

**Comments of the Berkshire Litchfield Environmental Council
Re: MA DPU 21-80, 21-81, 21-82; MA DPU 21-90, 21-91, 21-92 (MA DPU 20-69)**

Updated Sept 9, 2021 from January 15, 2014

**Written Comments To:
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**Re: Docket number D.P.U. 12-76, updated for MA DPU 21-80, 21-81, 21-82, MA DPU 21-90,
21-91, 21-92**

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Introduction:

The Berkshire-Litchfield Environmental Council is a 501 (3)(c) non-profit organization that focuses on environmental issues affecting the Northwest Corner of Connecticut and the Berkshires region of Massachusetts. BLEC addresses diverse environmental subjects, such as a proposed/failed hydroelectric pumped storage power plant, water and air contamination, land preservation, zoning controls, vernal pools protection, the environmental effects of radio frequency radiation associated with the siting of telecommunications infrastructure as well as the 'smart' grid, and industrial-scale wind turbines. Our focus is historically on the environmental effects of infrastructure. Founded in 1970, BLEC holds educational forums on emerging

environmental issues with speakers from federal agencies and researchers from around the world.

BLEC President, Starling W. Childs, is a former lecturer at the Yale School of Forestry and President of EECOS Inc. Environmental Consultants — a land-use planning/scientific assessment consultancy specializing in innovative farm and forest management and creative development designs.

BLEC Communications Director, B. Blake Levitt, is a decades-long member of the science press, former *New York Times* contributor, and award winning author of two books on the health and environmental effects of nonionizing radiation,¹ which includes the radiofrequencies of the electromagnetic spectrum used in smart grid/metering as the systems are currently designed. She has written on the smart grid for *Resilience* in 2011.²

With a focus on infrastructure, BLEC is uniquely qualified to address the Massachusetts Department of Public Utilities (DPU) on smart grid/meters.

BLEC submitted testimony to the MA DPU in 2014 in opposition to smart meter deployment. We submit below an updated version of our previous testimony for the subsequent grid modernization dockets 21-80, 21-81, and 21-82; and electric vehicle dockets 21-90, 21-91, 21-92.

Executive Summary: The Smart Grid is Not ‘Smart,’ Not Safe, and Not Green.

There are key areas that remain unaddressed in the current MA grid modernization decisions.

The Smart Grid is not ‘smart,’ not safe and not green, despite its laudatory goals of upgrading the ageing utility grid; saving energy via tiered pricing and real-time energy-use knowledge by consumers; and assisting with the buildout of more renewable energy sources.

The smart grid/metering system, as currently designed, stands to accomplish the exact opposite of those goals, as well as introduce new problems into the grid, as well as customer’s lives, that do not currently exist with the old grid — problems that far outweigh the hypothetical benefits. It makes no sense to institute a fully actualized smart grid until key issues are first resolved, or the potential for unintended consequences are better delineated.

The DPU’s 2013 “Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid,” — also called the “Straw Proposal” — placed adoption of the smart grid, advanced meter infrastructure (AMI), and time-of-use/tiered pricing business models as cornerstones to the utility upgrade.

¹ *Electromagnetic Fields, A Consumer’s Guide to the Issues and How to Protect Ourselves*, by B. Blake Levitt, first edition, Harcourt Brace, 1996, second edition, iUniverse, 2011; and editor of *Cell Towers – Wireless Convenience? or Environmental Hazard? Proceedings of the “Cell Towers Forum, State of the Science/State of the Law”*, first edition, Safe Goods/New Century Publishing, 2001, second edition, iUniverse 2010.

² *The Problems with Smart Grids*, B. Blake Levitt and Chellis Glendinning, Resilience, 2011
<https://www.resilience.org/resilience-author/b-blake-levitt/>

MA DPU 20-69 now mandates AMI functionality for the three investor owned utilities.

However, other grid upgrade design options are available that would accomplish many of the same goals without risks to health/environment, unfair pricing to vulnerable segments of the population, and risks to privacy and cyber security. It is bewildering to see Massachusetts — among the most progressive states in the country and one known for doing its homework before setting policy recommendations in motion — go in this direction. There is overwhelming resistance regarding smart grid/metering, as well as a reexamination of the intelligence of the entire smart grid concept by think-tanks and key agencies at the federal level. Massachusetts has an important opportunity to learn from this. The Straw Proposal and subsequent MA DPU 21-69 order takes the state in the wrong direction by endorsing smart grid/metering that has problems so systemic that they may not be fixable, according to the U.S. Government Accountability Office.³

The smart grid as currently designed is increasingly understood as an over-engineered, ill-advised, financial boondoggle at taxpayer expense, capable of endangering the security of the entire national grid, violating constitutional privacy protections and endangering public health. In addition, the smart grid/metering has not been found to save energy when all the new variables in the system are factored in. Plus, time-of-use pricing is largely punitive to those who can least afford it. Time-of-use-pricing is fundamentally a Wall Street model designed to maintain shareholder profits as we transition to more energy efficient models that will reduce demand. DPU appears not to understand that the smart grid takes us in the direction of more centralized utilities when a big thrust in environmental circles is toward less centralized facilities as the best way to address utilizing local renewable energy sources and faster response times when the power goes out.

MA DPU 20-69, which specifies AMI as the technology choice for investor-owned utilities, does not address any of the concerns expressed by independent think tanks, health and environmental experts, or informed consumers.

1. Not ‘Smart’

A report called “*Getting Smarter About the Smart Grid*”⁴ was published in 2012 by the National Institute for Science, Law and Public Policy in Washington, D.C. Written by smart grid technology expert, Timothy Schoechle, Ph.D., the report says billions of taxpayer dollars have been misspent by the federal government in subsidizing new smart meters. The report further notes that investment in technologies that would facilitate integration of renewable energy technologies and distributed (or local) power generation, as well as offer real-time in-home energy management capability, have languished, while subsidies for smart meters, that do not

³ *Cybersecurity – Challenges in Securing the Modernized Electricity Grid*, Testimony Before the Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, Statement of Gregory C. Wilshusen, Director Information Security Issues and David C. Trimble, Director Natural Resources and Environment, February 28, 2012.

⁴ *Getting Smarter About the Smart Grid*, by Timothy Schoechle, PhD., National Institute for Science, Law and Public Policy, Washington, D.C., 2012.

http://www.gettingsmarteraboutthesmartgrid.org/pdf/SmartGrid_Report_PDF-2012-11-26-Final.pdf

contribute to energy management efficiency or sustainability, have wasted enormous sums with taxpayer dollars. The report also notes that smart meters do not take us forward toward sustainability and that the only parties who benefit from the new meters are the utilities and meter companies, which include GE, Itron, Elster, Landis+Gry, Oncor and others. Most meters are made in China and do not increase manufacturing jobs in the US.

Some quotes from the report:

- “The meters also do not stimulate the economy, but do cut jobs. Their large-scale rapid deployment, benefiting utility and meter company stocks, conceals the reality that today’s utility business model is broken, being propped up by these market distortions, and may require a government bailout to truly embrace renewable energies in America.”
- "In reality, these meters and their dedicated networks are primarily for the benefit of utilities, reducing their operating costs and increasing profits by firing meter readers — ironically with federal stimulus funds — while doing essentially nothing to advance what should be the real goal of the smart grid: balancing supply and demand and integrating more renewable sources. Instead, the meter networks squander vast sums of money, create enormous risks to privacy and security, introduce known and still unknown possible risks to public health, and sour the public on the true promise of the smart grid.”
- "The present policy approach to electricity infrastructure in the United States depicted in the report, *Policy Framework for the 21st Century: Enabling Our Secure Energy Future*, issued by the National Science and Technology Council (NSTC) of the Executive Office of the President, evidences a fundamental lack of understanding of the problems associated with the future of electricity and energy.”
- "There are inherent conflicts in the monopoly utility business model preventing the nation from moving to a renewable energy economy, and utilities may eventually require a government bailout.”
- "Because Investor-Owned Utilities (IOUs) are paid on a per-kilowatt-of-energy-sold basis, and also receive a guaranteed rate-of-return (ROR) on assets, they do not have a financial incentive to encourage less energy usage, or to invest in technologies that would help citizens reduce energy consumption.”
- "Investors in utilities gain from the smart meter deployment, as they would from any other capital expenditure, while there is no clear gain and significant new risks (financial, privacy, security, health and safety, and cost) for the ratepayer and consumer.”
- "We must stop subsidizing a centralized, wasteful infrastructure approach that will not lead to sustainability and that puts the nation at long-term global economic disadvantage."

