

TOWN OF BEDFORD
ENERGY COMMISSION MINUTES
January 26, 2023

A meeting of the Bedford Energy Commission was held on Thursday, January 26, 2023 in the Town Meeting Room, 10 Meetinghouse Road.

I. Call to Order: Chairman Russell opened the meeting at 7:00 PM.

Present: John Russell (Chair), Chris Bandazian (Vice Chair), Bill Foote (SB Liaison), Andrew Gillis, Bing Lu, Carolyn Mahoney, Sue Thomas (Town Council Liaison),

Absent: Chuck Nettleship, Tom Elwood, Mindy Bator (SB alternate)

II. Approval of December 22, 2022 Minutes

MOTION by Mr. Gillis to approve the minutes of the December 22, 2022 meeting. Seconded by Mr. Bandazian. Vote taken – Motion Passed – 5-0 (Thomas and Mahoney abstained).

III. Presentation by Terry Murch of TSS USA Manufacturing and Bruce Benwell of Directed Energy Technologies

Chairman Russell introduced Terry Murch and Bruce Benwell. Terry is the co-founder of TSS with over 30 years of experience working with the electronic and defense industry. Bruce is president at Directed Energy Technologies, Inc., which is a testing, consulting and R&D company specializing in High Altitude Electromagnetic Pulsed (HEMP) and Directed Energy.

Mr. Murch mentioned the attacks on the grid in Ukraine, North Carolina and the Pacific Northwest. The electrical grid in every country has become a strategic target. In the US, so much runs on electricity; specifically water treatment, sewage treatment, heat, and hot water. The Defense Threat Reduction Agency has a statistic that if there were a HEMP event, 90% of the US population would perish in the first 12 months afterwards. Direct energy and EMP is an actual threat. TSS manufactures, designs and sells filters to mitigate the effects of EMP. When they talk to utilities, telecom companies, and groups like the Energy Commission, there's a scaled approach to this, they don't have to spend millions of dollars immediately to start protecting their assets.

The Triple Threat

- Solar Storm Activity
 - o Probable – Has happened in the past
- High Altitude Detonation (HEMP)
 - o Possible, low probability-high impact, crippling effect
- Intentional Electromagnetic Interference (IEMI)
 - o Probable – nation state and terrorist weapon

What/Who Could Make a DE Weapon?

- Commercial Magnetrons: 800-2kW average power, S-band (2.6-2.95GHz)
- Industrial Magnetrons: 1kW – 100s of kW, UHF (915MHz), S-band, X-band (8-12GHz)
- LINAC: up to 5Mw, S-band, C-band (5.8-8.2GHz), X-band
- Air Traffic Radars: S-band, X-band. Up to 1MW

Experience Base Needed

- <10kW – smart HS level with interest in electronics – cost: \$1K+
- 10k-50kW – electronic tech, ex-military – cost: \$10K+
- 50-500kW – engineer, experienced pulse power tech, grad student – cost: \$100K+
- >500kW – highly experienced pulse power team – \$100K+

IEMI Methods of Delivery

- Vehicle mounted modified microwave oven
- Suitcase devices
- Homemade devices

U.S. Strategic EMP Concerns

- Chinese manifesto was developed following the first Gulf War
 - o Translated title: “How to defeat a superior adversary”
 - o Promulgates initiating a “Black Out” war by completely turning off the adversary’s power via Disaster-Cyber-Kinetic-EMP
 - o Three other nation states have adopted this scenario
 - o ISIS/ISIL/DAESH has adopted this same strategy as a way to attack the USA

Mr. Lu wanted to know how much energy this attack was going to be compared to a lightning strike. Mr. Murch stated that they would be looking at a pulse that’s got 8 microsecond rise time, 150K volts, and 2.5K amps. The pulse wasn’t going to affect people. This was going to be coupled onto lines and it’s going to transfer right down to electronic and electrical devices. The rise time was about 10 times faster than a lightning strike. Mr. Lu didn’t think the commercial older power supplies would be able to withstand that much. Mr. Murch stated that he would send all of them a Powerpoint on transformers and protecting transformers.

