

Multi Municipal Wind Turbine Working Group
MINUTES

MMWTWG-2023-02
Thursday, March 9, 2023, 7:00 p.m.
Virtually via Microsoft Teams

Members Present: Mark Davis - Municipality of Arran-Elderslie - Citizen
Appointee
Brian Dudgeon - Municipality of Arran-Elderslie
Ryan Nickason - Municipality of Arran-Elderslie
Scott Mackey - Township of Chatsworth
Terry McKay - Township of Chatsworth
Paul McQueen - Municipality of Grey Highlands
Tom Allwood - Municipality of Grey Highlands
Dan Wickens - Municipality of Grey Highlands
Todd Dowd - Municipality of Northern Bruce Peninsula

Others Present: Julie Hamilton - Recording Secretary

1. Meeting Details

2. Call to Order

The Chair called the meeting to order at 7:00 pm. A quorum was present.

3. Adoption of Agenda

The Working Group passed the following resolution:

MMWTWG-2023-09

Moved by: Scott Mackey - Township of
Chatsworth

Seconded by: Ryan Nickason -
Municipality of Arran-
Elderslie

Be It Resolved that the Multi-Municipal Wind Turbine Working Group hereby adopts the agenda of the Thursday, March 9, 2023 as distributed by the Recording Secretary.

Carried

4. Disclosures of Pecuniary Interest and General Nature Thereof

There were no disclosures of pecuniary interest or general nature thereof declared at this time.

5. Minutes of Previous Meetings

5.1 January 12, 2023 MMWTWG Minutes

The Working Group passed the following resolution:

MMWTWG-2023-10

Moved by: Dan Wickens - Municipality
of Grey Highlands

Seconded by: Mark Davis - Municipality
of Arran-Elderslie - Citizen
Appointee

Be It Resolved that the Multi-Municipal Wind Turbine Working Group hereby approves the minutes of the Thursday, January 12, 2023 meeting as presented by the Recording Secretary.

Carried

6. Business Arising from the Minutes

6.1 Revisions to the Terms of Reference

The Working Group discussed the revised Terms of Reference as presented by the Recorded Secretary based on comments received from Members of the Working Group. Amendments were made during the discussion. These amendments will be finalized by the Recording Secretary and forwarded to Member Municipalities for approval by their respective Councils.

Subsequent to further discussion, the Working Group passed the following resolution:

MMWTWG-2023-11

Moved by: Dan Wickens - Municipality
of Grey Highlands

Seconded by: Ryan Nickason -
Municipality of Arran-
Elderslie

Be It Resolved that the Multi Municipal Wind Turbine Working Group hereby approves the Terms of reference as amended and

direct the Recording Secretary to forward a copy to each member Municipality for approval by their respective Councils.

Carried

6.2 Minister of Finance - Response to Wind Turbine Taxation Correspondence

The Members sought clarification on the taxation process referred to in the letter. The structure is assessed by MPAC based on the megawatts. Municipalities then apply their industrial tax rate to that assessment. The generation equipment such as turbines and generation equipment are exempt from taxation, similar to the equipment installed in other manufacturing facilities.

The Working Group will continue to pursue having MPP Rick Byers attend as a guest at a future meeting.

The Working Group passed the following resolution:

MMWTWG-2023-12

Moved by: Scott Mackey - Township of Chatsworth

Seconded by: Mark Davis - Municipality of Arran-Elderslie - Citizen Appointee

Be It resolved that the Multi Municipal Wind Turbine Working Group hereby accepts the correspondence from the Minister of Finance information purposes.

Carried

6.3 Wind Turbine Failures Letter

The letter highlights concerns associated with the catastrophic failures that have been seen with wind turbine projects. The Working Group discussed the efforts that had been made to communicate these concerns to other Municipalities.

The Chair and Recording Secretary will facilitate a follow up to the correspondence to address the recommendations raised by the Working Group in the original letter.

6.4 FOI Requests

No further information has been received on these requests to date.

6.5 Bill Palmer - Technical Issues related to Energy Storage

Mr. Palmer made a presentation to the Working Group regarding the technical issues associated with Battery Energy Storage Facilities.

He provided the an overview of the Ontario's energy supply and demand sources and what the IESO is projecting will be the demand needs by 2050.

Mr. Palmer then addressed battery storage systems (BESS) specifically.

Lithium Ion comprise approximately 90% of industrial/electrical supply storage batteries. Li-ion generally good for fast response, up to 4-hour discharge time however, barely adequate for shifting night supply to daytime usage of energy, a poor choice for storage needing days or weeks vs hours of storage, due to Li-ion self-discharge over time. There are several other alternatives under development.

Fire hazards are a main concern with the installations and the emission of toxic fumes and gases into the air is a potential health hazard. Additionally, the types of chemicals used in the batteries could combust and create explosions. Thermal runaway can also occur when the heat generated within a battery exceeds the amount of heat that is dissipated to its surroundings. If the cause of excessive heat creation is not remedied, the condition will worsen, creating a potentially unstoppable fire.

Since these unit are relatively new, first responders typically have limited experience with combating the battery fires, which behave much differently than typical fires.

Mr. Palmer briefly touched on hydrogen.

90% of the hydrogen produced today is from fossil fuels. To produce "green hydrogen" from renewable electricity from solar or wind will be "cost prohibitive". Hydrogen for vehicle fuel cells is stored under very high pressure of about 10,000 PSI. It needs heavy cylinders, with carbon fibre reinforced barriers. Hydrogen under pressure tends to react with metal, forming brittle hydrides, degrading the storage vessel. Fuel cells to make electricity from hydrogen for vehicle propulsion need

platinum or iridium, which are neither are cheap nor plentiful. Adding hydrogen above about 7% in concentration to natural gas supply network requires modifying all combustion equipment (furnaces, etc.) connected to the gas line for safety reasons. Batteries can typically reuse between 80–90% of the chemical energy stored, but fuel cells generally transform only 40% to 60% of their energy to produce electrical power. Overall, “Green Hydrogen” supply/usage efficiency is about 30%. 70% of the energy is wasted.

The Working Group thanked Mr. Palmer for his presentation.

Subsequent to further discussion, the Working Group passed the following resolution:

MMWTWG-2023-13

Moved by: Dan Wickens - Municipality
of Grey Highlands

Seconded by: Scott Mackey - Township of
Chatsworth

Be It Resolved that the Multi-Municipal Wind Turbine Working Group hereby receives the presentation made by Mr. Palmer regarding the technical issues associated with energy storage facilities for information purposes and that the presentation be forwarded to the Member Municipalities recommending that it be provided to their respective Fire Chiefs and comments provided back to the Working Group.

Carried

7. Delegations/Presentations

7.1 Ruby Mekker - Wind Turbines defined as a Health Hazard

Ms. Mekker spoke at a previous meeting regarding her efforts to clarify if industrial wind turbines are, or should be, recognized as health hazards.

