54
OTT633967 (415242)	-24	-64	-52	-40	-63
OTT633966 (415241)	-24	-50	-50	-37	-66
OTT633969 (415244)	-24	-61	-50	-39	-57
OTT891577 (3007055)	-26	-50	-40	-40	-58
OTT633956 (415231)	-24	-67	-47	-36	-62

[4] Vergnaud AC, Aresu M, McRobie D, Singh D, Spear J, Heard A, Elliott P. **Validation of objective records and misreporting of personal radio use in a cohort of British Police forces**. Environ Res. 2016 Apr 27;148:367-375.doi: 0.1016/j.envres.2016.04.018.*[Epub ahead of print]*

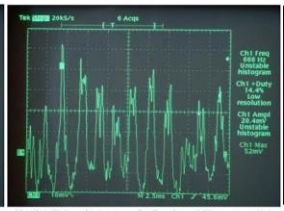
[5] Al-Bassam E, Elumalai A, Khan A, Al-Awadi L. **Assessment of electromagnetic field levels from surrounding high-tension overhead power lines for proposed land use**. Environ Monit Assess. 2016 May;188(5):316. Epub 2016 Apr 29.

Tracings of complex modulation streams, microwave frequencies from cellphone and *Wi-Fi* transmissions

Cell transmission from a Moto G Cell phone

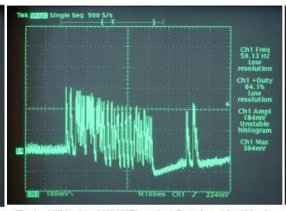


Typical cell phone call. 100 pulses per second

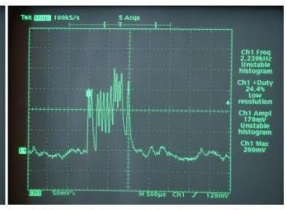


10x detail showing approx 2mS pulse widths per packet

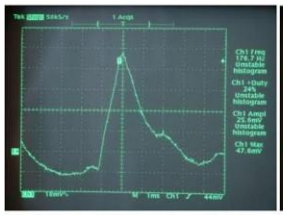
WIFI Transmission from a MOTO G cell phone



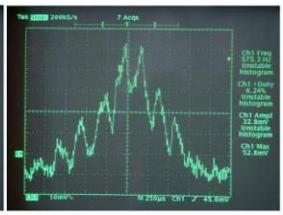
Typical "Display ON" WIFI packet. Data burst is 420mS



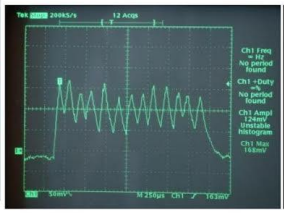
Data pulse detail zoomed 200x. Pulse width is 1mS



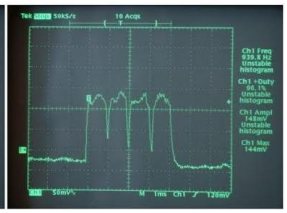
Integrated (smoothed) individual cell packet pulse as the EM2 sees it.



Single pulse detail with the integrator removed. The 3.3kHz and >80kHz sub-pulse data stream is now visible.



Data pulse zoomed 400x. Individual sub-pulses are 130uS with a frequency of about 7.7kHz. Packet is 1.75mS



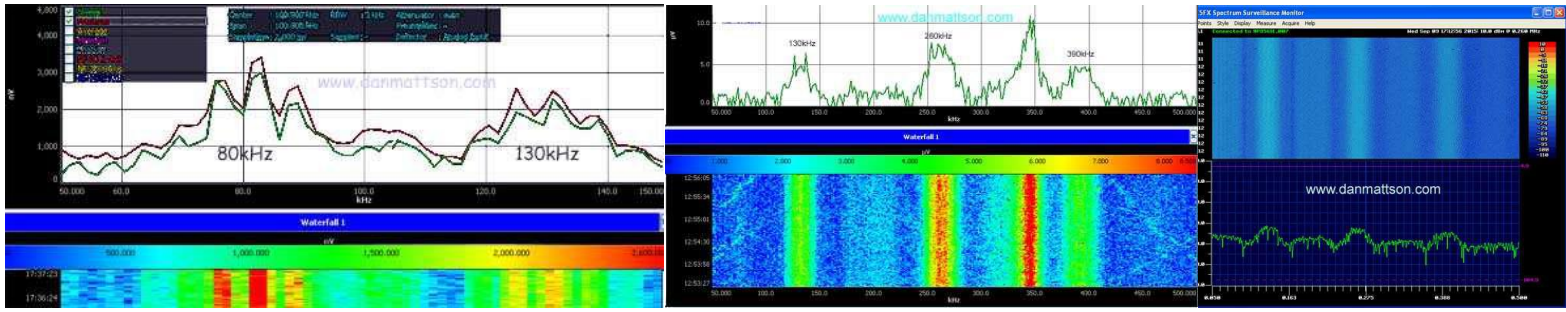
Another type of WIFI packet of 4mS length

Two series of data streams: from Cell and from Wi-Fi transmissions*. A* ***MotoG*** *cell phone was monitored by* ***Dave Marett****, PEng. The detector is* ***Essentia EM2*** *(10Hz – 100 GHz) front-connected to oscilloscope. Probe's integrator removed to show pulse hash detail: some goes to several MHz, VLF, ELF audio range as well. This "higher clock speed" hash forces regulatory agencies to limit interference from "clock" & switching devices that generate "clocks" and switching emissions.* [6]

[6] Holland Shielding. http://hollandshielding.com

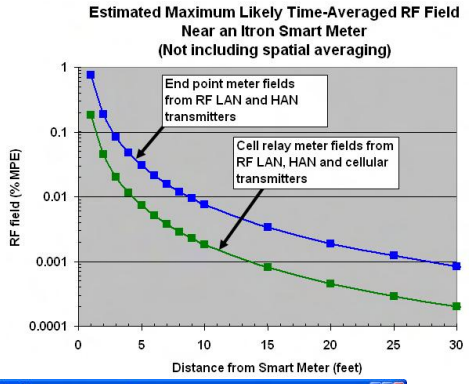
APPENDIX D

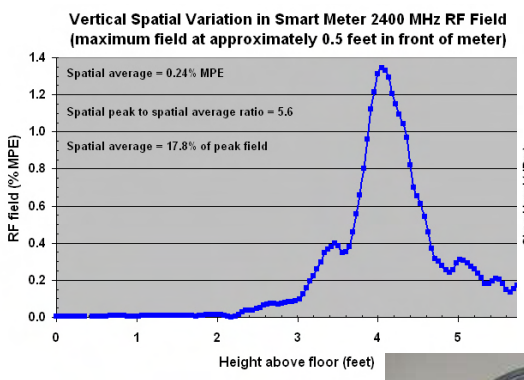
Other frequencies emitted by typical Smart meter – switching for extra billing, etc.

