

# **Proposed regulation change under the Oil, Gas and Salt Resources Act**

Regulating Compressed Air Energy Storage (CAES) in Porous Rock Reservoirs  
and Solution-Mined Salt Caverns

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Ministry of Natural Resources and Forestry



## Background/Context

Under the *Oil, Gas and Salt Resources Act* (OGSRA), the Ministry of Natural Resources and Forestry (MNRF) licenses the drilling and operation of wells<sup>1</sup> used for activities such as the exploration and production of oil and natural gas, salt solution-mining, and the underground storage of hydrocarbons. Last spring, the act was amended by the Ontario Legislature to allow other underground geological storage activities to be regulated under the OGSRA framework by prescribing them in the regulation under the act.

Changes are being proposed to Ontario Regulation 245/97 under the OGSRA that would make compressed air energy storage (CAES) projects subject to that act if they are using wells to access underground solution-mined salt caverns and porous rock reservoirs.

In addition to any proposed regulatory or approval requirements under the OGSRA, CAES projects would be subject to other provincial and municipal authorizations related to the above-ground components of their applicable activities. Additionally, any CAES proposal that would use an underground salt cavern or porous rock reservoir that is the property of the Crown would be subject to the existing requirements for leases issued by MNRF pursuant to Ontario Regulation 263/02 under the *Mining Act*. The issuance of a lease under this regulation is a disposition of a Crown-owned resource and would therefore generally also be subject to MNRF's Class Environmental Assessment for Resource Stewardship and Facility Development Projects.

### ***What is compressed air energy storage? Why and how is it used?***

It is a method of storing energy for future use by using compressed air as the energy storage medium. Compressed air energy storage can provide a number of services to electricity grids, including providing frequency regulation and voltage control.

Large-scale compressed air energy storage facilities can provide capacity services. Electricity can be taken from the grid and used to compress and store air in a cavern or vessel. When required, the compressed air is reheated, expanded, and used to drive a generator to supply electricity back to grid. Air must be stored at significant pressure in order to produce electricity.

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<sup>1</sup> Well' is a defined term in the act. Wells include holes drilled in the ground for various specified purposes (e.g., the production of oil or gas; the injection, storage and withdrawal of oil or gas in an underground geological formation; salt solution-mining).

In providing these services, energy storage can provide additional benefit to the electricity system by storing power during non-peak electricity production, which can then be used during peak demand periods. Energy storage services can also support renewable energy sources by providing electricity and other grid services to address the inherent intermittency of wind and solar generation.

### ***What areas of Ontario might be geologically suitable for underground CAES?***

Literature and research on CAES proposals/activities in other jurisdictions suggests that the underground geological formations frequently considered for CAES have the same general physical characteristics as those currently used in Ontario for salt solution-mining and the storage of natural gas and other hydrocarbons. The only known commercial CAES operations worldwide utilise solution-mined salt caverns for storage. CAES has been considered or proposed in porous rock reservoirs; however, these proposals have not yet proceeded to commercial development.

The Precambrian sedimentary rocks of the Canadian Shield (see Figure 1) are generally made up of igneous and metamorphic rocks that have low porosity and permeability – meaning that the rocks don't have a lot of spaces in them or that the spaces are not well connected to allow substances like air to flow through them - and are therefore unlikely to be suitable for CAES. Paleozoic rocks, also shown in Figure 1, that occur in the far north and southern Ontario are generally more porous and permeable, making them more suitable candidates for CAES.

Salt solution-mining, which creates the types of salt caverns that are being used in other jurisdictions for CAES, occurs exclusively in southwestern Ontario. The salt deposits where these caverns exist are shown in the inset map on Figure 1.

While underground CAES may be technically feasible in the types of rocks that exist in the far north, it is anticipated that projects are more likely to be proposed in southern Ontario where solution-mined salt caverns and porous rock reservoirs have previously been used for the production of oil, gas and salt resources, as these previous activities provide better baseline information for potential underground storage areas. Additionally, the lack of connection to the provincial electricity grid in the far north would create additional technical and economic challenges for any large-scale CAES project.