She felt that the Working Group had not understood her request at that time. She provided a brief overview of her concerns for any new members. She requested that the Working Group consider the draft letter she had prepared be distributed to the Government of Ontario.

The Working Group thanked Ms. Mekker for her presentation and recognizes the health concerns and hazards associated with wind turbines.

Subsequent to further discussion, the Working Group passed the following resolution:

MMWTWG-2023-14

Moved by: Mark Davis - Municipality
of Arran-Elderslie - Citizen
Appointee

Seconded by: Scott Mackey - Township of
Chatsworth

Be It Resolved that the Multi Municipal Wind Turbine Working Group hereby agrees to seek clarification/confirmation by way of a letter to the Ministry of Health about whether audible wind turbine noise of industrial wind turbines audible wind turbine noise at the levels permitted by the Government of Ontario are, or should be considered, a "health hazard" as defined by the Health Protection and Promotion Act of Ontario, something "that has or that is likely to have an adverse effect on the health of any person."

Carried

7.2 Warren Howard - WCO Battery System Storage Report

Mr. Howard provided a presentation on the Wind Concerns Ontario findings on the Battery Energy Storage Systems.

The IESO proposal only requires that proposals meet "good engineering and operating practices". They are not required to submit to design or other protection features.

Ontario Regulation 359/09 O. Reg. 359/09: Renewable Energy Approvals made under the Environmental Assessment Act does not speak to these types of regulations.

In his research, he did note a couple of standards that appear to be relevant.

National Fire Protection Association

- Standard 855 – 2020; Revised 2023

Underwriters Laboratory

- ANSI/CA/UL9540 – April 2021
- ANSI/CA/UL9540A - November 2019

Hydro One has some setbacks in place due to the damage that prolonged heat and smoke would do to their equipment however, there are no other known setbacks. The technology is too new to be covered in municipal zoning bylaws. Noise emissions could also be an issue based on municipal noise bylaw regulations.

Some items that were noted to consider regarding these projects is the management of toxic and explosive gases, dry sprinkler systems, access to large quantities of water, separation of modules to allow fire equipment access and acoustic barriers.

Also, local emergency support should have specialized training to be able to properly handle the scale of the potential fire hazards associated with these installations as well as the toxic fumes and run-off that could occur.

Mr. Howard's presentation made the following recommendations which are also covered in the Wind Concerns Ontario report, Assessment of Community Risks.

- Add Battery Storage to Regulation 359/09
- Establish minimum setbacks from all activities
- Require design certification by an accredited body (UL9540A) and meets all standards (i.e. UL9540, and NFPA 855)
- Monitoring and fire containment systems linked to local emergency services
- Assessment of all noise emissions with abatement as required
- Emergency plan agreed with local authorities including specifications on support required
- Final package presented to municipal council for approval before permits issued.

The Working Group thanked Mr. Warren for his presentation.

This presentation highlights the concerns that were raised in Mr. Palmer's presentations regarding the extreme fire hazards that are potentially present with these installations.

Several questions have been raised such as setback requirements, evacuation protocols, emergency preparedness plans especially with some of these installations being in the vicinity of a settlement area.

Subsequent to further discussion, the Working Group passed the following resolution:

MMWTWG-2023-15

Moved by: Scott Mackey - Township of Chatsworth

Seconded by: Dan Wickens - Municipality of Grey Highlands

Be It resolved that the Multi Municipal Wind Turbine Working Group hereby receives the presentation made by Mr. Howard regarding the WCO Battery Storage Systems Report and that it be forwarded to Member Municipalities along with Mr. Palmer's presentation and that a letter be forwarded to the Office of the Fire Marshall regarding fire suppression measures and emergency preparedness plans related to battery storage facilities.

Carried

8. Correspondence

8.1 Requiring Action

8.1.1 Approval of 2023 Meeting Schedule

Subsequent to further discussion, the Working Group passed the following resolution:

MMWTWG-2023-16

Moved by: Dan Wickens - Municipality of Grey Highlands

Seconded by: Todd Dowd - Municipality of Northern Bruce Peninsula

Be It Resolved that the Multi Municipal Wind Turbine Working Group hereby adopts the 2023 meeting schedule as presented.

Carried

8.1.2 2022 Year End Financial Statement

The Working Group passed the following resolution:

MMWTWG-2023-17

Moved by: Terry Mckay - Township of Chatsworth

Seconded by: Todd Dowd - Municipality of Northern Bruce Peninsula

Be It Resolved that the Multi Municipal Wind Turbine Working Group hereby receives the 2022 Year End Financial Statement for information purposes.

Carried

8.1.3 2023 Membership Fee

The fee is currently set at \$400.00 per Member Municipality. The fee will remain the same for 2023.

Subsequent to further discussion, the Working Group passed the following resolution:

MMWTWG-2023-18

Moved by: Dan Wickens - Municipality of Grey Highlands

Seconded by: Mark Davis - Municipality of Arran-Elderslie - Citizen Appointee

Be It Resolved that the Multi Municipal Wind Turbine Working Group hereby approves that the 2023 Membership Fee remain to be set at \$400.00 per Member Municipality.

Carried

8.1.4 Approval of Recording Secretary Invoice

The Working Group passed the following resolution:

MMWTWG-2023-19

Moved by: Ryan Nickason -
Municipality of Arran-
Elderslie

Seconded by: Terry Mckay - Township of
Chatsworth

Be It Resolved that the Multi Municipal Wind Turbine Working Group hereby approves payment of the invoice for the Recording Secretary Services for January and February, 2023.

Carried

8.2 For Information

None.

9. Members Updates

Member Mackey noted that a company was speaking to property owners in the area looking for properties for potential wind turbine projects. He did not have any specific details but received the information from a concerned citizen.

Chair Allwood noted that Stewart Halliday was appointed as the Citizen Appointee for Grey Highlands and would be in attendance in the future.

10. New Business

The Membership suggested reaching out to the municipalities with the new Terms of Reference to try to re-engage other municipalities with the new mandates, especially in light of the battery storage facilities and their associated risks.

Once the new Terms of Reference have been approved by the Member Municipalities, a letter will be drafted to be sent out to Ontario Municipalities.

11. Closed Session (if required)

There was no closed session required.

12. Resolution to Reconvene in Open Session

13. Adoption of Recommendations Arising from Closed Session (If Any)

Direction was given to staff in Closed Session for items

14. Adoption of Closed Session Minutes

15. Confirmation of Next Meeting

The next meeting will be held May 11, 2023 at 7pm via Teams.

16. Adjournment

The Working Group passed the following resolution:

Moved by: Mark Davis - Municipality
of Arran-Elderslie - Citizen
Appointee

Seconded by: Scott Mackey - Township of
Chatsworth

Be it Resolved that the meeting of the Multi-Municipal Wind Turbine
Working Group is hereby adjourned at 2:43 p.m.