DPU’s Straw Proposal addresses none of these concerns, nor does MA DPU 20-69, which has spawned MA DPU 21-80, 21-81, and 21-82, and MA DPU 21-90, 21-91, and 21-92.

2. How the Smart Grid Works:

A glaring hole in the 2013 Straw Proposal and in the grid modernization order 20-69 is that they do not go into detail about how the smart grid actually functions, the legitimate health

concerns associated with it (other than mild industry-friendly reassurances), environmental impacts, how easy it is to hack, or how unreliable wireless systems inherently are. Nor does the modernization order include accurate information about problems that have arisen in other states that have deployed smart meters.

The smart grid is a 2-way communications system that will eventually turn all of our appliances into radiofrequency radiation (RF) transceivers just like cell phones, capable of being controlled remotely by us and the utility companies. That's every washer, dryer, refrigerator, freezer, computer, printer, fax, coffee maker, stove, oven, furnace, air conditioner, and on and on — all turned into constant RF-emitting cell-phone like devices, transmitting RF in the 900 MHz — 3 GHz range of the electromagnetic spectrum, 24/7. The average home has at least 15 appliances. This is an involuntary ambient exposure that does not now exist and no government regulatory agency regulates for cumulative background exposures such as this.

The smart grid is a large-scale system being forced on citizens at a time when the International Agency for Research on Cancer (IARC), which is part of the World Health Organization, has classified RF in these frequencies as a 2B (possible) carcinogen⁵ along with formaldehyde, lead, DDT and exhaust fumes.

New appliances are already being equipped with internal antennas that cannot be deactivated without voiding warranties, even when people do not want such exposures. All of these indoor transmitters communicate with smart meters attached to the outside of homes and businesses, which will, in turn, transmit utility usage information several times a day, and sometimes several times a minute, to a new centralized hub like a cell tower or newly installed equipment on distribution poles throughout neighborhoods. Peak power bursts of RF when a device first transmits have been measured in excess of federal guidelines. These are unsafe, involuntary exposures, especially to the elderly, the infirm, pregnant women and children. In fact many people, once they understand how the smart grid actually works as illustrated below, do not want it. The smart grid was envisioned, created, and is now being enacted — with virtually no public buy-in.

The below illustration is taken from a report by Richard A. Tell for Hydro One in Canada. It shows how the wireless smart grid works, creating and bouncing radiofrequency signals from appliances to meters to houses to hubs in a “mesh” network.⁶ As should be obvious, it is a far more complex and vulnerable system than what currently exists.

⁵ http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

⁶ An Analysis of Radiofrequency Fields Associated with Operation of the Hydro One Smart Meter System, October 28, 2008, prepared for Hydro One Networks Inc., Toronto, Ontario M5G 2P5, by Richard A. Tell, Richard Tell Associates, ManyInc., Colville, WA 99114-9352

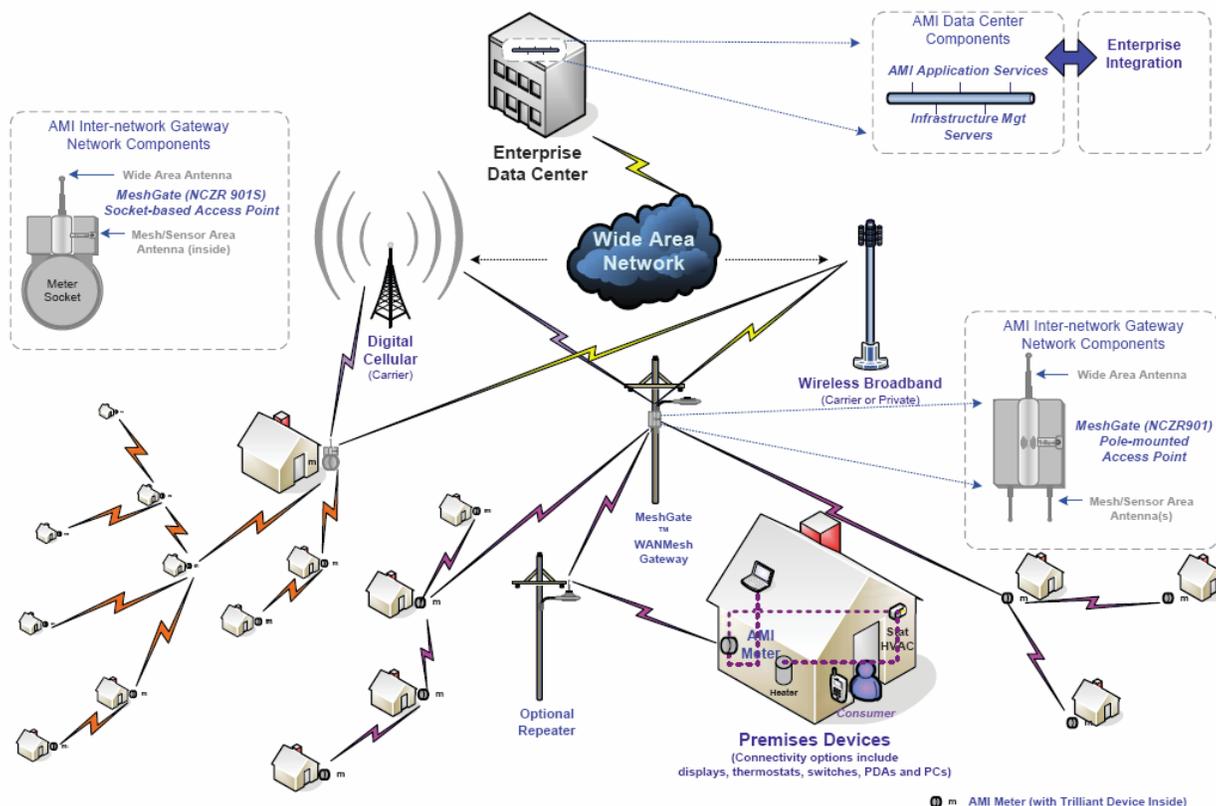


Figure 1. Illustration of components of the Hydro One Smart Meter system showing the use of radiofrequency (RF) signals for communications among electric power meters, relays, access points and, ultimately, Hydro One's enterprise management systems. (From Trilliant Networks' sales literature).

Many state utility companies within the past decade replaced the old mechanical analog meters with a first generation advanced metering model (AMR) that has an RF component. The first generation meters store usage data until it is called for by a van that passes through a neighborhood. As such, it is supposed to only transmit once a month. However, some first generation AMR meter models, like those used throughout New York State, transmit signals constantly but a van is still required to collect the data. Massachusetts' first generation AMR meters also transmit continuously in both Eversource and NGrid territories, regardless of how often the utility reads the data. These are more dangerous meters from a health standpoint as it is the frequency of signal transmission, not the usage data collection schedule, that is the biologically active component. Ratepayers and communities were never informed of the increase in ambient exposures. Some customers have belatedly discovered that the meters impacted their health deleteriously. Because ratepayers and their health care providers were not informed about the functionality of the meters, due to lack of informed consent, no assumptions can be made about the safety of the AMR meters currently in service.

In some locations with already high ambient RF backgrounds — such as industrial areas — metering can be done via landline phone networks with a modulated signal placed on the phone line, typically once a day.

The second generation of advanced metering infrastructure, called AMI, is the smart meter system. It transmits signals at a minimum of several times a day and at a maximum several times a minute. As seen in the illustration above, signals in the mesh network are designed to bounce from house to house. The final collector meter on the last house on the network fires constantly and can transmit usage data for between 500 and 5,000 dwellings, creating strong RF exposures that may exceed FCC guidelines. Apartments and office buildings where multiple meters are congregated together have significant exposures. No van or meter reader is required. It is a completely wireless network.