Mr. Murch wanted to talk about how vulnerable the grid and the critical infrastructure was. They’ve talked to emergency management folks about this. The government spends billions of dollars each year hardening their structures. If there was an EMP event or a directed energy attack with an IEMI device at any substation that’s got a medium voltage transformer, it would kill the transformer. Transformers typically have a basic insulation level of typically 50K volts. They would not necessarily stand up to that pulse. There’s also the data, the control equipment for running the operation. Those are very much at risk. The equipment needed to replace the damaged equipment had a two or three year lead time. You would end up having a blackout whether it’s regionally or on a national scale for quite a bit of time. Mr. Lu wanted to know if the attack had to physically connect or could it be wireless. Mr. Murch stated that it would be wireless.

EMP Hardening in the US

- Most of the lessons learned regarding HEMP hardening has evolved from work sponsored by the Department of Defense (DoD)
- The U.S. government believes this to be a clear and present danger and has spent billions EMP Hardening critical DoD electronics and critical facilities
- EMP is seen as a real threat to U.S. critical infrastructure including the grid
- Why? – to ensure “Seamless” operation before, during and after an event

Utilities and Commercial Enterprises

- Scaled approach based on realistic time-tables will enable non-governmental entities to:
 - o Cost effectively protect facilities

- Develop timelines that make sense
- Apply standard maintenance practices with EMP in mind to start the process

Mr. Murch talked about if there was a blackout. They would have to understand what was really critical to operate. He used examples such the police department and a water treatment facility in determining that. Every building has the ability to block radiation from EMP.

Radiated & Conducted Pulses

- Asset Protection
 - Radiated Pulse
 - Conducted Pulse

Mr. Murch talked about blocking off public/easy access to large buildings so there would be a much larger area between the building and the street where somebody could pulse the building. To protect critical equipment, you would use an EMP or HEMP filter. If it's a piece of equipment that's not quite as important, you put a surge protector on it. For equipment that wasn't absolutely necessary, you might put a \$10 surge protector on it.

Levels of Protection Scalable

The IET defines installations in 3 categories:

- Mission critical applications – cannot go down
- Critical infrastructure applications – what can be disrupted, but restarted
- Industrial applications – non critical to operation

They need to know what they need for running the Town to make it all work and then what helps make it work and then what's nice to have, but not absolutely necessary.

Levels of Protection

- Mission critical protection
 - Complies with the military standard (Mil-Std-188-125)
 - Full shield solution (Faraday cage)
 - Protect against radiated pulse
 - Filtering
 - Protects against conducted pulse
- Special or mission critical protection
 - Best protection
 - 80db to 11db attenuation
 - Most costly - \$1M+
- Critical infrastructure protection
- Industrial protection
 - Could be curb-side
 - May only have one critical or none critical assets
 - May have severe budget constraints

Mr. Murch stated that concerns are the grid with transformers. Some of the transformers have up to a two-year lead time. If they had a terrorist organization or nation state who decided to try and knock down parts of this country in a regional sense, it wouldn't be difficult to do.

Shielding Effectiveness of Existing Buildings

- Starting point
 - o Understand how existing structures provide natural shielding effectiveness
 - o Evaluate what level of protection is required to each system
 - Start at basic PM (preventative maintenance) to change out susceptible items to non-susceptible equipment (e.g. copper wire PLC to fiber optic)
 - o Find SME who will provide realistic evaluation and input to harden facility and to support effort

New IEMI Standards

- Until 2015, only the very onerous Mil-STD-188-125-1A existed to measure HEMP/IEMI protection...very costly/cost prohibitive
- More realistic approach to address civilian and critical infrastructure
- Trump's executive order - coordinating National resilience to electromagnetic pulses
- In 2015, new commercial EMP/IEMI standards published
 - o IEC 61000-4-36 IEMI – immunity test methods for equipment and systems
 - o IEC 61000-4-23&24 – radiated & conducted HEMP protection
 - o IEC 61000-5-10 – guidance on HEMP and IEMI publications
 - o DHS and DOE Guidelines – 2019

Mr. Lu wanted to know how they test to see if it works. Mr. Murch stated that every filter manufactured before it goes into an application has to be tested. Once they're installed, the Joint Chiefs of Staff set up a testing organization to go out and test the final facilities and they have to meet the standard to be approved. Chairman Russell wanted to know if they applied a pulse to it and Mr. Murch responded yes, they apply a pulse to it.