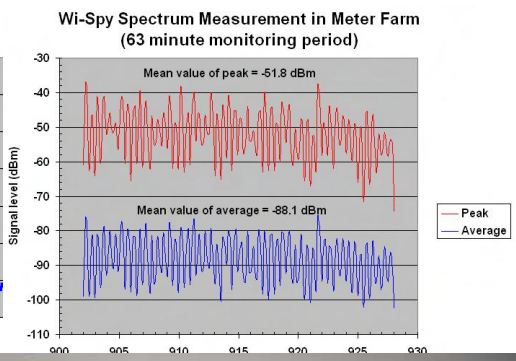


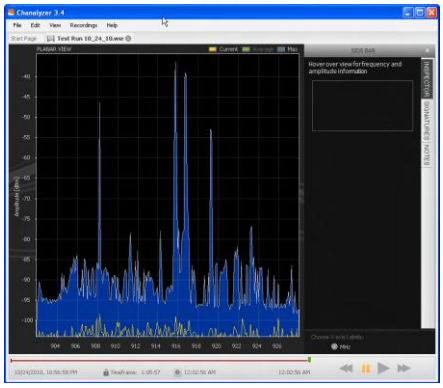
These 3 images are switching frequency emissions in Smart meter traced as induced current at one hot leg. The 130 kHz signal is computed it at 625µA induced into 120/240 volt wiring. The 80 kHz signal (top left) may be induced or than radiated "noise". Such spike-like interactions can come from phone & cable wires, as noted by ***Hydro Ottawa*** *– and they also leak into waterworks & onto urban / rural infrastructures. 340 kHz (middle) spike is sharable with electromagnetic swarming from some phone and cable lines, ground wires and powerlines.*

Position of EPRI (Electric Power Research Institute) [7] and independent on emissions from Smart meters





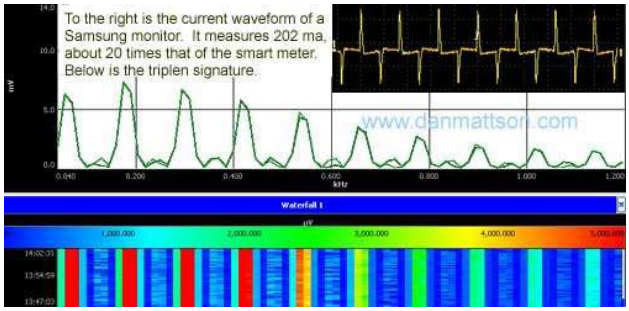




EPRI – Electric Power Research Institute *at Palo Alto, California, like* ***Hydro Québec*** *and other utilities tend to report only pulsed microwave radiation (902-928 MHz) and the ZigBee software transceiver signals for the HAN – Home Area Network to monitor indoor activities including RFIDs, circuits and "signatures", etc. They do not specify how number of meters, local co- factors & other co-utilities, supplier impact on final power density levels for users. Suppliers do not refer to ELF magnetic fields or to switch mode power supply switching frequency radiation (130 kHz) and associated harmonic emissions and distortions associated with installations. The switching mechanism within the circuit board in the bottom right Image converts 240 Volt AC to 12Vs DC and is described in data sheet as introducing "a small amount of frequency jitter, typically 8 kHz peak-to-peak, to minimize EMI emission." Electronics, electric utilities and telecommunication industries engineer try to overcome such transients, which are of primary concern. The switching device raises the issue of power factor which allows Smart meters to "meter" more. [Example for a typical refrigerator with a 0.7 power factor (420 Watts) may register as a 9.5 volt-amps (VA) in terms of random and continuous reactive loads, to be billed for 570 Watts – about 36% more. Furthermore such frequencies and harmonic distortions / noise can cause injurious affection on several fronts. EPRI concedes up to 14.0 microWatt/cm^2 power density versus European guideline of 0.1 microWatt/cm^2 and observations toward 100.0 microWatt/cm^2, and in cases of reflection, up to 8.904.39 microWatt/cm^2 (see: reference Cindy Sage engineering* **Itron** *Smart Meter comparative emission analysis below).*

[7] G.Mezei, Richard Tell Associates, Inc. **An Investigation of Radiofrequency Fields Associated with the Itron Smart Meter**. Final Technical report 1021126. December 2010 www.epri.com. *This report is issued with a disclaimer of the possibility of "damages for any information, apparatus, method, process, or similar item disclosed in this document*".

Example of a Home Area Network "signature" emission – LCD monitor – detectable by Smart meter *ZigBee*



*All non-linear (random, discontinuous) loads, such as switching power supplies, produce such a signature waveform and frequency profile and all are unique. At left is a "signature" from a **Samsung 21"** LCD monitor with analog (VGA) input.*

The interconnectedness objective has the potential for severe systemic upheavals. An early example was an end-of-the-month IBM New Orleans World Trade Center facility's inability to perform. After considerable trouble-shooting expertise confirmed integrity of software and hardware, it was observed that US Navy Coast Guard vessels were routinely testing – at full power – their radar at the harbour at the end-of-the-month, and thus affecting data and circuitry of IBM several kilometres away. Once the Coast Guard conducted such exercise further away, there was no issue. With the impetus for "smart" home / city / cars /devices - "HaLow" May 23, 2016 **IEEE 802.11ah** specification, we can stand guard for similarly "unexplainable" computer failures at airports, commerce, etc.

Itron *Smart Meter comparative emission levels analysis - sample*

Emission levels of Itron OPENWAY® SMART Meter $\mu W/cm^2$ (900 MHZ Antenna)	**At 20 cm**	**At 1 meter**	**At 3 meters**
Common peak exposure levels of single Itron Smart meter			
Smart meter, front Smart meter, back	~ 1 -10 ~ 0.010 - 0.100	outdoors indoors	
Sage Report—CALCULATED for 90% duty cycle			
1000% reflection 100% reflection 60% reflection	**8,904**.390 **1,294**.360 188.390	556.52 18.40 11.770	50.09 1.660 1.060
ACS Compliance Testing Laboratory (RSS-210/FCC15.247)—CALCULATED without reflection factor			
900 MHz LAN 2.4 GHz *ZigBee*	227.0 31.0	[9.0]	[1.0]
Electric Power Research Institute—CALCULATED for upper range of possible RF fields			
Peak level	(30 cm) 168.36	18.727	1.683
Itron, Inc.—CALCULATED			
Centron Sentinel		68.0 – 81.0	
Richard Tell Associates, Inc.—CALCULATED with ground reflection factor 2.56			
Maximum level	adjacent to meter 10.0	1.0	0.10
BC Centre for Disease Control—MEASURED (at British Columbia Hydro Laboratory)			
Peak level, front Min. detectable level of RF Probe	≤ 20.0 ≤ 20.0		
Safe Living Technologies (Ontario)—MEASURED single SMART meter at residence			
Peak level, front Indoor peak level, back	≥ 2.0 0.01 – 0.09		
Electric Power Research Institute—MEASURED single SMART meter at residence			
Peak level, front Indoor peak level, back	(30 cm) 5.337	1.134 Bedroom behind meter 0.061	In bath and bedroom2 0.055
ET&T (California)—MEASURED single SMART meter at residence			
Peak level, front		(30 cm) 2.10	
British Columbia Hydro—As quoted in its SMART Meter business case			
< 10.0		0.010	
British Columbia Hydro—CALCULATED AVERAGE based on transmit time per day			
0.6% duty cycle (8 min) 0.06% duty cycle (1 min)	2.0 0.160	[0.054] [0.006]	[0.006] [0.007]

The above compilation articulates how certain factors, such as reflection of signals, grouping of Smart meters, use of ***ZigBee***-type software (not yet completely implemented for supplementary data, remote-control and other application for which **Hydro Québec** reported to **Régie de l'Énergie** it is committing $100,000,000 in budgeting), duty cycle, the number of meters that a unit is reporting on behalf of - impact the level of power density emissions. There exist situations where the meter's emission levels exceed Health Canada's ***Safety Code 6*** and **ICNIRP** guidelines, even without significant reflective factors. In addition, the switching mechanism's 130 kHz and 380 kHz signal's power density are not accounted for in this table, nor the monitored 80 kHz spike, as illustrated previously.

- The old meter base connections may not have been in a condition for seamless exchange to a new meter
  - This should have been detected by the technician during the change over
  - Would installation guidelines help fix this?

- New meters may have defects that cause electrical failures or misalignment with old meter base
  - The meters are supposedly being designed and tested to specific standards to ensure safety
  - Do we have any policing bodies ensuring (like the CSA with Part II products) that the meters are designed correctly

- Careless installation during change over
  - Would installation guidelines help fix this?