3. Health Concerns are Real: Problems at the FCC

That there are potential adverse health and environmental effects from nonionizing radiation has been known since the advent of radar used in WW2 aboard U.S. ships when cataracts, numerous cancers and infertility were observed in U.S. Navy midshipmen and radar technicians. Since that time, and especially within the last 20-to-25 years, the use of wireless technologies has exploded — all without a clear understanding of the biological implications and without adequate regulatory controls. Ambient nonionizing radiation exposures are the fastest growing environmental exposures today. In fact, it has become a hidden variable in all research.

The Federal Communications Commission (FCC) has standards in place but they only regulate for acute, short term, high-intensity exposures capable of heating tissue the way a microwave oven cooks food. Although safety margins are built into the standards, **any biological effects below that thermal threshold are simply unregulated.** In addition, the FCC categorically excludes from review any device or application that falls below a certain power density threshold which most wireless products, including smart meters, do. That means that **there is no true regulatory oversight for just about all of the wireless products in use today with the exception of cell phones** which have to meet a threshold for a specific absorption rate of energy deposited in tissue.

In 2013, the FCC began reviewing the adequacy of cell phone and RF exposure limits and closed the docket in 2019 after receiving hundreds of comments, many requesting that the agency adopt more biologically accurate standards based on updated science. Many commented that the acute onset of electromagnetic hypersensitivity was associated with the installation of a wireless utility meter, some with quite sudden onset traced back to meter installation. On September 4, 2020, Researcher Beatrice Golomb testified to the MA DPU:

“I am opposed to the MA DPU conducting a targeted smart meter/time of use billing pilot for EV customers. According to a survey we conducted, smart meters were the single most common "trigger" for people newly developing intolerance to nonionizing radiation (i.e., for developing "electrosensitivity"). These findings comport with findings by others...”

Instead, FCC chose to re-affirm its obsolete 1996 standards⁷ and law suits followed. A recent court ruling against the FCC noted that agency's failure to provide an adequate rationale for its actions, and remanded the ruling back to FCC with a serious slap on the wrist when it wrote:

“...we find the Commission’s order **arbitrary and capricious** in its failure to respond to record evidence that exposure to RF radiation at levels below the Commission’s current limits may cause negative health effects unrelated to cancer. That failure undermines the Commission’s conclusions regarding the adequacy of its **testing procedures**, particularly as they relate to **children, and its conclusions regarding the implications of long-term exposure to RF radiation, exposure to RF pulsation or modulation, and the implications of technological developments that have occurred since 1996**, all of which depend on the premise that exposure to RF radiation at levels below its current limits causes no negative health effects. Accordingly, we find those conclusions arbitrary and capricious as well. Finally, we find the Commission’s order arbitrary and capricious in its complete failure to respond to comments concerning environmental harm caused by RF radiation.”⁸ (Emphasis added).

While the court did not try to arbitrate the science behind the standards, this ruling should give any regulatory authority serious pause in assuming safety for wireless devices until this is further settled at the federal level. There is credible reason for concern that has been established in decades of robust peer reviewed literature (see Table below) at exposures significantly below the FCC’s standards and certainly within exposures created by smart meters.

One primary criticism of how the FCC functions is that they time-average exposures rather than regulate for peak exposure, which is the most important biological metric. Smart meters, for instance, during the duty cycle, put out a peak burst of RF that has been found to exceed FCC limits by orders of magnitude. Yet that peak is averaged away into the duty cycle’s lower exposures and essentially disappears into what is deemed “safe.” That is like saying that a bullet passing through flesh is “safe” because it comes out the other side and moves more slowly by the time it passes through bone, blood and tissue. The FCC standards are based on a dose-metry model of how to make communications systems work with the least amount of transmitted power necessary, not on true biological models regarding the consequences to living systems in the path of technology.

In addition, the FCC standards — or indeed any state or federal regulatory entity — do not regulate for cumulative exposures from myriad sources all functioning together. RF power

⁷ U.S. FCC 2020. U.S. Federal Communications Commission 2020. Human Exposure to Radiofrequency Electromagnetic Fields and Reassessment of FCC Radiofrequency Exposure Limits and Policies. A Rule by the Federal Communications Commission on 04/01/2020 Published in: The Federal Register <https://www.federalregister.gov/documents/2020/04/01/2020-02745/human-exposure-to-radiofrequency-electromagnetic-fields-and-reassessment-of-fcc-radiofrequency>

⁸ Env't Health Tr. v. Fed. Comm'ns Comm'n, No. 20-1025, 2021 WL 3573769, at *1 (D.C. Cir. Aug. 13, 2021). [https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf)

density and categorical exclusion are considered one product at a time. The smart grid/metering mesh network will add a whole new layer of ambient RF exposure that does not now exist.

It is the unregulated, long-term, low-level, chronic exposures that are increasing exponentially today from all manner of wireless devices, such as cell phones, wifi, cordless domestic phones, myriad screen ‘apps,’ wireless security systems, baby monitors, and now smart grid/meters. Add to this ambient exposures from all of the infrastructure, such as cell towers and innumerable antenna arrays to support 2-through- 4G LTE, and now the 5G network creating ubiquitous internet connectivity and it is easy to understand why many governments and health agencies outside the U.S. are calling for a precautionary approach before further buildout.

What’s more, man-made radiation creates very different kinds of exposures — with unusual signaling characteristics like digital pulsing, phased array, and saw-tooth waveforms, and at much higher power intensities than anything found in nature. RF is actually a form of energetic air pollution. Myriad species are known to be fantastically sensitive to low-level energy and may be affected by these increasing background levels.⁹ No federal or state agency has standards to protect wildlife from RF — all standards are written for human exposure. That some individual smart meters conform to FCC standards, as noted in the MA Straw Proposal and Grid Modernization plan, should assure no one of safety.

4. What the Studies Show:

The information below is from a Table of what was submitted to the MA DPU in 2014 from a 2010 paper by Levitt and Lai¹⁰ of biological effects at extremely low intensities comparable to smart grid/metering. For an updated Table see Supplement 3 in Levitt BB, Lai HC, Manville AM. *Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: how species interact with natural and man-made EMF*.¹¹ These exposures cannot be considered biologically insignificant. Scores of studies have found otherwise, despite industry assurances.

⁹ Levitt BB, Lai HC, Manville AM. *Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient EMF levels in the environment*. Rev Environ Health. 2021 May 27. doi: 10.1515/reveh-2021-0026. Epub ahead of print. PMID: 34047144. <https://pubmed.ncbi.nlm.nih.gov/34047144/>

¹⁰ Levitt BB, Lai,H. *Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays*. Environ. Rev. **18**: 369–395 (2010) doi:10.1139/A10-018 Published by NRC Research Press.

¹¹ Levitt BB, Lai HC, Manville AM. *Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: how species interact with natural and man-made EMF*. Rev Environ Health. 2021 Jul 8. doi: 10.1515/reveh-2021-0050. Epub ahead of print. PMID: 34243228. <https://pubmed.ncbi.nlm.nih.gov/34243228/>

Table I.

A list of studies reporting biological effects at low intensities of RFR. These papers gave either SAR (W/kg) or power density ($\mu\text{W}/\text{cm}^2$) of exposure.