Mr. Benwell showed a picture that had a giant antenna and in the center was a 7 megavolt pulse generator. It was a simulator that the army operated. He used to work for the U.S. Army research laboratory in the nuclear weapons effect agency. This simulator was used for verifying that the EMP protection that was installed worked. This was how the army certified the equipment that was hardened. He showed a test that he was involved in (HEMP vulnerability testing).

What are your Electromagnetic Threats?

- High Altitude Electromagnetic Pulse
- "Portable" EM Systems
 - o Narrow Band (energy contained within a narrow frequency band)
 - o Wideband (energy spread over several decades)

Mr. Benwell showed a comparison of the time domain pulse from EMP and the time domain pulse for lightning. It was important to note the wave shapes. The EMP wave form was substantially shorter. It's not as long, so it doesn't have the average power that lightning would have, but it had a much higher frequency content. If you took those time domain wave forms and transformed them into the frequency domain, you would see that lightning has more energy in the low band compared to EMP, but EMP covers a much wider band. HEMP was a very unique phenomena. The only way it is produced is when a nuclear weapon is detonated high in the upper atmosphere.

High Altitude Electromagnetic Pulse (HEMP)

- HEMP is the transient radio-frequency wave impulse that is both intense (50kV/m) and widespread (reaching to the horizon) that is produced when a nuclear device is detonated

at high altitude. It is a singular phenomenon in that it is only generated in one way – by the detonation of a nuclear device in our upper atmosphere (typically 30-100km).

- At these heights, it is unlikely that any other nuclear induced environments (radiation, high energy particles) will affect people on the ground.
- HEMP is actually comprised of three distinct waves described as E1, E2 & E3 that independently vary in intensity depending on altitude of detonation, weapon yield, and weapon design.

Reality

A device detonated over Illinois would expose >80% of our country's EHV substations.

MOV Surge Arrestor Limitations

Mr. Benwell explained the surge arrestor clamping effect showing a comparison with HEMP and lightning.

Councilor Bandazian stated that Bedford and most municipalities have emergency operation plans drafted with the assistance of a dozen statewide regional planning commissions and the origins of threats like terrorism or nuclear attack are identified, but they are response oriented. Response can be prevention, but for what Mr. Benwell was describing it wasn't in his draft form emergency operations plan. When Mr. Benwell talks about the government, he assumes that he's talking about Federal government. He wanted to know if state and local governments or regional counties were doing anything that he's aware of. Mr. Murch stated that most emergency management folks they've talked to have talked to them about the fact that they had a backup generator. In reality, there's a good chance that that backup generator would be damaged during an attack. He thought more than likely an IEMI attack. Also, the radio systems they are using would be affected. The radios in the cars, the boards on those would be damaged so their communications would be very limited. That's what makes it so difficult. You would almost have to have a whole backup set of radios and a process so if they hit a large scale communication blackout, that there was some flag that told everybody to go get their replacement radio. That's just a communications standpoint.

Mr. Gillis wanted to know where that backup radio was. Those devices didn't have to be on to be affected by an EMP pulse. He wanted to know where they would you keep them. Mr. Benwell stated that his personal opinion was that an unpowered radio was pretty safe. What industry was doing now was preparing shielded storage space. It might not be a super sophisticated shielded volume, but it could be a commercially available cabinet with some additional gasketing.

Councilor Thomas wanted to know what the plan would be for the new Police station they were going to build. Mr. Benwell stated that his recommendation was that any important building should have some designed shielded volume with all of the most critical components. It could be just a single room. Mr. Gillis wanted to know if wire mesh would work or if it had to be metal. Mr. Benwell stated that it depends on the threat. IMI tends to be in the higher frequency band. Its shorter pulses, so they can radiate the pulses efficiently with an antenna or it's a narrow band like a microwave source. Those are all higher bands. Mesh was probably effective for things like that. They were hard to build mechanically, so a thin layer of metal was mechanically easier to manufacture. EMP was different, because it's so wide band and mesh would not be adequate.