- Considering the new smart meters fall under part 3 of the EC their installation has been left up to the utilities to determine. However they are directly plugged/meshing with a single component which falls under Part 2 which has to be installed in accordance with the requirements of part 1

- Therefore, when a utility owned (Part 3) component is directly meshed into a Part 2 component, would it make for more consistent connection, to have both components be scrutinized to the same standards and tested together and fall under the same installation guidelines

- Checking on the UL website we found that **only two** companies were listed which produced meters for the use in Canada
  - Schneider Electric USA Inc.
  - Triacta Power Technologies
  - Where are GE, Sensus etc.…?
- On the UL website we found a whole division which is devoted to Global meter testing and performance.
- On their website they state: UL tests for electronic electricity meters and their smart features to the requirements of the United States, Asia, Australia, Europe and South Africa
- While they don't say Canada it would make sense that they are testing ours as well?

- Both standards state the components must be able to withstand abuse, have performance requirement tests (accuracy tests), require current carrying parts be separated along with temperature rise tests.
- However the meter base standard has additional simulation tests to ensure the structural integrity of all components
- Why was that missing from the Measurement Canada LMB – EG – 07 specification.
- Well simply it was because the mandate of Measurement Canada was only to ensure accuracy.

- The following comes from the C22.2 No 115-M1989 Meter-Mounting Devices standard
  - Dated 1989
- Enclosures shall completely encase all current-carring parts when meters or other devices of proper types are mounted in position. Enclosures shall be so formed and assembled that they will have the strength and rigidity to resist the normal abuses to which they may be subjected without increasing their fire or accidental hazard due to partial collapse with resultant reduction of spacings, Loosening or displacement of parts, or other serious defects.
- Enclosures shall be of metal or other suitable material which, by investigation, has found to be satisfactory for the conditions of use
- Further states materials thickness. Types of connections. Torques applied to connections
- Additionally there are outlined Mechanical Strength tests
  - Metering connections shall be capable of withstanding the application of torques….
- Humidity, corrosion and weather tests

- Both standards state the components must be able to withstand abuse, have performance requirement tests (accuracy tests), require current carrying parts be separated along with temperature rise tests.
- However the meter base standard has additional simulation tests to ensure the structural integrity of all components
- Why was that missing from the Measurement Canada LMB – EG – 07 specification.
- Well simply it was because the mandate of Measurement Canada was only to ensure accuracy.

APPENDIX F

Evidence of harm

Below is key evidence, originally presented in the United States, and associated references, that the exposure of humans to radiofrequency radiation, and specifically cellular radiation, is harmful to health. In 2016, the **National Toxicology Program**, at the **National Institutes of Health**, linked cellular radiation to brain and heart tumors.

The National Toxicology Program (NTP), at the National Institutes of Health (NIH), just published the "Partial Findings" of a $25 million multi-year study of the impact of cellular radiation on health. The U.S. Food and Drug Administration "nominated" this NTP study. The NTP indicated that this is the largest and most complex study ever conducted by the NTP. Ronald M. Powell, Ph.D., USA, email ronpowell@verizon.net web site https://www.scribd.com/document/291507610/.

The NTP study exposed each of six separate groups of male rats to one of the six possible combinations of three different levels of cellular radiation and two different modulation formats. The modulation format is the method used to impress information on the cellular signal. A separate seventh group of male rats was used as a "control", that is, for comparison, and was protected from exposure to any cellular radiation. The NTP study found a "likely" causal relationship between exposure to cellular radiation and the occurrence of malignant (cancerous) brain tumors (glioma) and malignant nerve tumors (a form of schwannoma) of the heart in the male rats:

The rates of occurrence of brain glioma in the male rats ranged from 0 to 3.3 percent for the six groups exposed to radiation. The mean rate of occurrence was 2.0 percent across all six groups. The rates of occurrence of heart schwannoma in the male rats ranged from 1.1 to 6.6 percent for the six groups exposed to radiation. The mean rate of occurrence was 3.5 percent across all six groups.

The seventh group of male rats, which was used as a control and which was protected from exposure to any cellular radiation, experienced no instances of brain glioma or heart schwannoma. The NTP considered its findings so important to public health that it issued the "Partial Findings" (May 2016) prior to completing the full study. The NTP then presented those findings at an international conference (BioEM2016, June 2016) attended by 300 scientists from 41 countries. The NTP characterized the motivation for the early release of the "Partial Findings" this way:

> "Given the widespread global usage of mobile communications among users of all ages, even a very small increase in the incidence of disease resulting from exposure to RFR [radiofrequency radiation] could have broad implications for public health. There is a high level of public and media interest regarding the safety of cell phone RFR and the specific results of these NTP studies. "

You can learn more about this study from the following references:Reference: NTP's brief description of its study. National Toxicology Program: Cell Phones. (http://ntp.niehs.nih.gov/results/areas/cellphones/index.html)

Reference: NTP's published "Partial Findings" of the study. Michael Wyde, Mark Cesta, Chad Blystone, Susan Elmore, Paul Foster, Michelle Hooth, Grace Kissling, David Malarkey, Robert Sills, Matthew Stout, Nigel Walker, Kristine Witt, Mary Wolfe, and John Bucher, Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure), posted June 23, 2016. (http://biorxiv.org/content/biorxiv/early/2016/06/23/055699.full.pdf)
Reference: Informative discussion of the NTP study. Environmental Health Trust, Frequently Asked Questions about the U.S. National Toxicology Program Radiofrequency Rodent Carcinogenicity Research Study. (http://ehtrust.org/science/facts-national-toxicology-program-cellphone-rat-cancer-study)

In the "Partial Findings" reference cited above, the mean (average) rate of occurrence for malignant glioma in male rats was determined from Table 1 on page 13 as follows: (3 + 3 + 2 + 0 + 0 + 3)/(90 + 90 + 90 + 90 + 90 + 90) = 2.0 percent.

In the “Partial Findings” reference cited above, the mean (average) rate of occurrence for malignant heart schwannoma in male rats was determined from Table 3 on page 15 as follows: (2 + 1 + 5 + 2 + 3 + 6)/(90 + 90 + 90 + 90 + 90 + 90) = 3.5 percent.

Reference: Announcement of the BioEM2016 presentation. Results of NIEHS’ National Toxicology Program GSM/CDMA phone radiation study to be presented at BioEM2016 Meeting in Ghent, 05 June 2016 — 10 June 2016 Ghent University, Belgium. (http://www.alphagalileo.org/ViewItem.aspx?ItemId=164837&CultureCode=en)
Reference: Viewgraphs presented by Michael Wyde, Ph.D., NTP study scientist, at BioEM2016 Meeting, Ghent, Belgium, June 8, 2016. NTP Toxicology and Carcinogenicity Studies of Cell Phone Radiofrequency Radiation. (http://ntp.niehs.nih.gov/ntp/research/areas/cellphone/slides_bioem_wyde.pdf)

In September 2017, the NTP presented further findings from its study of the impact of cellular radiofrequency radiation on the DNA of both mice and rats. The NTP found the following:

> “These results suggest that exposure to RFR [radiofrequency radiation] has the potential to induce measurable DNA damage under certain exposure conditions.”

Reference: Abstract of data presented at the annual meeting of the Environmental Mutagenesis and Genomics Society, Raleigh, North Carolina, September 9-13, 2017. SL Smith-Roe and others, Evaluation of the Genotoxicity of Cell phone Radiofrequency Radiation in Male and Female Rats and Mice Following Subchronic Exposure. (https://ehtrust.org/national-toxicology-program-finds-cell-phone-radiation-induces-dna-damage/)

Further findings from the NTP are promised for 2018. The NTP study reinforces the classification of radiofrequency radiation, including cellular radiation, as a possible human carcinogen, made by the International Agency for Research on Cancer of the World Health Organization in 2011. In its “Partial Findings” the NTP noted that its study reinforces a decision made by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) in 2011. That decision classified radiofrequency radiation, including specifically cellular radiation, as a Group 2B carcinogen (possible carcinogen for humans). This classification was based on the increased risk of brain cancer (glioma) and acoustic neuroma (a form of schwannoma).