		SAR (W/kg)	Power density ($\mu\text{W}/\text{cm}^2$)	Effects reported
Belyaev et al. (2005) (in vitro)	915 MHz, GSM 24 & 48 hr	0.037		Genetic changes in human white blood cells
Belyaev et al. (2009) (in vitro)	915 MHz, 1947 MHz GSM, UMTS 24 & 72 hr	0.037		DNA repair mechanism in human white blood cells
Blackman et al. (1980) (in vitro)	50 MHz, AM at 16 Hz	0.0014		Calcium in forebrain of chickens
Boscol et al. (2001) (in vivo) (human whole body)	500 KHz-3 GHz, TV broadcast		0.5	Immunological system in women
Campisi et al. (2010) (in vitro)	900 MHz, CW or 50-Hz AM, 14 days, 5, 10, 20 min per day, CW- no effect		26	DNA damage in human glial cells
Capri et al. (2004) (in vitro)	900 MHz, GSM 1 hr/day, 3 days	0.07		A slight decrease in cell proliferation when human immune cells were stimulated with mitogen and a slight increase in the number of cells with altered distribution of phosphatidylserine across the membrane.
Chiang et al. (1989) (in vivo) (human whole body)	People lived close to AM radio and radar installations for more than one year		10	People lived and worked near AM radio antennae and radar installations showed deficits in psychological and short-term memory tests.
De Pomerai et al. (2003) (in vitro)	1 GHz 24 & 48 hr	0.015		Protein damages
D'Inzeo et al. (1988) (in vitro)	10.75 GHz CW 30-120 sec	0.008		Operation of acetylcholine-related ion-channels in cells. These channels play important roles in physiological and behavioral functions.
Dutta et al. (1984) (in vitro)	915 MHz, sinusoidal AM at 16 Hz	0.05		Increase in calcium efflux in brain cancer cells.
Dutta et al. (1989) (in vitro)	147 MHz, sinusoidal AM at 16 Hz 30 min	0.005		Increase in calcium efflux in brain cancer cells.
Fesenko et al. (1999) (in vivo) (mouse- wavelength in mm range)	From 8.15 - 18 GHz 5 hr to 7 days direction of response depended on exposure duration		1	Change in immunological functions.
Forgacs et al. (2006) (in vivo) (mouse whole body)	1800 MHz, GSM- 217 Hz pulses, 576 □s pulse width; 2hr/day, 10 days	0.018		Increase in serum testosterone.
Guler et al. (2010) (In vivo) (rabbit whole body)	1800 MHz AM at 217 Hz, 15 min/day, 7 days		52	Oxidative lipid and DNA damages in the brain of pregnant rabbits
Hjollund et al.	Military radars		10	Sperm counts of Danish military personnel, who operated

(1997) (in vivo) (human partial or whole body)				mobile ground-to-air missile units that use several RFR emitting radar systems, were significantly lower compared to references.
Ivaschuk et al. (1999) (in vitro)	836.55 MHz, TDMA 20 min	0.026		A gene related to cancer.
Jech et al. (2001) (in vivo) (human partial body exposure- not included)	900 MHz, GSM- 217 Hz pulses, 577 μ s pulse width; 45 min; narcoleptic patients	0.06		Improved cognitive functions.
Kesari and Behari (2009a) (in vivo) (rat whole body)	50 GHz; 2hr/day, 45 days	0.0008		Double strand DNA breaks observed in brain cells
Kesari and Behari (2009b) (in vivo) (rat whole body)	50 GHz; 2hr/day, 45 days	0.0008		Reproductive system of male rats
Kesari et al. (2010) (in vivo) (rat whole body)	2450 MHz, 50-Hz modulation, 2 h/day, 35 days	0.11		DNA double strand breaks in brain cells.
Kwee et al. (2001) (in vitro)	960 MHz, GSM 20 min	0.0021		Increased stress protein in human epithelial amnion cells.
Lebedeva et al. (2000) (in vivo) (human partial body)	902.4 MHz, GSM 20 min		60	Brain wave activation.
Lerchl et al. (2008) (in vivo) (hamster whole body)	383 MHz (TETRA), 900 and 1800 MHz (GSM) 24 hr/day, 60 days	0.08		Metabolic changes.
Magras and Xenos (1999) (in vivo) (mouse whole body)	'Antenna park'-TV and FM-radio, Exposure over several generations		0.168	Decrease in reproductive function.
Makova et al. (2005) (in vitro)	915 and 905 MHz, GSM 1 hr	0.037		Chromatin conformation in human white blood cells.
Mann et al. (1998) (in vivo) (human whole body)	900 MHz GSM pulse-modulated at 217 Hz, 577 μ s width, 8 hr		20	A transient increase in blood cortisol.
Marinelli et al. (2004) (in vitro)	900 MHz CW 2 - 48 hr	0.0035		Cell's self-defense responses triggered by DNA damage.
Navakatikian and Tomashevskaya (1994) (in vivo) (rat whole body)	2450 MHz CW and 3000 MHz pulse-modulated 2 μ s pulses at 400 Hz Single (0.5-12hr) or repeated (15-60 days, 7-12 hr/day) exposure, CW-no effect	0.0027		Behavioral and endocrine changes, and decreases in blood concentrations of testosterone and insulin.
Nittby et al. (2007) (in vivo) (rat whole body)	900 MHz GSM 2hr/wk, 55wk	0.0006		Reduced memory functions.

Novoselova et al. (1999) (in vivo) (mouse whole body-wavelength in mm range)	From 8.15 -18 GHz, 1 sec sweep time-16 ms reverse, 5 hr		1	Functions of the immune system.
Novoselova et al. (2004) (in vivo) (mouse whole body-wavelength in mm range)	From 8.15 -18 GHz, 1 sec sweep time-16 ms reverse, 1.5 hr/day, 30 days		1	Decreased tumor growth rate and enhanced survival.
Pavicic et al. (2008) (in vitro)	864 and 935 MHz, CW, 1-3 hrs	0.08		Growth affected in Chinese hamster V79 cells.
Panagopoulos et al. (2010) (in vivo) (fly whole body)	GSM 900 and 1800 6 min/day, 5 days		1 - 10	Reproductive capacity and induced cell death.
Panagopoulos and Margaritis (2010a) (in vivo) (fly whole body)	GSM 900 and 1800 6 min/day, 5 days		10	'Window' effect of GSM radiation on reproductive capacity and cell death.
Panagopoulos and Margaritis (2010b) (in vivo) (fly whole body)	GSM 900 and 1800 1- 21 min/day, 5 days		10	Reproductive capacity of the fly decreased linearly with increased duration of exposure.
Pérez-Castejón et al. (2009) (in vitro)	9.6 GHz , 90% AM, 24 hrs	0.0004		Increased proliferation rate in human astrocytoma cancer cells.
Persson et al. (1997) (in vivo) (mouse whole body)	915 MHz-CW and pulse-modulated (217-Hz, 0.57 ms; 50-Hz, 6.6 ms) 2-960 min; CW more potent	0.0004		Increase in permeability of the blood-brain barrier.
Phillips et al. (1998) (in vitro)	813.5625 MHz (iDEN); 836.55 MHz (TDMA) 2 hr and 21 hr	0.0024		DNA damage in human leukemia cells.
Polonga-Moraru et al. (2002) (in vitro)	2.45 GHz 1hr		15	Change in membrane of cells in the retina.
Pyrpasopoulou et al. (2004) (in vivo) (rat whole body)	9.4 GHz GSM (50 Hz pulses, 20 μ s pulse length) 1-7 days postcoitum	0.0005		Exposure during early gestation affected kidney development.
Roux et al. (2008a) (in vivo) (tomato whole body)	900 MHz		7	Gene expression and energy metabolism.
Roux et al. (2008b) (in vivo) (plant whole body)	900 MHz		7	Energy metabolism.
Salford et al. (2003) (in vivo) (rat whole body)	915 MHz GSM 2 hr	0.02		Nerve cell damage in brain.
Sarimov et al. (2004) (in vitro)	895-915 MHz GSM 30 min	0.0054		Human lymphocyte chromatin affected similar to stress response.
Schwartz et al. (1990) (in vitro)	240 MHz-CW and sinusoidal modulation at 0.5	0.00015		Calcium movement in the heart.

	and 16 Hz, 30 min, effect only observed at 16-Hz modulation			
Schwarz et al. (2008) (in vitro)	1950 MHz UMTS 24 hr	0.05		Genes in human fibroblasts.
Somosy et al. (1991) (in vitro)	2.45 GHz, CW and 16 Hz square- modulation, modulated field more potent than CW	0.024		Molecular and structural changes in cells of mouse embryos.
Stagg et al. (1997) (in vitro)	836.55 MHz TDMA duty cycle 33% 24 hr	0.0059		Glioma cells showed significant increases in thymidine incorporation, which may be an indication of an increase in cell division.
Stankiewicz et al. (2006) (in vitro)	900 MHz GSM 217 Hz pulses-.577 ms width 15 min	0.024		Immune activities of human white blood cells.
Tattersall et al. (2001) (in vitro)	700 MHz CW, 5-15 min	0.0016		Function of the hippocampus.
Velizarov et al. (1999) (in vitro)	960 MHz GSM 217 Hz square-pulse, duty cycle 12% 30 min	0.000021		Decrease in proliferation of human epithelial amnion cells.
Veyret et al. (1991) (in vivo) (mouse whole body)	9.4 GHz 1 □s pulses at 1000 pps, also with or without sinusoidal AM between 14 and 41 MHz, response only with AM modulation, direction of response depended on AM frequency	0.015		Functions of the immune system.
Vian et al. (2006) (in vivo) plant	900 MHz		7	Stress gene expression.
Wolke et al. (1996) (in vitro)	900, 1300, 1800 MHz, square-wave modulated at 217 Hz; Also 900 MHz with CW, 16 Hz, 50 Hz and 30 KHz modulations	0.001		Calcium concentration in heart muscle cells of guinea pig.
Yurekli et al. (2006) (in vivo) (rat whole body)	945 MHz GSM, 217 Hz pulse-modulation 7 hr/day, 8 days	0.0113		Free radical chemistry.