Ms. Mahoney wanted to know if the DoD was protecting their medical facilities. Mr. Benwell stated that they are protecting their prime power. Utility is always the biggest connection. His bias is HEMP, because that's his background and it's such a unique threat that it really requires special

attention. A lot of government buildings and critical infrastructure sites count on them (Bedford) to provide reliable power. Mr. Murch stated that they know that the DoD and DHS have put emphasis on critical infrastructure that supports military bases. So much of the power has been taken off base and given to the public utilities.

Mr. Lu thought given the size of Bedford, there were a lot more interesting targets in the area besides Bedford. Mr. Murch stated that it is a population center. It's a bedroom community for Boston. The idea was just to create a demoralizing affect. It doesn't mean that Bedford is counted out. With TSS and Directed Energy Technologies, if Bedford came to them and said we're building a Police station would you sit down with us and tell us what you think we need to harden, they would sit down with you and tell you what they think you need to harden and how to do it.

IV. Reports of Members and Committees

a. School projects progress and planning

Mr. Foote stated that there was nothing from the energy front. The warrants are defined and everything has been approved and it's going to be available for the March Election. They have a warrant for security enhancements. That's for hallway cameras in all the schools and intruder alert system for all the schools also. Chairman Russell wanted to know how many warrants they had. Mr. Foote stated that there were a lot of housekeeping ones, but this one was the only one with a dollar figure. If they do it over 20 years, the impact was going to be less than a cent per 1,000. It's \$800K between those two things and replacing the switchboards at Peter Woodbury and Memorial.

- 1. Progress with systems upgrades** – Nothing to report
- 2. Portfolio Manager**

Mr. Foote stated that he hadn't heard back from him (Todd Zollman). They had an old version, but he's not sure if he has engaged with Eversource since then. Todd has help now, so he will follow up with him. Councilor Bandazian stated that if they get the solar project through at the landfill it would be very convenient to be able to make a case.

- 3. New projects in 2023 budget** – Nothing to report

V. Old Business

b. Solar Project/Warrant Article of March 14th

- 1. Transfer Station – Town Council warrant article approval**
- 2. Warrant Article – What can we suggest to Bedford groups**
- 3. Plan presentation materials**
- 4. Timeline and Community outreach planning**

Councilor Bandazian stated that it's moved forward to the warrant. Chairman Russell thanked the Town Council. Councilor Thomas wanted to know if they understood why the wording was changed. Originally the warrant was going to say \$3.5M, but says the full price, because since it's a rebate and they don't have it in hand, they didn't want that holding up the project. They wouldn't be able to do the project. That's why it's calling for the full amount. It will be done no matter what, but the 30%ish they should get back would go towards that. That's what bond counsel had changed.

Chairman Russell wanted to know the likelihood they get the 30%. Councilor Bandazian stated that he would be in a better position after tomorrow. Senator Shaheen's office was doing an information session that he's signed up for as did Rick Sawyer, Jeff Foote, and Jeanne Walker. One of the issues is how incentives are stackable. That will affect the rebate. It will potentially affect how they finance it. He didn't know if tax-exempt bonds were stackable with the rebate. Mr. Lu thought firm words would make people feel more comfortable with it.

Mr. Foote wanted to know if the School could tack on to the Town's bond if it passes to reduce the bond charge. Councilor Thomas didn't think they could. Councilor Bandazian thought it would be challenging. Councilor Thomas stated that they were separate government agencies. She didn't think they could bond together. They were two separate projects. They would check on it.

Councilor Bandazian stated that the compactors had a longer payback than generating electricity, so it makes the ROI a little bit longer, but it's still very attractive. One key point in the budget handout is that the public will see that the electricity costs have gone up by 54% in one year. Their very conservative projections in the warrant article were based on a 3% per year increase.