Carried

Tom Allwood, Chair

Julie Hamilton, Recording
Secretary

Terms of Reference

Multi-Municipal Energy Working Group

MMEWG

Name:

The committee shall be known as the Multi-Municipal Energy Working Group (the "Committee"). The Committee may be cited by its short title MMEWG, when appropriate to do so.

Purpose:

The purpose of the Committee is to draw together representatives from municipalities to share, discuss and advocate "best practices" and other means to address mutual concerns regarding energy generation facilities and storage infrastructure to all the relevant Government Ministries and Agencies.

Activities:

The Committee will meet on a regular basis to discuss ongoing matters and, where applicable, make recommendations to the Councils of the member municipalities for support and/or action as applicable.

The Committee will also undertake research into various related topics and liaise with other similar working groups as appropriate to share information and ideas.

The Committee may form sub-committees to concentrate on specific matters, which sub-committees will report back to the Committee on an ongoing basis.

Delegated Authority:

The Committee is a working group and has no delegated authority except for the advocacy of best practices.

The Committee has no authority to direct staff from any of the member municipalities, and any recommendations requiring implementation, reports, staff action, or a commitment to expend money must first be approved by the respective Council or Councils as the case may be, depending on the municipality(ies) impacted, before any action by staff may be taken.

Committee Composition:

The membership of the Committee will be comprised of representatives appointed by Council resolution or by-law from participating municipalities as follows:

- Two members of council from each participating municipality appointed as regular members of the Committee
- One member of council from each participating municipality appointed as an alternate to attend in the absence of one or both of the regular member representatives from that municipality (appointment of alternate is at the discretion of each member municipality)
- One citizen member may be appointed by each member municipality for the purpose of bringing additional expertise to the discussion

Should any participating municipality wish to opt out of the Committee, a resolution from the participating municipality shall be received by the Committee by December 31st of the year they wish to cease membership. There will be no refund of the annual fee to the municipality wishing to opt out.

Term of Office:

All members of the Committee shall be appointed for the term of the Council of the member municipality that appointed them.

Each appointing Council reserves the ability to replace its appointees at its sole discretion and may do so at any time by notifying the Recording Secretary by way of resolution or by-law.

Administration of the Committee:

The Committee will elect a Chair and Vice-Chair from amongst its members on an annual basis, at the beginning of each calendar year.

The Committee will be governed by the Procedural By-law of the Municipality of Arran-Elderslie, except as set out in these Terms of Reference.

Meetings of the Committee shall be open to the public, subject to the exceptions set out in Section 239 of the *Municipal Act, 2001*, as amended.

A maximum of three (3) delegations will be permitted to be placed on the agenda for any Committee meeting, or at the discretion of the Committee. The request to be added to the agenda and the nature of the delegation must be provided to the Recording Secretary not less than five (5) business days prior to the meeting. Each delegation will be allotted ten (10) minutes for their presentation, at the discretion of the Committee.

Notwithstanding the limit to the number of delegations to be placed on the agenda, with the approval of a majority of the Committee members present, up to an additional three (3) 5-minute delegations may be permitted to address the

Committee at any given meeting on short notice.

Delegations will not be permitted to appear before the Committee to present the same information on more than one occasion, nor shall multiple delegations be permitted to repeat the same information as previous delegations, and the ruling of the Chair of the Committee with respect to this matter shall be final.

Staff attending meetings of the Committee are not members of the Committee.

All members of the Committee agree to provide financial support for the secretarial support for the Committee by forwarding, to the Municipality of Arran-Elderslie an amount as established by the Committee, and approved by consensus of the Councils of the participating municipalities. The Committee will review and levy this amount on an annual basis, at the beginning of the calendar year and this levy must be paid by June 1st in each year. In case of any participating municipality discontinuing their participating in Committee, the said municipality shall remain liable for payment of their support for that calendar year.

If the Committee is disbanded, the members of the Committee at the time of disbandment shall agree how the remaining funds shall be distributed, and approved by consensus of the Councils of the remaining participating municipalities.

The Committee shall provide an annual fee structure which shall be approved by Councils of the participating municipalities. A year-end financial statement will be forwarded to the Clerks of the participating municipalities by April 1st of the following year.

Minutes from Committee meetings will be presented for adoption by the Committee at its next regular meeting and once adopted, forwarded to the member municipalities for information and disposition of recommendations as necessary.

Membership:

A yearly record of membership will be established by the Recording Secretary and the agendas and minutes will reflect the name of the appointed member's municipality represented. This record of membership shall be updated from time to time as required, and be provided to all participating municipalities.

Quorum:

Quorum shall be a representation of appointed officials from a majority of the participating municipalities, either by one, two or three of the appointed

members or the alternate appointee (where such appointee exists). Quorum shall be more than 50% of the participating municipalities.

If there is no quorum within thirty minutes after the time appointed for the meeting, the Recording Secretary shall call the roll and record the names of the members present and the meeting shall stand adjourned until the next regular meeting or until a special meeting is called.

Voting Strength:

Each appointed member shall carry a voting strength of one (1) vote per individual.

Agendas and Minutes:

The Agendas will be prepared by the Recording Secretary and distributed to each participating municipality for posting in accordance with their standard practices.

The minutes, once adopted by the Committee, will be forwarded to each participating municipality and made public by each participating municipality in accordance with their standard practices.

Meeting Schedule:

It is expected that the Committee will meet on a bi-monthly basis, or at the call of the Chair, as may be determined from time to time.

Meetings will be primarily held virtually using Microsoft Teams or other suitable virtual platform in an effort to broaden the membership and participation area. Meetings may also be held in other appropriate formats to accommodate the needs of the Committee.

The platform in which meetings are held will be reviewed by the committee from time to time and altered to accommodate the needs of the committee by a general consensus of the committee members.

The Committee will establish a proposed meeting schedule on an annual basis at the beginning of the year to facilitate planning.

Remuneration:

Committee members shall be compensated for meeting attendance by their respective member municipality in accordance with their municipalities remuneration policy and/or procedures.

Staff Resources:

Secretarial support including preparation of agendas and minutes of meetings will be provided by the Recording Secretary who is hired by the Committee.

The Committee may appoint a technical assistant at a rate to be determined, and approved by consensus of the Committee, but will not exceed the annual budget.

Miscellaneous:

These Terms of Reference for the Multi-Municipal Wind Turbine Working Group are established by consensus of the Councils of the participating municipalities and can only be altered by consensus of those municipalities.