Reference: Announcement of the IARC classification. International Agency for Research on Cancer, IARC Classifies Radiofrequency Electromagnetic Fields as Possibly Carcinogenic To Humans, Press Release No. 208, 31 May 2011. (http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf)
Reference: Full report on the IARC classification. IARC Monographs: Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields, Volume 102, 2013. (http://monographs.iarc.fr/ENG/Monographs/vol102/mono102.pdf)

The findings of the NTP study, in combination with the findings of other studies conducted since 2011, have greatly increased the likelihood that the IARC will raise its classification of radiofrequency radiation to Group 2A (probable carcinogen for humans) or even to Group 1 (known carcinogen for humans) in the near future. In 2015, hundreds of international scientists appealed to the United Nations and the World Health Organization to warn the public about the health risks caused by electromagnetic fields (EMF), including radiofrequency radiation and, specifically, cellular radiation.

The Mayo Clinic describes acoustic neuroma here: http://www.mayoclinic.org/diseases-conditions/acousticneuroma/basics/definition/CON-20023851.

As of January 29, 2017, 224 scientists from 41 nations have signed an international appeal first submitted to the United Nations and to the World Health Organization in May 2015. These scientists seek improved protection of the public from harm caused by the radiation produced by many wireless sources, including

> "cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors" among others. Together, these scientists “have published more than 2000 research papers and studies on EMF.”

They state the following:

> "Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life."

Reference: Welcome to EMFscientist.org (https://www.emfscientist.org)

Reference: International EMF Scientist Appeal: Scientists call for Protection from Non-ionizing Electromagnetic Field Exposure, May 15, 2015 (updated October 10, 2016). (https://www.emfscientist.org/index.php/emf-scientist-appeal)

Reference: International Scientists Petition U.N. to Protect Humans and Wildlife from Electromagnetic Fields and Wireless Technology. (https://www.emfscientist.org/images/docs/International_EMF_Scientist_Appeal_Description.pdf)

In 2012, the BioInitiative Working Group published the most comprehensive of the recent analyses of the international biomedical research, showing a multitude of biological effects from exposure to radiofrequency radiation, including cellular radiation, at levels below the current exposure guidelines set by the Federal Communications Commission (FCC). The health risks posed by the expanding use of radiofrequency radiation in wireless devices are not limited to cancer, as devastating as that consequence is. The broad range of health effects was extensively reviewed in the BioInitiative Report 2012. This 1479-page review considered about 1800 peer-reviewed biomedical research publications, most issued in the previous five years. The BioInitiative Report 2012 was prepared by an international body of 29 experts, heavy in Ph.D.s and M.D.s, from 10 countries, including the USA which contributed the greatest number of experts (10). The report concluded the following:

> "The continued rollout of wireless technologies and devices puts global public health at risk from unrestricted wireless commerce unless new, and far lower exposure limits and strong precautionary warnings for their use are implemented."

Reference: BioInitiative Working Group, Cindy Sage, M.A. and David O. Carpenter, M.D., Editors, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation, December 31, 2012. (http://www.bioinitiative.org)

The BioInitiative Report 2012 documented, in its "RF Color Charts", examples of eight categories of biological effects that occurred at levels below the current exposure guidelines set by the FCC:

- stress proteins, heat shock proteins, and disrupted immune function
- reproduction and fertility effects
- oxidative damage, reactive ion species (ROS), DNA damage, and DNA repair failure
- disrupted calcium metabolism
- brain tumors and blood-brain barrier
- cancer (other than brain) and cell proliferation
- sleep, neuron firing rate, electroencephalogram (EEG), memory, learning, and behavior
- cardiac, heart muscle, blood-pressure, and vascular effects.

These biological effects were attributed to "Radiofrequency Radiation at Low Intensity Exposure" from "cell towers, Wi-Fi, wireless laptops, and smart meters".
Reference: See the "RF Color Charts", accessed from the left column of the web page below.
(http://www.bioinitiative.org)

U.S. Government agencies, and U.S. medical organizations, have disputed the validity of the FCC's exposure guidelines.

U.S. Government agencies, as well as U.S. medical organizations, have disputed the validity of the FCC's thermal exposure guidelines, maintaining that they are outdated and need to be updated to provide adequate protection of human beings, including children and seniors as well as other vulnerable groups.

U.S. Environmental Protection Agency

The Environmental Protection Agency (EPA) would be a better agency than the FCC to entrust with setting radiofrequency radiation exposure guidelines because the EPA has both health expertise and environmental responsibilities. The EPA is often cited by the FCC, and by the wireless industries, as one of the agencies that the FCC has consulted about the FCC's exposure guidelines, as if to increase the credibility of those guidelines. However, the fact that the EPA has explicitly disputed the validity of those guidelines is consistently omitted from those FCC citations.

Specifically, in 2002, the EPA addressed the limitations of the thermal exposure guidelines of the FCC, and the similar guidelines of private organizations, including the Institute of Electrical and Electronics Engineers and the International Commission on Non-Ionizing Radiation Protection:

> "The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-ionizing Radiation Protection, are thermally based, and do not apply to chronic, nonthermal exposure situations…. The FCC's exposure guideline is considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified."
>
> "Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines."

Reference: Letters from Frank Marcinowski, Director, Radiation Protection Division, EPA, and Norbert Hankin, Center for Science and Risk Assessment, Radiation Protection Division, EPA, to Janet Newton, President, the EMR Network, with copies to the FCC and the IEEE, dated July 16, 2002.
(http://www.emrpolicy.org/litigation/case_law/docs/noi_epa_response.pdf)

In summary, the EPA makes the following points: (1) the FCC 's thermal exposure guidelines do not protect against all harm, only the harm caused by too much heating; (2) the FCC's thermal exposure guidelines do not apply to "chronic, nonthermal exposure", which is the type of exposure generated by cell towers and many other wireless devices; and (3) when new FCC guidelines are developed for chronic nonthermal exposures, they must accommodate "children, the elderly, and people with various debilitating physical and medical conditions" because those groups are not accommodated now.

U.S. Food and Drug Administration

The Food and Drug Administration (FDA) is also often cited by the FCC, and by the wireless industries, as one of the agencies that the FCC has consulted about exposure guidelines. But the FDA is the agency that "nominated" the NTP study of the possible health effects of cellular radiation, in part because of the FDA's uncertainty about the validity of the FCC's exposure guidelines:

> "Currently cellular phones and other wireless communication devices are required to meet the radio frequency radiation (RFR) exposure guidelines of the Federal Communications Commission (FCC), which were most recently revised in August 1996. The existing exposure guidelines are based on protection from acute injury

from thermal effects of RFR exposure, and may not be protective against any non-thermal effects of chronic exposures."

Reference: Nominations from FDA's Center from [for] Device[s] and Radiological Health, Radio Frequency Radiation Emissions of Wireless Communication Devices (CDRH), Executive Summary, as attached to transmittal letter from William T. Allaben, Ph.D., FDA Liaison , to Dr. Errol Zeiger, Coordinator, Chemical Nomination and Selection, National Toxicology Program, May 19, 1999, (http://ntp.niehs.nih.gov/ntp/htdocs/chem_background/exsumpdf/wireless051999_508.pdf) The FDA's wisdom in nominating the NTP study was well justified by the NTP's publication of the "Partial Findings" described above. Those findings demonstrated both that the FCC's exposure guidelines are not protective and that the thermal assumption on which those guidelines are based is invalid.