Such studies demonstrate that low-level RF affects every aspect of biological function. This is a body of work that we ignore at our own peril, especially with the deployment of smart/grid/metering into every home and business.

David O. Carpenter, MD, MPH, founder of the University of Albany (NY) School of Public Health and director of the Institute for Health and the Environment at the State University of New York at Albany, School of Public Health, drafted an open letter signed by more than 54 scientists and medical professionals called “Smart Meters: Correcting the Gross Misinformation.”¹² The letter was recently updated and signed by many additional scientists and medical professionals from five continents. In the U.S., co-signers include researchers at Columbia University, Michigan State University, the University of California at Berkeley, the University of Colorado, the University of Pittsburgh, and the University of Washington.

Joel M. Moskowitz, Ph.D., Director, Center for Family and Community Health, School of Public Health, University of California, Berkeley, noted that “...Fifty-four experts on the health effects of electromagnetic fields (EMFs) have called for use of common sense and the development and implementation of best practices in using these technologies in order to reduce exposure and risk of health hazards. These scientists and medical professionals who come from twenty countries have published hundreds of peer-reviewed studies on the health effects of EMFs.”

Points from Dr. Carpenter’s letter include:

- “The mass deployment of smart grids could expose large chunks of the general population to alarming risk scenarios without their consent.”
- “Many scientists and medical experts urgently recommend that measures following the Precautionary Principle be applied immediately — such as using wired meters — to reduce biologically inappropriate microwave exposure. We are not advocating the abolishment of RF technologies, only the use of common sense and the development and implementation of best practices in using these technologies in order to reduce exposure and risk of health hazards.”
- “The International Agency for Research on Cancer (IARC) classified radiofrequency radiation as a 2B, possible human carcinogen.”
- “Children are especially at risk.”
- “While the specific pathways to cancer are not fully understood, it is scientifically unacceptable to deny the weight of the evidence regarding the increase in cancer cases in humans that are exposed to high levels of RF/microwave radiation”
- “More than 1,000 studies done on low intensity, high frequency, non-ionizing radiation, going back at least fifty years, show that some biological mechanisms of effect do not involve heat. This radiation sends signals to living tissue that stimulate biochemical changes, which can generate various symptoms and may lead to diseases such as cancer.”

¹² Smart Meters: Correcting the Gross Misinformation The open letter, a list of the 54 experts who signed it and their affiliations, and links to supplementary resources are available at: <http://maisonsaine.ca/smart-meters-correcting-the-gross-m...>
Source: Joel M. Moskowitz, Ph.D., Director, Center for Family and Community Health, School of Public Health, University of California, Berkeley.

- “This energy can cause DNA damage indirectly leading to cancer by a combination of biological effects. Recent publications have documented the generation of free radicals, increased permeability of the blood brain barrier allowing potentially toxic chemicals to enter the brain, induction of genes, as well as altered electrical and metabolic activity in human brains upon application of cell phone RF/microwaves similar to those produced by smart meters.”
- "High frequency EMFs such as the microwaves used in cell phones, smart meters, Wi-Fi and cordless "DECT" phones, appear to be the most damaging when used commonly."
- “Authorities are worried about the growing number of citizens who say they have developed electrohypersensitivity (EHS), especially since for many of them, the symptoms developed after the installation of such meters."
- “Adverse neurological effects have been reported in people who sustain close proximity to wireless meters, especially under 10 feet.”
- “Wireless smart meters typically produce atypical, relatively potent and very short pulsed RF/microwaves whose biological effects have never been fully tested. They emit these millisecond-long RF bursts on average 9,600 times a day with a maximum of 190,000 daily transmissions and a peak level emission two and a half times higher than the stated safety signal.”
- “People in proximity to a smart meter are at risk of significantly greater aggregate of RF/microwave exposure than with a cell phone, not to mention the cumulative exposure received by people living near multiple meters mounted together, pole-mounted routers or utility collector meters using a third antenna to relay RF signals from 500 to 5,000 homes.”
- “RF levels from various scenarios depicting normal smart meter installation and operation may violate even the out-of-date US public safety standards which only consider acute thermal effects."
- “Caution is warranted because the growing variety of RF/microwave emissions produced by many wireless devices such as smart meters have never been tested for their potential biological effects.”

In addition to Dr. Carpenter’s open letter, the American Academy of Environmental Medicine issued a report entitled “Electromagnetic and Radiofrequency Fields Effect on Human Health”¹³ which calls for, among other things:

- An immediate caution on Smart Meter installation due to potentially harmful RF exposure.
- Accommodation for health considerations regarding EMF and RF exposure, including exposure to wireless Smart Meter technology.
- Independent studies to further understand the health effects from EMF and RF exposure.
- Recognition that electromagnetic hypersensitivity is a growing problem worldwide.

¹³ “Electromagnetic and Radiofrequency Fields Effect on Human Health,” American Academy of Environmental Medicine, submitted by Amy L. Dean, DO, William J. Rea, MD, Cyril W. Smith, PhD, Alvis L. Barrier, MD

- Understanding and control of this electrical environmental bombardment for the protection of society.
- Consideration and independent research regarding the quantum effects of EMF and RF on human health.
- Use of safer technology, including for Smart Meters, such as hard-wiring, fiber optics or other non-harmful methods of data transmission.

Symptoms increasingly reported in the population, sometimes with sudden onset after smart meters have been installed include: heart arrhythmias, headaches, sleeplessness, dizziness, concentration problems ('brain fog'), memory loss, skin rashes, lowered libido, fatigue, malaise, miscarriages, immune system effects with more frequent colds/flu and fertility problems.¹⁴

This is just a fraction of what is currently available regarding concerns in professional circles and calls for reform and caution. The European Union's Environment Committee has called for caution, as has the European Parliament.¹⁵ Germany, France, Italy, Switzerland, Sweden, Austria, the UK, Spain, Israel, India, Japan, Australia, New Zealand, and other countries have in varying degrees also called for precaution when it comes to RF exposures. Many professional groups throughout Europe have called for more stringent controls.¹⁶ The U.S. lags far behind in research, regulatory update, and recommendations to protect the public. Industry is given way too much benefit of the doubt at the expense of public health.

Of special concern are people with implanted medical devices like deep-brain stimulators for Parkinson's, pain pumps, ventilators, some pacemakers, insulin pumps, and in-home hospital equipment. The radiofrequency interference (RFI) inherent to smart grid/metering can cause such equipment to go haywire, or even stop altogether. RFI from ambient exposures has caused wheelchairs to behave erratically and surgical beds have jump.

What's clear from the above information is that there is legitimate reason for concern from renowned researchers and organizations from all over the world. The DPU's Straw Proposal mentions none of this. Nor does the Grid Modernization 20-69 order instructing investor-owned utilities to file grid modernization plans that enable time-of-use billing via full deployment of AMI.

Massachusetts should not commence in the direction of smart grid/metering in light of this vast amount of information and the recent court ruling against FCC. To do so not only endangers the public health, it also puts the state in line for litigation. Furthermore, in 2014, the MA DPU misrepresented the FCC limits, claiming that they are protective of both thermal and non-thermal effects, materially misrepresenting the fact pertaining to safety.

¹⁴ Ibid.