Date of Adoption of Terms of Reference: February 2011

Date of Amendment: September 2015

Date of Amendment: March 2023

MULTI-MUNICIPAL WIND TURBINE WORKING GROUP

TOM ALLWOOD, COUNCILLOR, GREY HIGHLANDS, CHAIR

JIM HANNA, COUNCILLOR, TOWNSHIP OF HURON KINLOSS

1925 BRUCE ROAD 10, BOX 70, CHESLEY, ON N0G 1L0

519-363-3039 Fax: 519-363-2203

jhamilton@arran-elderslie.ca

March 24, 2023

Dear Municipal Clerks,

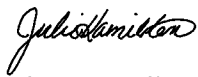
At the March 9, 2023 meeting of the MMWTWG, the Membership heard two presentation regarding Battery Energy Storage Systems. Both of these presentations complimented each other in providing both technical and regulatory information regarding the matter.

The presentations show a high probability that a severe fire hazard could present itself and these failures could potentially result in fires beyond the capabilities of local emergency services. There are further risks of toxic fumes and run-off during fire suppression measures.

The Members passed a motion that both presentations be provided to the Member Municipalities and recommends that they be forwarded to the respective Fire Chiefs for their review. The information may also be helpful to Members of Council.

The Working Group would welcome any comments that the Fire Chief's may have regarding the matter.

Warm Regards,



Julie Hamilton,

Recording Secretary

Deputy Clerk

Municipality of Arran-Elderslie,

1925 Bruce Road 10, PO Box 70

Chesley, ON N0G 1L0

519-363-3039 ext. 105

jhamilton@arran-elderslie.ca

Battery Energy Supply Systems

Impact on Host Municipalities

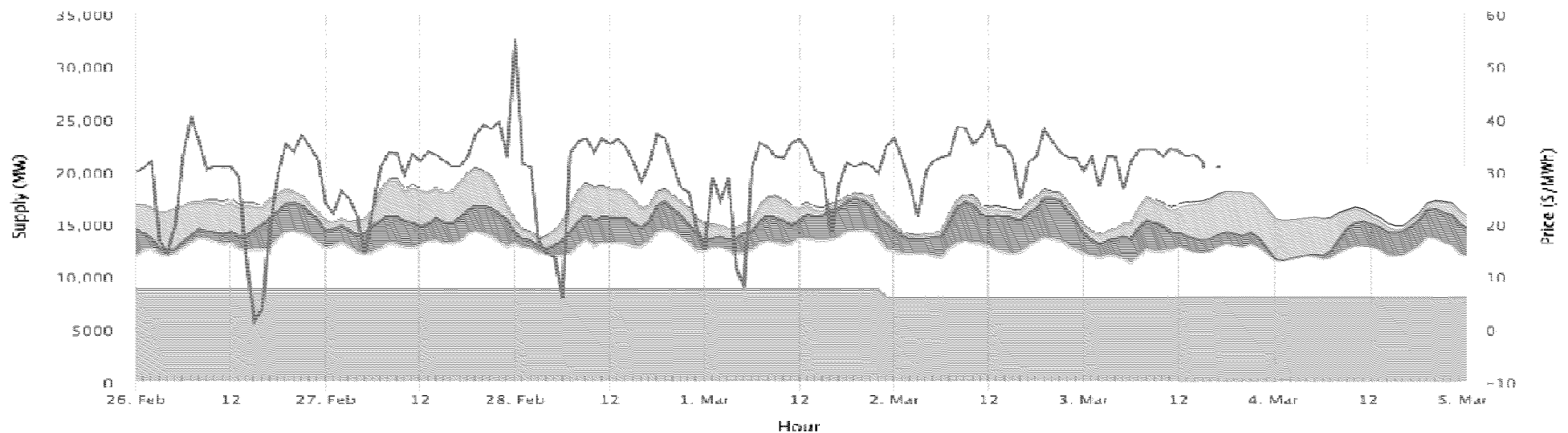
Presentation to Multi Municipal Wind Turbine Working Group

March 9, 2023

Bill (William K.G.) Palmer P. Eng.

What's the Issue?

Supply does not match Demand – Here's Last Week



Today 2-4 Mar 26 Feb-4 Mar

Generation By Fuel Type - Hourly
Nuclear — Hydro — Gas —
Wind — Solar — Biofuel —

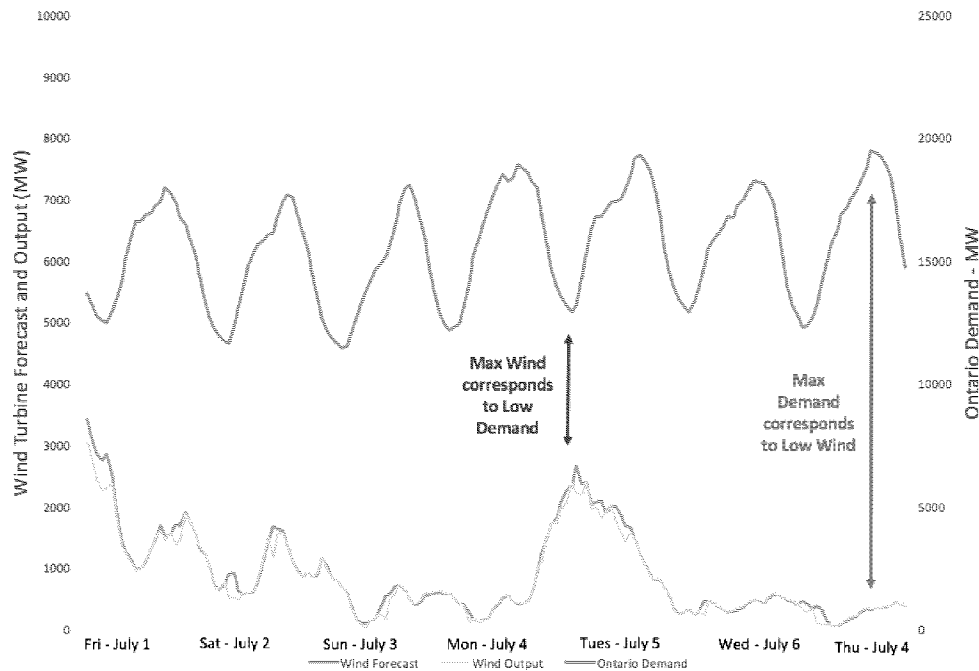
Imports Hourly —
Exports Hourly —
Net Import/Export - Hourly —