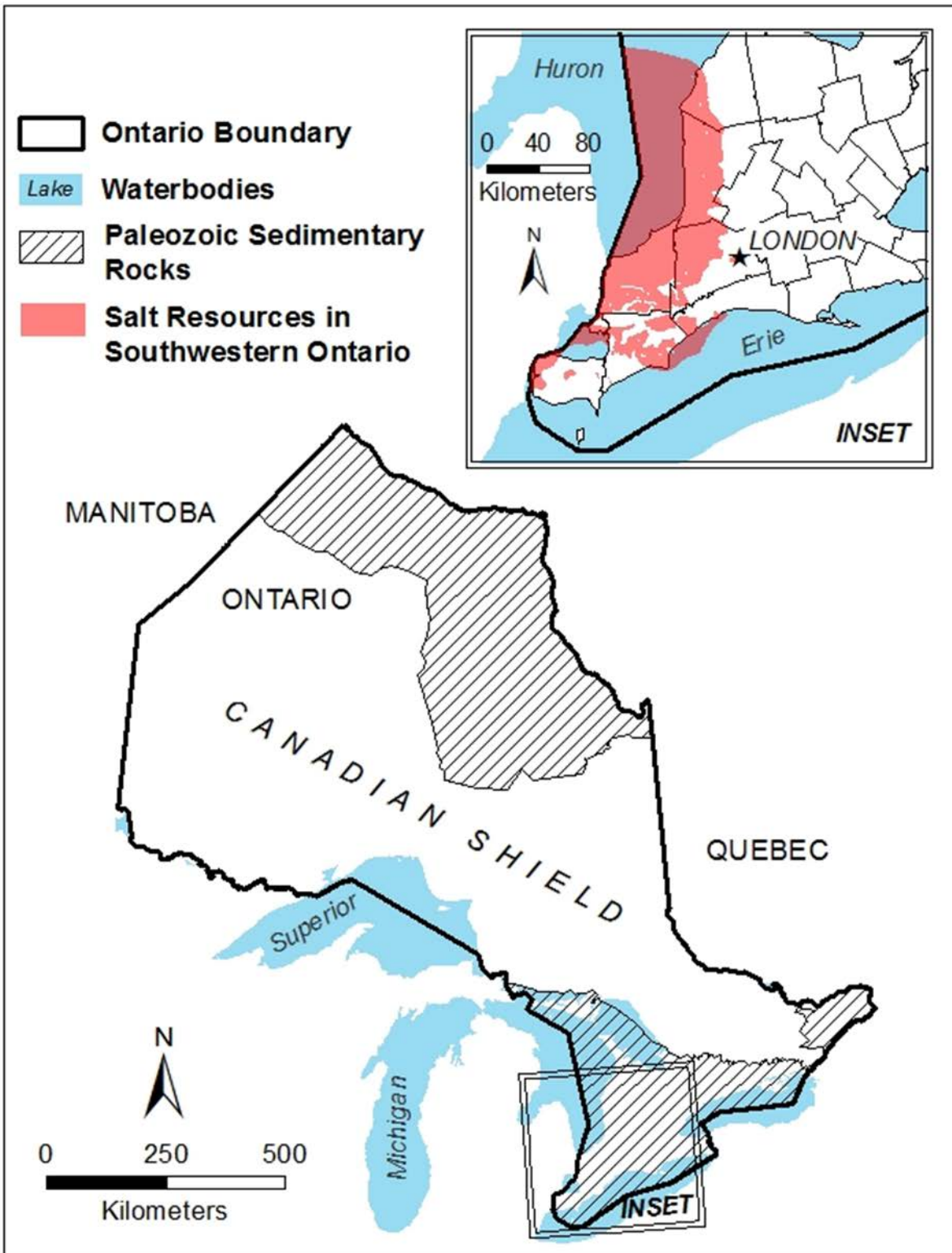


Figure 1: Location of major rock types and salt deposits relevant to compressed air energy storage in Ontario

### ***Are there any existing CAES projects in Ontario?***

There are no CAES projects that use underground geological formations for storage operating in the province at this time.

