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Fast & slow, data & complexity in a carbon storage case study

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Abstract

We show in a case study how carbon storage problems evolve from quick and broad, to slow, complex, and specific. This evolution is driven by changes in data and subsurface specificity.

The development of subsurface carbon storage begins with the task of assuring whether the site has sufficient capacity, injectivity and seal integrity for safe and permanent storage. This central question persists as the project moves through the early stages, being examined again and again with new data and in greater detail as the final project location and specifications come into clarity. This progression may seem like a flat circle, going around and around, repeating.

But carbon storage development is not truly a flat circle. It is more like an expanding gyre that grows as we acquire additional data and grapple with problems of increasing complexity.

The case study involves an ongoing BECCS carbon storage project in Saskatchewan, Canada. We follow this project from Site Screening through Characterization and discuss the experience of addressing key geophysical problems as the project evolves. Four specific issues are examined, starting with the lack of a sonic log anywhere nearby. A simple, ad hoc method is used to create a pseudo sonic log for tying, modeling seismic and addressing potential subsurface risks. Our second issue relates to this: we show how the rudimentary pseudo sonic and legacy 2D seismic was used to move the site. After the site was moved, we drilled an appraisal well and acquired comprehensive log, core and test data. This allowed us to compare our pseudo sonic with the actual sonic log. At this point in the project, simple, approximate, empirical or heuristic methods no longer suffice. The new data enables us to engage more complex and demanding problems, including our last two issues: Gassmann fluid substitution for seismic monitoring and the evaluation of geomechanical constraints for the injection operation.

Our aim throughout this talk is to bring the audience close to both the problems beings solved and the changing experience of subsurface analysis as data richness and project stages progress.

Bio

Lee Hunt is a professional geophysicist with 36 years of experience working virtually every play in the WCSB and many other basins. He has drilled over 400 horizontal and vertical wells, using 2D and 3D seismic, and has experience with the oldest, most primitive techniques as well as the newest, most advanced ones. And he has catalogued the value of these experiences in numerous conference presentations and journal publications. Lee was appointed the 2012 CSEG Distinguished Lecturer. He was chosen as the 2020 CSEG Symposium Honoree, made an Honorary Member of the CSEG in 2024, and was the CSEG Mentor of the Year in 2025. Lee and his co-authors won Excellence of Oral Presentation for the 1997 SEPM Convention, the 2000 CSEG Convention Best Paper Award, the 2008 CSEG Convention Best Geophysical Abstract, the 2008 CSEG Best Technical Luncheon Talk, the 2010 CSEG Convention Best Geophysical Oral Presentation, the Best Exploration Paper at VII INGPET in 2011, Honorable Mention for Best Paper in The Leading Edge in 2011, and Best Paper in the CSEG Recorder in 2011. He was a participant in the creation of the CSEG MLA, as well as APEGA's Guideline for Ethical Use of Geophysical Data. He was also one of the principal designers of the first CSEG *Value of Geophysics with Case Histories* course.

Lee currently works as Principal Advisor, Geophysics for Carbon Alpha, a Svante company developing carbon management solutions. On the personal side, Lee Hunt is an Ironman Triathlete, an enthusiastic sport rock climber and an author. His published works of fiction include the novels *Dynamicist, Herald, Knight in Retrograde, Last Worst Hopes,* and *Bed of Rose and Thorns.*