¹⁵ EUROPEAN PARLIAMENT EMF RESOLUTION, APRIL 2, 2009
<http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2009-0216+0+DOC+XML+V0//EN>

¹⁶ There are many resolutions and reports issued by professional organizations throughout Europe. One example is The Frieberger Appeal, 10/9/2002 Interdisciplinary Association for Environmental Medicine Tel. 07761 913490, FAX 913491, e-mail: igumed@gmx.de

5. European Systems: Powerline Carrier Technology (PLC), ‘Dirty Electricity,’

Of interest is the fact that most of the ‘smart’ systems throughout Europe are built on Powerline Carrier Technology (PLC) which does not have the same wireless component that U.S. and Canadian systems have.¹⁷ PLC places a modulated signal on existing powerlines to record energy use. Some systems are 2-way, not unlike broadband-over-powerline systems (BPL) in the U.S. which puts significant RF on powerlines used for Internet communications. Unfortunately BPL is also an unsafe system, with people measuring RF coming right through their light and electrical sockets. While there are simple PLC systems that are not 2-way — a few such systems exist in rural Vermont — anything that modulates in a 2-way capacity puts significant harmonics on the lines that can affect people adversely, and are not recommended as a substitute for smart grid/metering as currently designed. The safest systems are fiberoptic.¹⁸

High frequency harmonics on powerlines is colloquially called ‘dirty electricity’ by the industry. Research by Magda Havas, Ph.D.,¹⁹ of Trent University in Canada, and U.S. epidemiologist Samuel Milham, M.D.,²⁰ former director of the State Department of Health, Washington, links dirty electricity with diabetes, malignant melanoma, and cancers of the breast, thyroid, uterus and lung. BPL is 100% dirty electricity — that’s how it functions. And PLC has the same ambient exposure potential unless it is a tightly structured, non-2-way communication system.

¹⁷ Many smart meter networks in Europe are based on PLC. There is a white paper on this technology by one of the leading smart meter companies (Landis+Gyr): http://www.landisgyr.eu/files/pdf/LG_White_Paper_PLC.pdf

¹⁸ Katarina Gustavs www.buildingbiology.ca wrote in an email: “These PLC systems are certainly two-way and have all the monitoring and executing capabilities as an RF mesh network. In the US, Boulder, Colorado, (4.5 and 21 MHz http://www.bouldercolorado.gov/files/City%20Council/Study%20Sessions/2008/10-28-08/xcel-6-health-safety_of_bpl.pdf) runs such a system. In Canada, Fortis Alberta started with PLC (900-108 Hz <https://camrosecounty.civicweb.net/Documents/DocumentDisplay.aspx?ID=1338>) and now adds an RF mesh network. In Europe, these systems gather data by the second. Though PLC does not emit microwave radiation, it does emit electromagnetic fields in the frequency range a given PLC network is operating at, anywhere from a few hundred hertz to a few ten megahertz. This radiation is emitted from ALL wiring in the house, not just the electric meter. At the EI Wellspring Web site provided by Libby Kelly www.eiwellspring.org: http://www.eiwellspring.org/plc/PLC_antenna_effect.htm., one can find information on the emission and interference issues associated with PLC or BPL. A report from Sweden <http://www.eiwellspring.org/tech/FilteringNewSmartMeters.pdf> explains the challenges when someone tries to filter out the respective frequencies. In some locations in Germany, you can simply call your utility provider and ask for a filter to be put in at the meter... [This should be standard procedure.] Fiber-optic networks have the least amount of emissions. However, the “last mile” of such systems (the last connection to the consumer) is often wireless like in Chattanooga <https://www.epb.net/power/home/products/smart-meters>. Be aware that these low MHz signals (1-30 MHz) are not only used by utility providers but also by some phone and Internet provider companies. In British Columbia, for example, the traditional phone company Telus, which owns the copper wiring, offers high-speed Internet in the MHz range across its phone wiring. The traditional cable TV company Shaw, which owns the coaxial cable, offers digital phone in the MHz range also across the phone wiring in a house. These services are best avoided if the wiring is not all shielded.”

¹⁹ *Electromagnetic Hypersensitivity: Biological Effects of Dirty Electricity with Emphasis on Diabetes and Multiple Sclerosis*, Magda Havas, *Electromagnetic Biology and Medicine*, 25: 259–268, 2006

²⁰ *Dirty Electricity, Electrification and the Diseases of Civilization*, Sam Milham, MD, MPH, iUniverse, 2010

In testimony for MA DPU 20-69, Unitol stated that it has received no health complaints as the result of its powerline installations in New Hampshire. It is unclear how health impacts of the powerline technology have been quantified, and/or whether customers and their health care practitioners have been apprised of the technology implementation. Individuals developing sleep disorders, tinnitus and other health challenges do not usually contact their utility provider.

6. Privacy and Liability: Smart Meters as Surveillance Systems

Privacy is of enormous concern with smart grid/metering and constitutional issues are on the table. This alone is reason to halt the deployment until such time as questions are settled. Smart grid/metering provides for the first time near-real-time energy use, including specific information on when people are home, how many people live in a home, what appliances one owns, how appliances are used, whether one owns a security system or high-end consumer products like plasma TVs and whether they use certain types of medical equipment, for instance. Critics say there is far too much “granularity” in smart metering that opens us up to everything from insurance companies changing personal homeowner’s and medical policies, unconstitutional police searches and seizures, and home invasions/burglaries.

The simple truth is that a lot can be known about a person through their energy consumption habits. Smart meters offer significantly more detailed information about an individual’s energy usage than analog or first generation AMR meters. In addition, there are no controls in place to guarantee what a utility does with such personal information regarding sale to third parties seeking, for instance, to sell you new appliances; police seeking information; or the government tracking of individuals. The legal ramifications are legion.

Smart meters are fundamentally surveillance systems. Even former CIA Director David Petraus, in an article in Wired magazine²¹ entitled *CIA Chief: We’ll Spy on You Through Your Dishwasher*, mused about the emergence of an “Internet of Things” saying “Transformational’ is an overused word, but I do believe it properly applies to these technologies... particularly to their effect on clandestine tradecraft.”

According to a 2012 Congressional Research Service report,²² there are potential violations of the Fourth Amendment as well as violations of several federal statues including: The Electronic Communications Privacy Act (ECPA), The Stored Communications Act (SCA), The Computer Fraud and Abuse Act (CFAA), the Federal Trade Commission Act (FTC Act), and the Federal Privacy Act of 1974 (FPA) among other problems.

The authors say: “Installation of smart meters and communications technologies that accompany them may have unforeseen legal consequences for those who generate, seek, or use the data recorded by the meters. These consequences may arise under existing federal laws or

²¹ *CIA Chief: We’ll Spy on You Through Your Dishwasher*, Spencer Ackerman, WIRED, Danger Room, What’s Next in National Security, March 15, 2012.

²² *Smart Meter Data: Privacy and Cybersecurity*, Brandon J. Murrill, Edward C. Liu, and Richard M. Thompson II, Congressional Research Service, 7-5700, www.crs.gov R422338.

constitutional provisions governing privacy of electronic communications, data retention, computer misuse, foreign surveillance and consumer protection.”

They add that consumer data moving through a smart grid is stored in many locations both within the grid and in the physical world. “Thus, because it is widely dispersed, it becomes more vulnerable to interception by unauthorized parties and to accidental breach.”

Other legal scholars note that with smart meters, police will have access to data that might be used to track residents’ daily lives and routines while in their homes, including their eating, sleeping, and showering habits, what appliances they use and when, and whether they prefer the television to the treadmill, among a host of other details.²³ They say that insurance companies will be able to tell the ‘couch potatoes’ from more active customers, or if someone regularly comes home after the bars close.

This is all in violation of the Fourth Amendment in the U.S. Constitution for a reasonable expectation of privacy. Smart metering is primed for legal challenge. Indeed suits are already in the courts.²⁴

Then there is the issue of whether we actually want utilities controlling how and when our appliances work. Wireless technology is notoriously “buggy.” The possibility of errant RF signals from other sources turning off a furnace in the dead of winter when no one is home, or turning on an oven, or blasting an air conditioner with an infirm person at home incapable of turning it off are not out of the realm of possibilities. The issue of liability looms over who would be responsible if someone’s house burns down or when pipes freeze.

7. CyberSecurity:

Smart grid/metering creates security vulnerabilities that never existed with the old hardened utility grid in large part due to new IT connectivity. The problems are inherent to its very wireless design in a way that encryption alone can never fix. According to many experts, the smart grid as currently designed cannot be made safe from cyberattack, and it is more vulnerable to solar storms than the older utility grid. We are, in fact, making the national utility grid *less* stable in going ‘smart’ due to multiple factors.