Compare With

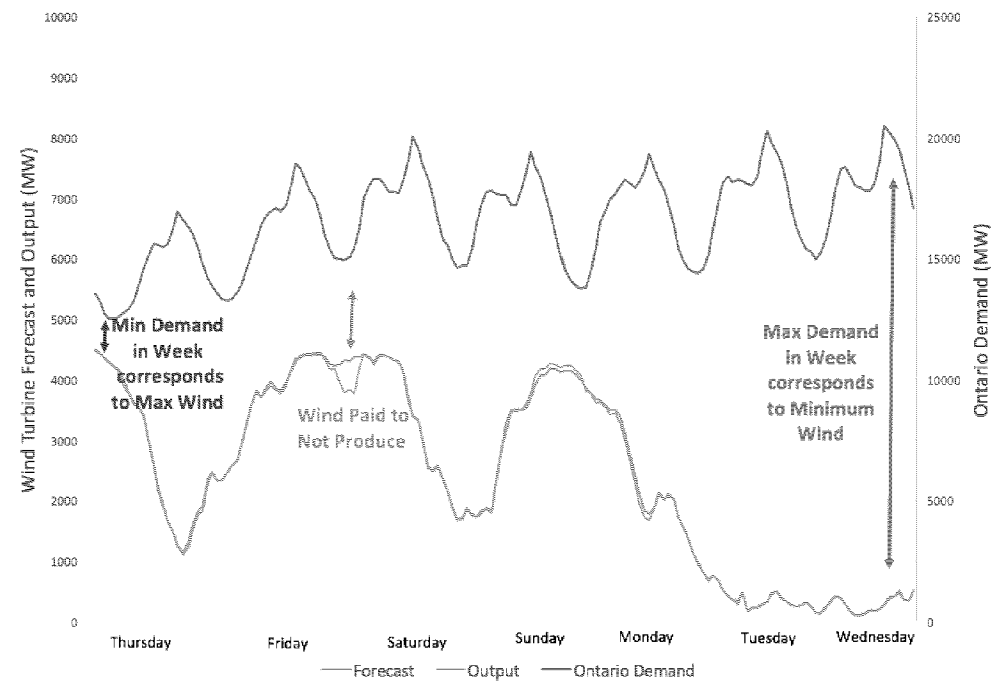
None
HIGP —

Two more examples of why adding more wind will make the need for storage more apparent

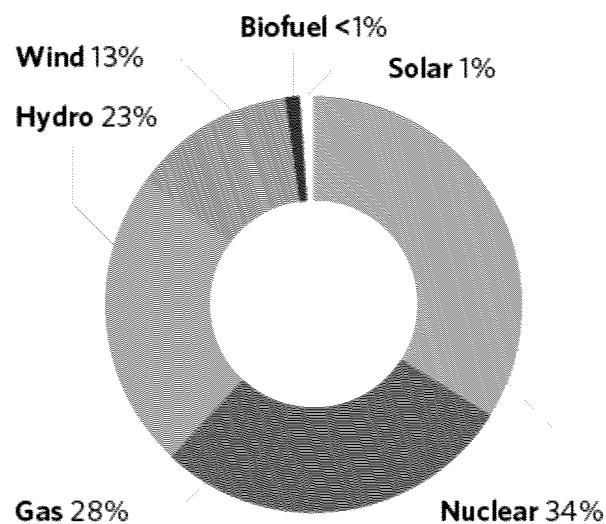
Ontario Demand and Wind - July 1 to 7, 2022



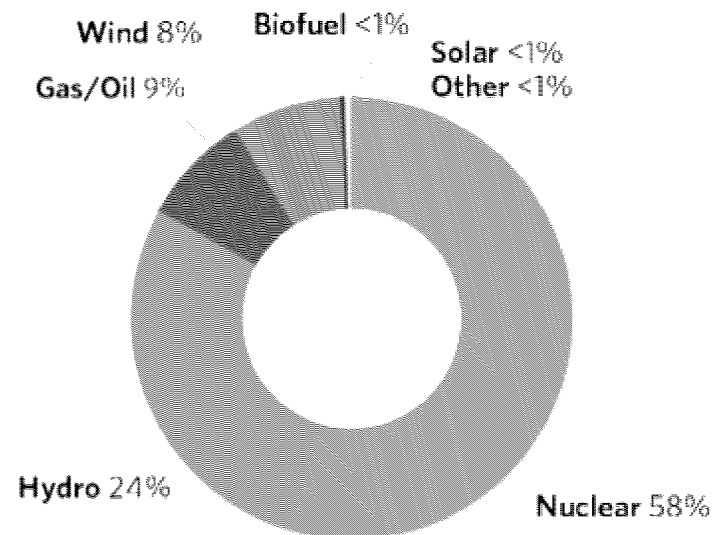
Ontario Demand and Wind - Dec 1-7, 2022



The Supply – Demand Mismatch is Growing



Nuclear	13,089 MW
Gas/Oil	10,482 MW
Hydro	8,868 MW
Wind	4,883 MW
Biofuel	296 MW
Solar	478 MW



Nuclear	83.0 TWh
Hydro	34.2 TWh
Gas/Oil	12.2 TWh
Wind	12 TWh
Biofuel	0.4 TWh
Solar	0.75 TWh
Other	0.01 TWh

Total 142.6 TWh

Here's today's Ontario Supply
Wind capacity > 38% of Nuclear

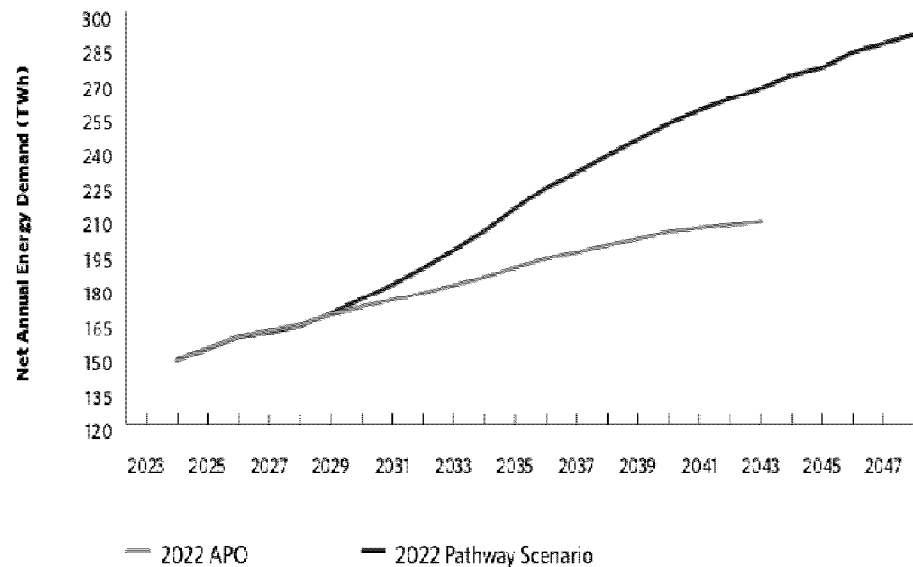
Here's What they Generated in 2021
Wind Generated < 15% of Nuclear

As the Proportion of Unreliable Generation Grows – There will be a Need for Batteries to Smooth the Valleys

- IESO “Pathways to Decarbonization” foresees the need by 2050 as:
 - 2,500 MW of battery storage – (by 2027- in 4 years!) \ (Perhaps not enough)
 - 6,000 MW of new solar (compared to 488 MW grid connected today)
 - 17,600 MW of new wind (compared to 4,883 MW grid connected today)
 - 657 MW new hydro
 - 17,800 MW of new nuclear (with only 300 MW committed today)
 - 15,000 MW of hydrogen equivalent (from ... somewhere else ???)
- BUT – the “Pathways” Document only *mentions* the transportation shift from petroleum to electricity in passing – sourced from who knows where?