There is an existing proposal to develop a CAES facility (1.75 MW) in a solution-mined salt cavern in Goderich, Ontario. The proponent has an existing contract with the Independent Electricity System Operator (IESO). The wells and cavern that the proponent seeks to use are currently under an OGSRA licence for salt solution-mining and, as a result, the ministry has been working with the proponent to align their proposed project with relevant standards regarding the design, operation, decommissioning and safety of wells and caverns.

### **Why are the Proposed Changes Needed?**

In Ontario, there is currently no clear regulatory oversight for the use of wells to access solution-mined salt caverns and porous rock reservoirs for CAES – creating an unclear operating environment for both businesses and the public.

While the OGSRA was amended last spring to allow for the regulation of these activities, the changes have no effect until a regulation is made prescribing the CAES projects and activities that would be subject to the act.

The proposed changes would also create an application process and standard operating requirements for subsurface activities associated with CAES projects using solution-mined salt caverns, providing greater clarity and certainty for the energy storage industry, local and Indigenous communities, and the public.

### **What is the Regulatory Proposal?**

It is proposed that amendments be made to Ontario Regulation 245/97 under the OGSRA in order to regulate subsurface projects and activities associated with CAES projects that use wells to access underground solution-mined salt caverns and porous rock reservoirs.

Any proposed authorizations or requirements for CAES under the OGSRA would be focused on the use of wells and subsurface activities. Surface activities (e.g., equipment, piping, etc.) beyond the emergency shut down valves would not be regulated by MNRF. These activities and equipment will be subject to other applicable approval processes and regulatory frameworks – for example, municipal approvals,

environmental compliance approvals under the *Environmental Protection Act*, and regulations under the *Technical Standards and Safety Act*.

In the context of the proposed regulation, CAES would refer to the process of compressing and injecting air into solution-mined salt caverns or porous rock reservoirs, storing it, and then withdrawing the air for the purpose of generating electricity.

The changes outlined in this document are proposed to take effect on January 1, 2018.

As discussed earlier, the only known commercial CAES operations worldwide utilise solution-mined salt caverns for storage; these two existing operations have been in operation for many years. CAES in porous rock reservoirs has been contemplated, but is still an emerging technology that has not been widely demonstrated; these projects require a more dynamic approach to regulation. As a result, this regulatory proposal addresses these two types of activities differently under separate headings below.

### **CAES in Solution-Mined Salt Caverns (Cavern CAES)**

The proposed changes to the regulation would establish application requirements for cavern CAES activities, including required information/studies and notification processes. New operating standards applicable to cavern CAES would be established. Further details about the proposed application requirements and operating standards are provided below.

If the proposed regulatory amendments are made, each individual well proposed to be utilized for this activity would require a well licence. Individuals or companies planning to drill new wells for this purpose would be required to apply for a new well licence. Those planning to convert an existing well that is already licenced under the act for a different purpose (e.g., currently used for salt solution-mining) would be required to apply to convert the existing well licence to another use.

In addition to well licences, injection permits would be required to authorize injection activities in wells. An injection permit may be issued for one well or multiple wells, depending on how the wells would be utilized for an individual project. Applications for new or converted well licences and injection permits could be submitted and reviewed concurrently.

Where the cavern to be used for a CAES project must be created prior to the injection of compressed air, all existing rules for and requirements for salt solution-mining under the OGSRA would apply to the creation of the cavern.

The proposed changes would also modify the provisions for registration of works in section 7 of the current regulation, making them applicable to cavern CAES operations;

this would require CAES operators to submit and maintain updated information about the operator and operation site. Section 23 would be modified to specify that, in addition to being qualified to examine works with related to hydrocarbon storage, a Class IV examiner may also examine cavern CAES works<sup>2</sup>.

As part of the application process, a proponent would be required to submit confirmation that they own the land or have entered into the necessary lease agreement with the owner of the underground storage area and well sites.

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### **Existing Requirements that will apply to Cavern CAES**

In addition to any new and modified regulatory provisions that are proposed, the existing requirements in the regulation under OGSRA that apply to all 'wells' would also apply to cavern CAES wells, including:

- applicable definitions in section 1,
- sections 3 and 4 that deal with well licences and the drilling of wells,
- well licence fees in section 5 and well security in section 16, and
- sections 17-22 that deal with subjects such as: well control and blowout prevention, plugging dry or unused wells, the protection of designated gas storage areas, the release of information, etc.