According to a 2012 U.S. Government Accountability Office report,²⁵ the GAO found the smart grid’s reliance on IT systems and networks exposes the electric grid to potential and known cybersecurity vulnerabilities, which could be exploited by attackers. Among other things, GAO found:

²³ Jack I. Lerner and Deirdre K. Mulligan, *Taking the “Long View” on the Fourth Amendment: Stored Records and the Sanctity of the Home*, 2008 Stan. L. Rev. 3, (2008).

²⁴ For a list of current smart grid/metering lawsuits with links to court documents, see the EMF Safety Network website at <http://www.smartmeterlawsuits.blogspot.com/>

²⁵ *Cybersecurity – Challenges in Securing the Modernized Electricity Grid*, Testimony before the Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives, Statement by Gregory C. Wilshusen, Director, Information Security Issues, and David C. Trimble, Director, Natural Resources and Environment, GAO-12-507T, February 28, 2012.

- A lack of coordinated approach to monitor industry compliance with voluntary standards. The Federal Energy Regulatory Commission (FERC) has not coordinated with utilities to determine if the voluntary approach is even effective.
- There is a lack of security features built into smart grid devices. A panel of experts convened by the GAO found that smart meters had not been designed with a strong security architecture and lacked important security features. Without securely designed systems, utilities are at risk for attacks occurring undetected.
- There is a lack of effective information-sharing within the electric utility industry without which utilities cannot protect their infrastructure assets from attack.
- There is a lack of metrics for even evaluating cybersecurity within the industry. Until such metrics are developed, utilities may not invest in security in a cost-effective manner or make informed decisions about cybersecurity investments.

The GAO report notes that the smart grid is vulnerable to a variety of attacks. They say:

“Threats to systems supporting critical infrastructure — which includes the electricity industry and its transmission and distribution systems — are evolving and growing. In February 2011, the Director of National Intelligence testified that, in the past year, there had been a dramatic increase in malicious cyber activity targeting U.S. computers and networks, including a more than tripling of the volume of malicious software since 2009. Different types of cyber threats from numerous sources may adversely affect computers, software, networks, organizations, entire industries, or the Internet. Cyber threats can be unintentional or intentional. Unintentional threats can be caused by software upgrades or maintenance procedures that inadvertently disrupt systems. Intentional threats include both targeted and untargeted attacks from a variety of sources, including criminal groups, hackers, disgruntled employees, foreign nations engaged in espionage and information warfare, and terrorists. Moreover, these groups have a wide array of cyber exploits at their disposal...”

The report adds that:

“While presenting significant potential benefits, the smart grid vision and its increased reliance on IT systems and networks also expose the electric grid to potential and known cybersecurity vulnerabilities, which could be exploited by a wide array of cyber threats. This creates an increased risk to the smooth and reliable operation of the grid. As we and others have reported these vulnerabilities include:

- an increased number of entry points and paths that can be exploited by potential adversaries and other unauthorized users;
- the introduction of new, unknown vulnerabilities due to an increased use of new system and network technologies;
- wider access to systems and networks due to increased connectivity; and
- an increased amount of customer information being collected and transmitted, providing incentives for adversaries to attack these systems and potentially putting private information at risk of unauthorized disclosure and use.”

The GAO report continues:

“We and others have also reported that smart grid and related systems have known cyber vulnerabilities. For example, cybersecurity experts have demonstrated that certain smart meters can be successfully attacked, possibly resulting in disruption to the electricity grid. In addition, we have reported that control systems used in industrial settings such as electricity generation have vulnerabilities that could result in serious damages and disruption if exploited. Further, in 2009, the Department of Homeland Security, in cooperation with DOE, ran a test that demonstrated that a vulnerability commonly referred to as “Aurora” had the potential to allow unauthorized users to remotely control, misuse, and cause damage to a small commercial electric generator. Moreover, in 2008, the Central Intelligence Agency reported that malicious activities against IT systems and networks have caused disruption of electric power capabilities in multiple regions overseas, including a case that resulted in a multicity power outage.”²⁶

The GAO, CIA and other government entities aren't the only ones worried. There have been cyber attacks close to home. It has been demonstrated that the smart grid can be penetrated by both wired and wireless networks. In August of 2009, hackers robbed 179,000 Toronto Hydro customers' names, addresses, and billing information from their e-billing accounts. Security consultant Mike Davis of IOActive, Inc.²⁷ in Seattle has shown how easy it is to install computer worms via any smart meter that can take over whole regions of the grid. Such worms can be programmed to alter billing information, gather information on electricity use for sale to third parties, or shut down hundreds of thousands of households.

Ross Anderson and Shailendra Fuloria²⁸ at Cambridge University's Computer Laboratory noted that hostile government agencies or terrorist organizations could bring whole countries to their knees by interrupting electrical generation. More so than traditional grids, they stress that smart grids create a new strategic vulnerability as the cyber equivalent of a nuclear attack.

Smart Grids are also easy to sabotage with simple jamming devices, mounted on cars, traveling through neighborhoods.

Although many of the citations noted above are from several years ago, none of these problems have been addressed or grids hardened in anticipation of such hostile actions and cyberattacks have only worsened. Is this the direction that DPU really wants to take the state of Massachusetts?

²⁶ For the full report and references to sources cited within, go to <http://www.gao.gov/> *Cybersecurity – Challenges in Securing the Modernized Electricity Grid*, Testimony before the Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives, Statement by Gregory C. Wilshusen, Director, Information Security Issues, and David C. Trimble, Director, Natural Resources and Environment, GAO-12-507T, February 28, 2012.

²⁷ [ioactive's mike davis to unveil smart grid research at black hat usa](http://www.ioactive.com/news-events/DavisSmartGridBlackHatPR.html) , Jul 28, 2009
<http://www.ioactive.com/news-events/DavisSmartGridBlackHatPR.html>

²⁸ *Who controls the off switch?* Ross Anderson and Shailendra Fuloria, 2011.

8. Safety: Fires, Appliances Acting Erratically, Billing Errors

Smart meters have started fires due, in part, to poor training of temporary installers, but also to defective meter manufacture. In 2011, California's PG&E said that as many as 23,000 meters could be defective but claimed that had nothing to do with increases in billing. There are also problems in the inherent engineering/safety issues when the differing voltages between the extremely low frequency 60 Hz powerline system marries to the ultra high frequency RF used in smart metering. Whenever a lower frequency is boosted to a higher frequency, more energy is required.

There are reports of appliances acting erratically after smart meters are installed. Ceiling fans with remote controls have started spontaneously at all hours of the day and night with fan paddles running backwards and changing speeds. Circuit boards in computers and appliances have burned out. Garage doors with remote control devices have spontaneously opened, among many other things. This indicates broad RFI from smart metering with other systems.

There are now hundreds of reports in several countries, including the U.S., of smart meters exploding or catching on fire. In New Zealand, firefighters reported 422 fires in 2010 involved with smart meters. There are numerous reports of fires in California, Florida, Pennsylvania, Illinois, and across Canada.²⁹ One California suit has been filed for wrongful death due to a smart meter fire.³⁰

There are billing errors galore after smart meters have been installed and a class action suit in California because of rampant problems there. People have seen bills go from \$200 to \$600 in one billing cycle with no increased energy use on their part. Complaints of the same are rampant across Canada, too, in some cases with bills jumping above \$800.00 for no apparent reason.

9. The Smart Grid Does Not Save Energy: 'Vampire' Loss, Meter Disposal Fees, Data Storage, and Tiered Pricing

Despite the promise of the smart grid saving energy via consumer choice and the ability to ration individual energy use to less costly times of day, there is no evidence that this promise has delivered anything substantial toward saving energy.

Connecticut is one of the few states to try a pilot program to see if smart metering works before a full buildout was commenced. In 2011, the State's Attorney General, George Jepsen, said in a press release³¹ that a pilot program of 10,000 such meters found no energy savings in

²⁹ *Smart Meter Causes Dumb Fire*, [Kim Zetter](#), *Wired*, 09.12.12

³⁰ See <http://www.smartmeterlawsuits.blogspot.com/> for details.