U.S. Department of the Interior

In 2014 the Department of the Interior (Fish and Wildlife Service) also addressed the limitations of the FCC's thermal exposure guidelines. The Department of the Interior was motivated by the multiple adverse effects of electromagnetic radiation on the health, and the life, of birds, particularly in connection with cell towers. The Department of the Interior stated the following:

"However, the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out o f date and inapplicable today."

Reference: Letter from Willie R. Taylor, Director, Office of Environmental Policy and Compliance, Office of the Secretary, United States Department of the Interior, to Mr. Eli Veenendaal, National Telecommunications and Information Administration, U.S. Department of Commerce, dated February 7, 2014. (https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf)

American Academy of Environmental Medicine

The American Academy of Environmental Medicine (AAEM), which trains physicians in preparation for Board Certification in Environmental Medicine, states the following:

"The AAEM strongly supports the use of wired Internet connections, and encourages avoidance of radiofrequency such as from WiFi, cellular and mobile phones and towers, and 'smart meters'." "The peer reviewed, scientific literature demonstrates the correlation between RF [radiofrequency] exposure and neurological, cardiac, and pulmonary disease as well as reproductive and developmental disorders, immune dysfunction, cancer and other health conditions. The evidence is irrefutable." "To install WiFi in schools plus public spaces risks a widespread public health hazard that the medical system is not yet prepared to address."

This date and the referenced URL were changed when this superior reference was posted, at my request, by the NTP/NIEHS/NIH.

Reference: American Academy of Environmental Medicine, Wireless Radiofrequency Radiation in Schools, November 14, 2013.(http://www.aaemonline.org/pdf/WiredSchools.pdf)

American Academy of Pediatrics

The American Academy of Pediatrics (AAP), whose 60,000 doctors care for our children, supports the development of more restrictive standards for radiofrequency radiation exposure in order to better protect the public, particularly the children. In a letter to the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA), dated August 29, 2013, the AAP states the following:

"Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to

pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes."

Reference: American Academy of Pediatrics, letter dated August 29, 2013 addressed to The Honorable Mignon L. Clyburn, Acting Commissioner, Federal Communications Commission, and The Honorable Dr. Margaret A. Hamburg, Commissioner, U.S. Food and Drug Administration. (http://apps.fcc.gov/ecfs/document/view?id=7520941318)
After reviewing the "Partial Findings" from the new study by the National Toxicology Program at the National Institutes of Health, described above, the American Academy of Pediatrics cautioned parents about the use of cell phones by their children:

"In light of the findings, the Academy continues to reinforce its recommendation that parents should limit use of cell phones by children and teens."

Reference: American Academy of Pediatrics, AAP responds to study showing link between cell phone radiation, tumors in rats, May 27, 2016. (http://www.aappublications.org/news/2016/05/27/Cancer052716)

We can act on our own to protect ourselves and our families, but only partially. Instead of increasing our exposure to cellular radiation, and to the radiation from other digital wireless devices, we can decrease our exposure and improve our chances for good health. Desirable steps in this direction include the following:

- Reduce or stop the use of cell phones. Reserve them for emergencies or other essential uses.
- Replace cordless telephones with corded telephones.
- Establish wired (Ethernet) interconnections between routers and the wireless devices that the routers support. Then turn off the wireless capabilities, such as Wi-Fi and Bluetooth, of them all.
- "Opt out" of the wireless smart meter on your residence, if your state or local electric power company permits. Many states, but not all, have an opt-out provision.
- Alert family members about the health risks posed by wireless devices, particularly for vulnerable groups such as pregnant mothers, unborn children, young and teenage children, adult males of reproductive age, seniors, the disabled, and anyone with a chronic health condition. Everyone is vulnerable, but these groups are more so.

Reference: For more information on reducing radiation at home, please see Ronald M. Powell, Ph.D., How to Reduce the Electromagnetic Radiation in Your Home, which is document (10) on the following list.
(https://www.scribd.com/document/291507610/)

APPENDIX G

Below are tables from the **Hydro Québec** submission to the **Régie de l'énergie** – Quebec's review board.

The table below indicates the work costs, including the informatics charges (*technologies d'informations*)

TABLEAU 4 : COÛTS DU PROJET LAD (2010-2017)

k$ (courants)	Travaux préparatoires[1]	2012	2013	2014	2015	2016	2017	TOTAL
Investissements	**36 736**	**86 574**	**247 128**	**205 054**	**145 985**	**69 704**	**48 783**	**839 964**
Infrastructures technologies d'informations (TI)	*17 372*	*18 787*	*10 132*	*6 170*	*11 417*	*8 265*	-	*72 143*
Bureau de projet	*7 100*	*3 083*	-	-				*10 183*
Sous-total	***12 264***	***64 704***	***236 996***	***198 884***	***134 568***	***61 439***	***48 783***	***757 638***
Compteurs achat et installation	*6 364*	*46 604*	*192 300*	*155 456*	*97 731*	*43 104*	*42 330*	*583 889*
Équipement de télécommunications	*1 900*	*10 920*	*33 414*	*33 277*	*28 112*	*11 970*	-	*119 593*
Bureau de projet		*3 083*	*5 238*	*5 343*	*5 299*	*5 405*	*5 356*	*29 724*
Frais d'emprunt à capitaliser		*1 388*	*920*	*599*	*172*	*190*	*344*	*3 613*
Autres	*4 000*	*2 709*	*5 124*	*4 209*	*3 254*	*770*	*753*	*20 819*
Charges d'exploitation	**5 234**	**13 156**	**25 789**	**31 929**	**36 850**	**24 216**	**20 264**	**157 438**
Relocalisation des ressources		-	*7 062*	*8 642*	*11 248*	*3 399*	*585*	*30 936*
Technologies d'informations	*4 628*	*6 919*	*7 808*	*9 857*	*11 221*	*11 233*	*11 370*	*63 036*
Télécommunications		*1 084*	*1 834*	*2 906*	*3 952*	*4 590*	*4 727*	*19 093*
Charges diverses	*606*	*5 153*	*9 085*	*10 524*	*10 429*	*4 994*	*3 582*	*44 373*
TOTAL	**41 970**	**99 730**	**272 917**	**236 983**	**182 835**	**93 920**	**69 047**	**997 402**

1. Travaux préparatoires (R-3723-2010) de 42 M$ sur la période 2010 à 2012

The table below indicates the expected savings from the loss of 1,000 salaried jobs and other sources.

TABLEAU 6 : GAINS ASSOCIÉS AU PROJET LAD

k$ (courants)	2012	2013	2014	2015	2016	2017	2018
Masse salariale	(103)	(8 234)	(19 933)	(36 214)	(42 057)	(47 682)	(62 493)
Autres Gains	(571)	(3 478)	(6 571)	(11 913)	(14 461)	(15 839)	(18 807)
Total	**(674)**	**(11 712)**	**(26 504)**	**(48 127)**	**(56 518)**	**(63 521)**	**(81 300)**

This table compares AMI vs. "as is" income, with gain derived from extra billing, salary recoup and harmonized taxes.