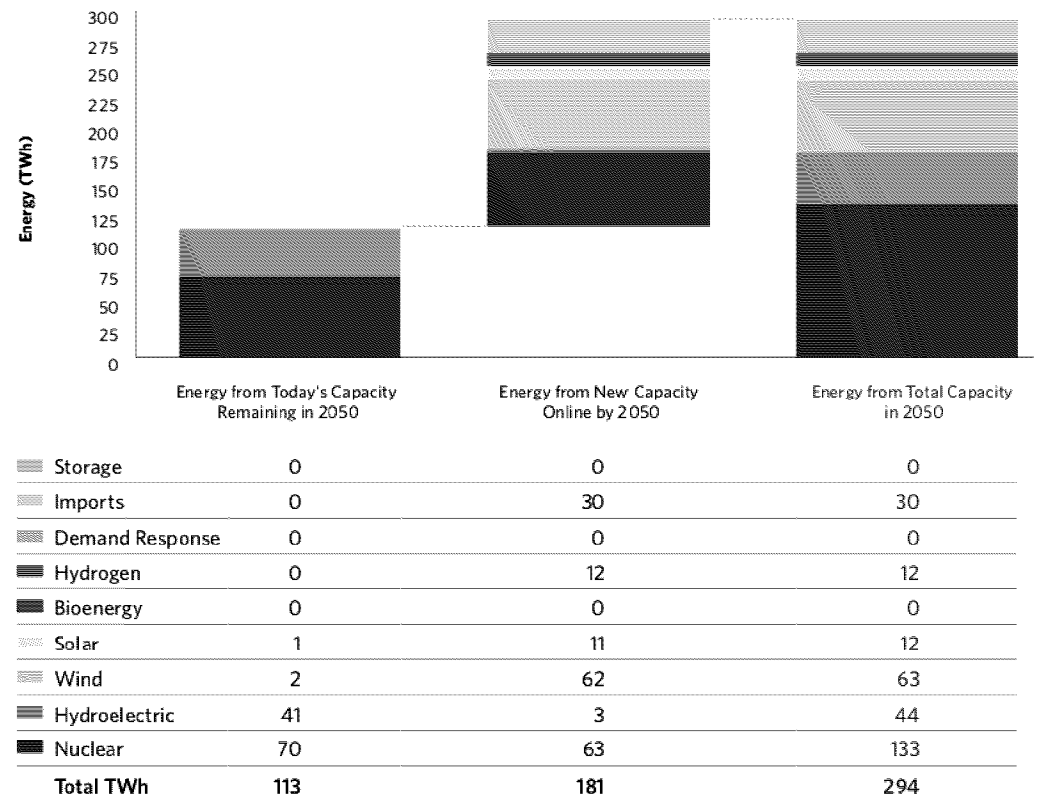
Here's What IESO Expects by 2050

Figure 7 | Energy Demand



IESO expects demand to double, and the increase in wind turbines to supply 22% of energy by 2050.

Figure 13 | Pathway Scenario - Energy in 2050



What was Ontario's Energy Demand (in 2019)

Figure 5: End-Use Demand by Sector (2019)

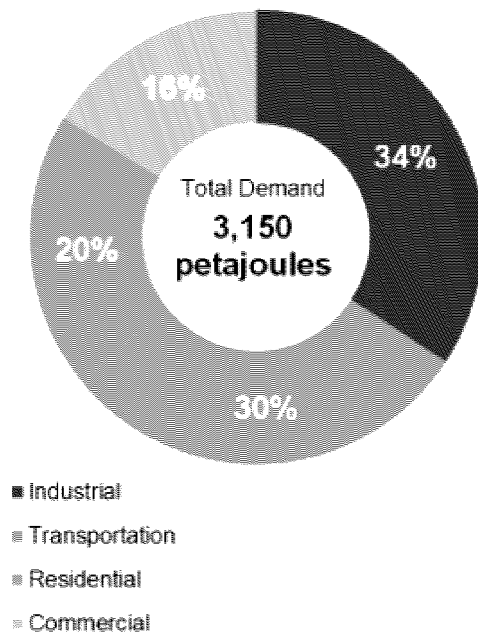
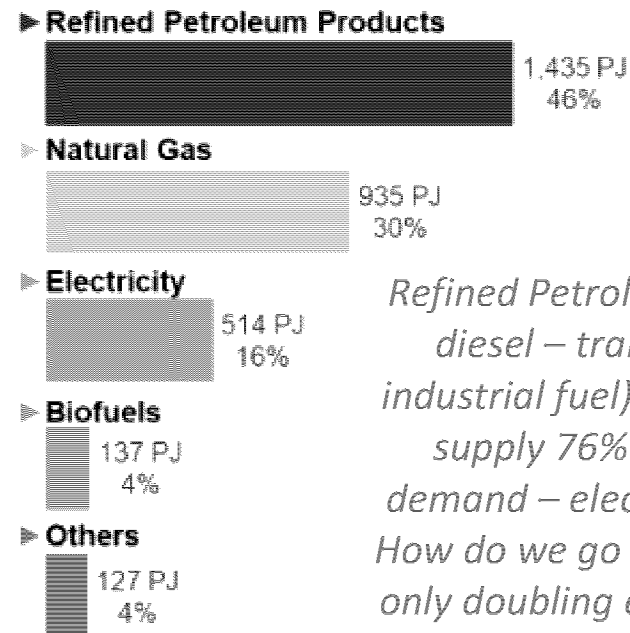


Figure 6: End-Use Demand by Fuel (2019)



Refined Petroleum (gasoline & diesel – transportation & industrial fuel) plus natural gas supply 76% of the energy demand – electricity only 16%. How do we go off oil and gas by only doubling electrical supply?

Battery Options

- Lithium Ion is the present champion (some 90% of industrial/electrical supply storage batteries)
 - has mostly replaced lead – acid as storage battery of choice except for motor vehicle starting duty
- Li-ion generally good for fast response, up to 4 hour discharge time. Barely adequate for shifting night supply to daytime usage of energy, a poor choice for storage needing days or weeks, vs, hours of storage, due to Li-ion self-discharge over time. Expensive ~ 135 to 250 US\$ per MWh, lithium scarce, fire hazard.
- Alternatives under development
 - Flow Batteries (charge stored in liquid electrolyte tanks, outside battery cell) e.g.
 - “Primus” zinc-bromide battery, said to be non-toxic, long term storage, good for 100 hour discharge
 - “ESS” iron-flow battery, said to be non-toxic, reduced need for fire protection than Li-ion.
 - Metal/Air Batteries
 - “Form Energy” iron-air batteries, cheaper than Li-Ion, said good for 100 hour discharge
 - “Zinc8” zinc-air battery, a Canadian start-up, designing for 8 hour + discharge cycle, cheaper than Li-Ion
 - “Aluminum-Air” battery, still in development, perhaps for long range motor vehicles. Replaceable not rechargeable.
 - Gravity storage
 - Pumped hydro (as at Meaford)
 - Energy-vault (crane storing blocks in tower, recover energy lowering blocks) aka “Gravity Storage”
 - Thermal storage, “thermo photo voltaic” cells sensitive to heat energy stored in carbon blocks for days
 - “HydroStor” compressed air storage - pilot plant now at Goderich, ON
 - Hydrogen extraction from water by electricity (electrolysis) – Later generation of electricity from fuel cells or as a heating fuel – BUT, mind the expense, as each step costs \$\$\$.