³¹ Press Release: *Jepsen Urges State Regulators to Reject CL&P's Plan to Replace Electric Meters*, Tuesday, February 8, 2011

2009, but would cost ratepayers \$500 million. He said that Connecticut Light & Power Company's plan to replace existing electric meters with advanced technology would be very expensive and would not save enough electricity for its 1.2 million customers to justify the expense. At the time, CL&P was also asking regulators to guarantee that the company would be allowed to recover its full cost of installation before the department actually evaluated what the costs were or if they were reasonable. (CL&P was eventually sold and became part of Eversource.)

To evaluate the technical capabilities and reliability of the advanced metering system, state regulators previously approved a limited study of 10,000 meters. Between June 1 and Aug. 31, 2009, CL&P tested the meters on 1,251 residential and 1,186 small commercial and industrial customers, who volunteered and were paid for their participation in the study. The company reported its results to the Department of Public Utility Control on Feb. 25, 2010. But according to Jepsen, "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." He noted that CL&P'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, and urged regulators to continue to evaluate emerging meter system technologies as well as other conservation programs and only approve installation of the advanced meters when they are cost effective.

No one has shown significant energy savings with either near-real-time energy use knowledge on the part of consumers or tiered pricing. It all remains theoretical at this time. Many people and businesses simply cannot change when or how they use energy. Tiered pricing automatically penalizes the elderly, the self-employed, the infirm, the unemployed, stay-at-home parents with young children and anyone else who functions on a normal daylight schedule. People can choose to do their laundry late at night but meals, bathing, and how often the furnace must function carry fewer options. In addition, with so many people now working remotely from home due to SARS-Co-V2 and a general reorganization of businesses toward a permanent remote workforce, time-of-use pricing will penalize many more who will have no choice but to meet workplace deadlines.

A simple educational insert in utility bills explaining the problem of peak demand, as well as showing which appliances typically use more energy and asking for voluntary help, might have better results than the utility company controlling our appliances remotely. There was skepticism 30 years ago about whether people would voluntarily recycle plastics, metal and glass. Today towns are proud of their voluntary recycling numbers and reduced wastestream.

Nowhere in the makeover of the world's utility grids has there been in-depth analysis/discussion of key increases in energy consumption that are inherent to smart technology. Environmentalists in particular have embraced smart technology without enough scrutiny. And actuaries do not factor in vampire energy use, for instance, when all of our appliances and meters are equipped with embedded transmitters using higher frequencies that require more energy. Plus such appliances are always in "on" mode even when not in use, or they wouldn't be

able to receive a remote signal to turn fully on or off. For years, environmentalists have advised anyone with an appliance that has a remote control capability, such as a TV, to unplug the device completely when not in use because they are never completely “off” if left plugged in. It’s called “vampire” energy and the smart grid proposes to increase that invisible energy consumption by orders of magnitude with trillions of new appliances and meters.

Nor has anyone factored in the extra energy required in the constant stepping up and down of voltage between the higher frequency RF components and the lower frequency utility lines — a process that uses far more energy than just leaving the old systems alone.

Also not factored into the larger picture is the energy required to store such vast amounts of data. New data storage facilities are among the biggest energy users today. The smart grid will greatly increase that need. Nor has the energy required to manufacture millions of new meters, power the vans to replace the old ones, and dispose of the old meters been factored in.

The smart grid is neither a short nor a long-term energy-saver when all aspects are considered, and it is far from an energy-saving panacea despite people’s best intentions and environmental aspirations. The smart grid originated in the largest corporations in the world — IBM, GE, Siemens, and others. It is fundamentally a Wall Street business model meant to shore up investor profits, especially as we transition to renewable sources when energy generation and consumption are expected to decrease for various reasons. One great irony in the green scenario is that some smart meters as currently designed do not run backward thereby disallowing people with home solar panels or small wind turbines to sell electricity back to the grid. The smart grid takes us in the exact opposite direction of distributed sources collecting energy from myriad points.

There is another dark horse regarding smart metering. The main purpose of a system that allows a utility to remotely turn electricity on and off is to shift customers not only to tiered pricing but also to prepaid plans. Anderson and Fuloria³² have written that the main purpose of smart metering is to ensure that customers who default on their payments can be switched remotely to a prepay tariff system where they purchase a card for so many hours of electricity in advance. Such a system has been in operation in South Africa for several years. Such a system increases shareholders’ bottom line because there are virtually no unpaid bills or wait times before turning people’s power off. But there are also no safeguards in place to protect people from mistaken shutoffs or recourse during winter months. This entire model is not consumer-friendly.

10. National and International Backlash:

There is enormous backlash — and successful lawsuits — against smart grid/metering at all levels and for very good reasons.³³ Massachusetts is likely to experience citizen backlash too

³² *Who controls the off switch?* Ross Anderson and Shailendra Fuloria, Computer Laboratory, Cambridge University, England, (Ross.Anderson@cl.cam.ac.uk) and (Shailendra.Fuloria@cl.cam.ac.uk).

³³ For a list of U.S. websites regarding local opposition to smart grid/meters and other information, see http://emfsafetynetwork.org/?page_id=6914

if it moves toward a large-scale smart meter buildout, despite the inclusion of an opt-out in the Grid Modernization ruling. Informational PR campaigns will not assuage resistance. The issues are too substantive.

11. Conclusion on Smart Grid/Metering:

No sane person could argue that our aging utility infrastructure does not need upgrading, or that government has no role to play, but smart grid/metering as currently designed isn't the way. On close examination, the smart grid is not smart, not safe, and certainly not green. It may also prove the exact opposite of resilient.

The problems with smart grid/metering are so legion and potentially catastrophic that it's amazing the DPU has gone in this direction. DPU, in writing the Straw Proposal and in issuing MA DPU 20-69, may have fallen for the superficial hype surrounding smart grid/metering and has willfully ignored the enormous body of work that has resulted since its early inception, not to mention the informed national backlash. Or DPU may simply be waiving significant issues aside in pursuit of a business-friendly ideology. In either case, more in-depth research would likely lead to a different course of action.

Simple compromises such as opt-out agreements, with or without extra fees to customers, or even with opt-in agreements, do not address the broader issues of privacy, security, and health. In a mesh network, one is exposed not only to one's own smart meter, but also to those of one's neighbors. An individual can opt-out but that only marginally alters that person's RF exposure. High frequency harmonics are traveling on the lines into that home, and neighboring meters' RF is creating an ambient environmental exposure.

As a country, we have walked blindly into this without understanding the full ramifications of how the smart grid functions. And we have done this with no real informed consent. The simple fact is that smart grid technology is vastly more complex than our ability to ever fully control it.

Finally, moving broadly to smart grid/metering will greatly increase ambient RF levels that are capable of disrupting numerous biological functions in many species of flora and fauna. Many non-human species have unique magnetoreception abilities that far surpass human reactivity and are therefore capable of adverse effects from man-made electromagnetic fields at vanishingly low intensities. Broad wildlife effects have been seen on orientation and migration, food finding, reproduction, mating, nest and den building, territorial maintenance and defense, and longevity and survivorship. Cyto- and geno-toxic effects have been observed. Two recent papers^{34,35} extensively explore current measured global levels to the peer-reviewed database and

³⁴ Levitt BB, Lai HC, Manville AM. Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient EMF levels in the environment. Rev Environ Health. 2021 May 27. doi: 10.1515/reveh-2021-0026. Epub ahead of print. PMID: 34047144.
<https://pubmed.ncbi.nlm.nih.gov/34047144/>

found potential effects to all flora and fauna studied. (The third paper in the series, which explores exposure standards, environmental laws, and policy recommendations, is currently in process.) These papers could further inform the MA DPU decision-making process as a fully built smart grid will greatly add to ambient exposures.

As noted in 2014 and reiterated here, Massachusetts could lead the country in a better approach and we encourage you to go back to the drawing board.

Respectfully Submitted,
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³⁵ Levitt BB, Lai HC, Manville AM. Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: how species interact with natural and man-made EMF. Rev Environ Health. 2021 Jul 8. doi: 10.1515/reveh-2021-0050. Epub ahead of print. PMID: 34243228. <https://pubmed.ncbi.nlm.nih.gov/34243228/>