TABLEAU 7 : RÉSULTATS DE L'ANALYSE ÉCONOMIQUE DU PROJET LAD (EN M$ ACTUALISÉS 2011)

M$ (actualisés 2011) période d'analyse 2011-2031	Scénario IMA*	Scénario de référence	Écart
Investissements	720,1	500,4	**219,7**
Charges d'exploitation	365,3	871,8	**(506,5)**
Taxe sur les services publics	1,5	-	**1,5**
Valeurs résiduelles	(85,6)	(81,2)	**(4,4)**
Total	**1 001,3**	**1 291,0**	**(289,7)**

* excluant l'infrastructure TI

The next table accounts financial returns (excluding the cost of telecommunications)

TABLEAU 8 :
ANALYSE FINANCIÈRE ET IMPACTS DU PROJET LAD SUR LES REVENUS REQUIS (K$ COURANTS)

en k$

	Scénario IMA	2012	2013	2014	2015	2016	2017	2021	2025	2031
	Charges	73 895	77 137	70 176	55 213	35 975	26 855	10 002	10 586	11 905
	Amortissement	4 626	20 456	35 564	47 459	55 184	57 183	52 613	52 491	22 477
	Taxe sur les services publics	0	16	77	136	182	196	175	154	123
	Frais financiers	2 473	13 820	25 967	34 241	37 827	38 045	27 097	14 881	13 876
A	**Revenus requis (excluant charges de radiation)**	**80 994**	**111 429**	**131 784**	**137 049**	**129 168**	**122 279**	**89 887**	**78 112**	**48 381**
B	**Revenus requis - Scénario de référence**	**65 974**	**76 797**	**87 145**	**95 856**	**104 455**	**111 485**	**127 292**	**143 307**	**149 238**
C=A-B	**Revenus requis (différentiel des scénarios)**	**15 020**	**34 632**	**44 639**	**41 193**	**24 713**	**10 794**	**-37 405**	**-65 195**	**-100 857**
D	**Amortissement et radiation des appareils en service**	**36 800**	**61 179**	**41 039**	**16 232**	**3 785**	**1 093**	**0**	**0**	**0**
E=C+D	**Revenus requis (différentiel)**	**51 820**	**95 811**	**85 678**	**57 425**	**28 498**	**11 887**	**-37 405**	**-65 195**	**-100 857**

Hydro Québec noted that there are risks with regards to ***over-spending*** (and relied on contractual guarantees for the AMI devices), ***client dissatisfaction*** (which it hoped to mitigate with special billing practices), ***meter failure*** (for which it gave a 15% contingency), ***communications failure*** (which it planned through constant security oversight and re-boots) and ***administrative issues*** (which it depended upon co-operation with the Review Board)

_____

Below is the US **National Institute of Standards and Technology** recap of how information from systems such as AMI has markets. Such extra revenue stake may be beyond the reach of the Board's decision-making, once it approves work order

Who wants our information and why?

Who wants smart meter data?	How could the data be used?
Utilities	To monitor electricity usage and load; to determine bills
Electricity usage advisory companies	To promote energy conservation and awareness
Insurance companies	To determine health care premiums based on unusual behaviors that might indicate illness
Marketers	To profile customers for targeted advertisements
Law enforcers	To identify suspicious or illegal activity*
Civil litigators	To identify property boundaries and activities on premises
Landlords	To verify lease compliance
Private investigators	To monitor specific events
The press	To get information about famous people
Creditors	To determine behavior that might indicate creditworthiness
Criminals	To identify the best times for a burglary or to identify high-priced appliances to steal

Source: "Potential Privacy Impacts that Arise from the Collection and Use of Smart Grid Data," National Institute of Standards and Technology, Volume 2, pp. 30–32, Table 5-3.
http://spectrum.ieee.org/energy/the-smarter-grid/privacy-on-the-smart-grid
Reprinted in www.burbankaction.com

Other Smart Grid/Smart Meter problems and issues

Overview: The Smart Grid/Smart Meter program has created a growing array of serious problems that end to require immediate action. The mounting public health emergency and the potential for a cyber-security and hacking crisis are just two issues that demonstrate the deeply flawed nature of the Smart Grid, Smart Meter, and Home Area Network programs. Doing nothing is not an option. The costly impacts to the public will continue to grow until such program halts, or is not debuted.

These problems include: Overcharging, accuracy, and the Structure Group report , Reliability questions, Privacy invasion, Fires and electrical problems, Health problems, Switching mode power supply (SMPS), Interference with electronics, Interference with medical devices, Hacking/cyber-security, Remote disconnection of power, Vulnerability to electromagnetic pulses (EMPs), No utility liability for hacked data, Increased burglary risk, Increased metal and infrastructure corrosion, impacts to building integrity, Job loss, Environmental costs, Smart Grid/Smart Meters – energy intensive, Control of household electrical use, Safety violations, Burdensome and excessive costs, Costs exceed benefits, Fraudulent claims and unavailable information, Strong-arm tactics by utilities, Potential violation of jurisdiction and mandate by utilities, No environmental assessment, Potential violation of provincial and federal laws, Overburdening utility easements, Criminal negligence, Ignoring realities and open process.

RELIABILITY

For this section, I will focus on PG&E. PG&E denied there were any technical problems for months until April 2010, when the CPUC forced them to release some records to the public. The records they released (there may be others) showed over 43,000 problems.

Problems with PG&E Smart Meters as of June 2010:

> "Among the problems that PG&E has admitted to are the following:
> • PG&E had to replace nearly 45,000 meters — 23,200 that were installed incorrectly, 12,376 that had data storage issues, and 9,000 that had wireless transmission problems.'
> • PG&E admits that less than 100% of its SmartMeters are accurate. This means that tens of thousands of PG&E customers are getting inaccurate bills.
> • Approximately 4% (13,674) of the Aclara SmartMeters 9 installed by PG&E are expected to have "poor read performance."
>
> • Based on "issues related to Aclara electric meter performance PG&E had to "contain" its deployment of Aclara meters at 145,000.
> • Deployment delays due to Silver Spring Network's inability to provide a consistent supply of SmartMeters.
> • "production performance problems" with Silver Spring Networks SmartMeters related to "[a]bility to read" the meters.
> • PG&E skipped approximately 12,000 meter installations between March 31 and May 20, 2009 based on interference with ground field interrupters ("GFI"). In buildings where a OFI is placed next to a Silver Spring Networks meter panel, PG&E determined that the SmartMeters could trip the GFI.
> • Silver Spring Networks found a problem with a component that could cause its meters to stop working. PG&E placed a "hold" on installing 340,000 meters that could be affected by this problem. As of March 2010, only 50,000 meters were removed from "hold" status. "
>
> City And County Of San Francisco's Petition To Modify Decision 09-03-026 To Temporarily Suspend PG&E's Installation Of Smart Meters, A.07-12-009, June 2010, p. 6.7

Criminal negligence is basically analogous to an "I don't care what happens" type of attitude. …Criminal negligence requires more than merely a mistake in judgment, inattention, or simple carelessness. It only pertains to conduct that is so outrageous and reckless that it marks a clear departure from the way an ordinary careful person would act under similar circumstances.

Fiscal impacts
Costs to residents forced out of homes
Property loss -- takings – loss of use of home
Costs to residents who become ill – medical expenses, shielding costs, damage to health, long-term costs
Death
Emotional harm
Fires, electrical wiring, appliance and electronic damage
Loss of wages
Unemployment costs
Cost of Smart appliances and devices
Environmental damage
Loss of bees
Increasing provincial/taxpayer liability for impacts from program not halted
Future costs of downed grid, locally, regionally, throughout the province, or the region
Grid blackout
Costs of Smart Meter/Smart Grid program through rates

The complicated communication and data management systems & new interfaces with the existing billing system are not subject to errors. While testing of smart meter generally pass using averaged data, they tend to fail at a manufacturer's specification at 50°C – a potential circumstance – as noted by Ontario Office of the Fire Marshall, and a factor in the conflagration in downtown Calgary due to underground installations that closed the financial hub for several days. Tolerances can vary between Boards, utilities and manufacturers. In California, for example, the "CPUC tolerances" are 2%, whereas PG&E tolerances for digital meters are .5%, and the manufacturer's tolerances are .2%.

Palo Alto (a municipal utility district) decided after 3 years of research not to install Smart Meters because the costs would exceed benefits, and the benefits are minimal. They had also been monitoring the problems and complaints with Smart Meters.

