

Site Characterization for CO₂ Storage ESCALANTE HYDROGEN POWER PLANT PROJECT

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Industry Partners





Potential industrial partners are Logos Resources and eH₂Power

This Escalante Power Plant will be producing CO₂ as a bi-product from blue hydrogen process utilizing natural gas

The plant is estimated to produce over 1.5 million metric tons of CO₂ for a period of not less than 30 years.



Carbon Storage + Blue Hydrogen

Capturing and sequestrating by-produced CO_2 qualifies the H_2 to be classified "Blue Hydrogen"





Escalante Power Plant Goals

Plant will be converted to a SMR-Hydrogengenerating station

Identify a suitable CO₂ storage complex within 75-mile radius of the Escalante Power Plant

Determine the capacity and produce an injection plan designed for long-term CO₂ storage





Possible Reservoirs & Seals









Base Map

- Utilized the well database developed for CUSP
- Found cores and P&P data at NMBGMR, USGS and NMOCD
- Looked at potential USDW's in the area
- Used the SWD wells to provide injection data





Summerville Formation - Seal





Subsea Structure

Isopach

Todilto Formation - Seal





Subsea Structure

Isopach

Entrada Sandstone - Reservoir



New Mexico Tech Petroleum Recovery Research Center

Subsea Structure

Isopach

Contour Map of TDS (mg/L) in the Entrada Ss.

Well Locations & TDS values





Petroleum Recovery Research Center

Entrada Cores & Petrography







San Luis Fed #1 (30-043-20099)

Thin section Entrada 4778 at arrow

Massive to cross-bedded sandstones

4771 – 4781'







Porosity = 25.7%

Scale = 0.51 mm

Entrada 4778





Porosity = 30.1%

Entrada 4778

Red arrow = Secondary porosity Brown arrow = Clay cements Scale = 0.05 mm





Porosity = 8% Entrada 4793

Calcite cements/overgowths reducing porosity Scale = 0.1 mm





Scale = 0.1 mm

Finer grained Bimodal Significant matrix Likely an interdune deposit <1% Porosity

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Entrada 4793

Model Location





Model Description

Dimension:

- 311 x 330 x 15
- 1,539,450 total grids
- 1000 ft² average grid size

Zones modeled:







Petrophysical property distribution

	Porosity, dec	Permeability, md	Average Thickness, ft
Salt Wash	0.17 to 0.23	1.9 to 21.7	287
Bluff	0.16	1.026	91
Summerville	0.04	0.006	75
Todilto	0.01	0.002	48
Entrada	0.01 to 0.25	0.01 to 507.13	100

100000 y = 0.01e^{43.336x} 10000 1000 100 10 1 0.15 0.2 0.25 0.3 0.35 0.05 01 0.4 0.1 0.01

Perm vs. Porosity (Entrada)



Entrada Porosity Map





Model Initialization

Pressure ▶ 0.426 psi/ft Entrada ~ 3650 psi @ Injector location ▶ Temperature 60.0 + 0.0163 * depth(ft) °F Entrada ~ 200°F @ Injector location ► Salinity ▶ 20,000 ppm for all intervals is assumed







Model Verification

- 13 regional active SWDs within injecting into Entrada Sandstone formation was added
- History matching was performed to verify the properties assigned to the model

ΔΡΙ	Well Name	Latitude	Longitude	TVD (ft)	Well	Status
,		Latitude	Longitude		Туре	
3003930148	CARRACAS SWD #002	36.997990	-107.250952	9334	SWD	
3003924278	CARRACAS UNIT 27 A #082	36.953957	-107.343425	10060	SWD	Active
3003926868	CARSON SWD #001	36.787414	-107.230275	9590	SWD	
3003926214	EUL CANYON SWD #1	36.961603	-107.414712	9235	SWD	
3003925465	JILLSON FEDERAL SWD #001	36.325713	-107.180083	8800	SWD	Active
3003924236	NORTHEAST BLANCO UNIT SIMS MESA	36.830393	-107.564145	8956	SWD	Active
3003927055	ROSA UNIT SWD #001	36.884527	-107.426675	9176	SWD	
3003930812	ROSA UNIT SWD #002	36.870988	-107.314770	9334	SWD	
3003923231	RUCKER LAKE #002	36.380128	-107.004781	8975	SWD	Active
3003924807	SAN JUAN 296 UNIT SWD #301	36.748372	-107.423891	9112	SWD	Active
3003924518	SAN JUAN 30 6 UNIT #002	36.804575	-107.546728	8930	SWD	Active
3003924549	SAN JUAN 31 6 UNIT #301	36.846163	-107.502143	9040	SWD	Active
3003922756	SIMMS FEDERAL #001	36.809108	-107.202985	9731	SWD	Active



Well Control

Regional SWDs will keep injecting with their last rate recorded

Injection Rates:

1.5 Mt/year

Maximum BHP: 90% of the formation fracturing pressure

	Long	Lat	Entrada, ft	Reservoir,	Surface, ft	Pr, psi	Pf, psi	90% of Pf, psi	BHT, F
INJ01	-107.44959	36.294333	990	1010	-6766.63	3312.8444	4653.978	4188.5802	186.75907



Preliminary Results – CO₂ Injected





Results – Gas Plume



Future work

Refine basin-wide geological models for CO₂ storage (tomorrow's talk)

- Explore other suitable CO₂ sequestration zones in San Juan Basin
 - Especially the Kirtland Shale Fruitland Coal zones
 - The Salt Wash member of the Morrison and the Bluff Sandstone are thick, sandy units that might be good for sequestration if the porosity and permeability is high enough
 - Deeper horizons like the Leadville, Molas and Paradox might have potential even though they are deep (>10,000 ft)
- Improve long-term CO₂ injectivity into coalbed seams



"It grows as it goes"

Crescit eundo

Thank You







Red arrow = Quartz Green arrow = Plagioclase Blue arrow = Rock fragment Pink arrow = Quartz overgrowth Brown arrow = Clay cements Black "grains" = Diagenetic pyrite

Scale = 0.1 mm

Entrada 4778





Plagioclase feldspar dissolution creating secondary porosity

Entrada 4778

Scale = 0.05 mm



EMU #001 (30-043-20175)

Porosity & Permeability Data from 5494-5537

1000

Permeability (mD)



FEDERAL 21 #002 (30-031-20487)

Porosity & Permeability Data from 5907-5932

Horiz Perm



SANTA FE H 20 #001 (30-045-22291)

Porosity & Permeability Data from 5608-5958

Well Control

Regional SWDs will keep injecting with their last rate recorded.

Injection Rates:

1.5 Mt/year

Maximum BHP: 90% of the formation fracturing pressure

	Long	Lat	Entrada, ft	Reservoir,	Surface, ft	Pr, psi	Pf, psi	90% of Pf, psi	BHT, F
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Model Verification - Rate



Water Rate SC

Model Verification - BHP



Well Bottom-hole Pressure, CMGBuilder00_SWD.sr3
 Well Bottom-hole Pressure, BHP.fhf

Preliminary Results – CO₂ trapped conditions

