The importance of geologic study for the application of carbon capture and storage (CCS) in Otsego County, Michigan
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ABSTRACT
The most recent Paris climate talks emphasized the importance of reducing carbon dioxide pollution associated with burning fossil fuels. In an attempt to mitigate CO₂ emissions, carbon capture and storage (CCS), which is a process by which CO₂ is pulled from a smokestack before it is released into our atmosphere and buried deep underground, is currently underway in Otsego County, Michigan. In order to safely and effectively store CO₂ into deep geologic formations, it is critical to gain a better understanding for the geologic "storage tank" in which these fluids will be stored. As part of this research effort, CO₂ flooding of reservoirs has been proven to be an effective means to increase the recovery of oil bypassed during primary production. In Michigan, the juxtaposition of the Devonian Antrim Shale natural gas trend, one that contains high levels of associated CO₂, with the mature Niagaran (Silurian) reef oil play, has led to opportunities of combined enhanced oil recovery efforts with the geological sequestration of CO₂.

OBJECTIVES
1) Create robust geologic models of pinnacle reefs in Michigan utilizing available core data at the MGRRE facility at WMU
2) Use the geologic models to accurately predict the flow properties for individual reef reservoirs
3) Utilize the resultant "flow unit" models for the simulation of CO₂ injection and fluid migration

CLIMATE CHANGE
PARIS CLIMATE CONFERENCE AGREEMENT
In December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal
Governments agreed:
1) a long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels
2) to aim to limit the increase to 1.5°C, since this would significantly reduce risks and the impacts of climate change
3) on the need for global emissions to peak as soon as possible
4) to undertake rapid reductions thereafter in accordance with the best available science

RESULTS

CO₂ SEQUESTRATION IN MICHIGAN

"PERFECT STORM"

CO₂ SOURCES
Natural Gas Processing Plant

Injection Well

"PETROLOGICAL GRID"

CO₂ Source: Natural Gas Processing Plant

Production Well

MODEL VOLUME VALIDATION

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<th>Parameter</th>
<th>MIGRE-60</th>
<th>MIGRE-120</th>
<th>MIGRE-240</th>
<th>HCPV gas</th>
<th>HCPV oil</th>
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IMPLICATIONS:
- The resultant geologic models are used by reservoir engineers for fluid-flow modeling
- The predictive power of the conceptual geologic model can be applied elsewhere for upcoming reef targets for CO₂ injection