Li-Ion Grid Backup (BESS) Risks (1st example)

Lithium ion battery energy storage systems (BESS) hazards (published Feb, 2023)

- Over 30 large-scale (1 MW +) Li-Ion BESS experienced failures resulting in destructive fires in the past 4 years
- contain flammable electrolytes, can create unique hazards when the battery cell enters thermal runaway.
- paper focusses primarily on small containerized BESS are often installed in standard shipping containers ranging from 8 feet to 53 feet in length, with a width and height of approximately 8 feet each.
- typically equipped with smoke detection, fire alarm panel, and some form of fire control and suppression system
- initiating event frequently a short circuit which may be a result of overcharging, overheating, or mechanical abuse. During thermal runaway, large amounts of flammable and potentially toxic battery gas will be generated.
- Journal of Loss Prevention in the Process Industries, Vol 81, Feb. 2023, 104932
- <https://doi.org/10.1016/j.jlp.2022.104932>

Li-Ion Grid Backup (BESS) Risks (2nd example)

Battery Hazards for Large Energy Storage Systems (Published 2022)

- Li-ion batteries have become popular in new grid-level installations due to rapidly decreasing prices and wide availability
- variety chemistries, from lithium iron phosphate (LFP) cathode to those with a nickel manganese cobalt oxide (NMC) cathode and with graphite, silicon composite, or lithium titanate (LTO) anodes. (Different Chemical Risks – Must Know the Specifics)
- The reactive and hazardous nature of Li-ion batteries under off-nominal conditions can lead to safety incidents and may cause extensive damage to the BESS. 42 reported failure incidents from 2011 to 2021.
- Li-ion batteries are prone to overheating, swelling, electrolyte leakage venting, fires, smoke, and explosions.
- gases produced as a result of a fire, smoke, and/or thermal runaway can accumulate to a combustible level and cause explosion.
- High and low temperatures lead to different unsafe conditions. High temperatures lead to ... violent venting, fire, and thermal runaway. Low temperatures increase the viscosity of the electrolyte ... leads to increased internal cell temperatures ... thermal runaway and fire. *Heaters installed, to heat batteries before charging, but if heaters fail “off” – or “on” can lead to same destructive result.*
- combustible gases such as hydrogen, carbon monoxide, methane, ethylene, and propylene can be produced in concentrations above the TLV.
- [doi: 10.1021/acsenergylett.2c01400](https://doi.org/10.1021/acsenergylett.2c01400)

Li-Ion Grid Backup (BESS) Risks (3rd example)

What are the fire safety risks of lithium-ion batteries? (Published Aug 2022)

- Dr Amer Magrabi, principal fire engineer at Lote Consulting, gave a talk on battery fire safety at the [Australasian Fire and Emergency Services Council \(AFAC\) conference](#) in Adelaide.
- “It’s an emerging risk, we’re still coming to grips with it.”
- “Once alight, lithium-ion battery fires are very hard to extinguish. Common fire suppressants don’t work and the fire can burn very fiercely. In some circumstances, the battery can explode.”
- “If you have a problem with one cell, it’s going to start spreading.” This unstoppable fire is called “thermal runaway.”
- Water may assist with absorbing heat from some small fires, but it reacts dramatically with lithium – making it a bad decision to go directly on fires.
- Lithium-ion fires don’t burn cleanly: batteries can vent toxic gases. It’s not always clear what these gases will be, as battery chemistry is a closely guarded commercial secret.”
- Some fire services have a code of not intervening in lithium-ion battery fires: they’re unlikely to suppress them because the risk to firefighters is too high.
- Instead, they wait for the reaction to finish, and protect the surrounding environment.
- 26 August 2022 / COSMOS Magazine

Li-Ion Grid Backup (BESS) Risks (4th example)

- **A comprehensive investigation on the thermal and toxic hazards of large format lithium-ion batteries with LiFePO₄ cathode** (Published 2020)
- Toxic gases released from lithium-ion battery fires pose a **very large threat** to human health.
- Li-Ion Batteries with higher state of charge (SOC) are found to have greater fire risks in terms of their burning behavior, normalized heat release rate, and fire radiation, as well as the concentration of toxic gases.
- The major toxic gases detected from the online analysis are CO, HF, SO₂, NO₂, NO and HCl.
- Results show that the effects of irritant gases are much more significant than those of asphyxiant gases. HF and SO₂ have much greater toxicity than the other fire gases. The maximum FEC value (*fractional effective concentration – a measure of toxicity impact*) is approaching the critical threshold in such fire scenarios.
- <https://doi.org/10.1016/j.jhazmat.2019.120916>.

Li-Ion Grid Backup (BESS) Risks (5th example)

- **Toxic fluoride gas emissions from lithium-ion battery fires** (published 2017)
 - Lithium-ion battery fires generate intense heat and considerable amounts of gas and smoke.
 - the emission of toxic gases can be a larger threat than the heat.
 - large amounts of hydrogen fluoride (HF) may be generated - HF can pose a serious toxic threat
 - The amounts of HF released from a large burning Li-ion battery packs could be 200 kg for a 1 MWh battery. The immediate dangerous to life or health (IDLH) level for HF is 0.025 g/m³ (30 ppm) and the lethal 10 minutes HF toxicity value is 0.0139 g/m³ (170 ppm). The release of hydrogen fluoride from a Li-ion battery fire can therefore be a severe risk and an even greater risk in confined or semi-confined spaces.
 - 15–22 mg/Wh of another potentially toxic gas, phosphoryl fluoride (POF₃), was measured in some of the fire tests
 - Using water mist resulted in a temporarily **increased** production rate of HF but the application of water mist had no significant effect on the total amount of released HF.
 - <https://doi.org/10.1038/s41598-017-09784-z>

Now – You Have the “Big Picture”

- so what can you do? (Other than reject BESS?)