Chairman Russell wanted to know when they could start broadcasting it. Councilor Thomas responded now; it's on the ballot. Mr. Gillis wanted to know if there was potential for more changes and Councilor Thomas responded no. Councilor Thomas stated that the numbers were correct. They just added more description saying it wasn't just solar. Chairman Russell wanted to make sure that they could take the warrant and say they have this fantastic project they want to tell them all about. Councilor Bandazian stated that when you start talking about incentives, he will know more at the end of tomorrow. It doesn't change the text. Mr. Lu thought they could have website updates on the Town website and Councilor Bandazian could put a comment below after he hears more. Councilor Bandazian stated that they will know by the 7th of February what article number this is; then they could say vote for article X. Councilor Thomas stated that yesterday it was Article 5. Councilor Bandazian stated that Mr. Sawyer thought it might change.

Chairman Russell thought they needed to think about how they were going to broadcast this to the groups and the mechanism for doing that. He's looking for volunteers to join him. Councilor Bandazian suggested that they line up the dates with the chairpersons of those organizations; he'll be there if he's available. Councilor Thomas thought Facebook was a way to get the word out.

Mr. Foote wanted to know the tax impact. Councilor Bandazian thought that it depended on the financing part of it. The first year would be better than the second year. The second year might be more of a break even. He thought a nickel was probably ballpark. Councilor Thomas stated that the road bonds would be expiring, so the timing was good. Mr. Foote mentioned the \$30M bond. Councilor Bandazian added the TIF bond, which they may be able to retire it next year.

Chairman Russell stated that regarding planning, they could draw people in as they get groups lined up. They'll try and develop some materials to present. Councilor Bandazian stated that there were only a handful of meetings that these organizations would have between now and March 14th. He thought they would get 5 or 10 minutes. Chairman Russell thought they should think about how they answer the question about tax impact. Councilor Bandazian thought that was getting into the weeds. When you have compactors you eliminate the need to capital reserve for a backhoe, so that goes away. There could be some personnel savings that would be more difficult to quantify, because you no longer need someone at the heavy equipment pay grade; they need somebody at the labor pay grade. You also eliminate diesel fuel. It probably all amounts to a penny on the tax rate. Until they actually have some real experience with it, it's hard to do anything other than to

make a good faith estimate. There were bits of an electric bill they would still have to pay. Mr. Foote thought the demand part of the bill. Councilor Bandazian thought that was down the road.

Chairman Russell wanted to know when the RFP was going out. Councilor Bandazian stated that they were still working on that. Public Works was working with a new consultant. Their goal was to have a firmer number, which he thought would be significantly lower than what is in the warrant article, but they don't know that. He hoped they had those numbers before people vote. The timing was tight, because you want to have 30 days for people to respond. Chairman Russell thought they could push messages out to Facebook groups as there were updates coming in. Councilor Thomas added that they could let them know there was a warrant article, what it's for, and it's going on the landfill. It was a perfect use for dead land and play it up that way; it's a perfect place for it.

a. Eversource 3-Phase Power update

Councilor Bandazian stated anytime in 2023. It's just up to the DPW construction schedule.

b. Solsmart – No update

VI. New Business:

a. CENH Updates – No update

b. Website

Chairman Russell thought it would become active with the warrant article. Maybe he and Ms. Mahoney would take the lead and Mr. Lu would jump in. Mr. Lu stated that he would jump in and look at the website and look for improvements.

Councilor Bandazian announced that they now have a Director of Strategic Initiatives, which was basically the Town Manager's position, but it was a position where Jeanne Walker, our Town engineer, had been promoted to and was approved last night by the Council. She would be sitting with them at their meetings as their designated staff person. He thought they would be working together on what comes next if the project passes. Councilor Thomas added that this Commission would finally have a Town employee who would be here.

VII. Reminders:

a. Next upcoming meeting February 23, 2023

VIII. Adjournment

**MOTION by Mr. Gillis to adjourn at 8:10 PM. Seconded by Councilor Bandazian.
All in favor.**

Respectfully submitted by,

Dawn Boufford