Cavern CAES proposals would also be subject to the existing fees for well licence applications and injection permit applications.

The existing OGSRA framework involving tribunals will apply to cavern CAES applications and operations. There are two different tribunals to which matters may be referred under the existing framework – the Ontario Energy Board (OEB) and the Mining and Lands Commissioner (MLC). Tribunal referral provisions in the act include those that relate to applications for licences and permits, transfers, conditions of approval, and situations where an approval is refused, suspended or cancelled as a result of an offence under the act.

Where applications are within 1.6km of a designated gas storage area or the minister is of the opinion that operations in a designated gas storage area would be affected, the matter would be referred to the OEB. Other referrals, if any, would be to the MLC.

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<sup>2</sup> "Work" is defined under the OGSRA and means a well or any pipeline or other structure or equipment that is used in association with a well. For CAES projects, works would include the underground storage area and well, up to and including the emergency shut down valves.



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## **Proposed Cavern CAES Application Requirements**

### **Proposed Fees & Security**

Applicants would be required to submit the required application fees and confirmation that the security required by section 16 of the regulations has been established.

### **Proposed Application Documentation Format**

The application standards would require all application documentation to be submitted digitally in PDF format, with the exception of maps, figures or other diagrams which may be submitted in PDF or JPEG format. One hard copy of the complete application would also be required.

### **Proposed Documentation Requirements**

Technical information provided in support of an application would be required to be prepared by specialized and qualified personnel (e.g., professional engineer), and individual assessments/reports would identify the responsible expert(s) and identify their relevant training/expertise in the subject field.

It is proposed that applicants would be required, through the application, to demonstrate that the cavern CAES project:

- would be conducted in a safe and environmentally sound manner,
- would be designed, constructed, operated, maintained, decommissioned and abandoned in accordance with:
  - all provincial operating standards for compressed air energy storage in caverns, and
  - Canadian Standard Association (CSA) Z341 Storage of Hydrocarbons in Underground Formations, with suitable adjustments for the storage of air.

The type of documentation that is proposed to be required to demonstrate the above requirements may include (as a minimum):

- Detailed information about the proponent, location, land ownership or lease arrangements granting the rights to conduct activities,
- Details regarding the proposed project and anticipated activities, all existing and proposed wells and underground geological formations/features that will be used in the storage project, and approvals being sought under the OGSRA and other legislative frameworks related to the project,



- Identification and description of surface users and uses, significant natural and human-made features, land uses, and relevant land use/operational constraints within 500m of any proposed well and also from the boundary of the storage cavern when projected on the surface,
- Detailed evaluation of neighbouring subsurface activities and their potential impact on the integrity of the storage facility, including an assessment of existing or abandoned wells, active or abandoned conventional subsurface mining operations, and currently or previously active subsurface operations,
- Identification and evaluation of the nature and extent of any potential surface and sub-surface impacts that may result during the construction, operation, decommissioning and abandonment of the well(s) and cavern. Planned methods of avoidance and mitigation, as well as related plans for monitoring, record-keeping and reporting would also need to be included,
- Detailed geological, geo-mechanical and geochemical evaluations related to the wells, storage area and geological formation proposed to be used for the project, demonstrating their suitability for the proposed activity,
- Hazard and risk analysis for the life-cycle of the proposed operation from start-up through decommissioning and abandonment,
- Detailed plans and programs for the development, operation, maintenance, decommissioning and abandonment for the wells and cavern; plans for monitoring, mitigation, emergency response, record-keeping and reporting; and any training programs or required expertise for personnel conducting activities.

### **Proposed Notification Requirements**

Proponents would be required to notify the following parties of the application, providing a project description and offering to provide digital copies of any application documentation on request:

- Landowners, local municipalities, and regional municipalities within 750m of any proposed well and also from the boundary of the storage cavern when projected on the surface,
- Operators of OGSRA wells in any designated gas storage area within 1.6km
- Utility corporations, if an easement exists within 750m of the boundary of the storage cavern (projected onto the surface), and
- Other ministries or agencies as directed by MNRF.