PRIVACY INVASION

Consumer profiling

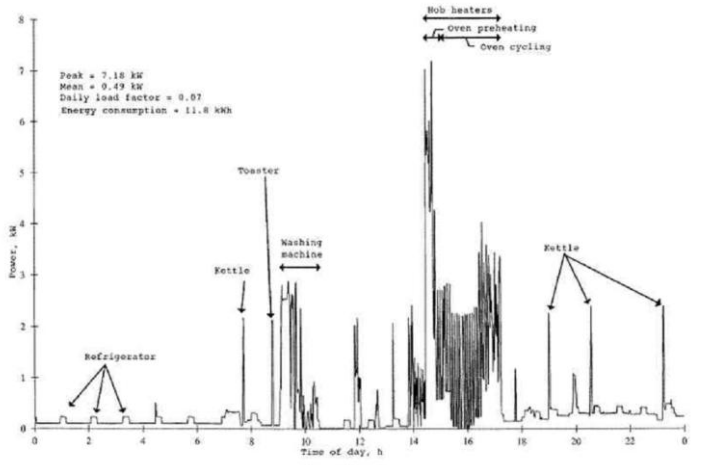


Image: National Institute of Standards and Technology

UTILITIES Power and Energy Surety in a Telecoms Sector Increasingly Vulnerable to Market Failure The foundation of U.S. wire line telecommunications is increasingly at risk of failure even as our reliance on digital networking continues to grow and government leaders strive to enact policies and programs that prove effective in providing affordable, reliable broadband information and communications services access to all. As highlighted in parts one and two LINKS of this three-part series, mid-tier telecoms carriers are proving particularly vulnerable amid the confluence of digital technology-fueled market disruption, industry consolidation and the inability of regulatory authorities to institute effective rules and guidance.

Owner-operators of the copper and fiber wires, central switching offices and network infrastructure that serve as the foundation for all wireless and wire line information and communications, mid-tier carriers are, or have been, the providers, at times the sole providers of telecommunications services in rural towns and small cities throughout the U.S. Yet they are not explicitly required to acquire the emergency, back-up power and energy capacity needed to ensure that these crucial information and communications assets will function when power outages or catastrophes occur. ... Mangum believes permitting power utilities to provide emergency, back-up power for telecommunications network operators, and recouping associated capital expenditures by adding them to their customer rate bases, is an increasingly viable solution. http://www.energycentral.com/c/iu/power-and-energy-surety-telecoms-sector-increasingly-vulnerable-market-failure/

Table II
PG&E SmartMeterTM Program Enabled Energy Conservation Programs
Subscription Statistics
December 31, 2011

		Energy Savings (MWh)		Demand Reduction (MW)		
Program	Service Accounts	Energy Savings	Financial Benefits (thousands)	Load Impacts (MWs)	Financial Benefits (thousands)	Total Financial Benefits (thousands)
Energy Conservation						
Customer Web Presentment	199,833	1,917	$94	0	$0	$0
Home Area Network	0	0	$0	0	$0	$0
Energy Alerts	73,261	0	$0	0	$0	$0
Total	243,432*	1,917	$94	0	$0	$0

* 29,662 customers were dually enrolled in CWP and EA; there were 243,432 unique service accounts

PG&E 2011 Program Year SmartMeter™ Program Enabled Demand Response and Energy Conservation Annual Report, 4-30-12, p. 21

The financial benefits for 2011 were $94,000 divided by 199,833 enrolled customers. Each customer saved 47 cents for the entire year. The energy savings per customer was .0096 MWh or 9.6 kWh for the entire year.

In contrast,

Utilizing power strips, unplugging electronics and small appliances not in use	Savings: 300 kWh/yr
Utilizing a variety of energy savings measures	Savings: 1,712 kWh/yr (average single family home)

Source: Pacific Gas & Electric, "Path to your Energy Savings", 11-04-09

9.6 kWh per year versus 300 kWh per year – that's a big difference.

UK National Audit Office (June 2011)

> The costs of the UK Government's plans to rollout smart meters to the country's homes and businesses could escalate while providing little saving, warns the National Audit Office (NAO).
>
> The report warns that the benefits are far from certain and there is limited evidence that consumers' behaviour would be permanently changed.
>
> http://www.energyefficiencynews.com/i/4225/

Smart Grid News (September 2011)

> "Illinois Gov. Pat Quinn, citing an excessive financial burden on consumers, "sweetheart deals" and no guarantees of improved service, knocked down legislation that would have paid for the widespread installation of smart meters and other electric grid improvements." His veto was overridden by the legislature.

Barbara Alexander, ”Smart Regulatory Approach For Smart Grid Investments”:

- Federal policies are not mandatory; states have discretion about adopting any PURPA policies, including Smart Grid policies in the Energy Policy Acts of 2005 and 2007
- Rate impacts (AMI costs alone in CA over $3 B; $200-400/meter is typical)
- Technology obsolescence
- Almost 50% of residential customers have very low price elasticities (less than -0.10); half will make very little usage changes
- YET all must pay for program; TURN found that 60% of customers who use less than 6,000 kWh annually would have to shift more than half their peak load to see bill savings when costs of AMI taken into account
- TURN concluded that only a relatively small group of high usage residential customers can realistically shift sufficient peak load to find bill savings.
- PUGET SOUND ENERGY: Mandatory TOU prices for all residential customers abandoned in 2002 when analysis showed negative cost benefit and higher, not lower, customer bills
- Customers with most adverse bill impacts: multi-family and mobile homes
- MAINE: Mandatory TOU prices for high use electricity customers made voluntary with onset of restructuring and widespread customer dissatisfaction in face of higher electricity prices
- Elderly customers in newly built multi-unit condos and senior and low income housing complexes most adversely affected and without alternative options
- NEW YORK: Previous efforts to push for Time of Use pricing resulted in state law that prohibits such time-based pricing except as voluntary options.

COSTS EXCEED BENEFITS

There is little to no benefit for the consumer, with debatable energy savings; thus the costs exceed any possible benefits.

Connecticut Attorney General George Jepson (February 2011):

> “(Connecticut Light & Power’s) proposal would force the company’s ratepayers to spend at least $500 million on new meters that are likely to provide few benefits in return,

> "The pilot results showed no beneficial impact on total energy usage. And, the savings that were seen in the pilot were limited to certain types of customers and would be far outweighed by the cost of installing the new meter systems,"

John Rowe, CEO of Exelon, parent company of Illinois utility company Commonwealth Edison, recently said of the smart grid:

> "… it costs too much, and we're not sure what good it will do. We have looked at most of the elements of smart grid for 20 years and we have never been able to come up with estimates that make it pay." (quoted by AG Madigan)

Illinois Attorney General Lisa Madigan (June 2011):

> "The utilities want to experiment with expensive and unproven smart grid technology, yet all the risk for this experiment will lie with consumers.
>
> The $63 million smart grid pilot program consumers are currently paying for has turned in disappointing results that reinforce what Rowe already knows. On hot summer days, people continue to run their air conditioners no matter how much information they have from their smart meter.
>
> Consumers don't need to be forced to pay billions for so-called smart technology to know how to reduce their utility bills. We know to turn down the heat or air conditioning and shut off the lights. The utilities have shown no evidence of billions of dollars in benefits to consumers from these new meters, but they have shown they know how to profit.
>
> I think the only real question is: How dumb do they think we are?"