- **6 practical steps to improve community safety near lithium-ion energy storage systems** (Published Sept. 2021)
 - By Steve Kerber *Vice President of Research at UL Firefighter Safety Research Institute.*
 - most first responders have limited experience with Li-Ion battery fires - behave differently than typical fires
 - Lithium-ion batteries have flammable chemical electrolytes and are susceptible to thermal runaway
 - lithium-ion batteries can spontaneously reignite hours or even days later after a fire event
 - safety requirements for ESS sites are still evolving as more information about the technology becomes available
 - what can be done right now to improve safety?
 - Lithium-ion battery ESS should incorporate gas monitoring that can be accessed remotely.
 - Lithium-ion battery ESS should incorporate robust communications systems to help ensure remote access to the battery management system, sensors and fire alarm control panel remains uninterrupted.
 - Owners and operators of ESS should develop an emergency operations plan in conjunction with local fire service personnel and the authority having jurisdiction and hold a comprehensive understanding of the hazards associated with lithium-ion battery technology.
 - Signage that identifies the contents of an ESS should be required on all ESS installations to alert first responders to the potential hazards associated with the installation.
 - Lithium-ion battery ESS should incorporate adequate explosion prevention protection as required in National Fire Protection Association (NFPA) 855 or International Fire Code Chapter 12, where applicable, in coordination with the emergency operations plan.
 - New lithium-ion battery ESS should be built in accordance with NFPA 855, the most current standards available for safety, and we are calling on local governments to mandate adoption within their cities and municipalities.
- <https://www.utilitydive.com/news/6-practical-steps-to-improve-community-safety-near-lithium-ion-energy-storage/585938/>

The “Other” Current Hype - Hydrogen

- Invest 20 minutes to watch, “The Trouble With Hydrogen” It’s easy watching, and very informative.
- <https://www.youtube.com/watch?v=Zklo4Z1SqkE>
- Briefly:
 - Most (>90%) hydrogen produced today is from fossil fuels. To produce “green hydrogen” from renewable electricity (solar or wind) will be “cost prohibitive” (3 or 4 times greater)
 - Hydrogen for vehicle fuel cells is stored under very high pressure of about 10,000 PSI
 - Needs heavy cylinders, with carbon fibre reinforced barriers
 - Hydrogen under pressure tends to react with metal, forming brittle hydrides, degrading the storage vessel.
 - Fuel cells to make electricity from hydrogen for vehicle propulsion need platinum or irridium – neither are cheap nor plentiful.
- Not mentioned in video:
 - Adding hydrogen above about 7% in concentration to natural gas supply network requires modifying ALL combustion equipment (furnaces, etc.) connected to the gas line for safety reasons, so that’s not an easy option.
 - Batteries can typically reuse between 80–90% of the chemical energy stored, but fuel cells generally transform only 40% to 60% of their energy to produce electrical power. (There are more losses, hence less efficiency.)
 - Overall, “Green Hydrogen” supply/usage efficiency is about 30%. 70% of the energy is wasted. That’s economically undesirable.
 - However, there are Big government subsidies for Green Hydrogen (big-hype) Too Good to be True ... usually is.
- An internet search for “Green Hydrogen Hype” returns over 6,000 results.

Battery Energy Storage Systems

Assessment of Community Risks

Multi-Municipal Wind Turbine
Working Group
March 9, 2023

IESO New Capacity Initiatives

Ministerial Directive – January 27, 2022

- Oneida Energy Storage – 250 MW

Ministerial Directive – October 6, 2022

Program	Capacity		Decision
Expedited	1500 MW	Expansions or new projects	Feb 2023
Upgrades	300 MW	Improve facility; amend contract	Q1 2023
LT1 RFP	2200 MW	Expansions or new projects	Oct 2023

Specific Requirements – October 7, 2022

- Storage - 1500 MW – Contracts up to 2047
- Natural Gas – 1500 MW – Contracts end in 2040

Battery Storage Incidents

- Press report of 2021 fire at Tesla's 300 MW battery storage project in Victoria, Australia:

*“The fire started on the morning of Friday July 30 and was not brought under control until the afternoon of Monday August 2. More than 30 **fire trucks** and support vehicles and about **150 fire fighters** from the County Fire Authority and local Fire Rescue Victoria responded, containing the flames so they only **affected two Megapacks** of the approximately 210 that make up the system”.*

- Incident is not isolated – other reports from US

IESO's RFP Requirements

Proposal/Contract Requirements

- Price, financial arrangements
- Municipal Support
- Indigenous Engagement/Participation
- Community Engagement
- Meet “good engineering and operating practices”

Municipal Support Submission

- Technology
- Location
- Capacity

Approval Process?

Standards for BESS Projects

National Fire Protection Association

- Standard 855 – 2020; Revised 2023
- Significant safety hazards – toxic/flammable gases; fire intensity and explosion control

Underwriters Laboratory

- ANSI/CA/UL9540 – April 2021
 - Fire detection/suppression/containment
- ANSI/CA/UL9540A - November 2019
 - Test methods at cell, module, unit & installation levels
 - Must meet performance criteria at each level

Setback Requirements

Hydro One

- Intense heat and smoke for prolonged periods represent increased risk to their system
- Setbacks of 250 m to 500 m from stations
- Setbacks of 150 m to 500 m from rights of way

Other Rules

- 359/09 applies to specified renewable energy projects while other types of projects excluded
- Battery storage projects are not in either list.
- No known provincial setbacks.

Municipal Zoning Rules

- Technology is too new to be covered in municipal zoning

Noise Emissions

Noise Issues Discussed at Meetings

- Focused on air cooling systems
 - Small projects would be allowed within noise by-laws
 - Noise emissions in large projects?
 - Need to be confirmed
- Regulation 359/09 outlines requirements for transformer stations associated with other renewable projects
 - Apply to Battery Storage?
- Need to include acoustic barriers in project design if required.

Issues to Consider

Design Considerations

- Management of toxic and explosive gases
- Dry sprinkler systems
- Access to large quantities of water
- Separation of modules to allow fire equipment access
- Acoustic barriers

Local Emergency Support Requirements

- Specialized training for unique hazards
- Scale and duration of emergency situations
- Ability to handle toxic fumes and run-off

Status of Known Projects

Projects with Municipal Support

- Sault Ste. Marie – at least one supported
- Guelph – one project supported
- Lambton Shores - 3 Enbridge projects supported.
- Arran-Elderslie – Solar Flow Through Project supported
- City of Ottawa – one project supported

Projects Refused Municipal Support

- Sault Ste. Marie – at least one declined
- Prince Edward County – rejected Solar Flow Through Project plus one other project
- Enniskillen – rejected one project

Recommendations

- Add Battery Storage to Regulation 359/09
- Establish minimum setbacks from all activities
- Require design certification by an accredited body (UL9540A) and meets all standards (i.e. UL9540, and NFPA 855)
- Monitoring and fire containment systems linked to local emergency services
- Assessment of all noise emissions with abatement as required
- Emergency plan agreed with local authorities including specifications on support required
- Final package presented to municipal council for approval before permits issued.