In addition to the above notifications, proponents would be required to submit a complete application package to the MNRF, and any municipalities, ministries or agencies that MNRF identifies.

MNRF would also identify the Indigenous communities and organizations that the proponent would be required to notify of the application. The requirements for engagement or consultation with Indigenous communities would be determined on a case-by-case basis.

Any party or person notified of the application would have an opportunity to provide comments within 90 days of receiving the notice. Comments would be provided directly to the applicant with a copy to the MNRF.

Applicants would be required to provide documentation to MNRF summarizing their notification activities, the responses received, any changes made to the application in response to the comments, and an explanation of any outstanding concerns that notified parties have with their application. Any comments provided to the applicant and MNRF from persons not directly notified of the application prior to the submission of the summary document would also be included in the summary to be provided to MNRF. A separate summary of notification and engagement with Indigenous communities and organizations would be required.

The applicant would be required to copy the parties that have commented on the application where they have also provided contact information.

### **Transition for the Current Cavern CAES Proposal in Goderich, Ontario**

A proposed cavern CAES project in Goderich, Ontario has the potential to be operational as early as 2018. This proposed activity is not currently subject to the OGSRA; however, in the interim while a regulation proposal is under development and consideration, the proponent has been working with the ministry to demonstrate that the activities in the wells and cavern can be carried out in a safe and responsible manner.

The proposed changes to the regulation would allow the minister to consider whether the submission of documentation and/or notification and engagement activities undertaken by the proponent prior to a regulation coming into effect satisfy these proposed application requirements. Where it is determined that the proponent's previous submissions and notifications are equivalent to what would be required by the regulation, the proponent may be deemed to have met the requirement.

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## **Proposed Cavern CAES Operating Standards**

New operating standards applicable to cavern CAES projects would be established governing the design, operation, construction, operation, maintenance, abandonment, and safety of underground storage systems.

The operating standards would also include, with suitable modification for the substance being air (e.g., modifications to address the corrosive nature of compressed air), some of the existing sections of the Oil, Gas and Salt Resources of Ontario Provincial Operating Standards, including those related to: well drilling, blowout prevention, well servicing and well plugging.

The proposed CAES operating standards may also adopt, with suitable modification for the substance of air, all or part of Canadian Standards Association (CSA) standards that govern well design for hydrocarbons as well as underground geological storage. These standards were not developed for the storage of air; however, many of the same principles or considerations would apply to cavern CAES storage.

It is also proposed that cavern CAES operators would be able to deviate from the provincial operating standards in reasonable circumstances with an equally protective approach and advance written approval of the ministry. This provision would not allow for deviations from application requirements.

## **CAES in Porous Rock Reservoirs (Reservoir CAES)**

As discussed in the background section of this document, CAES is also being studied and contemplated in porous rock reservoirs where the pore spaces in the rock are currently occupied by water or hydrocarbons. Due to the lack of demonstrated examples of this activity being undertaken worldwide, there is not enough evidence to support the adoption of a standardized approach to the regulation and approval of these types of activities.

There are also some outstanding challenges associated with some of these types of proposals that the energy storage industry is working to resolve - for example, finding methods to address the removal of residual gas from a porous rock reservoir before it can be safely used for CAES. As the technology develops, any challenges may be addressed over time through further research and demonstration projects

In order to accommodate future technological advances in this field, the potential need to authorize tests or demonstration projects, the wide range of projects that may be proposed, and the need to ensure that these projects are carried out in a safe and

environmentally responsible manner, the province is proposing an approach that considers individual projects in a reservoir on a case-by-case basis.

For reservoir CAES projects, it is proposed that each project would be prescribed individually in the regulation at the time it is brought forward by the proponent, with those regulation proposals being subject to public and Indigenous community consultation. While the process for the development and making of regulations can take several months, this approach will allow the province to establish the appropriate regulatory environment for each project individually, considering its unique circumstances and the most current science and experience available at that time.

Only reservoir CAES projects that have been prescribed in regulation and have obtained the necessary licences and injection permits under the OGSRA would be permitted to operate wells in porous rock reservoir storage areas.