Michigan Attorney General Bill Schuette (April 2012)

> …at least two very substantial issues remain that must be further addressed before the MPSC (Michigan Public Service Commission) authorizes or approves any further deployment of smart meters by Michigan electric utilities and the recovery from ratepayers of the costs of smart meter deployment. First, there must be a sufficient demonstration that implementation of the smart meter programs will actually produce a net economic benefit to customers. Second, customers must be afforded a meaningful and fair opportunity to opt out of smart meter installation without being penalized by unwarranted and excessive costs.
>
> A net economic benefit to electric utility ratepayers from Detroit Edison's and Consumers smart meter programs has yet to be established. In the absence of such demonstrated benefit, the Attorney General has opposed, and will oppose any Commission action that unjustly and unreasonably imposes the costs of such

programs upon ratepayers. To a significant extent, the asserted potential benefits to utility customers depend upon assumptions that a customer will consider additional "real time" data on electricity usage provided by smart meters, and adjust their electrical consumption to achieve cost savings under variable pricing programs that do not yet exist. (See Edison, Document No. 0146, p 5; and Consumers, Document No. 0148, pp. 6-7). Any assumption that large numbers of residential customers will have the time, ability and motivation to attend to, and act upon daily or even hourly changes in their electrical is questionable.

Comments, Michigan Public Service Commission Case No. U-17000, p. 3-4

What the record does reveal is that AMI is a pilot program that even Robert Ozar, Manager of the Energy Efficiency Section in the Electric Reliability Division of the PSC, concedes "is as yet commercially untested and highly capital intensive, resulting in the potential for significant economic risk and substantial rate impact." At best, the actual evidence presented by Detroit Edison to support the rate increase was aspirational testimony describing the AMI program in optimistic, but speculative terms. *What the record sadly lacks is a discussion of competing considerations regarding the program or the necessity of the program and its costs as related to any net benefit to customers.*

Michigan Court of Appeals Nos. 296374, 296379, slip opinion, pp. 7-9, April 10, 2012
Cited in Attorney General Comments, Case No. U-17000, p. 4-5

Division of Ratepayer Advocates, March 2012:

Executive Summary:
Key Findings presented in Section V of this report include:

- According to SCE's AMI business case, the total cost to customers will be greater than $5 billion, rather than the $1.6 billion cost explicitly approved by the CPUC, which only included nominal deployment costs;

- Many forecasted benefits have been delayed or reduced, which <u>erases</u> the projected margin of net benefits as calculated in SCE's business case [see below];

- SmartConnect-related costs not anticipated in SCE's original business case have already been approved by the CPUC in other proceedings, beyond the over $5 billion cost referenced above. In many cases, these costs were approved without a showing of incremental benefits, and DRA anticipates that more will be requested;

- SmartConnect features such as remote disconnect and SmartConnect-enabled time-varying rates have a high potential for adverse impacts for low-income and other "at-risk" customers… (p. 2)

…The failure to address and resolve questions about the benefits of smart metering and dynamic pricing versus the risks noted by consumer advocates has led such organizations to view smart metering propositions with mistrust. (p. 4-6)

Conclusion
The policy solutions developed concerning the issues raised in this RFI will have a profound impact on residential consumers, and low-income and fixed-income seniors in particular. It is unfortunate that many continue to inappropriately lump smart grid and smart meters together in a way that fails to address the consumer protections that are necessary in a transition to smart meters. As outlined in the attached paper, the adoption of smart meters should be carefully examined and considered in light of key concerns and, where implemented, should be accompanied by several essential consumer protections. (p. 10-11)

Comments to Department of Energy Smart Grid RFI: Addressing Policy and Logistical Challenges, November 1, 2010
http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/AARPNCLCPublic_CitizenCommentsDOE1101.pdf
Cited in
https://sites.google.com/site/nocelltowerinourneighborhood/home/wireless-smart-meter-concerns/going-deep-understanding-the-big-picture-and-real-costs-and-concerns

The "attached paper" mentioned above is the report:

The Need For Essential Consumer Protections: Smart Metering Proposals And The Move To Time-Based Pricing, August 2010
www.nclc.org/images/pdf/energy_utility_telecom/additional_resources/adv_meter_protection_report.pdf

SCE was the last electric IOU to file an AMI application (2007). At the time that PG&E and SDG&E submitted their applications (2005), SCE's business case analysis, including multiple scenarios, showed that AMI deployment was not a cost-effective endeavor. Two of its scenario analyses showed a Present Value Revenue Requirement (PVRR), largely due to the added Demand Response from large customers that already had interval meters. SCE stated that "the technology envisioned by the Ruling is unproven and commercially unavailable at this time." (p. 7-8)

…SmartConnect was adopted based on an estimate of $9.2 *million* in net benefits on a PVRR [Present Value Revenue Requirement) basis owing to the time-discounted value of money… (p. 10)

Conclusion:
The CPUC required California's large IOUs to file AMI applications and required a demonstration that AMI systems *could* produce net customer benefits. Initially, SCE found that AMI was *not* cost-effective for its customers, but AMI technological developments in 2005 and 2006 led to the SmartConnect application in 2007, which forecasted a very slim margin of lifetime net benefits on a present value basis. The CPUC authorized SmartConnect deployment costs of $1.634 billion, and SCE customers in aggregate have so far experienced a revenue requirement increase in excess of $193.1 million to cover these costs. This is a real cost increase, one which will certainly rise as more meters are purchased and deployed, and as SCE begins to incur post-deployment costs.

…Total SmartConnect costs paid by customers will actually be more than $5 billion (nominally), accounting for post-deployment costs and the financing costs incurred over the 20 years life of the SmartConnect system. This total cost will be even greater if the cost of future AMI-enabled investments and programs are included. While SCE's incremental cost requests have thus far been relatively conservative, it is important to note that PG&E and SDG&E have so far requested much higher amounts in incremental AMI funding: PG&E has requested and received approval for funding in excess of $500 million, and SDG&E has received funding approval for over $93 million. (p. 50)

Case Study of Smart Meter System Deployment: Recommendations for Ensuring Taxpayer Benefits; Hieta, Kao, Roberts

AARP, National Consumer Law Center, and Public Citizen:

...past experience with time of use rates cautions that initial interest in such rates tapers over time. In addition, the low take-rate in the PG&E service territory over the last two years does not bode well for the popularity of critical peak pricing.

...Studies to date attempting to show that low-income customers will benefit do not demonstrate that such will be the case.

- Many utilities offer Time of Use rate options to residential customers using interval meters; little customer interest
- RESTRUCTURING STATES: Most abandoned mandatory TOU and other rate design structures associated with generation supply management and assumed that the competitive market would provide such products.
- Utilities typically couple smart metering with the functionality of remote connection and disconnection of the meter; CA results document significant increase in volume of disconnections with AMI; elimination of premise visit increases risk of wrongful or disputed disconnection; health and safety risks
- These new meters may give rise to a host of degraded service options, e.g., prepayment (pay in advance and automatically disconnect when meter is not fed); service limiters
- Dynamic pricing does not "empower" customers; it presents a Hobson's Choice to many low use, low income, and elderly customers who must use electricity during peak hours for health and safety reasons (Chicago heat wave; over 700 deaths, mostly seniors living alone)
- A voluntary approach to dynamic pricing or relying on Peak Time Rebates is preferred approach; PTR has been successfully demonstrated to result is peak load reduction without TOU or CPP
- Smart Grid and smart metering must not be used as a means to impose dramatic changes in retail rate design for residential customers
    - Dynamic and time-based price programs must remain optional on an "opt in" basis
    - Rewards in the form of credits for peak usage reduction should be the preferred approach

      Presentation, July 15, 2010, 2010 National Energy and Utility Affordability Conference

      http://www.energyandutilityconference.org/Assets/2010%20Conference/2010%20Presentations/Plenary%201_Alexander.pdf

      As summarized in

https://sites.google.com/site/nocelltowerinourneighborhood/home/wireless-smart-meter-concerns/going-deep-understanding-the-big-picture-and-real-costs-and-concerns